Metro-North Railroad

METRO-NORTH COMMUTER RAILROAD COMPANY

A Public Benefit Corporation of
THE STATE OF NEW YORK

STATION IMPROVEMENTS AT

PURDY'S

CONTRACT NO. 1000106733

SPECIFICATIONS

November 20, 2019

Book 1 of 1

Submitted By:

AECOM

DIVISION 1
GENERAL REQUIREMENTS

SECTION 01 11 00 - SUMMARY OF WORK – PURDY'S STATION

PART 1 - GENERAL

1.1 WORK COVERED BY THE CONTRACT DOCUMENTS

A. Project Identification: CONTRACT NO. 1000106733; PURDY'S STATION IMPROVEMENTS

B. Owner: MTA – Metro-North (Metro-North)

1.2 PROJECT DESCRIPTION

A. Site Location: Metro-North Purdy's Station.

B. Site Description: Description of the station site follows below:

1. Purdy's Station:
   a. Located at 85 Titicus Road (NY 116) and Interstate I-684, North Salem, Westchester County, NY
   b. Elevated station on Harlem Line accessing two tracks
   c. Center island high-level concrete platform eight cars long
   d. Owned and managed by Metro-North.
   e. Includes entrance areas from the existing 400 stall parking lot.

1.3 SCOPE OF WORK

A. In Summary, this contract covers, but is not limited to furnishing and installing a new elevator at Purdy's Station, a Metro-North Station, as well as a pedestrian bridge extension from the elevator to Route 116. The existing staircase will be demolished, provide new sidewalk to connect to the Station Entrance. For the specific bid categorization, refer to the bid sheet and Measurement and Payment section of the specifications.

B. Purdy's Station Scope

1. Demolish the existing staircase, supports and foundations.
2. Install one (1) new ADA elevator, all necessary components and equipment, including the foundation, structural steel tower enclosed with glass panels, stainless steel glass panel cab, electric supply, roofing, lighting, communications, fire alarm system;
3. Provide an ADA compliant pathway (sidewalk) at the parking lot level from the elevator base to the station entrance including lighting, utility relocation and other parking lot modifications.
4. Provide a pedestrian extension (bridge) to connect the elevator entrance to the highway above (Route 116).

C. The work includes:

1. At the parking lot /grade level, generally consists of maintenance and protection of traffic and pedestrians, staircase removal, environmental cleanup as required, utility modifications as required, new elevator shaft structure and foundation, hydraulic lift, sump, elevator cab, all associated elevator machine elements, machine room structure and roof, glass panels, awning, steel access structure, columns and foundations from the Rte. 116 overpass to elevator shaft, glass panels, roof, LED lighting, CCTV system

(PODS), Help Point, emergency call box and wayfinding signage.

2. At grade level, a new windscreen will be installed as well as a new concrete sidewalk and curb with new lighting, new pavement, pavement markings, signage, drainage modifications and buried utilities.
3. Along Rte. 116: sidewalk modifications, bridge fence removal/replacement, wayfinding signage and no parking signage will be added.

1.4 CONSTRUCTION SEQUENCING

A. The work included in the Contract shall be progressed adhering to the proposed Construction Sequencing Plan, as described in 1.4.D of this section. This plan assigns separate work elements which proceed chronologically from the notice of award to completion of construction. The Contractor's construction schedule shall address all work elements in the order they are presented and any work from different work elements that are to be performed concurrently per the Contractor's construction schedule must first be approved by Metro-North.

B. The Contractor can present an alternate phasing schedule for Metro-North review and approval.

C. Construction sequencing as shown in the Contract Documents are proposed by Metro-North Railroad. The Contractor shall submit a detailed construction sequencing plan for all work to Metro-North for review and approval prior to the start of work.

D. The work elements described below are a summary of the work and are not to be considered exhaustive.

1. Work Element 1: Contract Requirements:
   a. Submit all required Metro-North Contract documentation
   b. Obtain all required construction related permits
   c. Set up construction related parking and smaller trailer for the Construction Manager and the Contractor at the Purdy's Station site.

2. Work Element 2: Install Maintenance and Protection of Traffic Devices and Protect Work Zones:
   a. Obtain approval from Metro-North on the overall Station Construction Sequencing Plan and individual station sequence plans for the project.
   b. Provide proper maintenance of protection of pedestrians and traffic including temporary signage to avoid the construction zone.
   c. Isolate and protect the projected work zone.
   d. Close a section of the parking lot for Contractor laydown and storage areas.

3. Work Element 3: Demolition of Existing Staircase
   a. Remove and dispose of existing goose neck light pole on staircase.
   b. Remove and dispose of existing staircase and steel columns.
   c. Remove and dispose of existing concrete footings for staircase columns.
   d. Remove existing steel connection to Rte. 116 overpass fascia.

4. Work Element 4: Install New Elevator and Machine Room
   a. Install protective sheeting where required.
   b. Install new elevator shaft steel structure foundation, steel shell, elevator hydraulic

lift in caisson, elevator tracks, cab, glass panel walls, roof, machine room structure foundation slab and CMU walls, door, roof, vents, elevator machine components, machine room mechanical, ventilation, electric and lighting, protective awning over elevator outside doors, CCTV system (PODS), emergency call box, fire alarm, and all connecting utility conduits.

c. Install wayfinding signage.
d. Install elevator drainage leaders from roof.

5. Work Element 5: Install New Access Bridge from sidewalk on Rte. 116 Overpass to New Elevator
   a. Install protective sheeting where required.
   b. Install new access bridge steel structural foundations, steel shell, glass panel walls, new roof, electric, lighting, CCTV system (PODs) and all connecting utility conduits.
   c. Install wayfinding signage, station sign and bird deterrent system.
   d. Install drainage leaders from roof.

6. Work Element 6: Parking Lot Area Improvements:
   a. Remove section of the existing asphalt pavement and curb.
   b. Install the utility corridor for power (lighting and elevator), communications, fire & safety, IT, phone, etc. between new elevator and the existing station elevator machine rooms where the connection cabinets are located.
   c. Install light pole foundations, pull boxes, conduits and erect new light poles along proposed sidewalk path.
   d. Modify existing drainage to accommodate the new sidewalk.
   e. Install new concrete sidewalk and curb and drop curbs as noted.
   f. Install asphalt sections and new pavement markings for parallel parking stalls. Add parking signs.
   g. Install a glass wind screen and foundations in front of the outside elevator door.

7. Work Element 7: Rte. 116 Improvements (NYSDOT)
   a. Remove section of existing bridge fence and install new bridge fence as required.
   b. Modify sidewalk adjacent to elevator as required.
   c. Install new wayfinding signage along Rte. 116.
   d. Install “no parking” signs along Rte. 116.

8. Work Element 8: Perform Site Work and Clean Up
   a. Remove pedestrian Maintenance and Protection devices and open new work zones.
   b. Demobilize and clean-up site.
   c. Project close out.

E. Maintenance of Operations:
   1. Within the various work elements noted above, there are requirements that impact the construction which are necessary to allow Metro-North to maintain operations throughout construction. These constraints must be included in the Construction Schedule and Construction Sequencing Plan of the Contractor and adhere to the following:
      a. Metro-North shall have uninterrupted access to and the use of Purdy’s station at all times. Existing, temporary or newly constructed facilities must always be operable. The Contractor shall coordinate the timing of changeover to new

services so as not to disrupt facility operations and passenger access to and from each station platform.

b. The Contractor shall give ten (10) business days of notice to Metro-North prior to any interruptions to access to the existing station including equipment rooms and elevator rooms, etc.

c. It is understood that this is construction work zone and Metro-North personnel will wear personal protective equipment.

d. The Contractor shall provide ten (10) business days' notice to Metro-North prior to any interruptions to the electric service. The Contractor shall coordinate schedule and weather/temperature sensitive activities with Metro-North property management. At no time from the beginning of October, thru the winter heating season, and until the end of April of the following year, shall the Metro-North not have access to use of a heating system.

e. The Contractor shall provide ten (10) business days' notice to Metro-North prior to any interruptions to the backup generators. The shutdowns shall not commence with a forecast of inclement weather. The Contractor shall check the national weather forecast to verify that no significant storms are imminent. The shutdowns shall not commence with a forecast of high energy demand for electricity in the region.

f. Disconnections of services to switch from existing to temporary, existing to new or temporary to new shall be coordinated with Metro-North. The Contractor shall give provide (3) business days' notice to Metro-North prior to any interruptions of any utility service to the station

g. Prior to work at the site, including demolition, the Contractor shall submit and have approved a detailed Construction Schedule and associated Construction Staging and Sequencing Plans for construction and commissioning of the new works in accordance with the requirements of the drawings and specifications.

PART 2 – PRODUCTS

2.1 DELIVERABLES

A. See Chapter 15 – Submittals of the Contract Terms and Conditions and specification Sections 01 31 00 and 01 33 00 for information on submittals and submittal procedures.

PART 3 - EXECUTION

3.1 GENERAL COORDINATION

A. Coordination to be performed by the Contractor shall includethe following:

1. The Contractor is required to coordinate his activities with Metro-North's operations.
2. The Contractor must submit, for approval by Metro-North and the various station location municipalities, detailed plans and procedures for the construction work.
3. The Contractor is responsible for all work associated with utilities, all coordination with utility companies, authorities and municipalities and all payments for all required utility hook-up installations and relocations.
4. Submit project Construction Sequencing Plans to Metro-North for approval. Access and sequencing of all tasks, including mechanical, electrical and plumbing accessories, must be coordinated with Metro-North.
5. All materials shall be amply protected throughout the period of construction and shall be thoroughly cleaned to the satisfaction of Metro-North.

B. This work is being performed adjacent to an existing operating train station and, as such, the

Contractor shall coordinate all its operations with Metro-North. The Contractor must permit the continued uninterrupted access to the station by the railroad, public and employees and maintain safe egress to and from each platform. Any requests for closings of egress points shall be coordinated with Metro-North and comply with State codes, rules and regulations.

C. This work is being performed adjacent to or on neighboring New York State, Town of North Salem. Westchester County right-of-way and, as such, the Contractor shall coordinate all its operations with these owners.

D. All Contractor's personnel must be qualified annually on Metro-North On-Track Protection in compliance with CFR 214 in order to enter upon railroad property – regardless of the project specific distance from actual tracks.

E. The Contractor shall retain the services of a Testing Agency(ies) meeting the requirements of ASTM E329 to perform all testing required by the Contract Documents. The Testing Agency must be approved by Metro-North prior to the start of any testing work.

3.2 PROJECT SCOPE

A. A detailed summary of work can be found in the various sections of these specifications. Additional work to be performed by the Contractor shall include the following:
   1. Temporary construction work for the safe and proper performance of the Contract Work. As required by the work of this Contract, this shall generally include but not be limited to, furnishing and installing the following: (See specifications for additional details.)
   2. Temporary offices – One (1) trailer for field engineer and others to be located near the site in North Salem, NY. In addition to a field trailer, a leased store front may also be sued as the field office.
   3. Temporary utilities, such as electric, water and sanitary
   4. Temporary portable toilet
   5. Rubbish containers
   6. Temporary erosion and sediment control devices
   7. Temporary fences and silt fence to separate the work zone fromactive roadways
   8. Storage facilities / area
   9. Temporary directional and informational signage
   10. Barrier and other safety requirements to maintain pedestrian and vehicular traffic flow and safety

B. The removal and relocation or disposal shall include, but not be limited to, the following items:
   1. Concrete/brick
   2. Underground utilities, structures and abandoned duct banks
   3. Staircase and lighting
   4. Bituminous and concrete pavements / sidewalks / curbs
   5. Debris and unclassified excavation
   6. Landscaping items not limited to trees
   7. Iron ROW fence
   8. Any excess materials brought on site by the Contractor for use in construction of the new facilities that are not a part of the final as constructed facilities including equipment and furnishings

C. The excavation, handling, and legal disposal of soil, debris and other contaminated/hazardous and non-hazardous materials within the Contract limits of work. Test the excavated materials

to determine what materials need to be removed and disposed of off- site and what material can remain on site for re-use on this project. No excess material is to remain on site.

D. Signing, striping, crosswalks, etc. as required.

E. The construction of utility (above ground and underground) services as required including electric for bollard and V-blade stanchion lighting.

F. Site grading and paving of the site including new curbs, stamped pavements and sidewalks, miscellaneous ramps, and all associated required execution to complete the work.

G. Construction of benches, leaning benches, digital information displays, USB charges and associated electrical connections.

H. All other work shown on the Contract Documents referenced documents, specified in the Contract Terms and Conditions and as specified herein.

3.3 PERMITS AND APPROVALS

A. The Contractor is required to obtain all necessary permits and approvals, as required to complete the work of this Contract, from Metro-North, the State of New York, the Town of North Salem, Westchester and all other agencies and organizations having jurisdiction.

B. The construction of all items of the various station improvements enhancements shall be done in accordance with all applicable Metro-North, federal and state laws, codes, rules and regulations. Metro-North is exempt from the jurisdiction of and so not required to obtain any permits or approvals from local (i.e. city or county) entities when performing work on Metro-North property. When performing work on property of others (i.e. Town of North Salem and NYS DOT) the Contractor is required to comply with all applicable Metro-North, federal and state laws, codes, rules and regulations, and must obtain permits in connection with the work.

C. Agencies and authorities have jurisdiction over specific aspects of this project. It shall be the responsibility of the Contractor to prepare all permits and supporting documentation and to obtain all approvals in a timely manner

D. The work performed shall strictly comply with the New York State Department of Environmental Conservation requirements and the NYCDEP including but not limited to soil erosion and sedimentation control.

E. Keep construction areas, access locations and adjacent public highways clean and free from tracked dirt, sand, and construction debris at all times. Provide wheel washing as necessary and as determined by Metro-North and in compliance with NYSDEC Best Management Practices. Provide dumpsters for debris storage and removal. Clean the work area at the end of each day.

F. The existing storm drainage system must be kept clean and maintained during construction. Any silting of inlets or piping due to inadequate sedimentation protection must be remedied prior to completion of construction.

G. Any diesel-powered non-road vehicle, fifty horsepower and greater, that is owned by or operated by the Contractor must be powered by ultra-low sulfur diesel fuel and utilize the best available technology for reducing the emission of pollutants.

H. Noise Control:

1. All equipment and operations shall not exceed permissible sound levels for construction and equipment operations established by all Federal, State and local agencies having jurisdiction.

2. All mechanical equipment utilized onsite will conform to the New York State, OSHA, and local noise codes and requirements.

3. Haul routes for mobile construction will be selected to provide the maximum distance possible between the construction site and nearby residential receptors.

4. The placement of idling equipment, air compressors, and generators near noise sensitive receptors must be avoided; such equipment not in use must be powered down.

5. The Contractor is responsible for responding to all summons or complaints and paying any and all fines levied against contractor resulting from noise control code violations. If Metro- North is fined or penalized as a result of the Contractor's violations, in addition to other remedies Metro-North may possess, said fine or penalty will be deducted from payments due the Contractor.

I. NYSEG does not allow lifting over overhead and aerial wires. All lifting operations near these wires shall be coordinated with NYSEG and the costs associated with such work are the responsibility of the Contractor.

J. Only disposal sites and transporters on the Metro-North Department of Environmental Compliance and Services approved list can be used. Metro-North reserves the right to arrange for transport and disposal of the materials.

3.4 REQUIREMENTS FOR WORK AFFECTING METRO-NORTH

A. Use of Explosives:
   1. The handling, storage or use of any explosives is prohibited.

B. Use of Cranes:
   1. The Contractor shall abide by Article 1.23 of the Contract Terms and Conditions.
   2. The Contractor shall be responsible for providing all material and labor for crane operations.
   3. The Contractor shall maintain a minimum distance of 10 feet away from any live wires but cannot boom over NYSEG feeders regardless of clearance.
   4. Any crane used on the project shall be grounded by a minimum 2/0 cable.
   5. Cranes and all its parts such as the bracing arms are prohibited from being located directly above existing underground utilities.
   6. The following data will be required for all hoisting operations adjacent to train operations:
      a. Sections showing locations of cranes, horizontally, and vertically, operating radii, with delivery or disposal locations shown. The location of the Metro-North and various public property owners right of way should also be shown.
      b. All required data shall be prepared and sealed by a Professional Engineer licensed in New York State.
   7. Submit for review by Metro-North, sketches defining the operations of all cranes used in support of construction. Also submit, at Metro-North's request, similar information for cranes or other equipment in use and capable of encroachment as prescribed in Article 1.23.
      a. These sketches shall include planned locations and movements of the equipment, calculations demonstrating the adequacy of the capacity of the crane for the loads, and interface between the footprint of the equipment and the movement of the boom and loads relative to the existing structure and surrounding buildings,

the support grillages and the protection of the existing utilities, and facilities, and any other pertinent details required by Metro-North.

3.5 CONTRACTOR'S USE OF WORK SITE

A. Work site operations are confined to areas permitted by Metro-North, ordinances and permits and to areas for which the Contractor has obtained easements. The Contractor will not be allowed to use any other areas of the site to perform these functions unless approved by Metro-North.

B. Deliveries of material and equipment to the site shall not interfere with the flow of pedestrian and/or vehicular traffic and shall be scheduled accordingly.

C. The Contractor shall not store material and/or equipment upon Metro-North Right-of-Way without the prior approval of Metro-North. If additional storage and work areas, beyond what is available at the site and on Metro-North property, are needed for operations, the Contractor shall secure those areas as required at no cost to Metro-North.

D. The Contractor shall provide appropriate site security to protect materials, plant and equipment.

E. The Contractor shall protect all existing surfaces and facilities from any damage resulting from construction operations.

F. All materials shall be amply protected throughout the period of construction and shall be thoroughly cleaned to the satisfaction of Metro-North prior to being turned over to the Metro-North.

G. Temporary power shutdowns shall be coordinated with Metro-North and NYSEG

H. Additional Site Restrictions:

1. The Contractor is advised that there are live Metro-North, NYSEG, etc., overhead and buried power and non-power utilities at the station site. These utilities must be protected at all times to ensure the continuation of operations.
2. Power feeder cables run aerially on poles and below ground in conduits or duct banks in and around the station. Their location must be identified by the Contractor and verified by Metro-North personnel before the commencement of operations that may interfere with their operation. Non-power utilities must also be identified by the Contractor and verified by Metro-North personnel before the commencement of operations that may interfere with their operation.
3. Utilities in and around the site are owned and maintained by third party utility companies/agencies. The Contractor shall coordinate the verification of all utilities with the third- party utility companies/agencies prior to the work in the vicinity of the utilities.

END OF SECTION

Attachment 1: Division of Work Matrix

SECTION 01 11 00 – SUMMARY OF WORK - ATTACHMENT 1 PURDY'S STATION – DIVISION OF WORK MATRIX								
ITEM	**PURCHASE**	**INSTALL**	**CONFIGURE**	**TEST**	**INTEGRATION**	**POWER AND COMM WIRING**	**RACEWAY AND J.B.**	**DESCRIPTION**
PODS	CONTRACTOR	CONTRACTOR	MNR	MNR	MNR	CONTRACTOR	CONTRACTOR	1. CONTRACTOR SHALL PROCURE CCTV PODS EQUIPMENT THROUGH ALLOWANCE LINE ITEM PROVIDED BY MNR. 2. CONTRACTOR SHALL COORDINATE PICKUP OF PODS FROM MNR. 3. CONTRACTROC TO BRING POWER TO PODS AND TERMINATE CAT 6 CABLES FROM CCTV CAMERAS 4. ALL CONFIGURATION OF COMPONENTS INTERNAL TO THE PODS SHALL BE PERFORMED BY MNR. 5. ALL TESTING OF COMPONENTS INTERNAL TO THE PODS INCLUDING COMMUNICATIONS TO CENTRAL SHALL BE PERFORMED BY MNR.
PODS MOUNTING BRACKET	CONTRACTOR	CONTRACTOR	N/A	N/A	N/A	N/A	CONTRACTOR	WALL/BEAM MOUNTING BRACKET SUPPLIED BY PODS VENDOR.
STRUTS, BOLTS AND MOUNTING HARDWARE	CONTRACTOR	CONTRACTOR	N/A	N/A	N/A	N/A	N/A	CONTRACTOR SHALL FURNISH AND INSTALL ALL STRUTS, CLAMPS AND BOLTS TO CREATE A FULLY FUNCTIONING SYSTEM.
CCTV CAMERA	CONTRACTOR	CONTRACTOR	MNR	CONTRACTOR	MNR	CONTRACTOR	CONTRACTOR	1. CONTRACTOR SHALL PROCURE CCTV CAMERAS THROUGH ALLOWANCE LINE ITEM. 2. CONTRACTOR TO BRING POWER TO CAMERA VIA PoE SWITCH IN PODS ENCLOSURE. 3. ALL CONFIGURATION OF COMPONENTS INTERNAL TO THE PODS SHALL BE PERFORMED BY MNR. 4. ALL TESTING OF COMPONENTS INTERNAL TO THE PODS INCLUDING COMMUNICATIONS TO CENTRAL
CCTV POWER SUPPLY	CONTRACTOR	CONTRACTOR	CONTRACTOR	N/A	N/A	N/A	CONTRACTOR	POWER SUPPLY SUPPLIED BY CCTV VENDOR.

CCTV MOUNTING BRACKET	CONTRACTOR	CONTRACTOR	N/A	N/A	N/A	N/A	CONTRACTOR	WALLL/BEAM/CEILING MOUNTING BRACKET SUPPLIED BY CCTV VENDOR.
STRUTS, BOLTS AND MOUNTING HARDWARE FOR CCTV	CONTRACTOR	CONTRACTOR	N/A	N/A	N/A	N/A	N/A	CONTRACTOR SHALL FURNISH AND INSTALL ALL STRUTS, CLAMPS AND BOLTS TO CREATE A FULLY FUNCTIONING SYSTEM.
INTERCOM	CONTRACTOR	CONTRACTOR	CONTRACTOR	CONTRACTOR	MNR	CONTRACTOR	N/A	1. ALL CONFIGURATION OF COMPONENTS INTERNAL TO THE INTERCOM SHALL BE PERFORMED BY MNR. 2. ALL TESTING OF COMPONENTS INTERNAL TO THE INTERCOM INCLUDING COMMUNICATIONS TO CENTRAL SHALL BE PERFORMED BY MNR. 3. CONTRACTOR SHALL FURNISH AND INSTALL ALL STRUTS, CLAMPS AND BOLTS TO CREATE A FULLY FUNCTIONING SYSTEM.
STRUTS, BOLTS AND MOUNTING HARDWARE FOR INTERCOM	CONTRACTOR	CONTRACTOR	N/A	N/A	N/A	N/A	N/A	CONTRACTOR SHALL FURNISH AND INSTALL ALL STRUTS, CLAMPS AND BOLTS TO CREATE A FULLY FUNCTIONING SYSTEM.

METRO-NORTH RAILROAD
PURDY'S STATION IMPROVEMENTS. DIVISION OF WORK MATRIX
ELECTRICAL

Task. No.	Task Description	Furnish By	Install By	Terminate By	Remarks
1	Existing Pole #2545 To Become Electric & Telephone Riser				Existing To Remain
	Electric Riser	Contractor	Contractor	MNR-Power	
	Telephone Riser	Contractor	Contractor	MNR-Comm	
	Upgrade Pole mounted Transformer	NYSEG	NYSEG	NYSEG	
	Terminate existing power to meter #83-190330	NYSEG	NYSEG	NYSEG	
	Disconnect & Remove Existing Service To Meter #83-190330	Contractor			Contractor To Remove Existing Service To Meter #83-190330
2	Install (2) 4" pull circuit for tel./Communication Service Riser	Contractor	Contractor	VERIZON	
3	Install (2) 4" PVC between the existing elvator machine room (#1) and the new elevator machine room	Contractor	Contractor	Contractor	

SECTION 01 11 01
CONTRACTOR REQUIREMENTS FOR WORK AFFECTING THE RAILROAD

TABLE OF CONTENTS

SECTION 01 11 01
CONTRACTOR REQUIREMENTS FOR WORK AFFECTING THE RAILROAD

PART 1 GENERAL

1.01 SCOPE

A. This section governs the Contractors planning of activities and performance of work which has the potential to affect the operation of the Railroad, Railroad facilities as well as the general public. The Contractor shall make detailed plans in accordance with all applicable federal, state and local regulations as well as requirements set forth under this contract for any operation which, in the opinion of the Engineer, affects the operation of the Railroad, Railroad facilities or the general public.

B. Submittals:

1. A detailed four week look-ahead schedule in the Metro-North required format detailing the Contractor's tasks.
2. Engineered Erection, Demolition or Other Rigging plans
3. Engineered Sheeting and Excavation Support Plans
4. Engineered Scaffolding Plans
5. Engineered Fall Protection Plans
6. Track Monitoring Data
7. Work Plans
8. Disabling Stored Equipment

C. Related sections include:

1. Metro-North Railroad Contract Terms and Conditions
    a. Contract Article 1.22 Requirements for Performing Work Adjacent to or Within the Right-of-Way of Metro-North
2. Standard Specifications
    a. 01_11_14 Working in Grand Central Terminal
    b. 01_18_01 Protection of Underground Metro-North Facilities
    c. 01_33_60 Safety, Health & Environmental Control

D. References:

1. US Department of Labor (USDOL) Occupational Safety and Health Administration (OSHA)
2. Metro-North Railroad:
    a. Metro-North Company Standards & Technical Provisions

b. Metro-North General Safety Instructions

c. Metro-North Operating Rules

d. Metro-North MW-4 Requirements for Track Inspection, Maintenance and Construction

e. Metro-North Electrical Operating Instructions MN-290

f. Metro-North Roadway Worker Safety Manual

g. Metro-North Station Standards & Guidelines

h. TS-2000 Track Clearance Diagrams

i. TS-2001-Sheet 1-Third Rail Clearance Diagrams

j. TS-2001-Sheet 2-Minimum Roadway Clearances

1.02 FOUR WEEK LOOK-AHEAD SCHEDULE

A. The Contractor shall submit a detailed four week look-ahead schedule at the end of every week that projects the Contractor's activities for four weeks beginning on the Monday after submission. The four week look-ahead schedule shall include the name of the scheduled activity, work shift start time and finish time, technical submittal status, inspection hold point if applicable, work plan submittal status, safe work plan submittal status, responsible Contractor and the projected time frame to complete each scheduled activity respectively.

B. The four week look-ahead schedule shall also project the Contractors requirements for Metro-North protective personnel, track and power outages to complete each activity. Requests made on the four week look-ahead for future protective personnel, track outages and power outages must be made in accordance with the contract terms and conditions.

C. Metro-North will not schedule protective personnel, track outages, Railroad power outages nor will the Contractor be allowed to work on activities that do not have approval on all submittals required for performance of the work.

D. Costs incurred by the Contractor for work stoppage or negative schedule impacts from a failure to abide by these requirements shall be borne by the Contractor.

1.03 RAILROAD PROTECTIVE PERSONNEL

A. General:

1. The Contractor is advised that during the course of the work Railroad protective personnel (Flagmen, Pilots and Groundmen) and track outages may be required.

a. Metro-North will furnish the services of all protective personnel as required by Metro-North to protect the operation and safety of train traffic and construction throughout the duration of this Contract. The

requirement for protective personnel will be at the sole discretion of Metro-North.

b. If the Contractor fails to notify Metro-North of a request for protective personnel in accordance with the Contract Article 1.22, the availability of protective personnel cannot be assured.

c. Cancellation of requests for protective personnel shall be received by Metro-North a minimum of ninety-six (96) hours prior to the scheduled work. Failure to notify Metro-North of work cancellation prior to this deadline shall result in the Contractor bearing all costs for protective personnel and related Metro-North costs (see Contract Article 1.22.H Protective Personnel).

d. If protective personnel are scheduled to work and no work is performed by the Contractor, the costs for the protective personnel and related Metro-North costs shall be borne by the Contractor. No charges will be incurred by the Contractor for scheduled protective personnel unable to work due to cancellation of the work for reasons beyond the Contractor's control such as inclement weather or Metro-North emergency.

e. The Contractor shall reimburse Metro-North for the above-noted charges within a reasonable time as determined by Metro-North. Failure to reimburse Metro-North will result in deduction of the charges from any moneys due the Contractor under this or any other contract with Metro-North or its affiliates.

f. The presence of a Metro-North Flagger (if any) shall not relieve the Contractor of responsibility for taking all proper precautions, especially in the vicinity of tracks and high voltage electrical circuits.

B. In the event of emergencies, the Contractor shall immediately do the necessary work, as directed by Metro-North, to restore the operation to a safe condition, and upon failure of the Contractor to implement the Engineer's orders immediately, Metro-North, at the expense of the Contractor may take whatever steps it deems necessary to restore the operation to a safe condition. In the event of an emergency creating danger to life or property at or near the site of the work, Metro-North may do anything necessary to alleviate such an emergency situation, including performing work, or directing another contractor to perform work. (See Contract Article 1.22.F Emergency Operations.)

C. The Contractor is notified that only one (1) conductor flagman shall be provided per station as required by Metro-North.

1.04 TRACK AND POWER OUTAGES

A. **Continuous track outages**: There will be **no** continuous track outages.

B. **Single track outage**:
   1. Weeknight (Monday – Thursday) – 12:30 AM to 4:30 AM
   2. Weekend Night (Friday – Sunday) – 12:30 AM to 4:30 AM (availability solely based upon no other conflicting events or programs – e.g. Yankee Games)

C. **Double Track Outage**:
   1. Weeknight or Weekend night – 12:30 AM to 4:30 AM assume 30-minute continuous foul-time windows every hour for a double track outage (availability solely based upon no other conflicting events or programs – e.g. Yankee Games)

Construction Operation	Outage
Installation of elevator tower in the parking lot adjacent to Main Line Track 2	Main Line Track 2 Single track outage
Other activities which may foul the track adjacent to the work location	Main Line Track 1 Single track outage or Main Line Track 2 Single track outage

D. Contractor shall dedicate the first half hour and last half hour of each outage period as defined by the track outage schedule for Metro-North to de-energize and re-energize the third rail system.

E. The Contractor is notified that certain construction operations may require obtaining a track outage from the Railroad. The Contractor shall assume that any and all operations which foul an adjacent live track may require a track outage. Fouling of the track is defined in the Contract Article 1.22.B Protection of Metro-North.

   1. A track outage shall constitute the removal of a track or traction power systems from service by the Railroad.

   2. The durations listed in the track outage schedule indicate the time track shall be removed from service and the time track shall be returned to service. The schedule is not inclusive of Contractor's actual working time on track. The primary goal of Metro-North is the safe operation of trains, therefore certain locations on the system may not be available for a normal Contractor 8 hour actual working time on track.

F. General:

   1. All requests for short term track outages must be submitted to the Engineer in writing no later than fourteen (14) days prior to the outage.

a. Track outages that require Metro-North to provide bussing to customers require the Contractor to provide all applicable outage requests and approved submittals a minimum or three weeks prior to scheduled work.

2. The written request shall include, as an attachment, a "four week look ahead schedule," in the required format, showing for each day, the requested outages (track/power), request for Metro-North flagman/pilot, an approved work plan detailing activities to be performed and hours of work at each location whether requiring an outage or not and hours of use or movement of all rail mounted equipment.

3. Restrictions on Track Outages

a. Off peak Track outages will be subject to holiday restrictions in accordance with Contract Article 1.22.I Holiday Restrictions.

b. At all times Contractor shall be prepared to immediately discontinue her or his operations and return the track for Railroad operations, when directed by the Engineer.

c. Any and all requests for traction power shut-offs shall be submitted concurrently with requests for track outages.

d. The Contractor is advised that the work site is an operating railroad and she or he shall be required to coordinate all of her or his operations with those of Metro-North and other (3rd Party) Metro-North Projects.

e. The use of on-track equipment is not permitted with Foul Time.

G. The Contractor shall, prior to obtaining track usage, make all preparations for on track work in an effort to maximize the Contractor's use of the track. Failure to do so may result in the costs for any ineffective use of railroad protective services to be borne by the Contractor.

H. The Contractor shall dedicate sufficient time in each period to restore the track to a fully operational mode, as determined by the Engineer. The Contractor shall also be responsible for any additional time and action required to return track to acceptable use from impact of Contractor operation.

1. Restoration of track to fully operational mode is subject to inspection of the Metro-North Track, Signal and Power Department personnel.

1.05 USE OF RAIL MOUNTED EQUIPMENT

A. The Contractor is advised that contract work may require use of rail mounted equipment in the performance of the Work. No Railroad owned equipment will be made available for use by the Contractor.

B. All equipment shall be inspected and approved by the Railroad prior to its use on Railroad property. Equipment shall be inspected at Metro-North's yard at 353 Parkway Homes Road North White Plains, New York, or at another site to be designated by the Railroad.

1. The Contractor shall submit an equipment-inspection request to Metro-North a minimum of two (2) weeks prior to the anticipated inspection date. The Contractor shall coordinate with Metro-North to determine time and location for equipment inspection.

2. The Contractor shall include, along with the inspection request, a copy of Metro-North Hi-Rail Inspection Form with pertinent information filled out. Contractor shall provide the original form on the date of inspection.

3. The Contractor shall have an operator present at the time of inspection.

4. Hi-Rail equipment shall be inspected prior to work and must be re-inspected every 3 months.

5. Re-inspection and approval will be required for any Hi-Rail equipment that has been altered, repaired or has left Metro-North property.

C. Prior to daily operation of rail mounted equipment the operator is responsible to conduct a daily safety and equipment inspection of the vehicle. Inspection shall be documented on the provided "Contractor Daily Hi-Rail Vehicle Inspection" form and submitted monthly for each vehicle while equipment is in use.

D. Contractor's Safety Engineer or Competent Person will lead a Hi-Rail Job Safety Briefing with all operators of rail mounted equipment. The safety briefing will be documented on the provided "Contractor Daily Hi-Rail Job Safety Briefing."

E. All Contractor rail mounted equipment operators shall be trained in the operation of the vehicle and the vehicle's rail gear. The Contractor shall submit to the Engineer the qualified operator's credentials including:

1. Commercial Driver's License

2. Previous experience working with rail mounted equipment (list railroads with experience, dates of work and type of rail mounted equipment operated).

3. Documented training in use of each piece of rail mounted equipment. This training to be provided by "in-house mechanic" for owned equipment or equipment rental vendor for rented equipment.

F. Access for Hi-rail vehicles shall take place from locations noted or other location as approved by Metro-North.

G. The Railroad will provide a pilot (conductor flag) to accompany each piece of rail mounted equipment to, from, and at the work locations. Arrangements to order,

cancellation of, and all other requirements for a pilot are the same as for conductor flags.

H. The Contractor is restricted from traveling through self-guarded frogs and switch point guards at no more than 1 MPH.

I. Metro-North Contractor's Hi-Rail Inspection and Vehicle/Equipment Requirements:

1. Prior to scheduling an inspection, all Contractors shall perform a pre-inspection on the vehicle/equipment. Failures will result in re-scheduling at the next available opening.

2. Contractor shall provide a copy of the Hi-Rail Manufacturer's specifications Front and Rear, including model numbers, guide wheel gage measurement, guide wheel and flange specifications and guide wheel load shall be provided. Failure to provide manufacturer's specifications will result in the equipment not being inspected.

3. The guide wheel gage shall be to manufacturer's specifications.

4. Tram measurement (diagonal measurement from center of front left guide wheel to center of rear right guide wheel vs. diagonal measurement from center of front right guide wheel to center of rear left guide wheel) shall not exceed 1/4 inch.

5. Guide Wheel Load shall be within manufacturer's specifications.

6. Wheel bearings and wheel seals shall be in satisfactory condition and greased.

7. Guide wheel and flanges shall be within manufacturer's specifications.

8. Rail brake components (brake shoes and rigging) shall be complete and in working order.

9. Steering lock shall be installed to prevent steering from turning.

10. Hydraulic cylinders and pump shall be in working order.

11. Hydraulic hoses and fittings shall be in satisfactory condition and no leaks.

12. Control levers shall be installed and in satisfactory condition.

13. Lifting handle for manual Hi-Rails shall be on board if applicable.

14. Rail sweeps when provided by manufacturer, shall be in working order.

15. Lock pins or acceptable means of preventing Hi-Rail cylinders from drifting shall be installed.

16. All lights (headlights, brake lights, travel lights, turn signals, marking lights, backup lights, work lights, flashers, strobe lights with 360° visibility), shall be operational. When operating on rails, with the vehicle/machine in the forward travel position, the headlights, travel and brake lights shall operate as normal. When traveling on rails in the reverse position, additional headlights, travel and brake lights shall be installed in the opposite orientation. Lighting circuit operation shall be such that when traveling forward on rails, only the front headlights and rear travel/brake lights are operational. When traveling in reverse on rails, only the rear headlights and front travel/brake lights operate.

17. All horns, change of direction and backup alarms shall be operational.

18. Suspension components shall be in satisfactory condition.

19. Tires shall be in satisfactory condition and air pressure checked. (Tire pressure affects traction and braking on Hi-Rail).

20. Booms and rotating upper structures shall have a boom cradle and/or pivot lock.

21. Tow tab(s) with a 1-1/8 inch hole and tethered pin shall be installed front and/or rear at 14 inches above rail when on Hi-Rail.

22. Rail clamps shall be installed when working from the side of a vehicle/machine, (i.e. lifting booms, rotary dumps, etc.) Exemptions for equipment with counterweights, suspension locks and manufactures approval shall be granted.

23. There shall be no fluid leaks.

24. 3rd rail clearance: Vehicle\equipment and components (i.e. steps, brackets, tool boxes), shall not extend beyond 24 inches measured from the inside of ball of rail, at a height below 10-7/8 inches, measured from the top of rail (see 3rd rail clearance diagram).

25. A First Aid kit, Flagging kit and Fire Extinguisher with a current inspection date shall be readily accessible.

26. Clearance for self-guarded frogs shall be a minimum of 2-3/4 inches above rail on all under carriage components.

27. Outriggers shall clear 3rd rail, electrical boxes, platforms, switch controls, etc. and secured to prevent drifting.

28. Max height shall not exceed 14 feet and 10 inches while traveling on rails in accordance with Metro-North Park Ave Tunnel diagram.

29. Max width shall not exceed 10 feet and 6 inches while traveling on rails in accordance with Metro-North Park Ave Tunnel diagram.

30. All components that are capable of drifting, swinging, opening, etc. (i.e. booms, jibs, outriggers, tool box doors, engine covers, etc.) shall be secured appropriately before traveling on rails.

J. Metro-North and Contractor's Push Cart Inspection

1. A declaration of intended use, listing all equipment/cargo that is to be transported, must be supplied at time of inspection.

2. The guide wheel gage shall be to manufacturer's specifications.

3. Tram measurement (diagonal measurement from center of front left guide wheel to center of rear right guide wheel vs. diagonal measurement from center of front right guide wheel to center of rear left guide wheel) shall not exceed 1/4 inch.

4. Wheel bearings and wheel seals shall be in satisfactory condition and greased.

5. Guide wheel and flanges shall be within manufacturer's specifications and be of Association of American Railroads profile.

6. Carts must have at least 1-foot tall lettering to identify carts maximum length, width, tare weight and gross weight.

7. All carts must have parking / emergency brakes that deploy with a lack of energy source (i.e. hydraulic / pneumatic pressure).

8. All carts with a rated capacity of 5,000 lbs. and above shall have service brakes with connections on both ends of the cart.

9. All carts with a rated capacity of 5,000 lbs. and under shall have a secondary means of securement to the tow vehicle in addition to the tow bar (i.e. safety chain with spring loaded safety hasps).

10. Rail brake components (brake shoes and rigging) shall be complete and in working order.

11. Hydraulic hoses and fittings shall be in satisfactory condition and exhibit no leaks.

12. Any equipment loaded on cart that has a boom and/or rotating upper structure must have boom cradle and/or pivot lock.

13. Rail clamps shall be installed when working from the side of a cart with machinery (i.e. lifting booms, excavators, etc.).

14. Tow tab(s) with a 1-3/16 inch hole and secure tethered pin shall be installed front and/or rear at approximately 14 inches above rail when on Hi-Rail. If pintle receiver is used, a toe tab adaptor plate must be supplied.

15. There shall be no fluid leaks.

16. 3rd rail clearance: Cart and components (i.e. machinery, steps, brackets, tool boxes) shall not extend beyond 24 inches measured from the inside of ball of rail, at a height below 10-7/8 inches, measured from the top of rail.

17. Cart and components (i.e. machinery, steps, brackets, tool boxes), shall not extend beyond the Metro-North Park Ave Tunnel.

18. Cart and components (i.e. machinery, steps, brackets, tool boxes), shall not extend beyond the Metro North Minimum.

19. Clearance for self-guarded frogs shall be a minimum of 2-3/4 inches above rail on all under carriage components.

20. All components of the cart and any loaded cargo must clear the 3rd rail, electrical boxes, platforms, switch controls, etc. and be secured to prevent drifting.

21. All components that are capable of drifting, swinging, opening, etc. (i.e. booms, jibs, outriggers, tool box doors, engine covers, etc.) shall be secured appropriately before traveling on rails.

22. Cart shall meet on track testing requirements up to and including 22 degrees of curvature.

K. Final approval of items not covered in this part that may be considered questionable, unsafe or cause any danger, shall be at the inspectors discretion.

L. The Contractor is advised that Metro-North may elect to have each two pieces of Hi-Rail equipment coupled together with tow bars for transport to the work location. Each piece of equipment shall have a driver/operator.

M. An emergency spill kit shall be readily accessible and be able to be deployed quickly in the event of a spill.

N. Refer also to FRA 49CFR214.503 to .533 for rules as they apply to Roadway Maintenance Machines and Hi-Rail Vehicles.

1.06 REQUIREMENTS FOR WORK NEAR ENERGIZED EQUIPMENT

A. All work by the Contractor or her or his Subcontractors near “energized” equipment must be performed under the supervision of Metro-North’s Power Department.

B. The Contractor shall submit written request to the Engineer fourteen (14) calendar days prior to the start of her or his work near energized equipment.

C. Third Rail Requirements:

1. Metro-North's third rail traction power system can be de-energized if, in the opinion of the Engineer, the Contractors work dictates such an outage. Generally, those operations that require the Contractor to place equipment or perform work on or immediately adjacent to the track will require an outage.

2. Contractor shall submit requests to de-energize the third rail in concurrence with requests for track outages.

3. Contractor shall designate the first half hour and last half hour of each track outage period for Metro-North to de-energize and re-energize the third rail system.

1.07 REQUIREMENTS FOR WORK NEAR OVERHEAD WIRES

A. All work by the Contractor while occupying track, adjacent to the track and work with equipment that has the extended reach to foul or enter a distance 10 feet from overhead wires and electrical apparatus is subject to the approval and supervision of a Metro-North Class A Power Department employee.

B. The Contractor shall organize and coordinate outages for all utility company owned overhead wires. Utility company outages will be required if Contractor employees, equipment or material will enter within 15 feet of utility company overhead wires.

C. The Contractor shall submit requests for overhead wire outages and for other Metro-North Class A support as outlined in this section in concurrence with track outage requests or otherwise, if no track outage is required, fourteen (14) calendar days prior to the work commencing.

D. Overhead power will be required to be de-energized at the discretion of a Metro-North Class A Power Department employee in the event that:

1. Unqualified Contractor employees need to work or enter within, by extended reach, 10 feet of any overhead wires or electrical apparatus.

2. Contractor equipment and material may enter within 10 feet or foul overhead wires or electrical apparatus.

3. A Metro-North Blue Tag Qualified Contractor lineman needs to work or enter within, by extended reach, 3 feet of overhead wires or electrical apparatus.

E. Contractor employees who are qualified as Journeyman Lineman are required to attend Metro-North Contractor Linemen Orientation Training provided that documentation supporting the employee's qualifications are provided along with the Contractors protective procedures. Upon completion of the orientation the employee will receive a numbered "Blue Tag" identifying the employee as qualified and is to be visible while the employee is working as a lineman.

F. The following procedures are to be followed in the event an outage is required:

1. Contractor shall note requirements for outages on the four week look ahead and work plans.

2. Prior to beginning work the Contractor's employees and Metro-North support personnel shall review work for the shift during the job safety briefing. Discuss needs for trolley and side power outages as well as required length of work zone for placement of ground cables.

3. Once the overhead wires are de-energized, tested and grounded to enclose the Contractors work area the Contractor's representative must sign Metro-North Clearance Form MP260 to indicate that the Contractor Representative has been instructed and will confine Contractor work within the limits outlined to her or him by Metro-North. Contractor shall not begin work under the outage until clearance to do so is provided.

4. Contractor shall understand that there may be adjacent energized wires near the work area and that the proper safe clearances to those energized wires must be maintained.

5. Contractor, at their own option, may choose to place their own ground cables inside of the Metro-North applied grounds.

6. Contractor shall notify Metro-North when work is complete, Contractor grounds are removed and all personnel are clear. Contractor Representative shall sign Metro-North Clearance Form MP260 indicating that she or he has been advised that the wires will be energized and all her or his forces shall remain at a safe distance from the wires.

G. In the event of a conflict, the Contractor shall comply with all current Metro-North Power Department requirements as those requirements shall supersede the requirements set forth in this specification.

H. The Contractor shall designate the first hour and last hour of a catenary system outage for Metro-North to de-energize and re-energize the system for operation.

1.08 REQUIREMENTS FOR WORK PLANS

A. Contractor shall submit for approval detailed work plans pertaining to work being performed on or about the right of way. Work plans shall be specific to location or task being performed. Contents of work plans shall include:

1. Description of work to be performed

2. Detailed means and methods in which work will be performed

3. Contractor shall specify how any uncompleted work will be secured at the end of the shift

4. List of equipment that will be utilized to complete the work

5. Contractor's crew size and number of work crews required to perform the task.
6. Access location(s) to the work site
7. Time requirements for work to be performed
8. Track usage requirements
9. Power outage requirements
10. Safe Work Plan number and submittal number
11. Rigging Plan submittal number
12. Scaffolding plan submittal number
13. Shoring plan submittal number
14. Fall Protection plan submittal number

B. The Contractors method of performing work specified in this section shall first be submitted to the Engineer for approval and may not be performed without such approval. The approval of the Engineer shall not release the Contractor from any of its obligations under this Contract.

1.09 REQUIREMENTS FOR ENGINEERED ERECTION, DEMOLITION, OR OTHER RIGGING

A. Comply with requirements provided in Contract Article 1.22.C Requirements for Erection, Demolition, or Other Rigging Operations Over or Adjacent to Metro-North Right-of-Way.

1. Provide, for approval by the Engineer, all information listed under Contract Article 1.22 and checklist (found in Section 2.02 of this Specification) in a comprehensive submittal for each rigging operation.

    a. Prior to commencement of work Contractor shall ensure adequate location of all underground public, private and Metro-North utilities.

1.10 REQUIREMENTS FOR ENGINEERED SHEETING AND SHORING

A. Comply with requirements provided in Contract Article 1.22.D Requirements for Sheeting for sheeting requirements for excavations within the Railroad live load influence line. All other excavations outside the Railroad influence line shall comply with requirements set forth under Specification Section 01 33 60 Safety, Health & Environmental Control.

1. Provide, for approval by the Engineer, all information required under the above referenced Contract Article 1.22 and checklist (found in Section 2.03 of this

Specification) in a comprehensive submittal prepared by a Professional Engineer (PE) licensed in the state that the work is being performed in for each location requiring shoring.

a. Submittal shall include distances of excavation from edge of tie, excavation size and depth.

b. Prior to commencement of work Contractor shall ensure adequate location of all underground public, private and Metro-North utilities.

1.11 REQUIREMENTS FOR SCAFFOLDING

A. Comply with requirements in Contract Article 1.22.E Requirements for Scaffolding as well as Specification Section 01 33 60 Safety, Health & Environmental Control for all scaffolds constructed.

1. Provide, for approval by the Engineer, all information required under the above referenced Contract Article 1.22, Specification Section 01 33 60, and checklist (found in Section 2.04 of this Specification) in a comprehensive submittal for each location requiring erection of scaffolds.

1.12 REQUIREMENTS FOR ENGINEERED FALL PROTECTION PLANS

A. Comply with requirements in Specification Section 01 33 60 Safety, Health & Environmental Control for site specific fall protection plans.

B. Provide, for approval by the Engineer, a fall protection plan prepared by a PE licensed in the state that the work is being performed in and checklist when anchorages, vertical and horizontal lifelines are to be used.

1. Engineered fall protection plans shall include location specific details, product data and calculations showing compliance with OSHA regulations.

1.13 REQUIREMENTS FOR TRACK AND CLEARANCE MONITORING

A. Comply with requirements in Contract Article 1.22.B Protection of Metro-North for track and clearance monitoring requirements.

1. Survey data for track monitoring before, during and after excavations within the railroad live load influence line shall be obtained at a distance at 25-foot centers as follows:

a. From the top of both running rails on each affected track for monitoring of vertical alignment.

b. From the centerline of each affected track for monitoring of horizontal alignment.

2. Survey data for track clearance monitoring before, during and after erection of new permanent or temporary structures above or adjacent to track(s) shall be obtained at 25-foot centers as follows:

    a. From the top of both running rails on each affected track to the structure for monitoring of vertical clearance.

    b. From the centerline of each affected track to the structure for monitoring of horizontal clearance.

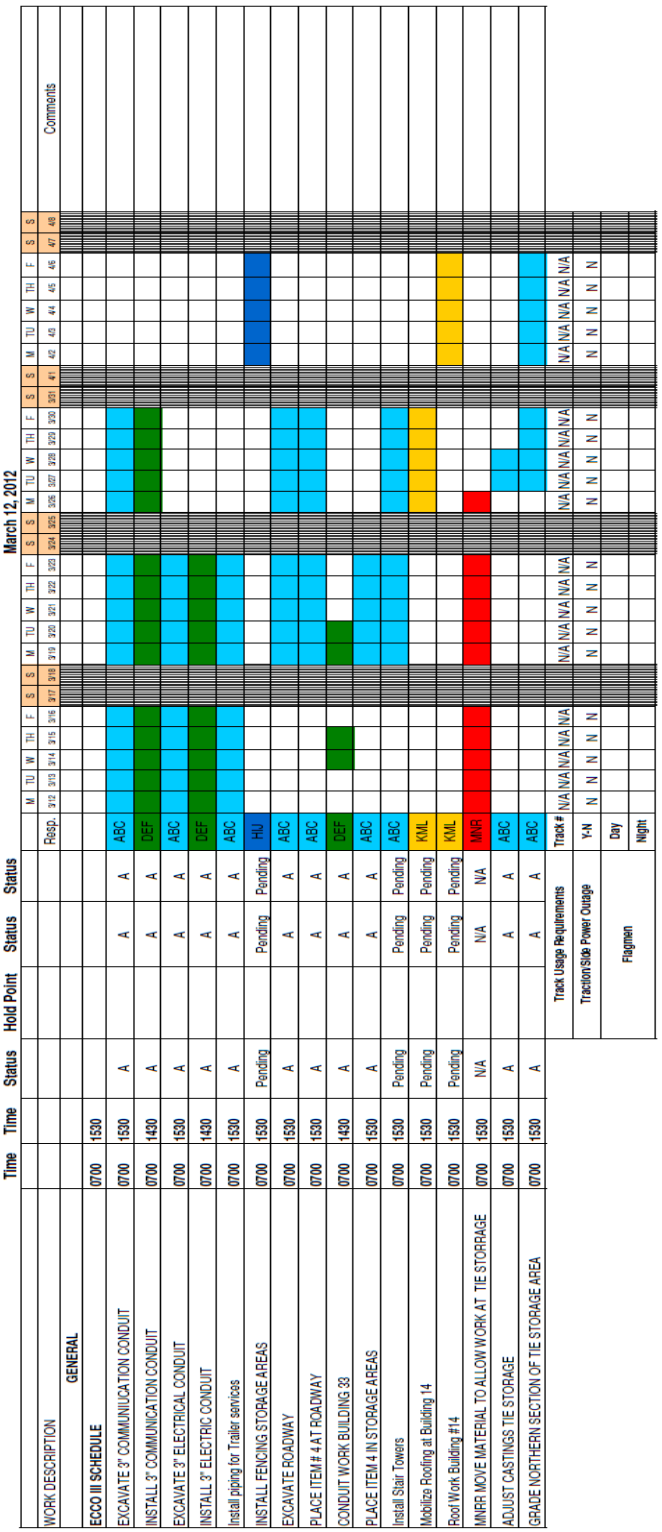
1.14 REQUIREMENTS FOR DISABLING OF EQUIPMENT

A. Contractor shall submit for approval a detailed plan for disabling of equipment stored on Metro-North property. Equipment shall be disabled in a unique manner that it may not be operated or relocated by any personnel not employed by the Contractor.

PART 2 DELIVERABLES

2.01 FOUR WEEK LOOK-AHEAD

A. Metro-North Railroad four week look-ahead sample format:



CONTRACTOR NAME - Contract # XXXXX PROJECT NAME

March 12, 2012

WORK DESCRIPTION	Start Time	Finish Time	Submittal Status	Inspection Hold Point	Work Plan Status	SWP Status	Resp.	M 3/12	TU 3/13	W 3/14	TH 3/15	F 3/16	S 3/17	S 3/18	M 3/19	TU 3/20	W 3/21	TH 3/22	F 3/23	S 3/24	S 3/25	M 3/26	TU 3/27	W 3/28	TH 3/29	F 3/30	S 3/31	S 4/1	M 4/2	TU 4/3	W 4/4	TH 4/5	F 4/6	S 4/7	S 4/8	Comments
GENERAL																																		
ECCO III SCHEDULE	0700	1530																																
EXCAVATE 3" COMMUNICATION CONDUIT	0700	1530	A		A	A	ABC																											
INSTALL 3" COMMUNICATION CONDUIT	0700	1430	A		A	A	DEF																											
EXCAVATE 3" ELECTRICAL CONDUIT	0700	1530	A		A	A	ABC																											
INSTALL 3" ELECTRIC CONDUIT	0700	1430	A		A	A	DEF																											
Install piping for Trailer services	0700	1530	A		A	A	ABC																											
INSTALL FENCING STORAGE AREAS	0700	1530	Pending		Pending	Pending	HIJ																											
EXCAVATE ROADWAY	0700	1530	A		A	A	ABC																											
PLACE ITEM # 4 AT ROADWAY	0700	1530	A		A	A	ABC																											
CONDUIT WORK BUILDING 38	0700	1430	A		A	A	DEF																											
PLACE ITEM 4 IN STORAGE AREAS	0700	1530	A		A	A	ABC																											
Install Stair Towers	0700	1530	Pending		Pending	Pending	ABC																											
Mobilize Roofing at Building 14	0700	1530	Pending		Pending	Pending	KML																											
Roof Work Building #14	0700	1530	Pending		Pending	Pending	KML																											
MINRR MOVE MATERIAL TO ALLOW WORK AT TIE STORAGE	0700	1530	N/A		N/A	N/A	MNR																											
ADJUST CASTINGS TIE STORAGE	0700	1530	A		A	A	ABC																											
GRADE NORTHERN SECTION OF TIE STORAGE AREA	0700	1530	A		A	A	ABC																											
Track Usage Requirements							Track #	N/A	N/A	N/A	N/A	N/A			N/A	N/A	N/A	N/A	N/A			N/A	N/A	N/A	N/A	N/A			N/A	N/A	N/A	N/A	N/A	
Traction/Side Power Outage							Y-N	N	N	N	N	N			N	N	N	N	N			N	N	N	N	N			N	N	N	N	N	
Flagmen							Day																											
							Night																											

A - APPROVED, S - SUBMITTED

Inspection Hold Point: Time allowed for special inspections or contract work (IE rebar or concrete inspections). Time allowed for MN inspection of work that affects the safe operation of the Railroad.

2.02 RAIL MOUNTED EQUIPMENT

A. Metro-North Railroad Quarterly Contractors Machine & Hi-Rail Gear Inspection form:

SECTION 01 11 01
CONTRACTOR REQUIREMENTS FOR WORK AFFECTING THE RAILROAD

METRO-NORTH RAILROAD QUARTERLY
CONTRACTORS VEHICLE/MACHINE AND HI-RAIL GEAR INSPECTION

11/12/2018

PROJECT MANAGER WORK ORDER # ____ ____ ____ ____ ____ MNR WO# ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

UNIT / PLATE #:_____ DATE: _____

MACHINE NAME:_____ VEHICLE MAKE/MODEL: _____

CONTRACTOR NAME:_____ HI-RAIL MANUFACTURER: _____

LOCATION:_____ LAST DATE INSPECTED: _____

MNR PROJECT MANAGER:_____PHONE_____ EMAIL: _____ FAX:_____

HI-RAIL GEAR INFORMATION & MEASUREMENTS			
	MODEL#	GUIDE WHEEL GUAGE (INCHES)	TRAM (INCHES) / MUST BE WITHIN 1/4"
		MANUFACTURERS SPECS / ACTUAL MEASUREMENT	
FRONT:	_____	_____ / _____	LEFT FRONT TO RIGHT REAR: _____
REAR:	_____	_____ / _____	RIGHT FRONT TO LEFT REAR: _____
			DIFFERENCE: _____

HI-RAIL CHECKLIST	N/A	PASS	FAIL	REPAIRED
1) WHEEL BRGS & SEALS	___	___	___	___
2) RAIL WHEELS	___	___	___	___
3) RAIL WHEEL FLANGES	___	___	___	___
4) RAIL BRAKES & RIGGING	___	___	___	___
5) GUIDE WHEEL LOAD	___	___	___	___
6) STEERING LOCK	___	___	___	___
7) HYD. CYLINDERS & PUMP	___	___	___	___
8) HYD HOSES & FITTINGS	___	___	___	___
9) CONTROL LEVERS	___	___	___	___
10) LIFTING HANDLE	___	___	___	___
11) RAIL SWEEPS	___	___	___	___
12) LOCK PINS AND/OR CYLINDER DRIFT LOCK(S)	___	___	___	___

VEHICLE CHECKLIST	N/A	PASS	FAIL	REPAIRED
13) TRAVEL LIGHTS F/R	___	___	___	___
14) STOP / TAIL LIGHTS F/R	___	___	___	___
15) HEADLIGHTS F/R	___	___	___	___
16) STROBE LIGHT(S) 360^	___	___	___	___
17) BACKUP ALARM	___	___	___	___
18) REVERSE LIGHTS	___	___	___	___
19) HORN(S)	___	___	___	___
20) SUSPENSION PARTS	___	___	___	___
21) TIRES/AIR PRESSURE	___	___	___	___
22) BOOM LOCK / CRADLE	___	___	___	___
23) TOW TAB(S)	___	___	___	___
24) RAIL CLAMPS	___	___	___	___
25) LEAKS	___	___	___	___

VEHICLE CHECKLIST	N/A	PASS	FAIL	REPAIRED
26) FIRST AID KIT	___	___	___	___
27) FLAGGING KIT	___	___	___	___
28) FIRE EXTINGUISHER: WITHIN INSPECTION DATE	___	___	___	___
29) 3RD RAIL CLEARANCE:	___	___	___	___
30) SELF GUARDED FROG CLEARANCE: MIN 2-3/4"	___	___	___	___
31) OUTRIGGER TO 3RD RAIL CLEARANCE	___	___	___	___
32) OVERALL HEIGHT: MAX ON HYRAIL: 14FT. 10IN.	Ft. ___		In. ___	
33) OVERALL WIDTH: MAX: 10FT. 6IN.	Ft. ___		In. ___	

PASSED INSPECTION: _____ **FAILED INSPECTION: _____** **DEFICIENCES CORRECTED:_____**

COMMENTS: _____

_____

_____

RESTRICTIONS:_____

*** This equipment complies with Metro North's standards as noted in above referenced items only, and clearance measurements are for travel to and from work location. The use of this equipment by Contractors, State Inspectors, or Metro North employees must follow all Metro North regulations and procedures unless other written procedures have been approved by Metro North.**

INSPECTED BY:_____ EMP#_____ DATE: _____

CONTRACTOR/ OPERATOR:_____ DATE: _____

INSPECTION REPORT REVIEWED BY:_____ EMP#_____ DATE: _____

COPIES: ORIGINAL- NWP SHOP, COPY- CONTRACTOR, COPY- PROJECT MANAGER APPROVAL/STICKER # : _____

SECTION 01 11 01
CONTRACTOR REQUIREMENTS FOR WORK AFFECTING THE RAILROAD

METRO-NORTH RR AND CONTRACTORS HI-RAIL INSPECTION and VEHICLE/EQUIPMENT REQUIREMENTS 8/4/2017

PRIOR TO SCHEDULING AN INSPECTION, ALL CONTRACTORS SHALL PERFORM A **PRE-INSPECTION** ON THEIR VEHICLE/EQUIPMENT. FAILURES WILL RESULT IN RE-SCHEDULING AT THE NEXT AVAILABLE OPENING.

THE FOLLOWING SHALL BE ADHERED TO:

A copy of the HI-rail Manufacturer's specifications Front and Rear, including model numbers, guide wheel gage measurement, guide wheel and flange specifications and guide wheel load shall be provided. FRA quote: The employer shall use the manufacturer's specifications that will insure the hi-rail can be operated in a safe manner. If there are no criteria provided to measure the tram (alignment), wheel wear, and gage on a hi-rail vehicle, then the inspection would not be in compliance with this section.

1) The guide wheel gage shall be to manufacturer's specifications.
2) Tram measurement (Diagonal measurement from center of front left guide wheel to center of rear right guide wheel vs. diagonal measurement from center of front right guide wheel to center of rear left guide wheel) **shall not exceed ¼ inch.**
3) Guide Wheel Load shall be within manufacturer's specifications.
4) Wheel bearings and wheel seals shall be in satisfactory condition and greased.
5) Guide wheel and flanges shall be within manufacturer's specifications.
6) Rail brake components (brake shoes and rigging) shall be complete and in working order.
7) Steering lock shall be installed to prevent steering from turning.
8) Hydraulic cylinders and pump shall be in working order.
9) Hydraulic hoses and fittings shall be in satisfactory condition and no leaks.
10) Control levers shall be installed and in satisfactory condition.
11) Lifting handle for manual hi-rails shall be on board if applicable.
12) Rail sweeps when provided by manufacturer, shall be in working order.
13) Lock pins or acceptable means of preventing hi-rail cylinders from drifting shall be installed.
14) All lights, (Headlights, brake lights, travel lights, turn signals, marking lights, backup lights, work lights, flashers, strobe lights with 360° visibility), shall be operational. When operating on rails, with the vehicle/machine in the forward travel position, the headlights, travel and brake lights shall operate as normal. When traveling on rails in the reverse position, additional headlights, travel and brake lights shall be installed in the opposite orientation. Lighting circuit operation shall be such that when traveling forward on rails, only the front headlights and rear travel/brake lights are operational. When traveling in reverse on rails, only the rear headlights and front travel/brake lights operate.
15) All horns, change of direction and backup alarms shall be operational.
16) Suspension components shall be in satisfactory condition.
17) Tires shall be in satisfactory condition and air pressure checked. (Tire pressure affects traction and braking on hi-rail).
18) Booms and rotating upper structures shall have a boom cradle and/or pivot lock.
19) Tow tab(s) with a 1-3/16 inch hole and secure tethered pin shall be installed front and/or rear at approximately 14 in. above rail when on hi-rail.
20) Rail clamps shall be installed when working from the side of a vehicle/machine, (i.e. lifting booms, rotary dumps, etc.) Exemptions for equipment with counterweights, suspension locks and manufactures approval shall be granted.
21) There shall be no fluid leaks.
22) 3rd rail clearance: Vehicle\equipment and components (i.e. steps, brackets, tool boxes), shall not extend beyond **24 inches measured from the inside of ball of rail, at a height below 10-7/8 inches, measured from the top of rail. (See 3rd rail clearance diagram).**
23) A First Aid kit and Fire Extinguisher with a current inspection date shall be readily accessible.
24) Flagging kit shall be readily accessible including- 2 safety flags (18"x18" red flag with 18" long handle), 2 flashlights with magnets (2-D size batteries installed, 4 extra D size alkaline batteries (Ray-O-Vac or equivalent), 12 (15 minute) safety flares.
25) Clearance for self-guarded frogs shall be a minimum of **2-3/4 inches** above rail on all under carriage components.
26) Outriggers shall clear 3rd rail, electrical boxes, platforms, switch controls, etc. and secured to prevent drifting.
27) Max height shall not exceed **14ft.10in.** while traveling on rails in accordance with Metro North Park Ave Tunnel diagram.
28) Max width shall not exceed **10 ft. 6in.** while traveling on rails in accordance with Metro North Park Ave Tunnel diagram.
29) All components that are capable of drifting, swinging, opening, etc. (i.e. booms, jibs, outriggers, tool box doors, engine covers, etc.) shall be secured appropriately before traveling on rails.
30) Vehicles shall meet on track testing requirements up to and including 22 degree of curvature. **All** rubber traction tires must maintain continuous contact with the ball of the rail throughout the duration of testing curve negotiation.

Final approval of items not covered on this list that may be considered questionable, unsafe or cause any danger, shall be at the inspector's discretion . Please reference attached **49CFR214.503** to **.533** for rules as they apply to Roadway Maintenance Machines (RMM's) and Hi-rail Vehicles. ***Please be aware that the above mentioned adherences may exceed 49CFR214.503 to .533 as dictated by Metro North Railroad. METRO NORTH RESTRICTS TRAVEL THRU SELF GUARDED FROGS and SWITHCH POINT GUARDS AT NO MORE THAN 1 MPH.**

B. Metro-North Contractor Daily Hi-Rail Inspection form:

Metro-North Railroad

CONTRACTOR DAILY HI-RAIL VEHICLE INSPECTION

Project Name:	✓= Satisfactory R =Unsatisfactory, Repairs Needed X=Not Applicable
Contractor/ Company Name:	Vehicle's Hi-Rail Gear to be Locked and Railed During Inspection
Truck/ Vehicle No.:	
MNR MOW Vehicle Inspection Date: / **Exp. Date**	
Date of Inspection Month : / **Year:**	

Operator
I have performed the daily inspection for this vehicle and noted no defects. Any Corrective Action made were to ensure the vehicle is in safe operating condition. Page 2 of 2 List Corrective Actions

Day	Print Name of Driver/Operator	Contractor RW I.D. No.:	Operator Qualifications (CDL & Operator Training)	Brake Test, Hand Brk Test, Pkg Break Test	Steering Mech. (Locked)	Lighting System(s)	Tire Pressure, Wheels & Rims	Vehicle Loading (check if over under load)	Hydraulic Hoses & Equipment	Fuel, Oil & Coolant	Coupling Device	Horn, Mirrors, wipers	O & M Manual for Vehicle & Hi-Rail Gear	Crane, Aerial Device etc.	Hi-Rail Gear: Front & Rear : Secured & Locked	Rail Clamps (used for off loading/side dumping)	Method of Communication in Place	Seat Belts and designated seating for others	Emergency Equipment: Fire Extinguisher, Eye Wash, First Aid kit, Spill Kit
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			
20																			
21																			
22																			
23																			
24																			
25																			
26																			
27																			
28																			
29																			
30																			
31																			

✓ = Satisfactory R =Unsatisfactory, Repairs Needed X=Not Applicable

NOTES:

1. This Form is to Stay with this Vehicle While on MNR Property.
2. Pre Inspect Vehicle of Non Hy-Rail Gear Prior to Getting on Rails
3. Vehicle Inspection to be Completed Daily by the Vehicle Operator .
4. Operator is to notify Supervisor and/or Project Personnel of any Defects which may effect safe operation of the vehicle.
5. Provide Comments and Additional Information on Page 2 of 2
6. Provide Haz. Mat'l Placard and Shipping Papers as Needed.

Metro-North Railroad

CONTRACTOR DAILY HI-RAIL VEHICLE INSPECTION

Provide Information on Corrective Actions and/or Additional Comments From Daily Inspection	
DATE:	
DATE:	
DATE:	
DATE:	
DATE:	
DATE:	
DATE:	
DATE:	
DATE:	

Periodic Maintenance & Record of Repairs		
Date	Mileage	Description of Repairs

Contractor's Supervisor Acknowledgement of Inspection: _____ Date: _____

C. Metro-North Railroad Quarterly Contractors Push Cart Inspection form:

METRO NORTH RAILROAD QUARTERLY CONTRACTORS PUSH CART INSPECTION

PROJECT MANAGER WORK ORDER # ____ ____ ____ ____ ____ MNR WO# ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

PUSH CART SERIAL #:_____ PUSH CART UNIT #_____ Date:_____

CONTRACTOR NAME:_____ PUSH CART MANUFACTURER: _____

LOCATION:_____ LAST DATE INSPECTED: _____

MNR PROJECT MANAGER:_____ PHONE:_____ EMAIL:_____ FAX: _____

PUSH CART INFORMATION & MEASUREMENTS		
WEIGHTS	**GUIDE WHEEL GUAGE (INCHES)**	**TRAM (INCHES) / MUST BE WITHIN 1/4"**
TARE WEIGHT: _____	MANUFACTURERS SPECS / ACTUAL MEASUREMENT	LEFT FRONT TO RIGHT REAR: _____
GROSS WEIGHT : _____	FRONT:_____ _____	RIGHT FRONT TO LEFT REAR: _____
	REAR:_____ _____	DIFFERENCE: _____

PUSH CART CHECKLIST	PASS	FAIL	N/A
1) WHEEL BRGS & SEALS	___	___	
2) RAIL WHEELS	___	___	
3) RAIL WHEEL FLANGES	___	___	
4) RAIL BRAKES & RIGGING	___	___	___
5) HYD. CYLINDERS & PUMP	___	___	___
6) HYD/ AIR HOSES & FITTINGS	___	___	___
7) TIE DOWN POINTS	___	___	___
8) LEAKS	___	___	___
9) PARKING/ EMERGENCY BRAKE OPERATION	___	___	___

PUSH CART CHECKLIST	PASS	FAIL	N/A
10) PIVOT/ROTATION LOCK	___	___	___
11) BOOM LOCK / CRADLE	___	___	___
12) TOW TAB(S)	___	___	
13) RAIL CLAMPS	___	___	___
14) LOCK PINS AND/OR CYLINDER DRIFT LOCKS	___	___	___
15) 1" WEIGHT MARKINGS	___	___	
16) 1" LENGTH MARKINGS	___	___	
17) 1" WIDTH MARKINGS	___	___	
18) TOW BAR SAFETY CHAIN	___	___	___

PUSH CART CHECKLIST	PASS	FAIL	N/A
19) PUSH CART MANUAL PRESENT IN VEHICLE	___	___	
20) 3RD RAIL CLEARANCE:	___	___	
21) SELF GUARDED FROG CLEARANCE: MIN 2-3/4"	___	___	
22) OUTRIGGER TO 3RD RAIL CLEARANCE	___	___	
23) OVERALL HEIGHT: MAX ON RAIL: 14FT. 10IN.	___	___	
HEIGHT- _____			
24) OVERALL WIDTH: MAX ON RAIL: 10FT. 6IN.	___	___	
WIDTH- _____			

PASSED INSPECTION: _____ **FAILED INSPECTION**: _____

COMMENTS: _____

_____

_____

* This equipment complies with Metro North's standards as noted in above referenced items only, and clearance measurements are for travel to and from work location. The use of this equipment by Contractors, State Inspectors, or Metro North employees must follow all Metro North regulations and procedures unless other written procedures have been approved by Metro North.

INSPECTED BY:_____ MAN#_____ DATE: _____

INSPECTION REPORT REVIEWED BY:_____ MAN#_____ DATE: _____

CONTRACTOR/ OPERATOR:_____ DATE: _____

COPIES: ORIGINAL- NWP SHOP, COPY- CONTRACTOR, COPY- PROJECT MANAGER INSPECTION STICKER # : _____

PUSH CART INSPECTION FORM-CONTRACTORS 8-10-18

METRO-NORTH RR AND CONTRACTORS PUSH CART INSPECTION 8/10/2018

PRIOR TO SCHEDULING AN INSPECTION, ALL CONTRACTORS SHALL PERFORM A **PRE-INSPECTION** ON THEIR PUSH CART/EQUIPMENT. FAILURES WILL RESULT IN RE-SCHEDULING AT THE NEXT AVAILABLE OPENING.

THE FOLLOWING SHALL BE ADHERED TO:

A copy of the rail cart manufacturer's specifications, including model numbers, guide wheel gage measurement, guide wheel and flange specifications, tram measurements, engineered drawings and manufactured weight capacities must be provided. If there is no criteria provided to measure the tram (alignment), wheel flange wear, and gage on a push cart, a Metro-North inspection will not be able to be performed.

1) A declaration of intended use, listing all equipment/cargo that is to be transported, must be supplied at time of inspection.
2) The guide wheel gage shall be to manufacturer's specifications.
3) Tram measurement (Diagonal measurement from center of front left guide wheel to center of rear right guide wheel vs. diagonal measurement from center of front right guide wheel to center of rear left guide wheel) **shall not exceed ¼ inch.**
4) Wheel bearings and wheel seals shall be in satisfactory condition and greased.
5) Guide wheel and flanges shall be within manufacturer's specifications and be of A.A.R profile.
6) Carts must have at least 1" tall lettering to identify carts maximum length, width, tare weight and gross weight.
7) All carts must have parking / emergency brakes that deploy with a lack of energy source (i.e. hydraulic / pneumatic pressure).
8) All carts with a rated capacity of 5,000 lbs. and above shall have service brakes with connections on both ends of the cart.
9) All carts with a rated capacity of 5,000 lbs. and under shall have a secondary means of securement to the tow vehicle in addition to the tow bar. (i.e. safety chain with spring loaded safety hasps).
10) Rail brake components (brake shoes and rigging) shall be complete and in working order.
11) Hydraulic hoses and fittings shall be in satisfactory condition and exhibit no leaks.
12) Any equipment loaded on cart that has a boom and/or rotating upper structure must have boom cradle and/or pivot lock.
13) Rail clamps shall be installed when working from the side of a cart with machinery (i.e. lifting booms, excavators, etc.).
14) Tow tab(s) with a 1-3/16 inch hole and secure tethered pin shall be installed front and/or rear at approximately 14 in. above rail when on hi-rail. If pintle receiver is used a toe tab adaptor plate must be supplied.
15) There shall be no fluid leaks.
16) 3rd rail clearance: Cart and components (i.e. machinery, steps, brackets, tool boxes), shall not extend beyond **24 inches measured from the inside of ball of rail, at a height below 10-7/8 inches, measured from the top of rail. (See 3rd rail**
17) Cart and components (i.e. machinery, steps, brackets, tool boxes), shall not extend beyond the Metro North Park Ave Tunnel
18) Cart and components (i.e. machinery, steps, brackets, tool boxes), shall not extend beyond the Metro North Minimum
19) Clearance for self-guarded frogs shall be a minimum of **2-3/4 inches** above rail on all under carriage components.
20) All components of the cart and any loaded cargo must clear the 3rd rail, electrical boxes, platforms, switch controls, etc. and be secured to prevent drifting.
21) All components that are capable of drifting, swinging, opening, etc. (i.e. booms, jibs, outriggers, tool box doors, engine covers, etc.) shall be secured appropriately before traveling on rails.
22) Clearance for self-guarded frogs shall be a minimum of **2-3/4 inches** above rail on all under carriage components.
23) All components of the cart and any loaded cargo must clear the 3rd rail, electrical boxes, platforms, switch controls, etc. and secured to prevent drifting.
24) Cart shall meet on track testing requirements up to and including 22 degree of curvature.

Final approval of items not covered on this list that may be considered questionable, unsafe or cause any danger, shall be at the inspector's discretion . **METRO NORTH RESTRICTS TRAVEL THRU SELF GUARDED FROGS and SWITHCH POINT GUARDS AT NO MORE THAN 1 MPH.**

Push Cart Declaration of Intended Use

Contractor name- _____

Metro North Project Manager _____

Metro North project location _____

Cart I.D. #- _____

Tare weight-_____

Gross weight-_____

Contents to be carried-_____

_____

_____

_____

_____

2.03 WORK PLAN

A. Metro-North Work Plan Sample:

The following outline and template is presented as an aid to assist Contractors in preparing their Work Plans. This template shall be completed by the Contractor and submitted as a Work Plan. Any deviations from the Work Plan must be approved in writing, by the Engineer prior to the date that the work has been scheduled.

Contract Number / Project Name	**10000XXXXX New Haven Line Power Improvements**		
General Contractor	**Generic Electric**		
Subcontractor	**N/A**		
Submittal #	**011101-008.1**		
Submittal Name	**Wire Pulls for Catenary 58**		
Safe Work Plan #	**Plan # 21 - Approved**	**SWP Submittal #**	**013360-010.1A**

(Check One)	☐Initial Submittal ☒Revised Submittal	Revision Number Revision Date	001 02/01/2016

Work Plan Details		
A. **Corresponding Submittal Numbers and Status**		
1. Rigging Plan	N/A	N/A
2. Scaffolding Plan	N/A	N/A
3. Shoring Plan	N/A	N/A
4. Fall Protection Plan	N/A	N/A
B. **Description of Work**		
Pull wires from the basement of Substation 61 to Catenary 58.		
C. **Outages**		

Track	Power
Task 1: Foul Time Hell Gate 1&2 to cross workers and equip.	N/A
Task 2: Shifts 1&2 Tracks 2&4. Shifts 3&4 Tracks 1&3.	Shifts 1&2 South Side power and Tracks 2&4. Shifts 3&4 North Side power and Tracks 3&1.
Task 3: Foul Time Hell Gate 1&2 to cross workers and equip.	Outage within Substation 61 to access basement area for wire pulls.

Work Plan Details	
D. **Labor**	
Task 1: Foreman, 2 Electricians, 2 Laborers	
Task 2: Crew 1: Foreman and Lineman. Crew 2: 2 Electricians and 3 Laborers	
Task 3: Foreman, Lineman, 2 Electricians and 3 Laborers	
E. **Equipment**	
Task 1: Greenlee cable tugger, Cable reel truck and hand tools.	
Task 2: Rental HY-Rail articulating boom bucket truck, Greenlee cable tugger and hand tools.	
Task 3: Greenlee cable tugger, Cable reel truck and hand tools.	
F. **Time Requirements**	
Task 1: Shift time 7:00AM to 3:00PM. It is anticipated that it will take approximately 4 hours to set up and pull each of the four wires.	
Task 2: Shift time 10:00PM to 5:00AM. It is anticipated that it will take approximately 4 hours to set up and pull each of the four wires.	
Task 3: Shift time 10:00PM to 5:00AM. It is anticipated that it will take approximately 4 hours to set up and pull each of the four wires.	
G. **Site Access**	
Task 1: Access east of Webster Avenue, EMH-01 area, through substation 61 yard. Crossing of Hell Gate Tracks 1&2 required. Access west of Webster Avenue, EMH-01 area, via city of New Rochelle leaf dump on Beechwood Avenue.	
Task 2: Crew 1 will access the Tower 58 area via HY-Rail pads at Pelham station and proceed north to the site once track outage is granted. Crew 2 will access the Tower 58 area via the city of New Rochelle leaf dump on Beechwood Avenue at shift start time.	
Task 3: Access to the site via the substation 61 yard. Requires crossing of Hell Gate Tracks 1&2.	
H. **Breakdown of Work**	
Task 1: Pull four segments of wire on the wayside from EMH-01 through previously installed concrete duct bank to EMH-02. These segments of wire will also include necessary “slack” for pulls from EMH-02 to termination points on tower 58. Each wire pull will be completed once started and the manhole covers will be returned at the end of each shift.	
Task 2: Pull four segments of wire from EMH-02 on the wayside through previously installed concrete duct bank and previously installed RGS conduits to termination points on Tower 58. The wire pulls must be completed once started, manhole cover returned and wire securely fastened to termination points for future connections by others.	
Task 3: Pull four segments of wire from EMH-01 through previously installed concrete duct bank into the basement of substation 61. Each wire pull must be completed once started and manhole cover for EMH-01 will be returned at the end of each shift.	

Work Plan Details
Additional Comments and Attachments:
1.
2.
3.
4.

Prepared By:

Printed Name: _____ **Signature:** _____ **Date:** _____

Checked By:

Printed Name: _____ **Signature:** _____ **Date:** _____

2.04 ERECTION DEMOLITON OR OTHER RIGGING

A. Metro-North Railroad Crane Plan Checklist:

The following outline and checklist is presented as an aid to assist Contractors in preparing their Crane Erection Plans. This checklist shall be completed by the Contractor and submitted with the Crane Erection Plan. Failure of the Contractor to complete this checklist and submit it along with the Crane Erection Plan shall be grounds for rejection of the submittal. Any deviations from the Crane Erection Plan must be approved in writing, by the Engineer prior to the date that the work has been scheduled.

Contract Number / Project Name			
General Contractor			
Erecting Contractor			
Submittal #			
Operational Objective:			
Crane Model/Type (All Terrain/Tires)		**Maximum Capacity**	
Critical Pick - Independent Reviewer Required	**Yes / No**		

(Check One)	☐Initial Submittal ☐Revised Submittal	Revision Number Revision Date	

Operational Requirements/Restrictions

1. The lifting operation may not take place if wind speeds are 20mph or higher, or if there are anticipated wind gusts of 30mph or higher.
2. If there is rain, fog, snow, or lightning the operation may not take place.
3. When the crane is not in use, it must be stored with the boom down.

Operation Dates/Hours:	Start Date:		End Date:		Start Time:		End Time:	

General Notes

1. Rigging and lifting operations shall not commence unless the Railroad has approved the required submittals.
2. Lifting operations occurring over track shall not be performed without proper Metro-North supervision (Transportation “Flag” Protection) and necessary protection of track (i.e. Track Outages, etc.).
3. No lift shall be made over property owned by others without written permission from the property owner.

SECTION 01 11 01
CONTRACTOR REQUIREMENTS FOR WORK AFFECTING THE RAILROAD

Description	Included	Comments / Notes Identify Revised Sections- Revision Number & Date
A. Personnel Certifications, Licenses, and Qualifications		
1. All Erection Plans and Calculations must be prepared and stamped by a Professional Engineer licensed in the state in which the project is located.		
2. Qualified Rigger Certification and Resume.		
3. Identify Competent Person responsible for crane inspection, testing, rigging, and lifting operation.		
B. Narrative		
1. Provide a Narrative Describing:		
a) The intent of the operation.		
b) The hazards associated with the operation (i.e. proximity to the tracks, buildings, underground infrastructure).		
2. Provide a timeline for the operation indicating the order of lifts and repositioning or re-hitching if applicable.		
C. Calculations		
1. Provide calculations for the following items:		
a) Weight of various items to be lifted including a 150% safety factor.		
b) Crane capacity of various items, (include crane block and rigging) at defined radius and boom length.		
c) Tensions in Rigging Components: Slings, Shackles and Rigging assembly.		
d) Maximum Outrigger Load, Unloaded Condition, and Outrigger Dunnage Design.		
i. Include load transferred to soil, soil bearing capacity, lateral earth pressure distribution and mat details.		
e) Dunnage Mat Details including calculations of shear and bending moment of mat. (Actual timber dimensions shall be used for dunnage mat calculations.)		
D. Drawings		
1. Provide drawings of the following:		
a) Scaled Plan View of the site including:		
i. Crane location showing center pin, outriggers/dunnage mats, and tail swing.		
ii. Radius of all picks.		

Description	Included	Comments / Notes Identify Revised Sections- Revision Number & Date
iii. Delivery, setting, and disposal locations.		
iv. Underground and overhead utilities/structures.		
b) Profile View of Load Rigged including, the block, slings (configuration and geometry), shackles, spreader bar and any other hardware components which make up the rigging assembly.		
c) Cross-section View of obstructions proving that proposed swing is possible.		
2. Provide details of Special Dunnage, Cribbing, or other Protection, which will be utilized.		
E. Cut Sheets		
1. Provide cut sheets for the following:		
a) Slings, Shackles, and all Rigging Components.		
b) Crane, including dimensions, outrigger configurations, and lifting charts.		
F. Other Supporting Documentation		
1. Provide protection for all surface and subsurface structures and utilities.		
2. Maintenance and Protection of Traffic Plan.		
3. Provide DOT Road Permits for Crane Travel.		
4. Provide Street Closure Permit.		
G. Field Work Requirements (Verify In Field)		
1. Crane Center Pin and Outriggers must be spray painted in the field at least 48 hours prior to operation.		
2. Verify Radii and Clearance for Critical Picks.		
3. Confirm the stability of the foundation for crane outrigger loads.		
4. Confirm there are no underground utilities or structures (Call Before You Dig and Metro-North Utility Locate Protocol).		
5. Confirmation that Engineer visited the site.		
6. Engineer to be present during operation.	Yes / No	
H. Crane Check List		

SECTION 01 11 01
CONTRACTOR REQUIREMENTS FOR WORK AFFECTING THE RAILROAD

Description	Included	Comments / Notes Identify Revised Sections- Revision Number & Date
1. Certificate of Crane Inspection and written statement from the crane owner indicating the date of the last inspection.		
2. Copy of Crane Maintenance Records.		
3. Crane Operators License.		

Additional Comments:
1.
2.
3.
4.

Metro-North Reviewed By:

Printed Name: _____ **Signature:** _____ **Date:** _____

Metro-North Checked By:

Printed Name: _____ **Signature:** _____ **Date:** _____

2.05 SHEETING AND SHORING

A. Metro-North Railroad Sheeting and Shoring Plan Checklist:

The following outline and checklist is presented as an aid to assist Contractors in preparing their Sheeting and Shoring Plans. This checklist shall be completed by the Contractor and submitted with the Sheeting and Shoring Plan. Failure of the Contractor to complete this checklist and submit it along with the Sheeting and Shoring Plan shall be grounds for rejection of the submittal. Any deviations from the Sheeting and Shoring Plan must be approved in writing, by the Engineer prior to the date that the work has been scheduled.

Contract Number / Project Name	
General Contractor	
Installing Contractor	
Submittal #	

(Check One)	☐ Initial Submittal ☐ Revised Submittal	Revision Number Revision Date	

Description	Included	Comments / Notes Identify Revised Sections- Revision Number & Date
A. General Notes		
1. Railroad Live Load Influence Line: Sheeting shall be required on all excavations where the side of the excavation is intercepted by the Railroad Live Load Influence Line. The Live Load Influence Line is defined as a line originating at the bottom outside edge of tie and extending downward at a slope of 1 vertical to 1.5 horizontal.		
2. Theoretical Railroad Embankment Line: Maintain Lateral Support of the track system. Lateral support shall consist of a compacted stone ballast shoulder level with the top of tie for at least one foot outside the end of tie supported by a slope no steeper than one (1) vertical to two (2) horizontal.		
3. Plans and Calculations must be prepared and stamped by a Professional Engineer licensed in the state in which the project is located.		
B. Material Requirements		
1. If Timber Sheeting is utilized the wood must be treated with wood preservatives in accordance with the American Wood Preservers Association standards for timber in contact with soil.		
C. Drawings		
1. Plan View (including Clearance to Track Center Line).		
2. Elevation View showing the Track Influence Line and Railroad Embankment Line.		

D. Calculations		
1. Static Loads.		
2. Structural Dead Load.		
3. Soil Pressure Loads.		
4. Hydrostatic Pressure Loads.		
5. Railroad Live Load of Cooper E-80.		
6. Other Loading Magnitude as may be directed by the Engineer.		

Additional Comments:
1.
2.
3.
4.

Prepared By:

Printed Name: _____ **Signature:** _____ **Date:** _____

2.06 SCAFFOLDING

A. Metro-North Railroad Scaffolding Plan Checklist:

The following outline and checklist is presented as an aid to assist Contractors in preparing their Scaffolding Erection Plans. This checklist shall be completed by the Contractor and submitted with the Scaffolding Erection Plan. Failure of the Contractor to complete this checklist and submit it along with the Scaffolding Erection Plan shall be grounds for rejection of the submittal. Any deviations from the Scaffolding Erection Plan must be approved in writing, by the Engineer prior to the date that the work has been scheduled.

Contract Number / Project Name	
General Contractor	
Erecting Contractor	
Submittal #	

(Check One)	☐ Initial Submittal ☐ Revised Submittal	Revision Number Revision Date	

Description	Included	Comments / Notes Identify Revised Sections- Revision Number & Date
A. General Notes		
1. Wood must conform to ASTM E-84 Fire Retardant specification for exterior application 30 minute duration.		
2. Plans and Calculations must be prepared and stamped by a Professional Engineer licensed in the state in which the project is located.		
B. Scaffolding Design Requirements for Containing Finely Broken Concrete Decking		
1. Calculations		
a. Live Load of 200 lbs. per square foot applied uniformly over the entire structure*		
b. 2 kip concentrated load*		
*The two loads are not to be applied simultaneously for design purposes.		
2. Drawings		
a. Plan View (include Clearance to Track Center Line).		
b. Elevation View.		
3. Cut Sheets		
a. Scaffolding legs and cross bracing.		

Description	Included	Comments / Notes Identify Revised Sections- Revision Number & Date
b. All Hardware Components.		

Additional Comments:
1.
2.
3.
4.

Prepared By:

Printed Name: _____ **Signature:** _____ **Date:** _____

2.07 ENGINEERED FALL PROTECTION PLAN

A. Metro-North Engineered Fall Protection Plan Checklist:

The following outline and checklist is presented as an aid to assist Contractors in preparing their Engineered Fall Protection Plans. This checklist shall be completed by the Contractor and submitted with the Engineered Fall Protection Plan. Failure of the Contractor to complete this checklist and submit it along with the Engineered Fall Protection Plan shall be grounds for rejection of the submittal. This checklist is not for preparation of the Contractor's site specific Fall Protection Plan as required for the Safety, Health & Environmental Control Plan. Any deviations from the Engineered Fall Protection Plan must be approved in writing, by the Engineer prior to the date that the work has been scheduled.

Contract Number / Project Name	
General Contractor	
Erecting Contractor	
Submittal #	

(Check One)	☐ Initial Submittal ☐ Revised Submittal	Revision Number Revision Date	

Description	Included	Comments / Notes Identify Revised Sections- Revision Number & Date
A. General Notes		
1. Plans and Calculations must be prepared and stamped by a Professional Engineer licensed in the state in which the project is located.		
B. Fall Protection Design Requirements		
1. Calculations		
a. Horizontal life lines designed to a factor of safety of two.		
b. Vertical life lines minimum breaking strength of 5000 lbs. per person.		
c. Anchorage point design to meet OSHA guidelines.		
d. Fall clearance.		
2. Drawings		
a. Plan View.		
b. Elevation View.		
c. Anchorage Point Details.		

Description	Included	Comments / Notes Identify Revised Sections- Revision Number & Date
3. Cut Sheets		
a. All Hardware Components.		

Additional Comments:
1.
2.
3.
4.

Prepared By:

Printed Name: _____ **Signature:** _____ **Date:** _____

PART 3 EXECUTION

NOT USED

END OF SECTION

Metro-North Railroad
Contractor Hi-Rail Vehicle and Push Carts
General Information Required

Contractor Information Needed for Hi-Rail Vehicles and Push Carts:

1. **Construction Management to require a Safe Work Plan (SWP) submittal for Hi-rail equipment, to include (and not be limited to)**:

    a. Contractor supplying Hi-Rail Gear and compatibility with equipment.

    b. A copy of MFR's Spec for both the Hi-Rail Gear and Equipment

    c. Operations & Maintenance Manual for Hi-Rail Gear and Vehicle (or verification the Manual will be kept with the equipment).

    d. Operator to conduct 'Daily Inspection' of Hi-Rail Vehicle & use MNR's Daily Inspection form (as provided in the specification).

    e. Hi-Rail Gear to be greased regularly (or before use)

    f. Contractor to provide a List of Qualified Operators for the project.

    g. **Contractor to identify in submittal tentative routes the vehicle will travel** (identify if equipment will be used in GCT vs ROW; track locations; access to tracks; tracks no.'s; interlocking; switches - to the best of their knowledge with assistance from the CM)

    h. Contractor will identify lay over locations on and off track (changes to be noted on Daily inspection form; CM is to be given copies of inspections monthly).

    i. Contractor to Identify a Mechanic they will use and be available for maintenance if needed.

2. **Construction Management to request a Safe Work Plan Submittal for Operator Qualifications and proficiency- Information to include:**

    a. CDL (commercial Driver's License)

    b. Provide Operators previous experience with Hi-Rail equipment/gear (list railroad, date and type of equipment used).

    c. Document Operators training and/or instruction given by a 'House Mechanic' if owned, or by rental Equipment Vendor Mechanic.

    d. **OPERATION IN GCT:** MNR Pilot (is to work with Contractor's Operator) and WALK Hi-Rail equipment through switches, interlocking & Frogs and any other type or potential situation that could cause equipment derailment.

3. **Copy of MNR MOW Hi-Rail inspection Form to be given to MNR CM.**
4. **Copies of Daily Inspection forms (to be part of the Monthly Submittal Package)**
5. **Push Cart Declaration of Intended Use (If Applicable)**

METRO NORTH RAILROAD QUARTERLY
CONTRACTORS VEHICLE/MACHINE AND HI-RAIL GEAR INSPECTION

PROJECT MANAGER WORK ORDER # _____ _____ _____ _____ _____ MNR WO# _____

Last 8 of VIN #: _____ VEHICLE UNIT # _____ Date: _____

MACHINE TYPE: _____ VEHICLE MAKE/MODEL: _____

CONTRACTOR NAME: _____ HI-RAIL MANUFACTURER: _____

LOCATION: _____ LAST DATE INSPECTED: _____

MNR PROJECT MANAGER: _____ PHONE: _____ EMAIL: _____ FAX: _____

HI-RAIL GEAR INFORMATION & MEASUREMENTS

MODEL#	GUIDE WHEEL GUAGE (INCHES)		TRAM (INCHES) / MUST BE WITHIN 1/4"
	MANUFACTURERS SPECS	ACTUAL MEASUREMENT	LEFT FRONT TO RIGHT REAR:
FRONT:			RIGHT FRONT TO LEFT REAR:
REAR:			DIFFERENCE:

HI-RAIL CHECKLIST	PASS	FAIL	N/A
1) WHEEL BRGS & SEALS			
2) RAIL WHEELS			
3) RAIL WHEEL FLANGES			
4) RAIL BRAKES & RIGGING			
5) GUIDE WHEEL LOAD			
6) STEERING LOCK			
7) HYD. CYLINDERS & PUMP			
8) HYD HOSES & FITTINGS			
9) CONTROL LEVERS			
10) LIFTING HANDLE			
11) RAIL SWEEPS			
12) LOCK PINS AND/OR CYLINDER DRIFT LOCK(S)			

VEHICLE CHECKLIST	PASS	FAIL	N/A
13) TRAVEL LIGHTS F/R			
14) STOP / TAIL LIGHTS F/R			
15) HEADLIGHTS F/R			
16) STROBE LIGHT(S) 360°			
17) BACKUP ALARM			
18) REVERSE LIGHTS			
19) HORN(S)			
20) SUSPENSION PARTS			
21) TIRES/AIR PRESSURE			
22) BOOM LOCK / CRADLE			
23) TOW TAB(S)			
24) RAIL CLAMPS			
25) LEAKS			

VEHICLE CHECKLIST	PASS	FAIL	N/A
HI-RAIL MANUAL 26) PRESENT IN VEHICLE			
27) FIRST AID KIT			
28) FLAGGING KIT			
29) FIRE EXTINGUISHER: WITHIN INSPECTION DATE			
30) 3RD RAIL CLEARANCE:			
31) SELF GUARDED FROG CLEARANCE: MIN 2-3/4"			
32) OUTRIGGER TO 3RD RAIL CLEARANCE			
33) OVERALL HEIGHT: MAX ON HYRAIL: 14FT. 10IN.			
34) OVERALL WIDTH: MAX: 10FT. 6IN.			

PASSED INSPECTION: _____ **FAILED INSPECTION:** _____

COMMENTS: _____

_____

_____

RESTRICTIONS: _____

* This equipment complies with Metro North's standards as noted in above referenced items only, and clearance measurements are for travel to and from work location. The use of this equipment by Contractors, State Inspectors, or Metro North employees must follow all Metro North regulations and procedures unless other written procedures have been approved by Metro North.

INSPECTED BY: _____ MAN# _____ DATE: _____

INSPECTION REPORT REVIEWED BY: _____ MAN# _____ DATE: _____

CONTRACTOR/ OPERATOR: _____ DATE: _____

COPIES: ORIGINAL- NWP SHOP, COPY- CONTRACTOR, COPY- PROJECT MANAGER

INSPECTION STICKER # : _____

METRO-NORTH RR AND CONTRACTORS HI-RAIL INSPECTION and VEHICLE/EQUIPMENT REQUIREMENTS 8/4/2017

PRIOR TO SCHEDULING AN INSPECTION, ALL CONTRACTORS SHALL PERFORM A **PRE-INSPECTION** ON THEIR VEHICLE/EQUIPMENT. FAILURES WILL RESULT IN RE-SCHEDULING AT THE NEXT AVAILABLE OPENING.

THE FOLLOWING SHALL BE ADHERED TO:

A copy of the HI-rail Manufacturer's specifications Front and Rear, including model numbers, guide wheel gage measurement, guide wheel and flange specifications and guide wheel load shall be provided. FRA quote: The employer shall use the manufacturer's specifications that will insure the hi-rail can be operated in a safe manner. If there are no criteria provided to measure the tram (alignment), wheel wear, and gage on a hi-rail vehicle, then the inspection would not be in compliance with this section.

1) The guide wheel gage shall be to manufacturer's specifications.
2) Tram measurement (Diagonal measurement from center of front left guide wheel to center of rear right guide wheel vs. diagonal measurement from center of front right guide wheel to center of rear left guide wheel) **shall not exceed ¼ inch.**
3) Guide Wheel Load shall be within manufacturer's specifications.
4) Wheel bearings and wheel seals shall be in satisfactory condition and greased.
5) Guide wheel and flanges shall be within manufacturer's specifications.
6) Rail brake components (brake shoes and rigging) shall be complete and in working order.
7) Steering lock shall be installed to prevent steering from turning.
8) Hydraulic cylinders and pump shall be in working order.
9) Hydraulic hoses and fittings shall be in satisfactory condition and no leaks.
10) Control levers shall be installed and in satisfactory condition.
11) Lifting handle for manual hi-rails shall be on board if applicable.
12) Rail sweeps when provided by manufacturer, shall be in working order.
13) Lock pins or acceptable means of preventing hi-rail cylinders from drifting shall be installed.
14) All lights, (Headlights, brake lights, travel lights, turn signals, marking lights, backup lights, work lights, flashers, strobe lights with 360° visibility), shall be operational. When operating on rails, with the vehicle/machine in the forward travel position, the headlights, travel and brake lights shall operate as normal. When traveling on rails in the reverse position, additional headlights, travel and brake lights shall be installed in the opposite orientation. Lighting circuit operation shall be such that when traveling forward on rails, only the front headlights and rear travel/brake lights are operational. When traveling in reverse on rails, only the rear headlights and front travel/brake lights operate.
15) All horns, change of direction and backup alarms shall be operational.
16) Suspension components shall be in satisfactory condition.
17) Tires shall be in satisfactory condition and air pressure checked. (Tire pressure affects traction and braking on hi-rail).
18) Booms and rotating upper structures shall have a boom cradle and/or pivot lock.
19) Tow tab(s) with a 1-3/16 inch hole and secure tethered pin shall be installed front and/or rear at approximately 14 in. above rail when on hi-rail.
20) Rail clamps shall be installed when working from the side of a vehicle/machine, (i.e. lifting booms, rotary dumps, etc.) Exemptions for equipment with counterweights, suspension locks and manufactures approval shall be granted.
21) There shall be no fluid leaks.
22) 3rd rail clearance: Vehicle\equipment and components (i.e. steps, brackets, tool boxes), shall not extend beyond **24 inches measured from the inside of ball of rail, at a height below 10-7/8 inches, measured from the top of rail. (See 3rd rail clearance diagram).**
23) A First Aid kit and Fire Extinguisher with a current inspection date shall be readily accessible.
24) Flagging kit shall be readily accessible including- 2 safety flags (18"x18" red flag with 18" long handle), 2 flashlights with magnets (2-D size batteries installed, 4 extra D size alkaline batteries (Ray-O-Vac or equivalent), 12 (15 minute) safety flares.
25) Clearance for self-guarded frogs shall be a minimum of **2-3/4 inches** above rail on all under carriage components.
26) Outriggers shall clear 3rd rail, electrical boxes, platforms, switch controls, etc. and secured to prevent drifting.
27) Max height shall not exceed **14ft.10in.** while traveling on rails in accordance with Metro North Park Ave Tunnel diagram.
28) Max width shall not exceed **10 ft. 6in.** while traveling on rails in accordance with Metro North Park Ave Tunnel diagram.
29) All components that are capable of drifting, swinging, opening, etc. (i.e. booms, jibs, outriggers, tool box doors, engine covers, etc.) shall be secured appropriately before traveling on rails.
30) Vehicles shall meet on track testing requirements up to and including 22 degree of curvature. **All** rubber traction tires must maintain continuous contact with the ball of the rail throughout the duration of testing curve negotiation.

Final approval of items not covered on this list that may be considered questionable, unsafe or cause any danger, shall be at the inspector's discretion. Please reference attached **49CFR214.503** to **.533** for rules as they apply to Roadway Maintenance Machines (RMM's) and Hi-rail Vehicles. ***Please be aware that the above mentioned adherences may exceed 49CFR214.503 to .533 as dictated by Metro North Railroad. METRO NORTH RESTRICTS TRAVEL THRU SELF GUARDED FROGS and SWITHCH POINT GUARDS AT NO MORE THAN 1 MPH.**

Metro-North Railroad

CONTRACTOR DAILY HI-RAIL VEHICLE INSPECTION

Project Name:	
Contractor/ Company Name:	
Truck/ Vehicle No.:	
MNR MOW Vehicle Inspection Date:	**Exp. Date**
Date of Inspection Month :	**Year:**

Operator

I have performed the daily inspection for this vehicle and noted no defects. Any Corrective Action made were to ensure the vehicle is in safe operating condition. Page 2 of 2 List Corrective Actions

✓ = Satisfactory R =Unsatisfactory, Repairs Needed X=Not Applicable

Vehicle's Hi-Rail Gear to be Locked and Railed During Inspection

Day	Print Name of Driver/Operator	Contractor RW I.D. No.:	Operator Qualifications (CDL & Operator Training)	Brake Test, Hand Bk Test, Pkg Break Test	Steering Mech. (Locked)	Lighting System(s)	Tire Pressure, Wheels & Rims	Vehicle Loading (check if over/under loaded)	Hydraulic Hoses & Equipment	Fuel, Oil & Coolant	Coupling Device	Horn, Mirrors, wipers	O & M Manual for Vehicle & Hi-Rail Gear	Crane, Aerial Device etc.	Hi-Rail Gear: Front & Rear : Secured & Locked	Rail Clamps (used for off loading/side dumping)	Method of Communication in Place	Seat Belts and designated seating for others	Emergency Equipment: Fire Extinguisher, Eye Wash, First Aid kit, Spill Kit
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			
20																			
21																			
22																			
23																			
24																			
25																			
26																			
27																			
28																			
29																			
30																			
31																			

✓ = Satisfactory R =Unsatisfactory, Repairs Needed X=Not Applicable

NOTES:

1. This Form is to Stay with this Vehicle While on MNR Property.
2. Pre Inspect Vehicle of Non Hy-Rail Gear Prior to Getting on Rails
3. Vehicle Inspection to be Completed Daily by the Vehicle Operator .
4. Operator is to notify Supervisor and/or Project Personnel of any Defects which may effect safe operation of the vehicle.
5. Provide Comments and Additional Information on Page 2 of 2
6. Provide Haz. Mat'l Placard and Shipping Papers as Needed.

Metro-North Railroad

CONTRACTOR DAILY HI-RAIL VEHICLE INSPECTION

Provide Information on Corrective Actions and/or Additional Comments From Daily Inspection	
DATE:	
DATE:	
DATE:	
DATE:	
DATE:	
DATE:	
DATE:	
DATE:	
DATE:	

Periodic Maintenance & Record of Repairs		
Date	Mileage	Description of Repairs

Contractor's Supervisor Acknowledgement of Inspection: _____ **Date:** _____

METRO NORTH RAILROAD QUARTERLY
CONTRACTORS PUSH CART INSPECTION

PROJECT MANAGER WORK ORDER # _____ _____ _____ _____ _____ **MNR WO#** ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____

PUSH CART SERIAL #:_____ **PUSH CART UNIT #**_____ **Date:**_____

CONTRACTOR NAME:_____ **PUSH CART MANUFACTURER:** _____

LOCATION:_____ **LAST DATE INSPECTED:** _____

MNR PROJECT MANAGER:_____ **PHONE:**_____ **EMAIL:**_____ **FAX:** _____

PUSH CART INFORMATION & MEASUREMENTS		
WEIGHTS	**GUIDE WHEEL GUAGE (INCHES)**	**TRAM (INCHES) / MUST BE WITHIN 1/4"**
TARE WEIGHT: _____	**MANUFACTURERS SPECS** **ACTUAL MEASUREMENT**	**LEFT FRONT TO RIGHT REAR:** _____
GROSS WEIGHT : _____	**FRONT:**_____ _____	**RIGHT FRONT TO LEFT REAR:** _____
	REAR:_____ _____	**DIFFERENCE:** _____

PUSH CART CHECKLIST				PUSH CART CHECKLIST				PUSH CART CHECKLIST			
	PASS	**FAIL**	**N/A**		**PASS**	**FAIL**	**N/A**		**PASS**	**FAIL**	**N/A**
1) **WHEEL BRGS & SEALS**	___	___		10) **PIVOT/ROTATION LOCK**	___	___	___	19) **PUSH CART MANUAL PRESENT IN VEHICLE**	___	___	
2) **RAIL WHEELS**	___	___		11) **BOOM LOCK / CRADLE**	___	___	___	20) **3RD RAIL CLEARANCE:**	___	___	
3) **RAIL WHEEL FLANGES**	___	___		12) **TOW TAB(S)**	___	___		21) **SELF GUARDED FROG CLEARANCE: MIN 2-3/4"**	___	___	
4) **RAIL BRAKES & RIGGING**	___	___	___	13) **RAIL CLAMPS**	___	___	___	22) **OUTRIGGER TO 3RD RAIL CLEARANCE**	___	___	
5) **HYD. CYLINDERS & PUMP**	___	___	___	14) **LOCK PINS AND/OR CYLINDER DRIFT LOCKS**	___	___	___				
6) **HYD/ AIR HOSES & FITTINGS**	___	___	___	15) **1" WEIGHT MARKINGS**	___	___		23) **OVERALL HEIGHT:** MAX ON RAIL: 14FT. 10IN.	___	___	
7) **TIE DOWN POINTS**	___	___	___	16) **1" LENGTH MARKINGS**	___	___		**HEIGHT-** _____			
8) **LEAKS**	___	___	___	17) **1" WIDTH MARKINGS**	___	___		24) **OVERALL WIDTH:** MAX ON RAIL: 10FT. 6IN.	___	___	
9) **PARKING/ EMERGENCY BRAKE OPERATION**	___	___	___	18) **TOW BAR SAFETY CHAIN**	___	___	___	**WIDTH-** _____			

PASSED INSPECTION: _____ **FAILED INSPECTION:** _____

COMMENTS: _____

_____

_____

*** This equipment complies with Metro North's standards as noted in above referenced items only, and clearance measurements are for travel to and from work location. The use of this equipment by Contractors, State Inspectors, or Metro North employees must follow all Metro North regulations and procedures unless other written procedures have been approved by Metro North.**

INSPECTED BY:_____ **MAN#**_____ **DATE:** _____

INSPECTION REPORT REVIEWED BY:_____ **MAN#**_____ **DATE:** _____

CONTRACTOR/ OPERATOR:_____ **DATE:** _____

COPIES: ORIGINAL- NWP SHOP, COPY- CONTRACTOR, COPY- PROJECT MANAGER **INSPECTION STICKER # :** _____

METRO-NORTH RR AND CONTRACTORS PUSH CART INSPECTION 8/10/2018

PRIOR TO SCHEDULING AN INSPECTION, ALL CONTRACTORS SHALL PERFORM A **PRE-INSPECTION** ON THEIR PUSH CART/EQUIPMENT. FAILURES WILL RESULT IN RE-SCHEDULING AT THE NEXT AVAILABLE OPENING.

THE FOLLOWING SHALL BE ADHERED TO:

A copy of the rail cart manufacturer's specifications, including model numbers, guide wheel gage measurement, guide wheel and flange specifications, tram measurements, engineered drawings and manufactured weight capacities must be provided. If there is no criteria provided to measure the tram (alignment), wheel flange wear, and gage on a push cart, a Metro-North inspection will not be able to be performed.

1) A declaration of intended use, listing all equipment/cargo that is to be transported, must be supplied at time of inspection.
2) The guide wheel gage shall be to manufacturer's specifications.
3) Tram measurement (Diagonal measurement from center of front left guide wheel to center of rear right guide wheel vs. diagonal measurement from center of front right guide wheel to center of rear left guide wheel) **shall not exceed ¼ inch.**
4) Wheel bearings and wheel seals shall be in satisfactory condition and greased.
5) Guide wheel and flanges shall be within manufacturer's specifications and be of A.A.R profile.
6) Carts must have at least 1" tall lettering to identify carts maximum length, width, tare weight and gross weight.
7) All carts must have parking / emergency brakes that deploy with a lack of energy source (i.e. hydraulic / pneumatic pressure).
8) All carts with a rated capacity of 5,000 lbs. and above shall have service brakes with connections on both ends of the cart.
9) All carts with a rated capacity of 5,000 lbs. and under shall have a secondary means of securement to the tow vehicle in addition to the tow bar. (i.e. safety chain with spring loaded safety hasps).
10) Rail brake components (brake shoes and rigging) shall be complete and in working order.
11) Hydraulic hoses and fittings shall be in satisfactory condition and exhibit no leaks.
12) Any equipment loaded on cart that has a boom and/or rotating upper structure must have boom cradle and/or pivot lock.
13) Rail clamps shall be installed when working from the side of a cart with machinery (i.e. lifting booms, excavators, etc.).
14) Tow tab(s) with a 1-3/16 inch hole and secure tethered pin shall be installed front and/or rear at approximately 14 in. above rail when on hi-rail. If pintle receiver is used a toe tab adaptor plate must be supplied.
15) There shall be no fluid leaks.
16) 3rd rail clearance: Cart and components (i.e. machinery, steps, brackets, tool boxes), shall not extend beyond **24 inches measured from the inside of ball of rail, at a height below 10-7/8 inches, measured from the top of rail. (See 3rd rail**
17) Cart and components (i.e. machinery, steps, brackets, tool boxes), shall not extend beyond the Metro North Park Ave Tunnel
18) Cart and components (i.e. machinery, steps, brackets, tool boxes), shall not extend beyond the Metro North Minimum
19) Clearance for self-guarded frogs shall be a minimum of **2-3/4 inches** above rail on all under carriage components.
20) All components of the cart and any loaded cargo must clear the 3rd rail, electrical boxes, platforms, switch controls, etc. and be secured to prevent drifting.
21) All components that are capable of drifting, swinging, opening, etc. (i.e. booms, jibs, outriggers, tool box doors, engine covers, etc.) shall be secured appropriately before traveling on rails.
22) Clearance for self-guarded frogs shall be a minimum of **2-3/4 inches** above rail on all under carriage components.
23) All components of the cart and any loaded cargo must clear the 3rd rail, electrical boxes, platforms, switch controls, etc. and secured to prevent drifting.
24) Cart shall meet on track testing requirements up to and including 22 degree of curvature.

Final approval of items not covered on this list that may be considered questionable, unsafe or cause any danger, shall be at the inspector's discretion . **METRO NORTH RESTRICTS TRAVEL THRU SELF GUARDED FROGS and SWITHCH POINT GUARDS AT <u>NO MORE THAN 1 MPH.</u>**

Push Cart Declaration of Intended Use

Contractor name- _____

Metro North Project Manager _____

Metro North project location _____

Cart I.D. #- _____

Tare weight-_____

Gross weight-_____

Contents to be carried-_____

_____

_____

_____

_____

SECTION 01 14 00 - WORK RESTRICTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:
   1. Section 01 41 00 - Regulatory Requirements.

1.2 SUMMARY

A. This Section specifies restrictions regarding:
   1. Temporary construction.
   2. Noise.
   3. Explosives and blasting.
   4. OSHA regulated workplace activities.

1.3 REFERENCES

A. Reference Standards:
   1. New York City Building Code
   2. Town of North Salem, NY:
      Town of North Salem Municipal Code, http://encode360.com/BEO803
      b. The Town of North Salem Supplemental Building Code, found at Town Hall.
      c. Occupational Safety and Health Administration (OSHA):
         1) 29 CFR 1910 Occupational Health and Safety Standards.
         2) 29 CFR 1926 Safety and Health Regulations for Construction.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Temporary Construction:
      a. Other than maintenance and protection of traffic plans, there is no temporary construction foreseen with the station enhancements.
   2. Noise Restrictions:
      a. In accordance with the various municipalities having jurisdiction over each station, the Contractor must follow all local noise ordinances and restrictions including filing for the required permits and construction stipulations from each local agency.

b. Additional permit restrictions affecting the Work are specified in Section 01 41 00, Regulatory Requirements.

1.5 SITE CONDITIONS

A. Explosives and Blasting:
1. Explosives and blasting are not allowed by Metro-North inthe performance of the Work of this Project.

B. Occupational Safety and Health Administration (OSHA) Restrictions:
1. Comply with the applicable restrictions on OSHA regulatedworkplace activities.

1.6 PROTECTION OF UNDERGROUND METRO-NORTH FACILITIES

A. General
1. Metro-North maintains its own network of electrical, communications, gas, oil, sewer, and water facilities. The purpose of the procedures herein is to protect and prevent damage to private underground facilities owned by Metro-North. While these procedures have been developed in accordance with the requirements established by 16 NYCRR Part 753 and Dig Safely New York for public and private underground facilities, the Contractor is hereby notified that Metro-North's requirements for protection of its facilities are more restrictive than that of 16 NYCRR Part 753.
2. The Contractor shall take all necessary precautions to identify, locate, avoid contact with, and protect existing public, private, and Metro-North facilities. In addition to the requirements of 16 NYCRR Part 753, the Contractor shall provide for the location of Metro-North's facilities in accordance with the requirements herein.

B. Duty To Provide Notification
1. NOTE: The requirements herein do not supersede, nor lessen the responsibilities of the Contractor to locate public and private facilities in accordance with the requirements of the 16 NYCRR Part 753, commonly cited as Industrial Code 53 or Code Rule 53, and Section 16-345 of the Regulations of the Department of Public Utility Control for Connecticut.
2. Excavation shall be conducted in accordance with 16 NYCRR Part 753 for work in New York State, 16-345 for work in Connecticut, and the requirements specified herein. The definition of "Excavation" shall be the same as described in Section 753–1.2 Definitions of 16 NYCRR Part 753. In conformance with previously cited regulations, the Contractor must notify the local One Call Center to allow member agencies to mark locations of underground facilities prior to commencing excavation. Depending on the work location, the Contractor shall contact the appropriate One Call Center.
3. In addition to contacting the appropriate One Call Center, the Contractor shall request the identification of:
   a. Utilities owned and operated by Metro-North in accordance with the following process, and
   b. Identification of private utilities along or within the Metro-North Right-of-Way via private utility locate service companies

State	Name	Telephone	
New York	Dig Safely New York	(800) 962-7962	811
	Westchester Counties		

C. Timing Of Notification

1. The Contractor shall identify the areas in which they intend to work on the Four Week Look Ahead Schedule presented to Metro-North during the Bi-Weekly Progress Meeting and/or Weekly Coordination Meeting.
2. The Contractor shall complete and submit a *Metro-North Utility Location Request* (see request form at end of this section) identifying locations where excavation or other types of ground disturbance are required. Said request shall be submitted to the Engineer a minimum of three (3) weeks prior to the start date of excavation.

D. Identification / Mark-Out Process

1. The Contractor shall physically demarcate / mark out all locations to be disturbed with white paint, flags, or stakes in accordance with the Common Ground Alliance Best Practices prior to submittal of the Utility Location Request. Should the size of the work area preclude the ability to mark the entire excavation area, the Contractor shall utilize flags or stakes to demarcate the limits of the work and paint arrows between the limits. Alternatively, if available, and agreeable to Metro-North, the Contractor may identify locations to be disturbed on project drawings or plans. Copies of the same shall be attached to and submitted with the *Metro-North Utility Location Request.*
2. The Engineer will submit the *Metro-North Utility Location Request* completed by the Contractor to the Metro-North Force Account Manager assigned to the project.
3. The Force Account Manager will distribute the *Metro-North Utility Location Request* to the appropriate Metro-North Departments responsible for conducting utility identification. The Metro-North Departments included in the utility identification process are Communications and Signal, Power, and Structures.
4. The Metro-North Departments shall conduct the identification; locating and marking the buried utilities, within (2) weeks of receiving the request from the Force Account Manager. Utilities shall be field identified in accordance with the Common Ground Alliance Best Practices utilizing the standard colors for locating utilities. (See Uniform Colors at the end of this section).
5. Upon completion of field identification, a *Metro-North Utility Location Ticket* (see ticket at end of this section) shall be completed by each of the responsible departments; Power, Communications, Signal, and Structures, and returned to the Force Account Manager.
6. The Force Account Manager shall review the *Metro-North Utility Location Tickets* to verify that they have been satisfactorily completed by each of the appropriate departments and forward them to the Engineer, or other Metro-North personnel responsible for managing the Contractor activities.
7. The Engineer shall provide copies of the completed *Metro-North Utility Location Tickets* to the Contractor and retain the originals for the project files. The Contractor shall review the *Utility Location Tickets* and compare it against the *Utility Location Request* form to ensure it has been satisfactorily completed. The Contractor shall review available As Built drawings for the work location(s) and compare the information to the field identified utilities. If a discrepancy exists between what is shown on the As Built drawings and the utilities physically marked out in the field, the Contractor shall immediately notify the Engineer.

E. Documentation & Preservation of Markings

1. Upon completion of the utility mark-out and receipt of the *Metro-North Utility Location Tickets*, but prior to disturbance, the Contractor shall prepare and provide a photograph or video record of the utility mark-out. The record should include a description of the general location (i.e. state, county, town/village), milepost, control point, track number and include visual landmarks to assist in identification.
2. It is the responsibility of the Contractor to maintain and preserve the markings provided for the duration of the work. This includes transferring mark outs outside of the work area using offsets. For work within the rail traffic envelope, it is recommended that the Contractor transfer markings, or provide offsets on the side of the running rail. If some of the markings may be destroyed during the course of your work, or if the excavation will be taking place over a long period of time, *take measurements and photos first.* Should the Contractor be negligent in maintaining the markings, and additional work is required to re-identify utilities, the Contractor shall be responsible for the costs associated with providing the extra location services and such shall be deducted from the next progress payment.

F. Verification of Underground Facilities via Test Pitting / Pot Holing

1. The Contractor shall not begin disturbance until having, 1) received the completed *Metro-North Utility Location Tickets*, 2) completed video or photo documentation of the mark out, and 3) transferred the marks as necessary to preserve them throughout the course of the work.
2. Where an underground facility has been staked, marked or otherwise identified and the tolerance zone overlaps with any part of the work area, or the projected line of a bore/directional drill intersects the tolerance zone, the excavator shall verify the precise location, type, size, direction of run and depth of such underground facility or its encasement. Verification shall be completed before the excavation or demolition is commenced or shall be performed as the work progresses.
3. The verification of underground facilities shall be accomplished by exposing the underground facility or its encasement to view by means of hand dug test pits at one or more points where the work area and tolerance zone overlap, or more points as designated by Metro-North. The Contractor shall excavate Test Pits / Pot Holes to identify the actual locations of the buried utilities/facilities. Unless otherwise identified in the project documents, the Contractor shall assume the following:
   a. one (1) test pit will be required every twenty-five feet (25') if proposed excavation is within five feet (5') of an existing utility,
   b. one (1) test pit will be required wherever an excavation is crossing an existing utility,
   c. within interlockings, one (1) test pit will be required every fifty feet (50') between opposing home signals.
   d. test pits will be required adjacent to each substation, railroad facility, and abandoned utility, or appurtenances thereto, to determine location and direction of buried utilities emanating from or leaving said facilities
4. The Contractor is urged to consider use of soft excavation methods (i.e. vacuum excavation).
5. Powered or mechanized equipment may be used within the tolerance zone for removal of pavement or masonry, but only to the depth of such pavement or masonry. Only when agreed to in writing by Metro-North, may powered equipment be used within the tolerance zone below the depth of pavement or masonry prior to the verification of the location of facilities.
6. Metro-North, or their agents and Contractors working under their direct supervision, may use powered equipment to locate their own facilities within the tolerance zone.
7. Unless otherwise identified, the minimum size of Test Pits shall be one (1) cubic yard. Should the Contractor not be able to locate the marked utility within the Test Pit area, the Contractor shall enlarge the test pit excavation towards the direction the utility is most likely located, or

as directed by the Engineer. Once the test pits confirm utility locations, the Contractor will be released to excavate in that area.

8. Measurement and Payment: Refer to Measurement and Payment section of the Contract.
9. Existing utilities shall be taken out of service (i.e. de-energized, depressurized) and tested to verify the same, prior to being spliced into, demolished, removed, or otherwise disturbed. The Contractor shall implement a means of positively identifying existing utilities to be disturbed during the work. A means of identifying the utility as "in service" or "out of service" shall be implemented and made known to project personnel.

G. Unverifiable Underground Facilities

1. Should the Contractor be unable to verify the location of a facility, after diligent search at a reasonable depth, excavation shall not be allowed to proceed, and the Contractor shall notify the Engineer. The Engineer will contact the Force Account Manager and inform them of the inability to locate the previously marked utility. The Force Account Manager will notify the representative of the appropriate Metro-North Department having marked the utility. Within (24) twenty-four hours of notification, this department shall return to the area and attempt to further identify the location of the utility or use other means mutually agreeable to the Contractor and Metro-North (i.e. continue to hand excavate until utility is located). Metro-North will identify if and where any additional test pits are necessary to locate/expose the utility, or if problem areas exist that could restrict the Contractor's excavation.

H. Commencement of Excavation or Demolition

1. The excavator may proceed with excavation or demolition on the stated commencement date if, prior thereto, he or she has received completed *Metro-North Utility Location Tickets* from each Metro-North Department identifying that:
   a. No underground facilities were located in or within fifteen feet (15') of the work area; or
   b. That any underground facility located in or within fifteen feet (15') of the work area has been marked
2. The excavator may proceed with the excavation or demolition prior to the stated date of commencement only if he or she has received notification from each department that no underground facilities are located in or within fifteen feet (15') of the work area.
3. The excavator shall not commence the excavation or demolition on the stated commencement date if he or she has been notified by Metro-North that the marking of an underground facility located in or within fifteen feet (15') of the proposed work area will not be completed on the stated commencement date. In such case, Metro-North shall promptly report such to the excavator and inform of a prompt and practicable completion date, which in no case shall be more than two (2) working days after the excavator's stated commencement date, unless a longer period is agreed to by both parties.

I. Responsibilities of The Excavator

1. Every excavator shall be familiar with the provisions of this procedure and 16 NYCRR Part 753, especially those relating to size and depth indications, color coding, center line or offset staking or marking and the location of underground facilities by designations other than staking or marking.
2. Whenever the excavator determines that a review of the staking, marking or other designation is necessary or that additional information is required, he or she shall notify the Engineer.
3. Starting on the stated commencement date, the excavator shall be responsible for protecting and preserving the staking, marking or other designation until no longer required for proper and safe excavation or demolition work at or near the underground facility.

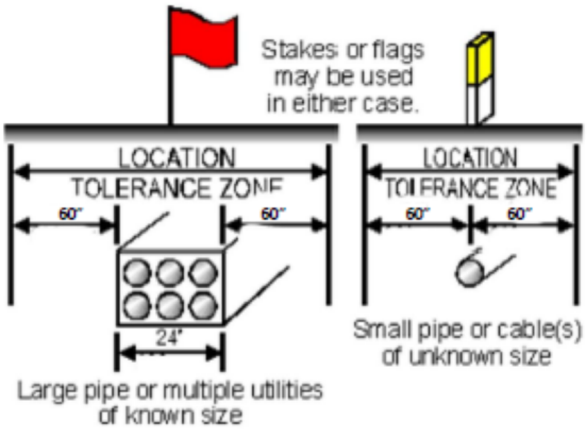
4. Whenever mechanized excavation equipment is utilized within five feet (5') of a facility, a ground spotter shall be provided to oversee the excavation.

J. Powered Excavation Limitations

1. The Contractor shall not proceed with excavation until the locations of the utilities shown on the as-built drawings and those marked in the field are confirmed through manual excavation of test pits. Metro-North and the Contractor must concur that the procedures herein were followed before production excavation begins.
2. After verifying the location of an underground facility, the Contractor may utilize powered excavation equipment as long as it does not endanger the facility. At no time shall the Contractor employ powered or mechanical excavating equipment closer than twelve inches (12") in any direction from the staked, marked or otherwise designated or known outside diameter or perimeter of such facility or its protective coating unless agreed to in writing by Metro-North. Upon request, any such written agreement shall be furnished to the Contractor by Metro-North.

K. Tolerance Zone

1. Before mechanized digging equipment is used in a Tolerance Zone, the presence and location of the facility must be verified. Refer to the diagram for an understanding of the Tolerance Zone.
2. For markings that indicate the width of the facility, the tolerance zone is the width of the facility plus an additional five feet (5') on either side of the facility. For example, the facility on the left is marked as being twenty-four inches (24") wide. So, five feet (5') on either side gives us an approximate location or Tolerance Zone of twelve feet (12'). (see diagram)
3. For markings that do not indicate the width of the facility, the tolerance zone is five feet (5') on either side of the markings. No width is provided for the facility on the right, so five feet (5') on either side gives us an approximate location or Tolerance Zone of ten feet (10'). (see diagram)



L. Discovery of Unknown Facilities

1. Should the Contractor uncover, unearth, or otherwise identify an unmarked / unknown facility, excavation that may further disturb said utility shall cease, and the Contractor shall immediately notify the Engineer. Excavation shall not proceed until the utility is identified and a determination can be made on how to proceed by Metro-North.
2. The Engineer will contact the Force Account Manager and inform them of the unmarked/unknown facility.
3. The Force Account Manager will notify the representatives of the appropriate Metro-North Departments.

4. Within twenty-four (24) hours of notification, these departments shall return to the area and attempt to identify the utility. The responsible department will identify if and where any additional test pits are necessary to locate/expose the unmarked utility and test the utility as necessary to determine if the utility is in service or out of service / abandoned. If abandoned or no longer in service, the responsible department may authorize the immediate removal of the interference or will provide direction as how to handle the unmarked utility as soon as possible, but no longer than twenty-four (24) hours from time of field identification by the department.
5. The Contractor is hereby notified that Metro-North Force Account Departments are subject to call out for Railroad emergencies. In this case, the Contractor is advised to identify other work that can be completed in addition to the anticipated week's production.

M. Damage to Underground Facilities
1. Excavators shall take all reasonable precautions to prevent contact or damage to underground facilities and their protective coatings, including but not limited to, compliance with accepted engineering practices and any reasonable directions provided by Metro-North.
2. In the event of contact with or damage to an underground facility, the excavator shall immediately notify the Engineer. All excavation or demolition in the immediate vicinity of the contacted or damaged portion of the underground facility shall be suspended until such portion is repaired and the Engineer advises the excavator that excavation or demolition may proceed.
3. No backfilling shall be done by the excavator in the vicinity of the contact or damage until Metro-North conducts an inspection and makes any necessary repairs; and, the excavator shall undertake no repairs unless and until authorized by Metro-North.
4. Should damage to an underground facility occur and it be determined that the Contractor is negligent in its actions; it did not exercise reasonable precautions to prevent contact or damage to underground facilities and their protective coatings, the Contractor is responsible for all costs associated with the repair and restoration of the damage facility. Such costs shall be deducted from the Contractor's next progress payment.

N. Identification of Underground Facilities in Danger of Failing
1. An excavator who by removing the surrounding materials exposes an underground facility which in his or her judgment appears to have failed or to be in potential danger of failing from corrosion or other causes shall immediately report such condition to the Engineer.
2. The excavator shall delay any further work in the immediate vicinity of such underground facility which could jeopardize it but may proceed in areas not affecting the questionable facility.
3. The excavator may proceed in such immediate vicinity after the Engineer responds and takes necessary action in regard thereto and advises the excavator that he or she may proceed.

O. Support and Protection for Underground Facilities
1. An excavator shall provide prompt and adequate support and protection for every underground facility located in the work area as is reasonably specified by the Engineer.
2. In the absence of any specifications, the excavator shall provide support and protection in accordance with generally accepted engineering practice, including but not limited to shoring and bracing.
3. Support shall be at least equivalent to the previously existing support and shall protect the underground facility against freezing and against traffic and other loads.
4. Support shall be maintained during excavation, during backfilling and, if necessary, after backfilling is completed.
5. Metro-North may, in agreement with the excavator, provide such support.

P. Backfilling Requirements

1. An excavator performing excavation or demolition at an underground facility shall backfill such excavation with materials and in such manner as specified by the Engineer or, in the absence of such specifications, with suitable materials and in such manner as will avoid damage to, and provide proper support for, such underground facility and its protective coating both during and after backfilling operations.
2. The excavator shall not place large rock, frozen earth, rubble, debris or other heavy or sharp materials or objects which could cause damage to or scraping against any underground facility.
3. The backfill beneath and around any underground facility shall be properly compacted in accordance with generally accepted engineering practice.
4. Heavy loads and excessive forces shall not be imposed on any exposed underground facility at any time during backfilling operations.

Q. Emergency Requirements

1. In the event of an emergency involving danger to life, health or property as a result of damage to an underground facility containing gas or liquid petroleum products or as a result of an electrical short or escape of gas or hazardous fluids, the excavator shall:
2. Proceed to evacuate his or her employees and all other endangered persons from the immediate vicinity to the best of his or her ability;
3. Immediately call 911 and the Engineer to inform of the exact location, nature of the emergency and type of underground facility which is affected.

R. Responsibility to Employees

1. Every excavator subject to the provisions of this Part shall make certain that all of his or her employees directly involved in excavation or demolition are thoroughly familiar with the applicable provisions of this Part and especially the provisions of this Subpart relating to their safety.

S. Documentation & Marking of Facilities

1. As to facilitate future identification, the Contractor shall identify all in service and abandoned utilities on As Built drawings.
2. The Contractor shall mark all new buried utilities with warning tapes specifically designed and manufactured for subgrade utility identification. The warning tape shall be of durable impervious material, designed to withstand extended underground exposure without material deterioration or fading of color. All tapes, unless otherwise directed by the specific utility, shall be detectable to a depth of at least three feet (3') with a commercial radio-type metal locator. The tape shall be of the color assigned to the type of facility and shall be durably imprinted with an appropriate warning message. The tape shall also comply with the specific requirements of the utility that owns the facility.
3. Warning tapes shall be installed the entire length of the utility, in one continuous unbroken length. Tapes shall be located a minimum of twelve inches (12") above the buried utility unless the excavation's depth, other underground facilities, or other engineering considerations make this minimum separation infeasible. The tapes shall extend a minimum of two feet (2') above grade and be tied or otherwise secured to the utility where it exits the ground. This is to facilitate access to the tape to allow sending of an electronic signal to aid in future identification of the utility.

UNIFORM COLOR CODE - UTILITY IDENTIFICATION ASSIGNED COLORS	
White	To delineate proposed excavation site

Pink	Survey markings
Green	Storm and sanitary sewers and drainage systems, including force mains and other non-hazardous materials
Blue	Water
Orange	Communication lines or cables, including, but not limited to, those used in, or in connection with, telephone, telegraph, fire signals, cable television, civil defense, data systems, electronic controls, track signal and control, and other instrumentation
Red	Electrical power lines, electrical power conduits and other electrical power facilities, railroad traction power (i.e. 3rd rail or catenary), traffic signals and appurtenances and illumination facilities
Yellow	Gas, oil, petroleum products, steam, compressed air, compressed gases and all other hazardous liquid or gaseous materials except water
Brown	Other
Purple	Radioactive materials, reclaimed water, irrigation

LIST OF LOCATING COMPANIES FOR PRIVATELY OWNED FACILITIES
(This is not a comprehensive listing; check local listings for more alternatives.)

Absolute Locating 24/7 2713 West Main Street, Unit 2, Wappingers, NY 12590 Phone: (845) 750-3157 Contact: Ryan Craven	**Pipedream Services** www.pipedreamservice.com 10 Fronckowiak Ave, Cheektowaga, NY 14227 Phone: (716) 894-9236 Contact: Steven L. Craft
Accumark, Inc. www.accumark.us 668 Stony Hill Rd, Suite 107, Yardley, PA 19067 Phone: (215) 369-3569 Contact: Van Singer, P.E.	**Premier Utility Services, LLC** www.premierlocatingllc.com 100 Marcus Blvd, Hauppauge, NY 11788 Phone:1-800-262-8600 Contact: Ed Heaney
ACS Underground Solutions www.acsunderground.com P.O. Box 448, Georgetown, CT 06829 Phone: (203) 544 7190 Contact: Ian Beaver	**ProTek Locating** www.proteklocating.com 10-37 51st Ave, 1st Floor, Long Island City, NY 11101 Phone: (718) 472-2304 Contact: Craig Anderson
Eastern Locating Services Inc. www.easternlocating.com PO Box 9485, Trenton, NJ 08650 Phone: (607) 585-0577 Contact: Ken Samu	**Puls Inc.** www.pulsinc.com 2299 Broadhead Road Suite G-1, Bethlehem, PA 18020 Phone: (610) 419-1232 Contact: Stanley Kalsky
ECSM Utility Contractors, Inc www.ECSMINC.com 1200 Walnut Bottom Rd, Suite 101, Carlisle, PA 17015 Phone: (717) 258-8001 Contact: Gerald L. Redden	**Underground Surveying, LLC** www.undergroundsurveying.com 152 Deer Hill Ave Suite 207, Danbury, CT 06810 Phone: (203) 312-9844 Contact: Peter C. Viola
Master Locators Inc. www.masterlocators.com 2426 East Helms Manor, Boothwyn, PA 19061 Phone: (610) 358-0172 Contact: Art Worthman	**Utility Survey Corp.** www.u-survey.com 87 East Main Street, Washingtonville, NY 10992 Phone: 1-800-825-9283 Contact: Garry Williams

UTILITY LOCATION REQUEST

(TO BE COMPLETED & SUBMITTED BY CONTRACTOR)

Date Request Submitted	
Contract Number	**Project Description**
General Contractor Company Name	
Address	
Field Contact	Telephone
Excavating Contractor Company Name	
Address	
Field Contact	Telephone

Excavation Site Information			
State (circle appropriate)	**NY**		**CT**
City, Town, Village		County	
Street Address			
Excavation site is located between… (Describe two closest intersecting streets)	1)		
	2)		
Milepost	Control Point		Track Number(s)
Excavation Dimensions (in feet) **Length**		**Width**	**Depth**
Has proposed excavation been field identified with white paint?		**YES**	**NO**
Project drawings/plans identifying proposed excavation attached?		**YES**	**NO**
Describe work causing disturbance			
Describe equipment to be used			
Excavation Start Date		Approximate Duration (days)	
Other			

METRO-NORTH Resident Engineer/Construction Manager			
Name		Phone	

METRO-NORTH Force Account Manager			
Name		Phone	

UTILITY LOCATION TICKET

(TO BE COMPLETED BY METRO-NORTH & RETURNED TO CONTRACTOR)

Check the box applicable to the represented department

☐ Power Department ☐ Signal Department

☐ Communications Department ☐ Structures Department

Contact's Name		Phone	
Date location request received		Date location completed	

Field Mark Out complete?	**YES**	**NO**
Utilities identified within the demarcated area?	**YES**	**NO**
If Yes, Describe		

Problems encountered during utility identification/mark out?	**YES**	**NO**
If Yes, Describe		

Recommended locations of Test Pits have been marked out?	**YES**	**NO**
Additional Test Pits Required?	**YES**	**NO**
If Yes, Describe		

Notes / Special Instructions	

Response provided to the Metro-North personnel responsible for managing the Contractor's work?	**YES**	**NO**	
If Yes, provide contact's name and date notified		**Date**	

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

[This Page Left Intentionally Blank]

SECTION 01 18 01
PROTECTION OF UNDERGROUND METRO-NORTH RAILROAD FACILITIES

A. GENERAL

Metro-North maintains its own network of electrical, communications, gas, oil, sewer, and water facilities. The purpose of the procedures herein is to protect and prevent damage to private underground facilities owned by Metro-North Railroad. While these procedures have been developed in accordance with the requirements established by 16 NYCRR Part 753 and Dig Safely New York for public and private underground facilities, the Contractor is hereby notified that Metro-North Railroad's requirements for protection of its facilities are more restrictive than that of 16 NYCRR Part 753.

The Contractor shall take all necessary precautions to identify, locate, avoid contact with, and protect existing public, private, and Metro-North Railroad facilities. In addition to the requirements of 16 NYCRR Part 753, the Contractor shall provide for the location of Metro-North's facilities in accordance with the requirements herein.

B. DUTY TO PROVIDE NOTIFICATION

NOTE: The requirements herein do not supersede, nor lessen the responsibilities of the Contractor to locate public and private facilities in accordance with the requirements of the 16 NYCRR Part 753, commonly cited as Industrial Code 53 or Code Rule 53, and Section 16-345 of the Regulations of the Department of Public Utility Control for Connecticut.

Excavation shall be conducted in accordance with 16 NYCRR Part 753 for work in New York State, 16-345 for work in Connecticut, and the requirements specified herein. The definition of "Excavation" shall be the same as described in Section 753–1.2 Definitions of 16 NYCRR Part 753. In conformance with previously cited regulations, the Contractor must notify the local One Call Center to allow member agencies to mark locations of underground facilities prior to commencing excavation. Depending on the work location, the Contractor shall contact the appropriate One Call Center.

In addition to contacting the appropriate One Call Center, the Contractor shall request the identification of:

a) Utilities owned and operated by Metro-North Railroad in accordance with the following process, and

b) Identification of private utilities along or within the Metro-North Right-of-Way via private utility locate service companies

State	Name	Telephone	
New York	Dig Safely New York	(800) 962-7962	811
	New York City & Long Island (Five Boroughs of New York City and Nassau and Suffolk Counties of Long Island)	(800) 272-4480	
Connecticut	Call Before You Dig	(800) 922-4455	

C. TIMING OF NOTIFICATION

The Contractor shall identify the areas in which they intend to work on the Four Week Look Ahead Schedule presented to Metro-North Railroad during the Bi-Weekly Progress Meeting and/or Weekly Coordination Meeting.

The Contractor shall complete and submit a *Metro-North Railroad Utility Location Request* (see request form at end of this section) identifying locations where excavation or other types of ground disturbance are required. Said request shall be submitted to the Engineer a minimum of three (3) weeks prior to the start

date of excavation.

D. IDENTIFICATION / MARK-OUT PROCESS

1. The Contractor shall physically demarcate / mark out all locations to be disturbed with white paint, flags, or stakes in accordance with the Common Ground Alliance Best Practices prior to submittal of the Utility Location Request. Should the size of the work area preclude the ability to mark the entire excavation area, the Contractor shall utilize flags or stakes to demarcate the limits of the work and paint arrows between the limits. Alternatively, if available, and agreeable to Metro-North Railroad, the Contractor may identify locations to be disturbed on project drawings or plans. Copies of the same shall be attached to and submitted with the *Metro-North Railroad Utility Location Request.*
2. The Engineer will submit the *Metro-North Railroad Utility Location Request* completed by the Contractor to the Metro-North Railroad Force Account Manager assigned to the project.
3. The Force Account Manager will distribute the *Metro-North Railroad Utility Location Request* to the appropriate Metro-North Railroad Departments responsible for conducting utility identification. The Metro-North Railroad Departments included in the utility identification process are Communications and Signal, Power, and Structures.
4. The Metro-North Departments shall conduct the identification; locating and marking the buried utilities, within (2) weeks of receiving the request from the Force Account Manager. Utilities shall be field identified in accordance with the Common Ground Alliance Best Practices utilizing the standard colors for locating utilities. (See Uniform Colors at the end of this section).
5. Upon completion of field identification, a *Metro-North Railroad Utility Location Ticket* (see ticket at end of this section) shall be completed by each of the responsible departments; Power, Communications, Signal, and Structures, and returned to the Force Account Manager.
6. The Force Account Manager shall review the *Metro-North Railroad Utility Location Tickets* to verify that they have been satisfactorily completed by each of the appropriate departments and forward them to the Engineer, or other Metro-North Railroad personnel responsible for managing the Contractor activities.
7. The Engineer shall provide copies of the completed *Metro-North Railroad Utility Location Tickets* to the Contractor and retain the originals for the project files. The Contractor shall review the *Utility Location Tickets* and compare it against the *Utility Location Request* form to ensure it has been satisfactorily completed. The Contractor shall review available As Built drawings for the work location(s) and compare the information to the field identified utilities. If a discrepancy exists between what is shown on the As Built drawings and the utilities physically marked out in the field, the Contractor shall immediately notify the Engineer.

E. DOCUMENTATION & PRESERVATION OF MARKINGS

Upon completion of the utility mark-out and receipt of the *Metro-North Railroad Utility Location Tickets*, but prior to disturbance, the Contractor shall prepare and provide a photograph or video record of the utility mark-out. The record should include a description of the general location (i.e. state, county, town/village), milepost, control point, track number and include visual landmarks to assist in identification.

It is the responsibility of the Contractor to maintain and preserve the markings provided for the duration of the work. This includes transferring mark outs outside of the work area using offsets. For work within the rail traffic envelope, it is recommended that the contractor transfer markings, or provide offsets on the side of the running rail. If some of the markings may be destroyed during the course of your work, or if the excavation will be taking place over a long period of time, take measurements and photos first. Should the Contractor be negligent in maintaining the markings, and additional work is required to re-identify utilities, the Contractor shall be responsible for the costs associated with providing the extra location services and such shall be deducted from the next progress payment.

F. VERIFICATION OF UNDERGROUND FACILITIES VIA TEST PITTING / POT HOLING

1. The Contractor shall not begin disturbance until having, 1) received the completed *Metro-North Railroad Utility Location Tickets*, 2) completed video or photo documentation of the mark out, and 3) transferred the marks as necessary to preserve them throughout the course of the work.
2. Where an underground facility has been staked, marked or otherwise identified and the tolerance zone overlaps with any part of the work area, or the projected line of a bore/directional drill intersects the tolerance zone, the excavator shall verify the precise location, type, size, direction of run and depth of such underground facility or its encasement. Verification shall be completed before the excavation or demolition is commenced or shall be performed as the work progresses.
3. The verification of underground facilities shall be accomplished by exposing the underground facility or its encasement to view by means of hand dug test pits at one or more points where the work area and tolerance zone overlap, or more points as designated by Metro-North Railroad. The Contractor shall excavate Test Pits / Pot Holes to identify the actual locations of the buried utilities/facilities. Unless otherwise identified in the project documents, the Contractor shall assume the following:
    a) one (1) test pit will be required every twenty-five feet (25') if proposed excavation is within five feet (5') of an existing utility,
    b) one (1) test pit will be required wherever an excavation is crossing an existing utility,
    c) within interlockings, one (1) test pit will be required every fifty feet (50') between opposing home signals.
    d) test pits will be required adjacent to each substation, railroad facility, and abandoned utility, or appurtenances thereto, to determine location and direction of buried utilities emanating from or leaving said facilities
4. The Contractor is urged to consider use of soft excavation methods (i.e. vacuum excavation).
5. Powered or mechanized equipment may be used within the tolerance zone for removal of pavement or masonry, but only to the depth of such pavement or masonry. Only when agreed to in writing by Metro-North Railroad, may powered equipment be used within the tolerance zone below the depth of pavement or masonry prior to the verification of the location of facilities.
6. Metro-North Railroad, or their agents and Contractors working under their direct supervision, may use powered equipment to locate their own facilities within the tolerance zone.
7. Unless otherwise identified, the minimum size of Test Pits shall be one (1) cubic yard. Should the Contractor not be able to locate the marked utility within the Test Pit area, the Contractor shall enlarge the test pit excavation towards the direction the utility is most likely located, or as directed by the Engineer. Once the test pits confirm utility locations, the Contractor will be released to excavate in that area.
8. Existing utilities shall be taken out of service (i.e. de-energized, depressurized) and tested to verify the same, prior to being spliced into, demolished, removed, or otherwise disturbed. The Contractor shall implement a means of positively identifying existing utilities to be disturbed during the work. A means of identifying the utility as "in service" or "out of service" shall be implemented and made known to project personnel.

G. UNVERIFIABLE UNDERGROUND FACILITIES

Should the Contractor be unable to verify the location of a facility, after diligent search at a reasonable depth, excavation shall not be allowed to proceed and the Contractor shall notify the Engineer. The Engineer will contact the Force Account Manager and inform them of the inability to locate the previously marked utility. The Force Account Manager will notify the representative of the appropriate Metro-North Department having marked the utility. Within (24) twenty-four hours of notification, this department shall

return to the area and attempt to further identify the location of the utility, or use other means mutually agreeable to the Contractor and Metro-North Railroad (ie. continue to hand excavate until utility is located). This department will identify if and where any additional test pits are necessary to locate/expose the utility, or if problem areas exist that could restrict the Contractor's excavation.

H. COMMENCMENT OF EXCAVATION OR DEMOLITION

1. The excavator may proceed with excavation or demolition on the stated commencement date if, prior thereto, he or she has received completed *Metro-North Railroad Utility Location Tickets* from each Metro-North Department identifying that:

   a. No underground facilities were located in or within fifteen feet (15') of the work area; or

   b. That any underground facility located in or within fifteen feet (15') of the work area has been marked

2. The excavator may proceed with the excavation or demolition prior to the stated date of commencement only if he or she has received notification from each department that no underground facilities are located in or within fifteen feet (15') of the work area.

3. The excavator shall not commence the excavation or demolition on the stated commencement date if he or she has been notified by Metro-North Railroad that the marking of an underground facility located in or within fifteen feet (15') of the proposed work area will not be completed on the stated commencement date. In such case, Metro-North Railroad shall promptly report such to the excavator and inform of a prompt and practicable completion date, which in no case shall be more than two (2) working days after the excavator's stated commencement date, unless a longer period is agreed to by both parties.

I. RESPONSIBILITIES OF THE EXCAVATOR

1. Every excavator shall be familiar with the provisions of this procedure and 16 NYCRR Part 753, especially those relating to size and depth indications, color coding, center line or offset staking or marking and the location of underground facilities by designations other than staking or marking.

2. Whenever the excavator determines that a review of the staking, marking or other designation is necessary or that additional information is required, he or she shall notify the Engineer.

3. Starting on the stated commencement date, the excavator shall be responsible for protecting and preserving the staking, marking or other designation until no longer required for proper and safe excavation or demolition work at or near the underground facility.

4. Whenever mechanized excavation equipment is utilized within five feet (5') of a facility, a ground spotter shall be provided to oversee the excavation.

J. POWERED EXCAVATION LIMITATIONS

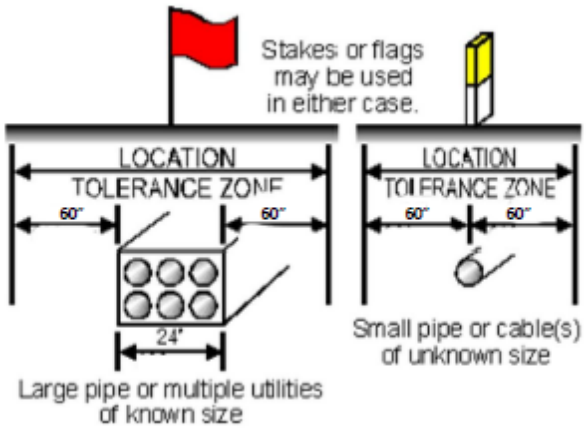
The Contractor shall not proceed with excavation until the locations of the utilities shown on the as-built drawings and those marked in the field are confirmed through manual excavation of test pits. Metro-North Railroad and the Contractor must concur that the procedures herein were followed before production excavation begins.

After verifying the location of an underground facility, the Contractor may utilize powered excavation equipment as long as it does not endanger the facility. At no time shall the Contractor employ powered or mechanical excavating equipment closer than twelve inches (12") in any direction from the staked, marked or otherwise designated or known outside diameter or perimeter of such facility or its protective coating unless agreed to in writing by Metro-North Railroad. Upon request, any such written agreement shall be

furnished to the Contractor by Metro-North Railroad.

K. TOLERANCE ZONE

1. Before mechanized digging equipment is used in a Tolerance Zone, the presence and location of the facility must be verified. Refer to the diagram for an understanding of the Tolerance Zone.
2. For markings that indicate the width of the facility, the tolerance zone is the width of the facility plus an additional five feet (5') on either side of the facility. For example, the facility on the left is marked as being twenty four inches (24") wide. So five feet (5') on either side gives us an approximate location or Tolerance Zone of twelve feet (12'). (see diagram)
3. For markings that do not indicate the width of the facility, the tolerance zone is five feet (5') on either side of the markings. No width is provided for the facility on the right, so five feet (5') on either side gives us an approximate location or Tolerance Zone of ten feet (10'). (see diagram)



L. DISCOVERY OF UNKNOWN FACILITIES

1. Should the Contractor uncover, unearth, or otherwise identify an unmarked / unknown facility, excavation that may further disturb said utility shall cease, and the Contractor shall immediately notify the Engineer. Excavation shall not proceed until the utility is identified and a determination can be made on how to proceed by Metro-North Railroad.
2. The Engineer will contact the Force Account Manager and inform them of the unmarked/unknown facility.
3. The Force Account Manager will notify the representatives of the appropriate Metro-North Departments.
4. Within twenty-four (24) hours of notification, these departments shall return to the area and attempt to identify the utility. The responsible department will identify if and where any additional test pits are necessary to locate/expose the unmarked utility, and test the utility as necessary to determine if the utility is in service or out of service / abandoned. If abandoned or no longer in service, the responsible department may authorize the immediate removal of the interference, or will provide direction as how to handle the unmarked utility as soon as possible, but no longer than twenty-four (24) hours from time of field identification by the department.
5. The Contractor is hereby notified that Metro-North Force Account Departments are subject to call out for Railroad emergencies. In this case, the Contractor is advised to identify other work that can be completed in addition to the anticipated week's production.

M. DAMAGE TO UNDERGROUND FACILITIES

1. Excavators shall take all reasonable precautions to prevent contact or damage to underground

facilities and their protective coatings, including but not limited to, compliance with accepted engineering practices and any reasonable directions provided by Metro-North Railroad.

2. In the event of contact with or damage to an underground facility, the excavator shall immediately notify the Engineer. All excavation or demolition in the immediate vicinity of the contacted or damaged portion of the underground facility shall be suspended until such portion is repaired and the Engineer advises the excavator that excavation or demolition may proceed.

3. No backfilling shall be done by the excavator in the vicinity of the contact or damage until Metro-North Railroad conducts an inspection and makes any necessary repairs; and, the excavator shall undertake no repairs unless and until authorized by Metro-North Railroad.

4. Should damage to an underground facility occur and it be determined that the Contractor is negligent in its actions; it did not exercise reasonable precautions to prevent contact or damage to underground facilities and their protective coatings, the Contractor is responsible for all costs associated with the repair and restoration of the damage facility. Such costs shall be deducted from the Contractor's next progress payment.

N. IDENTIFICATION OF UNDERGROUND FACILITIES IN DANGER OF FAILING

1. An excavator who by removing the surrounding materials exposes an underground facility which in his or her judgment appears to have failed or to be in potential danger of failing from corrosion or other causes shall immediately report such condition to the Engineer.

2. The excavator shall delay any further work in the immediate vicinity of such underground facility which could jeopardize it but may proceed in areas not affecting the questionable facility.

3. The excavator may proceed in such immediate vicinity after the Engineer responds and takes necessary action in regard thereto and advises the excavator that he or she may proceed.

O. SUPPORT AND PROTECTION FOR UNDERGROUND FACILITIES

1. An excavator shall provide prompt and adequate support and protection for every underground facility located in the work area as is reasonably specified by the Engineer.

2. In the absence of any specifications, the excavator shall provide support and protection in accordance with generally accepted engineering practice, including but not limited to shoring and bracing.

3. Support shall be at least equivalent to the previously existing support and shall protect the underground facility against freezing and against traffic and other loads.

4. Support shall be maintained during excavation, during backfilling and, if necessary, after backfilling is completed.

5. Metro-North Railroad may, in agreement with the excavator, provide such support.

P. BACKFILLING REQUIREMENTS

1. An excavator performing excavation or demolition at an underground facility shall backfill such excavation with materials and in such manner as specified by the Engineer or, in the absence of such specifications, with suitable materials and in such manner as will avoid damage to, and provide proper support for, such underground facility and its protective coating both during and after backfilling operations.

2. The excavator shall not place large rock, frozen earth, rubble, debris or other heavy or sharp materials or objects which could cause damage to or scraping against any underground facility.

3. The backfill beneath and around any underground facility shall be properly compacted in accordance with generally accepted engineering practice.

4. Heavy loads and excessive forces shall not be imposed on any exposed underground facility at

any time during backfilling operations.

Q. EMERGENCY REQUIREMENTS

1. In the event of an emergency involving danger to life, health or property as a result of damage to an underground facility containing gas or liquid petroleum products or as a result of an electrical short or escape of gas or hazardous fluids, the excavator shall:
   a. Proceed to evacuate his or her employees and all other endangered persons from the immediate vicinity to the best of his or her ability;
   b. Immediately call 911 and the Engineer to inform of the exact location, nature of the emergency and type of underground facility which is affected.

R. RESPONSIBILITY TO EMPLOYEES

Every excavator subject to the provisions of this Part shall make certain that all of his or her employees directly involved in excavation or demolition are thoroughly familiar with the applicable provisions of this Part and especially the provisions of this Subpart relating to their safety.

S. DOCUMENTATION & MARKING OF FACILITIES

1. As to facilitate future identification, the Contractor shall identify all in service and abandoned utilities on As Built drawings.
2. The Contractor shall mark all new buried utilities with warning tapes specifically designed and manufactured for subgrade utility identification. The warning tape shall be of durable impervious material, designed to withstand extended underground exposure without material deterioration or fading of color. All tapes, unless otherwise directed by the specific utility, shall be detectable to a depth of at least three feet (3') with a commercial radio-type metal locator. The tape shall be of the color assigned to the type of facility and shall be durably imprinted with an appropriate warning message. The tape shall also comply with the specific requirements of the utility that owns the facility.
3. Warning tapes shall be installed the entire length of the utility, in one continuous unbroken length. Tapes shall be located a minimum of twelve inches (12") above the buried utility unless the excavation's depth, other underground facilities, or other engineering considerations make this minimum separation infeasible. The tapes shall extend a minimum of two feet (2') above grade and be tied or otherwise secured to the utility where it exits the ground. This is to facilitate access to the tape to allow sending of an electronic signal to aid in future identification of the utility.

T. MEASUREMENT & PAYMENT

The Preliminary Design included test pitting of the fiber optic line at five hundred foot (500') intervals. (See Fiber Optic Line Survey-Test Pitting Information/Data.) When existing test pitting information/data is insufficient, the Design Builder shall perform additional test pitting as needed. Test pitting shall be included in the lump sum for Item 3.00 Site Prep and Earthwork.

UNIFORM COLOR CODE - UTILITY IDENTIFICATION ASSIGNED COLORS	
White	To delineate proposed excavation site
Pink	Survey markings
Green	Storm and sanitary sewers and drainage systems, including force mains and other non-hazardous materials
Blue	Water
Orange	Communication lines or cables, including, but not limited to, those used in, or in connection with, telephone, telegraph, fire signals, cable television, civil defense, data systems, electronic controls, track signal and control, and other instrumentation
Red	Electrical power lines, electrical power conduits and other electrical power facilities, railroad traction power (i.e. 3rd rail or catenary), traffic signals and appurtenances and illumination facilities
Yellow	Gas, oil, petroleum products, steam, compressed air, compressed gases and all other hazardous liquid or gaseous materials except water
Brown	Other
Purple	Radioactive materials, reclaimed water, irrigation

LIST OF LOCATING COMPANIES FOR PRIVATELY OWNED FACILITIES
(This is not a comprehensive listing; check local listings for more alternatives.)

Absolute Locating 24/7 2713 West Main Street, Unit 2, Wappingers, NY 12590 Phone: (845) 750-3157 Contact: Ryan Craven	**Pipedream Services** www.pipedreamservice.com 10 Fronckowiak Ave, Cheektowaga, NY 14227 Phone: (716) 894-9236 Contact: Steven L. Craft
Accumark, Inc. www.accumark.us 668 Stony Hill Rd, Suite 107, Yardley, PA 19067 Phone: (215) 369-3569 Contact: Van Singer, P.E.	**Premier Utility Services, LLC** www.premierlocatingllc.com 100 Marcus Blvd, Hauppauge, NY 11788 Phone:1-800-262-8600 Contact: Ed Heaney
ACS Underground Solutions www.acsunderground.com P.O. Box 448, Georgetown, CT 06829 Phone: (203) 544 7190 Contact: Ian Beaver	**ProTek Locating** www.proteklocating.com 10-37 51st Ave, 1st Floor, Long Island City, NY 11101 Phone: (718) 472-2304 Contact: Craig Anderson
Eastern Locating Services Inc. www.easternlocating.com PO Box 9485, Trenton, NJ 08650 Phone: (607) 585-0577 Contact: Ken Samu	**Puls Inc.** www.pulsinc.com 2299 Broadhead Road Suite G-1, Bethlehem, PA 18020 Phone: (610) 419-1232 Contact: Stanley Kalsky
ECSM Utility Contractors, Inc www.ECSMINC.com 1200 Walnut Bottom Rd, Suite 101, Carlisle, PA 17015 Phone: (717) 258-8001 Contact: Gerald L. Redden	**Underground Surveying, LLC** www.undergroundsurveying.com 152 Deer Hill Ave Suite 207, Danbury, CT 06810 Phone: (203) 312-9844 Contact: Peter C. Viola
Master Locators Inc. www.masterlocators.com 2426 East Helms Manor, Boothwyn, PA 19061 Phone: (610) 358-0172 Contact: Art Worthman	**Utility Survey Corp.** www.u-survey.com 87 East Main Street, Washingtonville, NY 10992 Phone: 1-800-825-9283 Contact: Garry Williams

UTILITY LOCATION REQUEST

(TO BE COMPLETED & SUBMITTED BY CONTRACTOR)

Date Request Submitted			
Contract Number		**Project Description**	
General Contractor Company Name			
Address			
Field Contact		Telephone	
Excavating Contractor Company Name			
Address			
Field Contact		Telephone	

Excavation Site Information					
State (circle appropriate)	**NY**			**CT**	
City, Town, Village		County			
Street Address					
Excavation site is located between… (Describe two closest intersecting streets)	1)				
	2)				
Milepost		Control Point		Track Number(s)	
Excavation Dimensions (in feet)	**Length**		**Width**		**Depth**
Has proposed excavation been field identified with white paint?				**YES**	**NO**
Project drawings/plans identifying proposed excavation attached?				**YES**	**NO**
Describe work causing disturbance					
Describe equipment to be used					
Excavation Start Date		Approximate Duration (days)			
Other					

MNR Resident Engineer/Construction Manager			
Name		Phone	
MNR Force Account Manager			

Name		Phone	

UTILITY LOCATION TICKET

(TO BE COMPLETED BY METRO-NORTH RAILROAD & RETURNED TO CONTRACTOR)

Check the box applicable to the represented department

☐ Power Department ☐ Signal Department

☐ Communications Department ☐ Structures Department

Contact's Name		Phone	
Date location request received		Date location completed	

Field Mark Out complete?	**YES**	**NO**
Utilities identified within the demarcated area?	**YES**	**NO**
If Yes, Describe		

Problems encountered during utility identification/mark out?	**YES**	**NO**
If Yes, Describe		

Recommended locations of Test Pits have been marked out?	**YES**	**NO**
Additional Test Pits Required?	**YES**	**NO**
If Yes, Describe		

Notes / Special Instructions	

Response provided to the Metro-North personnel responsible for managing the Contractor's work?	**YES**	**NO**	
If Yes, provide contact's name and date notified		**Date**	

SECTION 01 20 00 - MEASUREMENT AND PAYMENT (PURDY'S STATION)

PART 1 - GENERAL

1.1 SUMMARY

A. Provide the work of this section in accordance with requirements of the Contract Documents.

B. This Section Includes but is not limited to measurement and payment criteria applicable to portions of the work performed as a lump sum, unit price, allowances and options as exercised by the Railroad during the course of the Contract shall be measured and paid in accordance with this section.

C. Defect assessment and non-payment for rejected work.

1.2 AUTHORITY

A. Metro-North will take all measurements and compute quantities accordingly.

B. The Contractor shall assist by providing necessary equipment, workers, and survey personnel as required.

1.3 DESCRIPTION OF BID ITEMS

The following descriptions of Bid Items for this Contract define how various items of work shall be paid:

A. Purdy's Station
   1. Item No. 21 – (Lump Sum) Mobilization:
      a. This item consists of the activities necessary to begin the project. These activities will include both administrative tasks such as CPM preparation, submittals, work schedules for staging and physical activities such as establishing the smaller field office, communication lines, and field survey/engineering layouts.
      b. The Maximum amount for this item is 4% of the total Base Bid amount excluding allowances (Base Bid items 22 – 30) for the requirements in Sections 01 31 00, 01 35 29, 01 50 00, and 01 71 13.
      c. Five (5) percent of Item No. 21 total mobilization costs will be paid upon completion of the smaller Metro-North Field Trailer at Purdy's Station. Eighty-five (85) percent of the mobilization costs will be paid in 3 equal monthly payments with the first payment to be made 30 calendar days after the constructor begins actual field work. The remaining ten (10) percent of the mobilization costs will be paid upon the complete demobilization of equipment from Purdy's Station.
      d. Partial payments may be reduced by an amount determined by the Engineer if in his determination any of the following apply:
         1) The plant and equipment at the site are insufficient or are not suitable for the performance of the work.

2) The plant and equipment brought on the project are not being utilized or sufficiently utilized for the prosecution of the work.
3) The plant and equipment brought on the project and committed to the work are removed from the project without permission of the Engineer.
4) In the event of a reduction in partial payments as provided herein, the remainder of the partial payments which are unpaid at the date of such reduction, will be paid with subsequent progress payments as and when the conditions stated are rectified.

2. Item No. 22 - (Lump Sum) Demolition of Existing Staircase:
   a. Traffic Control for the north east corner of the parking lot:
      1) The Work consists of closing a section of the existing parking lot – (three northernmost stalls) to provide access for machines and equipment to remove and dispose of the existing steel staircase. This item consists of all labor, materials, tools, traffic control equipment and services required by the Contract Documents for the closure of the parking area and the installation and removal of all temporary traffic control devices specified and any other incidentals necessary to complete the work.
   b. Remove and Dispose of Staircase and Lead Abatement:
      1) The Work consists of submission and approval of the Contractor's demolition plan. Once approved, work includes the dismantling and disposal (hauling away) of the existing staircase (including the lead paint per Metro-North report attached), light pole and associated conduits, cutting of the existing steel columns and steel connection to the Rte. 116 overpass and excavation and removal of the existing support column concrete footings. This item consists of all labor, materials, tools, cutting and lifting equipment and services required by the Contract Documents for the removal and disposal of the staircase and any other incidentals necessary to complete the work include transport off site to a qualified land fill.
3. Item No. 23 – (Lump Sum) Install Elevator and Machine Room:
   a. Traffic Control for the north east corner of the parking lot:
      1) The Work consists of closing a section of the existing parking lot – (22 northernmost stalls along ROW fence and four stalls along north corner) to provide access and Contractor lay down for the project. Work to include installing concrete barriers with chain link fence and way finding signage for patrons to stay clear. This item consists of all labor, materials, tools, traffic control equipment and services required by the Contract Documents for the closure of the parking area and the installation and removal of all temporary traffic control devices specified and any other incidentals necessary to complete the work.
   b. Install Elevator and Elevator Shaft:
      1) Work consists of installing the elevator foundation, hydraulic lift in caisson, sump, steel shell, lift tracks, elevator cab, glass panels, doors, roof, awning over outside door, elevator machine room concrete slab and foundation, CMU walls, door, vents, roof, elevator machine elements, machine room power, electrical, lighting, IT, ventilation, mechanical, fire & safety, CCTV cameras (PODS), emergency call box and telephone. The EMR door is to be future access control. This item consists of all labor, materials, tools, equipment and services required by the Contract Documents for the complete construction of the elevator and elevator structural shell building specified and any other incidentals necessary to complete the work.
   c. Install Pedestrian bridge from Rte. 116 Overpass to new Elevator:

1) Work consists of installing the pedestrian bridge foundations and steel support columns, pedestrian bridge steel frame and roof, glass panel walls and concrete composite floor slab, bridge LED lighting, station sign, wayfinding signage, and expansion joints. This item consists of all labor, materials, tools, equipment and services required by the Contract Documents for the complete construction of the pedestrian bridge structural specified and any other incidentals necessary to complete the work.

4. Item No. 24 – (Lump Sum) Install Parking Lot Improvements:
   a. Traffic Control for the north east corner of the parking lot:
      1) Work consists of increasing the closed area south of the entrance area to install the utility corridor back to the existing cabinets in the existing elevator machine room. Work to include installing temporary barrels with Type 'A' blinking strobe lights for temporary lane closures to conduit trenching. Steel plates will be use during off hours to open the area back up to traffic. This item consists of all labor, materials, tools, traffic control equipment and services required by the Contract Documents for the closure of the parking area and the installation and removal of all temporary traffic control devices specified and any other incidentals necessary to complete the work.
   b. Install Utility Corridor:
      1) Work consists removing existing asphalt pavement, excavating and installing a multiple dunk bank array to accommodate electric, (lighting and elevator), communications, telephone, IT and security between the new elevator and the pole riser located on Rte. 116. Work also includes installing the new light pole foundations, conduit runs, pull boxes, and erecting the new light poles. This item consists of all labor, materials, tools, equipment and services required by the Contract Documents for the complete construction of the duct bank and light poles specified and any other incidentals necessary to complete the work.
   c. Install Sidewalk and Curb:
      1) Work consists of removing existing asphalt pavement and excavating as needed and installing a new concrete sidewalk and curb from the new elevator to the exiting station entrance. In addition, parking lot drainage improvements, new parking lot pavement and pavement markings, drop curbs and parking signage will be included. A new glass wind screen will be added in front of the new elevator outside doors to protect against rain and snow entering the elevator. This item consists of all labor, materials, tools, equipment and services required by the Contract Documents for the complete construction of the sidewalk and curb specified and any other incidentals necessary to complete the work.

5. Item No. 25 – (Lump Sum) Install Rte. 116 Elements

   a. Traffic Control along Rte. 116:
      1) Work consists of closing the existing shoulder on eastbound Rte. 116 to install the elements along Rte. 116 overpass. Work to include installing temporary shoulder closure MPT following MUTCD standard practices for a two-lane roadway. This item consists of all labor, materials, tools, traffic control equipment and services required by the Contract Documents for the closure of the shoulder and the installation and removal of all temporary traffic control devices specified and any other incidentals necessary to complete the work.
   b. Rte. 116 Work Elements:
      1) Work to consist of removing sections of existing bridge fencing, installing new bridge fencing, installing new wayfinding signage, installing no parking s modifying the existing sidewalk to accommodate ADA requirements. This

item consists all labor, materials, tools, equipment and services required by the Contract Documents for the complete construction of the bridge fencing and sidewalk modifications as specified and any other incidentals necessary to complete the work.

B. Unit Price Items

1. Item No. 26 – (Ton) Hauling & Disposal of Hazardous Soil:
   a. This item consists of hauling and off-site disposal of hazardous soil in accordance with Metro-North procedure and standards, the contract documents and the quantities listed on the bid sheet. A list of Metro-North pre-qualified haulers and landfills is included in the contract specifications.
   b. This item consists of all labor, materials, tools, equipment and services required by the Contract Documents for the construction of all the components specified and any other incidentals necessary to complete the work.
   c. This item shall be measured and paid based on the number of tons of waste classified as hazardous soil that must be disposed of, including all labor, sampling and analysis, equipment, loading, stabilization, transport, disposal, decontamination, material documentation, permits and material to complete the work.
   d. Metro-North reserves the right, upon its sole determination to utilize Metro-North on-call contractors for transport and disposal of hazardous soil, with the Contractor remaining responsible for loading.
   e. All excavation and stockpiling related costs shall be included in the lump sum of other items in the contract-based contract work. Refer to specification 02 61 00 Sampling, Testing, Handling, Loading, Removal and Disposal of Soils.
   f. Work shall not be charged to this unit price without written authorization from Metro-North. The actual amount of work and associated cost shall be identified based on the unit price and quantity at the time when work is required.

2. Item No. 27 – (Ton) Hauling & Disposal of Non-Hazardous Petroleum Contaminated Soil:
   a. This item consists of hauling and off-site disposal of non-hazardous, petroleum contaminated soil in accordance with Metro-North procedure and standards, the contract documents and the quantities listed on the bid sheet. A list of Metro-North pre-qualified haulers and landfills is included in the contract specifications.
   b. This item consists of all labor, materials, tools, equipment and services required by the Contract Documents for the construction of all the components specified and any other incidentals necessary to complete the work.
   c. This item shall be measured and paid based on the number of tons of waste classified as non-hazardous, petroleum contaminated soil that must be disposed of, including all labor, sampling and analysis, equipment, loading, stabilization, transport, disposal, decontamination, material documentation, permits and material to complete the work.
   d. Metro-North reserves the right, upon its sole determination to utilize Metro-North on-call contractors for transport and disposal of Non-Hazardous Petroleum Contaminated Soil, with the Contractor remaining responsible for loading.
   e. All excavation and stockpiling related costs shall be included in the lump sum of other items in the contract-based contract work. Refer to specification 02 61 00 Sampling, Testing, Handling, Loading, Removal and Disposal of Soils for ability to reuse soils on site. Any and all soil excavated and re-used on site shall be included in the lump sum under other items in the contract based on contract work. The reuse on site of excavated soil must be approved by Metro-North Environmental Compliance and Services Department.
   f. Work shall not be charged to this unit price without written authorization from Metro-

North. The actual amount of work and associated cost shall be identified based on the unit price and quantity at the time when work is required.

3. Item No. 28 – (Ton) Hauling & Disposal of Excess Non-Hazardous PCB Contaminated Soil:
   a. This item consists of hauling and off-site disposal of non-hazardous PCB contaminated soil that cannot be backfilled/re-used on site in accordance with Metro-North procedure and standards, the contract documents and the quantities listed on the bid sheet. A list of Metro-North pre-qualified haulers and landfills is included in the contract specifications.
   b. This item consists of all labor, materials, tools, equipment and services required by the Contract Documents for the construction of all the components specified and any other incidentals necessary to complete the work.
   c. This item shall be measured and paid based on the number of tons of waste classified as non-hazardous PCB contaminated soil that must be disposed of, including all labor, sampling and analysis, equipment, loading, stabilization, transport, disposal, decontamination, material documentation, permits and material to complete the work.
   d. Metro-North reserves the right, upon its sole determination to utilize Metro-North on-call contractors for transport and disposal of Excess Non-Hazardous PCB Contaminated Soil, with the Contractor remaining responsible for loading.
   e. All excavation and stockpiling related costs shall be included in the lump sum of the various items in the contract-based contract work. Refer to specification 02 61 00 Sampling, Testing, Handling, Loading, Removal and Disposal of Soils for ability to reuse soils on site. Any and all soil excavated and re-used on site shall be included in the lump sum of other items in the contract based on contract work. The reuse on site of excavated soil must be approved by Metro-North Environmental Compliance and Services Department.
   f. Work shall not be charged to this unit price without written authorization from Metro-North. The actual amount of work and associated cost shall be identified based on the unit price and quantity at the time when work is required.

4. Item No. 29 – (Ton) Hauling & Disposal of Excess Non-Hazardous Soil/Fill:
   a. This item consists of hauling and off-site disposal of non-hazardous soil/fill that cannot be backfilled/re-used on site in accordance with Metro-North procedure and standards, the contract documents and the quantities listed on the bid sheet. A list of Metro-North pre-qualified haulers and landfills is included in the contract specifications.
   b. This item consists of all labor, materials, tools, equipment and services required by the Contract Documents for the construction of all the components specified and any other incidentals necessary to complete the work.
   c. This item shall be measured and paid based on the number of tons of waste classified as non-hazardous soil/fill that must be disposed of, including all labor, sampling and analysis, equipment, loading, stabilization, transport, disposal, decontamination, material documentation, permits and material to complete the work.
   d. Metro-North reserves the right, upon its sole determination to utilize Metro-North on-call contractors for transport and disposal of Excess Non-Hazardous Soil/Fill, with the Contractor remaining responsible for loading.
   e. All excavation and stockpiling related costs shall be included in the lump sum of the various items in the contract-based contract work. Refer to specification 02 61 00 Sampling, Testing, Handling, Loading, Removal and Disposal of Soils for ability to reuse soils on site. Any and all soil excavated and re-used on site shall be included in the lump sum of other items in the contract based on contract work. The reuse on site

of excavated soil must be approved by Metro-North Environmental Compliance and Services Department.

f. Work shall not be charged to this unit price without written authorization from Metro-North. The actual amount of work and associated cost shall be identified based on the unit price and quantity at the time when work is required.

5. Item No. 30 – (Ton) Hauling & Disposal of Excess Non-Hazardous C&D Soil/Fill:
   a. This item consists of hauling and off-site disposal of non-hazardous C&D soil/fill in accordance with Metro-North procedure and standards, the contract documents and the quantities listed on the bid sheet. A list of Metro-North pre-qualified haulers and landfills is included in the contract specifications.
   b. This item shall be measured and paid based on the number of tons of waste classified as non-hazardous C&D soil/fill that must be disposed of, including all labor, sampling and analysis, equipment, loading, stabilization, transport, disposal, decontamination, material documentation, permits and material to complete the work.
   c. Metro-North reserves the right, upon its sole determination to utilize Metro-North on-call contractors for transport and disposal of Excess Non-Hazardous C&D Soil/Fill, with the Contractor remaining responsible for loading
   d. All excavation and stockpiling related costs shall be included in the lump sum of the various items in the contract-based contract work. Refer to specification 02 61 00 Sampling, Testing, Handling, Loading, Removal and Disposal of Soils for ability to reuse soils on site. Any and all soil excavated and re-used on site shall be included in the lump sum of other items in the contract based on contract work. The reuse on site of excavated soil must be approved by Metro-North Environmental Compliance and Services Department.
   e. Work shall not be charged to this unit price without written authorization from Metro-North. The actual amount of work and associated cost shall be identified based on the unit price and quantity at the time when work is required.

C. Allowances
   1. Item No. 31 – (Lump Sum) Buried and/or Unforeseen Materials in Conflict with New Construction:
      a. This item has an allowance of $10,000 for all design, labor, materials, tools, equipment, and services required for the excavation, removal, relocation, abatement and legal disposal of all materials in conflict with new construction work, including but not limited to old foundations, railroad ties, tanks, utilities or any other hidden obstruction, that is NOT included in the base scope of work of the contract documents or that could NOT be reasonably anticipated from the contract documents..
      b. Work shall not be charged for this allowance without written authorization from Metro-North. The actual amount of work and associated costs shall be negotiated at the time of the work is defined and required. In the event the full amount of the allowance is not utilized, the remaining unused funds shall be credited to the Authority at the end of the job.
      c. Payment based on actual cost.

   2. Item No. 32 – (Lump Sum) Unforeseen Asbestos and Lead Abatement:
      a. This item is an allowance of $10,000 for asbestos and lead abatement including testing, demolition, hauling and off-site disposal in accordance with Metro-North procedures and standards and the contract documents for work NOT depicted and described in

Technical Specification 02 82 13 and 02 83 19. This allowance is for asbestos and lead abatement work NOT included in other items of the base contract.

b. A list of Metro-North pre-qualified haulers and landfills is included in the Contract specifications. All requirements in the contract documents for this work shall be followed for work performed under this allowance item. This item consists of all labor, materials, tools, equipment and services required by the Contract Documents for the construction of all the components specified and any other incidentals necessary to complete the work.

c. Work shall not be charged for this allowance without written authorization from Metro-North. The actual amount of work and associated costs shall be negotiated at the time of the work is defined and required. In the event the full amount of the allowance is not utilized, the remaining unused funds shall be credited to the Authority at the end of the job.

d. Payment based on actual cost.

3. Item No. 33 – (Lump Sum) Additional Conduit and Cabling:

a. This item is an allowance of $10,000 for performing additional conduit and cabling utility work. This allowance is only for items NOT included in the base scope of work of the contract documents or that could NOT be reasonably anticipated from the contract documents.

b. Work shall not be charged for this allowance without written authorization from Metro-North. The actual amount of work and associated costs shall be negotiated at the time of the work is defined and required. In the event the full amount of the allowance is not utilized, the remaining unused funds shall be credited to the Authority at the end of the job.

c. Payment based on actual cost.

4. Item No. 34 – (Lump Sum) Relocation of Various Metro-North Items:

a. This allowance is an allowance of $15,000 for assisting Metro-North with the relocation of Metro-North items at various locations on site. This allowance is for items NOT included in the base scope of work of the contract documents or that could NOT be reasonably anticipated from the contract documents.

b. Work shall not be charged for this allowance without written authorization from Metro-North. The actual amount of work and associated costs shall be negotiated at the time of the work is defined and required. In the event the full amount of the allowance is not utilized, the remaining unused funds shall be credited to the Authority at the end of the job.

c. Payment based on actual cost.

5. Item No. 35 – (Lump Sum) Test Pits:

a. This item is an allowance of $10,000 for additional test pits. This item consists of all labor, materials, tools, equipment and services required above and beyond what is required by the Contract Documents. Test pits as required under the base contract shall be as noted in the base contract.

b. Work shall not be charged for this allowance without written authorization from Metro-North. The actual amount of work and associated costs shall be negotiated at the time of the work is defined and required. In the event the full amount of the allowance is not utilized, the remaining unused funds shall be credited to the Authority at the end of the job.

c. Payment based on actual cost.

6. Item No. 36 – (Lump Sum) Additional Signage:
   a. This item is an allowance of $5,000 for additional signage. This item consists of all labor, materials, tools, equipment and services required above and beyond what is required by the Contract Documents for the design and construction of all sign components specified and any other incidentals necessary to complete the work. Signs as required under the base contract shall be as noted in the base contract.
   b. Work shall not be charged for this allowance without written authorization from Metro-North. The actual amount of work and associated costs shall be negotiated at the time of the work is defined and required. In the event the full amount of the allowance is not utilized, the remaining unused funds shall be credited to the Authority at the end of the job.
   c. Payment based on actual cost.

7. Item No. 37 – (Lump Sum) Rock Excavation:
   a. This item is an allowance of $25,000 for rock excavation. This item consists of all labor, materials, tools, equipment and services required above and beyond what is required by the Contract Documents for the design and construction of all components related to rock excavation and any other incidentals necessary to complete the work. Rock excavation under the base contract shall be as noted in the base contract.
   b. Work shall not be charged for this allowance without written authorization from Metro-North. The actual amount of work and associated costs shall be negotiated at the time of the work is defined and required. In the event the full amount of the allowance is not utilized, the remaining unused funds shall be credited to the Authority at the end of the job.
   c. Payment based on actual cost.

8. Item No. 38 – (Lump Sum) CCTV Camera - PODS:
   a. This item is an allowance of $25,000 for procuring materials for PODS-cameras. This item consists of all labor, materials, tools, equipment and services required above and beyond what is required by the Contract Documents for the design and construction of all components related to procuring materials for PODS- cameras and any other incidentals necessary to complete the work. Procuring materials for PODS- cameras under the base contract shall be as noted in the base contract.
   b. Work shall not be charged for this allowance without written authorization from Metro-North. The actual amount of work and associated costs shall be negotiated at the time of the work is defined and required. In the event the full amount of the allowance is not utilized, the remaining unused funds shall be credited to the Authority at the end of the job.
   c. Payment based on actual cost.

9. Item No. 39 – (Lump Sum) NYSEG service:

   a. This item is an allowance of $50,000 for upgrade of electrical service by NYSEG. This item consists of all labor, materials, tools, equipment and services required above and beyond what is required by the Contract Documents for the design and construction of all components related to upgrade of electrical service and any other incidentals necessary to complete the work. Upgrade of electrical service under the base contract shall be as noted in the base contract.
   b. Work shall not be charged for this allowance without written authorization from Metro-North. The actual amount of work and associated costs shall be negotiated at the time of the work is defined and required. In the event the full amount of the allowance

is not utilized, the remaining unused funds shall be credited to the Authority at the end of the job.

c. Payment based on actual cost.

10. Item No. 40 – (Lump Sum) Install Rte. 116 Elements (NYSDOT – Guard Rail Realignment) including Traffic Control along Rte. 116 to perform the associated work:
    a. This item is an allowance of $25,000 for installation of NYSDOT Rte. 116 elements including the associated Traffic Control along Rte. 116 to perform the associated work. This item consists of all labor, materials, tools, equipment and services required to complete the guard rail realignment as required by the Contract and any other incidentals necessary to complete the work.
    b. Work shall not be charged for this allowance without written authorization from Metro-North. The actual amount of work and associated costs shall be negotiated at the time of the work is defined and required. In the event the full amount of the allowance is not utilized, the remaining unused funds shall be credited to the Authority at the end of the job.
    c. Payment based on actual cost.

D. Payment
    a. Payment for Work governed by Lump Sum shall be made based on a line item breakdown for each station furnished by the Contractor. The line item breakdown shall include a listing of line items, line item quantities, line item costs and line item total costs per station. The sum of line item costs shall be equal to the total lump sum amount. Payment shall be made on a percentage basis of work completed per each individual line item on the detailed cost breakdown.
    b. Payment of all work shall not be made until the work has been inspected and accepted by the Engineer. All costs for work to be performed shall be covered by the bid prices and further broken down in the detailed line item breakdown.
    c. Payment of Work governed by unit prices shall be made based on the actual measurements and quantities accepted by the Engineer multiplied by the unit price for that Item of Work.
    d. Payment of work governed by options shall be made based on Metro-North exercising the option and paid in the accordance with lump sum payments as described above.
    e. Payment for work governed by construction allowances shall be made based on percentage of work complete as determined by METRO-NORTH. Costs shall be submitted in accordance with the Terms and Conditions Chapter entitled "Changes to the Contract."
    f. Payment for any Asbestos and/or lead abatement work shall only be processed with a Manifest.

1.4 DEFECT ASSESSMENT

A. The Contractor shall replace the work, or portions of the work not conforming to specified requirements.

B. If, in the opinion of Metro-North, it is not practical to remove and replace the Work, Metro-North will direct one of the following remedies:
    1. The defective Work will be partially repaired to the instructions of Metro-North, and the unit price will be adjusted at the discretion of Metro-North.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:
   1. Section 01 20 00 – Measurement and Payment.
   2. Section 01 32 00 – Construction Progress Documentation.
   3. Section 01 33 00 - Submittal Procedures.
   4. Section 01 40 00 – Quality Requirements.
   5. Section 01 50 00 - Temporary Facilities and Controls.

1.2 SUMMARY

A. This Section specifies requirements for:
   1. Project Coordination:
      a. Coordinating the Work of this Contract with other work affecting or affected by this Contract.
      b. Coordinating the work of the Contractor's employees, Subcontractors, Suppliers, manufacturers, and fabricators.
   2. Project Meetings:
      a. Attendees required at Project meetings.
      b. Administration of Project meetings, including, but not limited to:
         1) Frequency of Project meetings.
         2) Minimum requirements for meeting agendas.
         3) Project meeting procedures.
         4) Responsibilities of meeting attendees.
            a) Responsibility for recording and distributing meetings minutes.
      c. This Section describes the various types of Project meetings, including.
         1) The Preconstruction Conference.
         2) Progress Meetings.
         3) Pre-installation Meetings.
         4) Progress Schedule Update Meetings.
         5) Other meetings.
   3. Electronic Communication Protocols.

1.3 REFERENCES

A. Abbreviations and Acronyms:
   1. EEO: Equal Employment Opportunity.
   2. QC: Quality control.

B. Reference Standards:
1. State of New York:
a. New York State Energy Research and Development Authority (NYSERDA):
1) New York State Executive Order No. 111 – "Green and Clean" State Buildings and Vehicles Guidelines.
b. Official Compilation of the Rules and Regulations of the State of New York (NYCRR).
1) NYCRR 16 Part 753 Protection of Underground Facilities.
2. United States Government:
a. Buy America Act (Pub. L. 103–429, 49 U.S.C. 5323(j))
b. Federal Transit Administration (FTA):
1) 49 CFR 661 Buy America Requirements.
c. Occupational Safety and Health Administration (OSHA):
1) 29 CFR 1910 Occupational Health and Safety Standards.
2) 29 CFR 1926 Safety and Health Regulations for Construction.

1.4 PROJECT COORDINATION

A. Coordination with Local Jurisdictions and Agencies:
1. Coordinate the Work of this Contract with State and local governmental and private agencies having jurisdiction over the Work, and document and comply with their requirements.
a. Coordinate traffic control measures with appropriate agencies in accordance with Section 01 50 00, Temporary Facilities and Controls.
b. Document and meet the requirements of governmental and private agencies having jurisdiction over utility work and insure that all required permits have been obtained before connecting permanent and temporary utilities to the Work of this Contract.
c. Strictly enforce safety rules and regulations imposed by the Town of North Salem, the State of New York, the Occupational Safety and Health Administration (OSHA), Metro-North, and others having jurisdiction.
2. State and local jurisdictions and agencies include, but are not limited to the following:
a. Metro-North.
b. State of New York.
1) New York State Department of Environmental Conservation (NYSDEC).
2) New York State Department of Transportation (NYSDOT).
c. Westchester County, NY.
d. Town of North Salem, NY.
1) Department of Building.
2) Parking Department.
3) Planning Department.
4) Department of Public Safety.
5) Department of Public Works.
6) Department of Traffic.

B. Coordination with Area Residents:
1. Notify area residents of work to be done that may affect their neighborhood or property.
2. Prior to beginning the Work, survey dwellings and properties near the Project as specified in Section 01 32 00, Construction Progress Documentation, and note conditions to prevent claims.

1.5 FACILITY SERVICES COORDINATION

A. Coordinate the Work of this Contract with local utilities, whether or not they are listed in the Contract Documents, so that utility interconnections and interfaces to the Work do not delay this Contract; and so utility service to the community is not adversely impacted.
   1. Notify utility companies or other parties being affected by construction; and endeavor to have necessary adjustments of public or private utility fixtures, pipelines, or other appurtenances made as soon as possible.
   2. Notify public utilities operating overhead power lines whenever construction operations are within clearance envelopes established by statute.
   3. Two to ten days prior to the start of digging or excavation Work not counting the day of the call, contact Dig /Safety. New York by calling 1- 800-962-7962 or 811 to arrange for utility owners to locate and mark their underground utilities.
      a. Comply with applicable State of New York statues.
         1) Strict compliance with NYCRR 16 Part 753 is obligatory.
      b. If unexpected active underground facilities are encountered during the performance of the Work, immediate notify the Construction Manager.

B. Unless otherwise shown on the Contract Drawings or stated in the Specifications, maintain all utilities whether underground or overhead in continuous service throughout the entire Contract period.
   1. Safeguard and maintain conflicting utilities as shown on the Contract Drawings, including overhead wires and cables and their supporting poles, and underground utilities, whether or not they are inside or outside a proposed trench.
      a. The owners of conflicting water lines, gas lines, meter boxes, and other utility appurtenances at the Site may be asked to relocate their utilities prior to the beginning of the Work this Contract.

C. Coordinate acquisition of temporary utilities to support the Work of this Contract in accordance with Section 01 50 00, Temporary Facilities and Controls.

D. In the event that an existing service, or other large structure, is found to impede the performance of the Work, notify the Construction Manager as soon as practicable.
   1. If in the course of the Work a conflicting utility line that was not shown on the Contract Drawings is discovered, Metro-North will either negotiate with the utility owner to relocate the line, relocate the utility using Metro-North forces, change the alignment and grade of the conflicting trench, or declare the conflict as extra work to be performed at an agreed upon negotiated price.
      a. If a price cannot be agreed upon, then perform the work as "Force Account Work".
   2. If temporarily or permanently relocating or shutting down any utility or appurtenance will simplify construction operations, the Contractor at his option may make the necessary arrangements and agreements with the utility's owner for any expense related to the relocation or shutdown and construction if at no increase in the Contract Price, and if the following is observed:
      a. Reconstruct all property to its original or new location as soon as possible and to a condition at least as good as its previous condition.
      b. Any such relocation or shutdown and reconstruction of utilities is subject to inspection and approval by both the Construction Manager and the owner of the utility.

1.6 MULTIPLE CONTRACT COORDINATION

A. The Metro-North reserves the right to perform other or additional work at or near the Site, including any storage site, with forces other than those of the Contractor.
   1. Utility construction and development projects may also occur adjacent to or within the Contract limits of work.

B. If the Contract Documents give notice that other work may affect the Work of this Contract, do the following:
   1. Attend construction progress meetings in accordance with the requirements specified herein.
   2. Review drawings and Contractor submittals from related contracts for adequacy of coordination and compatibility with the Work of this Contract and report any shortcomings of those drawings and submittals when found.
   3. Include the cost of the resulting coordination effort in the Guaranteed Maximum Price (GMP) bid for this Contract.

C. Take the initiative in identifying, defining, coordinating, and documenting all interface points between the Work of this Contract and adjacent work.
   1. Survey the physical, mechanical, and electrical interfaces of related contracts and facilities.
      a. Document all interface points identified.
      b. Report any shortcomings of interface points and facilities that affect the Work of this Contract.
   2. When the Work of this Contract overlaps with other contracts entered into by the Metro-North, coordinate the Work of this Contract with the other Contractors working at or near the construction Site, with the Construction Manager, with the Construction Manager's inspectors, and with the Metro-North personnel.
      a. Request each Contractor involved to submit a current schedule for the work of their contract for review.
      b. After this review and consultations, the Construction Manager will determine if the schedules are acceptable or if corrections are needed to coordinate between contracts.
         1) If corrections are required, update the Contract's progress schedule in accordance with the requirements of Section 01 32 00, Construction Progress Documentation, to reflect the required corrections.
      c. The Contractor, through the Construction Manager will resolve any disagreements that may arise among the Contractors over the method or sequencing of the Work.
         1) In case of unavoidable interferences or schedule impacts, the Contractor, through the Construction Manager will establish the priority of the work elements, which in general will be in the sequence that the contracts were awarded.
         2) The Construction Manager's decision in these matters is final.
   3. Whenever the work of other Contractors occurs either within or next to this Contract's Site, do the following:
      a. Cooperate with other Contractors' forces.
      b. Carry out the Work under this Contract in a way that will minimize interference and delay for all forces involved.
      c. Place and dispose of the materials being used so as not to interfere with the operations of other Contractors' forces.
      d. Coordinate with other Contractors to perform the Work in proper sequence to meet schedule requirements of this and the other contracts.

D. Take responsibility for any damages to or interruption of service caused by the Work of this Contract.

1. If the Work performed as a part of this Contract damages the work of another Contractor, promptly repair or replace the damaged work at no increase in the Contract Price.

1.7 PROJECT MEETINGS

A. Meeting Participation:
   1. Participation in all Project meetings specified herein is mandatory, and appropriate representatives of the Contractor's staff, Subcontractors, Suppliers, manufacturers, and fabricators are required to attend.
      a. Attend meetings prepared to discuss the items which the Contractor has been notified will be on the meeting's agenda and those specified in this Section.
         1) Advise the Construction Manager of items to be added to a meeting's agenda at least 24 hours in advance of the meeting.

B. Minutes of Meetings:
   1. The Construction Manager is responsible for recording the minutes of all meetings, and for distributing them to all parties present and to those on an agreed upon distribution list within five (5) Days of each meeting.

C. The Preconstruction Conference:
   1. The Construction Manager will schedule a Preconstruction Conference within 21 days of the Notice to Proceed and will notify all parties concerned of the exact time and place of this meeting.
      a. Attendance at this meeting by the Contractor and his principal Subcontractors is mandatory; but the Contractor has the option to invite additional parties as required.
      b. Do not commence the Work of this Contract without first attending the Preconstruction Conference.
      c. The meeting is typically held at the Site, or at an alternate location designated by the Construction Manager.
      d. The Construction Manager will conduct the Preconstruction Conference, and will address the conduct of the Work, lines of communication, and the similar items as indicated in Subparagraphs 1.7.C.3.a and 1.7.C.3.b.
      e. The Construction Manager will invite Metro-North representatives to the Preconstruction Conference.

D. Other entities concerned with the progress, or involved in planning, coordination, or performance of future activities, will also be represented.
   1. All participants at the conference must be familiar with the Project and authorized to conclude matters relating to the Work.
   2. Preconstruction Conference's Agenda:
      a. The Preconstruction Conference's agenda will include at a minimum the following items, but is not limited to these items:
         1) Establishing a sound working relationship among all parties, including the Contractor and his Subcontractors, the Metro-North representatives, the Construction Manager's staff, representatives from affected utilities, and other appropriate agencies.
            a) Designate which employees are the Contractor's responsible personnel.
            b) Distribute a list of the Contractor's proposed Subcontractors.
         2) Distributing and discussing the Contractor's Final Schedule.
            a) Discuss critical Work sequencing.

b) Discuss progress schedules.

3) Distributing and discussing of the Contractor's Final Schedule of Values required by the Agreement and the Contract Terms and Conditions, and Section 01 20 00, Measurement and Payment Procedures.
   a) Discuss using the Schedule of Values to prepare payment requests.
4) Discussing Submittal schedules and procedures, and of delivery schedules and procedures.
   a) Discuss submittal of Working Drawings, Shop Drawings, Project Data, and Samples.
   b) Discuss major equipment deliveries and priorities.
   c) Discuss materials furnished by the Metro-North.
   d) Discuss the requirement to provide a Submittal Schedule as specified in Section 01 33 00, Submittal Procedures.
   e) Discuss the requirement to provide a Delivery Schedule.
5) Reviewing the concerns of the community.
6) Reviewing safety requirements:
   a) Define the Contractor's responsibility for making arrangements for safety, first aid, emergency actions, security, and a full-time safety representative.
   b) Discuss Metro-North requirements for a Contractor's Safety Program and Safety Plan, Surveillance and Security Control Program, and Site Security Plan; and the introduction of the Metro-North construction safety and security representatives.
   c) The Metro-North is responsible for providing a construction "hotline" telephone number which will be answered by Metro-North representative during regular working hours, or by an answering service during other times, for the Contractor to use for emergency communications with the Metro-North.
   d) The Contractor is responsible for holding weekly safety meetings and for holding tool box/lunch box meetings as required.
7) Discussing procedures for processing field decisions and Contract Change Orders.
8) Discussing requirements for maintaining record documents.
9) Discussing miscellaneous procedures, such as safety, recordkeeping, first aid, security, housekeeping, and similar items.
10) Discussing office and storage area locations.
11) Discussing the Owner's use of premises requirements.
12) Discussing coordination with affected utilities.
13) Open discussion.

b. The Construction Manager is responsible for addressing the following items at the preconstruction conference:
   1) Responsibilities and authorities of Metro-North's and the Construction Manager's organizations.
   2) Equal Employment Opportunity (EEO) and affirmative action requirements.
   3) Requirements of labor provisions stipulated by the U.S. Department of Transportation (DOT) as required.
   4) Laws, codes, traffic regulations, permit requirements, and other public agencies' regulations.
      a) Buy America Act requirements.
      b) New York State Executive Order No. 111.
      c) Other laws, codes, regulations, and requirements.

5) Procedures for processing Requests for Information (RFIs), Change Requests, Change Orders, Shop Drawings, Working Drawings, Product Data, and Samples
6) Monthly pay estimate cut-off dates.
7) Partial and final payments.
8) Community affairs functions and procedures.
9) A list of dates for generating data for the draft Project Schedule Monthly Update Reports in accordance with Section 01 32 00, Construction Progress Documentation.

c. The Contractor is responsible for performing the following activities at the Preconstruction Conference:
1) Ensuring that the Contractor's Project Manager/Superintendent, Quality Control Manager, Safety Representative, Equal Employment Opportunity (EEO) Officer, Subcontractor representatives, and Community Affairs representatives attend the meeting.
a) Introduce Contractor representatives, and briefly describe each person's responsibilities.
(1) Prepare and distribute the Contractor's Organization Chart and Contact List.
b) Distributing and discussing a list of the major Subcontractors proposed.
(1) Discussing how the Contractor's quality control (QC) personnel will perform independently of the rest of the construction workforce to insure quality in the constructed facilities as required in Section 01 43 00, Quality Requirements.
c) Identifying the public involvement contact and discuss how they will work with the Metro-North public involvement representative.
2) Distributing and discussing the Final Contract Construction Schedule.
a) Submit the Final Construction Schedule in accordance with Section 01 32 00, Construction Progress Documentation.
(1) Describe the construction sequencing.
(2) Discuss major equipment deliveries and priorities.
(3) Discuss the coordination and notifications required for utility Work.
(4) Describe temporary street closings and street restoration.
3) Submitting the Final Schedule of Values.
4) Describing the general layout of the Site.
a) Discuss the use of offices, storage areas, construction areas, and temporary easements.
b) Describe haul routes.

d. Discussing construction methods.
e. Describing noise, emissions, dust, and water pollution control.
f. Describing erosion and sediment control procedures and drawings.
g. Defining housekeeping procedures.

E. Progress Meetings:
1. Unless otherwise directed or agreed, the Construction Manager will hold weekly Progress Meetings at the Site, or at an alternate location designated by the Construction Manager.
a. Attend additional meetings or meetings scheduled at a different frequency as directed by the Construction Manager at no increase in the Contract Price.
2. A typical Progress Meeting's agenda will include, but may not be limited to, the following items:
a. Reviewing the minutes of the previous meetings.

b. Noting field observations, problems, and decisions taken since the last Progress Meeting.
c. Identifying present problems and planning the resolution of each.
d. Presenting the log of outstanding nonconformance reports, planned corrective actions, subsequent operations impacted, and a schedule for closure of the nonconformance reports.
e. Reviewing the status of the Contractor's Contract Construction Schedule and Work Plan.
    1) Plan the progress of the Work for the next work period and assess its effect on the related work of others.
        a) Present the look-ahead schedule of the Work Plan for the next 21 Days.
            (1) Prepare, distribute, and discuss a time-scaled look-ahead schedule based on and correlated with the activity numbers and descriptive nomenclature of the accepted Contract Construction Schedule.
    2) Provide a 7-day history documenting the achievements of the past 7 days.
        a) Include this as-built schedule for the previous 7 days within the look-ahead schedule.
    3) Discuss the current and previous Project Schedules and Work Plans, particularly how they relate to actual achievements.
        a) Incorporate the Construction Manager's comments into the as-built schedule for the previous 7 days.
        b) Expedite the Work to insure its completion within the approved Project Schedule.
f. Reviewing Project safety requirements.
g. Reviewing the status of other Contractors work in regard to shared access.
h. Coordinating occupancy arrangements and access requirements with the Construction Manager.
i. Reviewing the status of progress payment requests, change proposals and Change Orders, Submittals, and Requests for Information.
j. Reviewing other outstanding issues.
k. Providing current as-build drawings to the Construction Manager for review.

F. Pre-installation Meetings
1. Internally coordinate the Work by scheduling and conducting pre- installation meetings that include the Contractor's employees, Subcontractors, Suppliers, manufacturers, and fabricators as attendees.
    a. The Construction Manager may also require that the Contractor, his Subcontractor(s), and/or others to attend meetings held to discuss selective items of Work.
2. For each activity affecting proper sequencing of the Work, schedule and conduct pre-installation meetings.
    a. Schedule the pre-installation meetings with your employees, Subcontractors, Suppliers, manufacturers, fabricators, and other affected parties as appropriate.
    b. Hold pre-installation meetings for Contract activities according to the early start dates for the activities established in the approved Contract Schedules required under Section 01 32 00, Construction Progress Documentation, and well in advance of the submittal dates for related Shop Drawings so the activity is not delayed.
        1) Prepare all documentation and procedures in advance for presentation at the meeting; including but not limited to, copies of drawings and Contract Drawings, Specifications, submittals, certifications, inspection and test procedures, and other pertinent documentation for use during the meeting.

c. Coordinate the work of your own employees, Subcontractors, Suppliers, manufacturers, fabricators, and other affected trades.

3. The Construction Manager may also require that a pre-installation conference be held with the Contractor and its Subcontractor(s) on selective items of Work.

G. Progress Schedule Update Meetings:

1. Unless otherwise directed, the Construction Manager will hold monthly Progress Schedule Update Meetings to be attended by the Construction
2. Manager, the Contractor, and applicable Subcontractors as required.
3. The agenda of the Progress Schedule Update Meetings will, at a minimum, include a joint review of an agreement on the amount of progress made on the Work of the Contract and the update of the Schedule of Value quantities as shown in the draft Progress Schedule Update Reports.
4. After agreement is reached concerning the amount of progress made on the Work of the Contract and updated quantities, submit the Progress Schedule Update Report and the progressed Schedule of Values which then serves as the progress Payment Request.

H. Other Meetings:

1. In addition to the regularly scheduled meetings, ad-hoc meetings may be called to address significant matters or situations that have a bearing on the successful execution of the Work.
2. On an as needed basis, meetings may be called to discuss issues with representatives of local jurisdictions, public involvement representatives and news reporters, or other agencies involved with the Contract.

1.8 ELECTRONIC COMMUNICATION PROTOCOLS:

A. Electronic communications protocols for the Project are specified in the individual Specification Sections.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 71 00 - Examination and Preparation.

1.3 SUMMARY

A. This Section specifies requirements for
   1. Adequate planning, scheduling, managing, and executing the Work.
   2. Final 90-Day Schedule.
   3. Contract Schedule.
   4. Monthly Update Reports.
   5. As-Built Schedule.
   6. Obtaining Contract time adjustments.
   7. Requirements for photographing and videotaping existing conditions prior to beginning construction activities.
   8. Requirements for providing pre-construction and new construction photographs of the construction as directed by the Construction Manager.
   9. Camera requirements.

1.4 REFERENCES

A. Abbreviations and Acronyms:
   1. CPM: An acronym referring to the Critical Path Method of construction scheduling wherein any delay to an activity on the critical path will result in a delay to the Project.

B. Definitions:
   1. Activities: Discrete items of Work that must be accomplished under the Contract, and when complete, produce definable, recognizable entities or stages within the Project.
   2. Day: Calendar days unless specifically noted otherwise.
   3. Float: The number of Days by which an activity can be delayed without lengthening the Critical Path and extend the Substantial Completion date.

4. Fragnet: Short for “fragment of a network” and consisting of a set of activities copied from a portion of an existing project schedule that are saved and applied elsewhere within the same or another project schedule, or that are modified and re-applied to the schedule from which the fragnet was copied in order to modify the schedule.
5. Contract Milestone: A principal event specified in the Contract Documents relating to an intermediate or final completion date or time.
6. Project Schedule: The Final 90-Day Schedule, Contract Construction Schedule, Monthly Status Reports, and any subsequent revisions to the Contract Construction Schedule as described below are collectively referred to as the Project Schedule.
7. Working Day: A day when work is be performed.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preconstruction Conference and Pre-Installation Meetings:
   1. Pre-Construction Conference:
      a. Attend the Pre-Construction Conference as required by Section 01 31 00, Project Management and Coordination.
   2. Pre-Installation Meetings:
      a. As required to properly coordinate and schedule particularly complex and/or sensitive installations, arrange pre-installation meetings with the affected Subcontractors and other affected entities, such as utilities, railroads, the Town of North Salem, or the New York State Department of Transportation (NYSDOT), to discuss special scheduling requirements of those entities before beginning the work of their trades or working on their right-of-way and property, and schedule the Work appropriately.

B. Scheduling:
   1. For scheduling requirements refer to the Terms and Conditions of the Contract
      1)

C. Qualifications:
   1. Photographer’s Qualifications:
      a. Employ a photographer who is a professional photographer with previous experience providing construction photography, and who is acceptable to the Construction Manager.
      b. Submit the photographer’s qualifications including the name and documented qualifications of the proposed commercial photographer, and a list of previous assignments, to the Construction Manager for approval.

1.6 SUBMITTALS

A. Action Submittals:
   1. Submit the following to the Construction Manager for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:
      a. Special Procedure Submittals:
         1) Contract Schedule.
         2) Monthly Update Reports.
            a) Draft Monthly Update Reports.
            b) Final Monthly Update Reports.
         3) Contractor’s proposed revisions to the accepted Contract Schedule.

4) Proof construction photographs.
5) Electronic digital copies of photographs.
6) Select construction photographs.
7) Pre-construction video discs.

b. Qualification Statements:
1) Photographer's qualifications.

1.7 EXISTING CONDITIONS

A. Preconstruction Photographs and Videos;
1. Prior to start of construction operations; photographically document Site conditions at each station.
a. Preconstruction Photographs:
1) Take aerial photographs.
2) Take a sufficient number of views to show existing conditions adjacent to the property before starting the Work.
b. Preconstruction Videos:
1) Record digital video of the pre-existing conditions at the Site and surrounding properties from different points of view.
2) Take video of existing improvements adjoining the property in sufficient detail to accurately record the physical conditions at the start of construction.
3) The Construction Manager will also select a number of items of special interest within the limits of the Site to be videotaped in detail.
4) With the video, provide a narrative describing the areas being videotaped and recorded, and the vantage point and direction of view.
c. Submit 2 sets of the discs of the digitally recorded preconstruction video to the Construction Manager for approval.
1) Record and submit the video on CD-R or DVD ± R recordable discs.
2) Use a video format compatible with the latest release of Windows media.
2. Do not begin construction activity until the submitted photographs and video has been approved.

PART 2 - PRODUCTS

2.1 CAMERA EQUIPMENT

A. Color Digital Camera:
1. Furnish a color digital camera having a capacity of at least 2.1 megapixels and capable at a minimum of 150 dots per inch resolution.

B. Color Digital Video Camcorder:
1. Furnish a color digital video camcorder having a resolution at least equal to that of the digital camera specified in Subparagraph 2.1.A and using digital video media capable of being used to produce still photographs.

PART 3 - EXECUTION

3.1 SURVEY AND LAYOUT DATA

A. Furnish and document survey and layout data as specified in Section 01 71 00, Examination and Preparation.

3.2 PROGRESS PHOTOGRAPHS AND VIDEOS

A. Refer to Progress Photographs requirements in the Terms and Conditions of the Contract.

B. Construction Videos:
   1. Prior to commencing construction, videotape the general worksite to record existing features and conditions of the surrounding environment as specified in Paragraph 1.6.A.
   2. The Construction Manager may require additional videotaping of construction Milestones during the course of construction, including the following:
      a. Start of construction including clearing, grubbing, and demolition operations as applicable.
      b. Highlights of the final inspection and acceptance of the Work by the Metro-North.
   3. Label the video cassettes with the following information:
      a. Name of the photographer
      b. Date the video was taken
      c. Contract number and title
      d. Subject of the video
      e. Location of the video
   4. Include a complete, clearly spoken narration of evens being photographed and an unobtrusive time and date indicator on the video recordings that accurately depicts the time and date when the videos were taken.
      a. Begin the narrative by giving the information required by Subparagraph 3.2. D.3.
   5. Digital Copies:
      a. Submit electronic digital copies of construction videos to the Construction Manager on digital media as directed and approved by the Construction Manager.

END OF SECTION

[This Page Left Intentionally Blank]

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 RELATED SECTIONS

A. Section 01 33 29 - Sustainable Design Reporting.

B. Section 01 81 13 - Sustainable Design Requirements.

1.3 SUMMARY

A. This Section specifies:
   1. Requirements and procedures for submitting information to the Construction Manager for review, information, approval, or facilitating Project Closeout.
   2. Requirements for a Master Submittal Schedule, a Cost Breakdown Schedule, and Color Schedules.

1.4 REFERENCES

A. Abbreviations and Acronyms:
   1. MSDS: Material safety data sheets.

B. Definitions:
   1. Action Submittals: A category of submissions requiring responsive action by the Construction Manager that includes Product Data, Shop Drawings, Samples, Certificates, delegated design submittals, sustainable design submittals, special procedure submittals, and qualification statements.
   2. Certificates: Contractor or manufacturer prepared written instruments certifying that products comply with the requirements of the Project Manual and Contract Drawings, or certification of the qualifications of individuals and organizations.
   3. Closeout Submittals: A category of submissions required during project closeout that are subject to procedures specified by Metro-North, and that includes maintenance contracts, operation and maintenance data, bonds, warranty documentation, record documentation, sustainable design closeout documentation, and software.
   4. Design Calculations: Engineering, mathematical, or scientific computations as required to determine or prove the correctness of a proposed solution to a design issue.
   5. Informational Submittals: A category of submissions that do not require responsive action by the Construction Manager that includes test and evaluation reports, manufacturer's instructions, source and site quality control submittals, and manufacturer's reports.

6. Maintenance Material Submittals: A category of submissions that do not require responsive action by the Construction Manager other than confirmation of receipt at the specified location, and that includes spare parts, extra stock materials, and tools.
7. Product Data: Product descriptive literature; product specifications, sizes, types, dimensions, and weights; product performance curves and capacity rating schedules; published details; the product manufacturer's name, trade names, and model numbers; information regarding product components, their arrangement, and accessories; installation instructions for the product or system; and product utility requirements for wiring, piping, service connection data, and motor sizes complete with electrical characteristics.
8. Samples: Physical specimens of products and systems prepared and delivered, or erected, by the Contractor or manufacturer as requested in the various Specifications Sections.
9. Shop Drawings: Detail drawings prepared by the Contractor, Subcontractors, or manufacturers, and that depict the products to be installed as part of the Work.
10. Submittals: Calculations, certificates, color schedules, Product Data, photographs, Samples, schedules, Shop Drawings, manuals, test reports, Working Drawings, and other similar information submitted to the Construction Manager for review and approval.
11. Technical Data: Plans that are required to be prepared, or studies required to be performed, as a part of the Work of this Contract and as additional engineering, mathematical, or scientific information regarding various aspects of a product's design or performance.
12. Test Reports: Reports, generally originating from an independent testing agency, that state or verify the results of required testing, and that often include some analysis of those results.
13. Working Drawings: Contractor prepared detail drawings that depict the Contractor's plan for temporary equipment or structures and other such work as may be required for construction, but which does not become an integral part of the completed Work.

C. Reference Standards:
1. American Institute of Architects/Construction Specifications Institute/National Institute of Building Sciences (AIA/CSI/NIBS):
   a. United States National CAD Standard® (NCS).
2. American Society of Mechanical Engineers (ASME):
   a. ASME Y14.24 – Types and Applications of Engineering Drawings.
   b. ASME Y14.34 – Associated Lists.
   c. ASME Y14.35M – Revision of Engineering Drawings and Associated Documents.
   d. ASME Y14.100 – Engineering Drawing Practices.
3. Instrument Society of America (ISA)
   a. ANSI/ISA-5.1 - Instrumentation Symbols and Identification.
   b. ISA-5.2 - Binary Logic Diagrams for Process Operations.
   c. ISA-5.3 - Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic, and Computer Systems.
   d. ISA-5.4 - Instrument Loop Diagrams.
   e. ISA-5.5 - Graphic Symbols for Process Displays.
   f. ANSI/ISA-51.1 - Process Instrumentation Terminology.

1.5 SUBMITTALS

A. Submittal Types:
1. Product Data:
   a. Furnish the product manufacturer's descriptive literature and specifications, including such items as standard catalogs; brochures; diagrams; schedules; performance charts; illustrations; calculations; schematic drawings; bills of material, delivery tickets, batch

tickets, catalog cut sheets; capacity rating schedules; details; lists of previous installations; published installation, erection, application, and placing instructions; material safety data sheets (MSDS), and other descriptive data related to the Work of the Contract.

1) Modify manufacturer's standard information to deleteinformation which is not applicable to the work of the Contract and supplement the standard information with additional information applicable to this Contract.

2. Shop Drawings:
   a. If Shop Drawings are specified, furnish completely dimensioned and annotated information regarding the submitted product or system, which typically includes information such as the following:
      1) Material and construction details.
      2) Fabrication drawings.
      3) Layout and setting drawings and erection diagrams asnecessary to illustrate the assembly or installation of various elements of the Work, such as anchor bolt layouts.
      4) Locations and details of service and systems connections, including utility and electrical characteristics, utility connection requirements, and the location of utility outlets for functional equipment and appliances.
      5) Schematic diagrams, such as electrical wiring diagrams or pneumatic schematics.
      6) Weights of principal parts and completely assembled items.
      7) Ratings, such as the rated horsepower of motors or gear and bearing ratings.
      8) Service factors for equipment.
      9) Plans, details, and elevation views to identify and clarify the relationships between items, such as piping layouts or face- mounted and internally-mounted components of controlpanels.
      10) Process and instrumentation diagrams employing symbols and nomenclature that are in accordance with ANSI/ISA-5.1, ISA-5.2, ISA-5.3, ISA-5.4, ISA-5.5, and ANSI/ISA-51.1 to identify control system functions and components.
      11) If appropriate, indicate the relation of submitted items to adjacent structures or materials.
         a) If appropriate, include field dimensions and clearly identify them as such.
         b) Verify field measurements, and coordinate with pertinent drawings from other contracts where applicable.
   b. Working Drawings:
      1) For temporary items as may be required for construction, furnish completely dimensioned and annotated drawings andassociated calculations which typically include information for items such as the following:
         a) Temporary decking.
         b) Temporary bulkheads.
         c) Support of excavation.
         d) Support of utilities.
         e) Ground water controls.
         f) Forming and falsework.
      2) Identify calculations by reference to the Working Drawing to which the calculations pertain.
      3) Where appropriate, have a Registered Architect orProfessional Engineer licensed in an appropriate discipline for the submitted working drawings and calculations sign and seal the drawings.
3. Samples, Color Schedules, and Mock-Ups:

a. Furnish Samples and mock-ups that illustrate functional and aesthetic characteristics similar in every way to the actual materials or equipment to be incorporated into the Work, and do not incorporate the Sample or mock-up material or equipment into the Work until approval to do so is received from the Construction Manager.
    1) Furnish required Samples and mock ups at no additional cost to the Owner.
b. Furnish office Samples of sizes and quantities that clearly illustrate the full color range and functional characteristics of products and materials, including attachment devices.
c. Send duplicate copies of transmittal letters for Sample submittals under separate cover and enclose a copy of the transmittal letter with the shipment of the Sample.
d. Erect field Samples and mock-ups at the Site as specified in individual Specification Sections, and as may be necessitated by the Contractor submitting value engineering proposals, at locations acceptable to the Construction Manager.
e. Color Schedules:
    1) Furnish color selection charts and samples that show all color options available for the products and systems specifying color schedule submissions.

4. Certificates:
    a. Furnish Certificates of Compliance and Certified Material Test Reports as specified.
        1) For those products for which no Product Data, Shop Drawings, Samples or test reports are specified or required, and for other items requiring these documents, furnish certificates that certify that the products comply with the requirements of the Contract.
        2) Include a copy of each certificate with the product for which the certificate is prepared.
    b. If the qualifications of individuals and organizations for performing some portion of the work are specified, furnish certificates authenticating the qualifications of these individuals and organizations for performing the work indicated for them.
    c. Ensure that the Construction Manager receives certificates no later than 30 Days before the product so certified is to be installed or the service is to be performed.
5. Design Submittals:
    a. Refer to the Contract Terms and Conditions for requirements.
6. Special Procedure Submittals:
    a. If special plans, phasing, or other special procedures are required to be submitted by the Specifications, furnish submittals complying with the special requirements specified for the submittal in the individual Specification Sections.
7. Qualification Statements:
    a. Provide qualification statements from applicators, fabricators, erectors, and installers that provide information, such as descriptions of their experience, lists of past projects, references, resumes, certifications, or certifications, as specified to prove that individuals or entities are qualified and capable of performing the Work they will be assigned under the Contract.
8. Test and Evaluation Reports:
    a. Test Reports:
        1) Furnish certified test reports of required tests, that state, verify, and analyze the results of the testing performed by an independent testing agency, and that demonstrate proof of compliance of the tested items with the Contract requirements.
    b. Evaluation Reports:
        1) Furnish evaluation reports from model code-writing organizations indicating the compliance of building materials and products with the model code.
9. Manufacturer's Instructions:

a. Furnish the manufacturer-prepared published or written instructions required to document the manufacturer's installation, erection, application, adjusting, testing, storage, maintenance, and other instructions for information as specified.

10. Manufacturer's Reports:
    a. Furnish the manufacturer's field reports documenting the testing and verification actions taken by the manufacturer's representatives to verify compliance with the manufacturer's standards or instructions.
11. Maintenance Contracts:
    a. Furnish maintenance contracts for the items indicated, for the durations specified, and having the scope required by the Contract Documents.
12. Operation and Maintenance Data:
    a. Operation and Maintenance (O&M) Manuals:
        1) Furnish Operation and Maintenance (O&M) Manuals in accordance with the requirements of Metro-North.
13. Bond and Warranty Documentation:
    a. Furnish bonds and sample warranties requiring approval by the Construction Manager and furnish final executed warranties for review of their accuracy as specified by Metro-North.
14. Record Documentation:
    a. Record documents include Shop Drawings, record drawings and specifications, addenda, Change Orders, Field Orders, photographs, and videotapes.
    b. Photographs and Videotapes:
        1) Furnish photographs and videotapes in accordance with the requirements of Section 01 32 00, Construction Progress Documentation, and other Sections as required.
    c. As-built Documentation:
        1) Furnish as-built documentation recording the actually constructed Work in accordance with the requirements of Metro-North, as required.
15. Software:
    a. Furnish computer software, including backup copies when required, and program documentation to allow the Owner to operate the computerized systems as specified.

B. Submittal Format:
1. Physical Form of Submittals:
    a. Whenever possible, submit information electronically.
        1) When the nature of the submittal is not conducive to being submitted electronically, such as material Samples, spare parts, or warranties, submit the physical item to the Construction Manager or other entity as required herein.
    b. Markings made on submittals by the Contractor or by his suppliers or manufacturers, whether written or otherwise, must be in a color other than red.
        1) Red is reserved for the exclusive use of the Construction Manager in marking Submittals.
    c. Prepare drawings and record documents to a high standard of quality, such as that set forth in the United States National CAD Standard (NCS), the ANSI Y14 Series, and/or other approved lower tier specifications defining equal drafting quality.
    d. Furnish printed submittal information in the form of high resolution, letter quality originals or photocopies marked to identify the submittal and to indicate which information is specific to this Contract.
        1) Furnish submittal pages and sheets sized 8-1/2 by 11 inches, or if larger, folded to 8-1/2 by 11 inches size so that any title blocks are clearly visible without one having to unfold the sheet.

2) Unless otherwise stated in the Contract Documents, furnish submittal drawings of similar size and scale as the plan sheets prepared and offered for sale to potential bidders, or a sheet provided on a different size media and using a proportional scale.
   a) Fold submittal drawings similarly to printed submittal information and insert them in binder pockets as appropriate.
3) Bind each set of printed submittal information in hard cover, loose- leaf, 3-ring or 19-ring binders.
   a) Provide binders that allow a minimum ring space of 1/2-inch when closed to facilitate opening and closing the binder, and accessing and removing any sheet in the binder as necessary.
   b) Provide a table of contents for each binder.

e. For Samples, such as physical specimens of pipe railing or roofing material, provide appropriate packing, specimens, and quantities to demonstrate clearly the nature of the item.

f. Electronic Media Submittals:
1) For submittals prepared on electronic media, furnish compact discs (CDs) containing a copy of the submittal data.
2) For documents submitted on electronic media, format the documents using software compatible with Microsoft Word 2007™, or XP™, Microsoft Excel 2007™, and AutoCAD 2018©.
3) For software submittals on electronic media, furnish submittals formatted to use the software originator's standard operating system.
   a) Microsoft Windows© is the preferred operating system if it is an option and is compatible with the product associated with the software.

g. For submittal format requirements regarding Operation and Maintenance (O&M) Manuals, comply with the requirements specified by Metro-North.

2. Submittal Identification:

a. Contract Identification Information:
1) Identify each submittal individually by permanently adhering the following Contract identification information, as applicable, to the submittal:
   a) Owner's name.
   b) Contract name.
   c) Owner's contract number.
   d) Contract location.

b. Submittal Numbering:
1) Uniquely identify each submittal by including an submittal identification number on the submittal developed as follows:
   a) For a submittal specified in a Specification Section or other document in the Project Manual, begin the unique number with a capital "S" prefix and the number of the Specification Section or other document in the Project Manual in which the submittal is specified.
      (1) For example, for a submittal specified by this Specification Section, the submittal number would begin with "S 01 33 00".
      (2) If an item is only defined on the Contract Drawings and not anywhere in the Specifications, substitute a capital "D" for the "S" prefix in the submittal number and use the Contract Drawing number in lieu of the Specification Section number.
         a. For example, a submittal for electrical equipment appearing only on Contract Drawing E-140 would begin with "D E-140".

b) Next, add a hyphen and a sequential integer number for each subsequent submittal required within the Submittal Article of same Specification Section or other document in the Project Manual.
   (1) For example, the hyphenated number for a second required submittal within this Specification Section would be "-2", and the modified number would become "S 01 33 00-2".
   (2) If an item is only defined on the Contract Drawings and not anywhere in the Specifications, the modified number for the second required submittal on the E-140 Contract Drawing would then be "D E-140-2".

c) To further differentiate various identifiable parts of a submittal, add two decimal places to the modified number to identify which part of the submittal is being indicated.
   (1) For example, to differentiate between a submittal number for a color selection chart for paint and coatings from a color selection chart for fiberglass, add ".01" to the number for the paint and coatings color selection chart to make it "S 01 33 00-8.01", and add ".02" to the number for the fiberglass color selection chart to make it "S 01 33 00-8.02".

d) To indicate whether a submittal is the initial submittal for an item or a re-submittal that is required because the previous submittal for the item was returned from the Construction Manager with a review status that requires a re-submittal, add sequential alphabet letters as a suffix to the submittal number to indicate which submittal in the sequence is being identified.
   (1) For example, if a previous submittal is not approved and must be resubmitted or additional information regarding the item must be provided, add an alphabetic suffix to the previous submittal number to index the suffix to the next letter of the alphabet and generate the submittal number for the re-submittal
      a. For example, if the initial submission of the second required submittal in this Section, submittal number S 01 33 00-2.00, must be resubmitted several times, the submittal number for the first re-submittal would be "S 01 33 00-2.00A", the submittal number for the second re-submittal would be "S 01 33 00-2.00B", and so forth.
      b. The submittal number for the resubmission of a submittal required only by a Contract Drawing is similarly revised; the submittal number for a re- submittal of submittal number D E-140-2.00 would be "D E-140-2.00A".

c. Identification of Products, Systems, and Services:
   1) Although the Specification Section or Contract Drawing number in which a product, system, or service is specified is part of the submittal number, the products, systems, or services within the Section or on the Contract Drawing need to be further identified to specifically show which particular item is being submitted and for what purpose it will be used as follows:
      a) Provide a brief written title or description, including such items as the model number, style number, serial number, or lot number, to clearly and uniquely identify the product, system, Sample, or service submitted and describe where it is to be used or where it is to perform.
      b) Indicate the Article, Paragraph, or Subparagraph references from Specification Sections and the Contract Drawing number or numbers,

revision number or numbers, and the dates of the Contract Drawings or revisions to correlate the submitted products with the Contract Documents.

(1) Indicate the titles of details, sections, elevations, schedules, or other similar identifiers on the Contract Drawings that may help locate the source of the submittal.

c) Provide names, addresses, and phone numbers of the Contractor, Subcontractors, suppliers, vendors, manufacturers, and if applicable the seal and signature of a Professional Engineer currently registered in the State of New York for the involved discipline.

2) If catalogs, brochures, or catalog cut pages are submitted, provide each separate catalog, brochure, or single page with the identification required in Subparagraph 1.04. B.2.

a) If submitted catalogs or brochures contain multiple items for approval, identify each item separately.

(1) In this instance, include page and catalog item numbers as part of the product identification.

3) Identify all deviations from the Specifications and Contract Drawings on submittals.

d. Dates:

1) Indicate the date of the submittal and, if applicable, revision dates too.

e. Contractor's Certification Statement:

1) Verify that the Contractor's Certification Statement required by Paragraph 1.04.E is affixed to each submittal.

3. Space for Construction Manager's Stamp:

a. Provide a clear space approximately 3 inches high by 4 inches wide adjacent to the submittal identification information to receive the Construction Manager's stamp, on which the Construction Manager will indicate the status or disposition of the submittal following the Construction Manager's review.

C. Procedures for Submitting Information:

1. Unless specified otherwise, send submittals to the Construction Manager accompanied by a letter of transmittal that lists all items in the submittal:

a. If, because of standard shop practice or other reasons, submittals show variations from the Contract requirements, specifically identify these variations and the reasons for them in the letter of transmittal.

1) In the event the variations are acceptable to the Owner, suitable action will be taken to properly adjust the Contract.

2) In the event the variations are not accepted by the Owner, the Contractor is not relieved of the responsibility for executing the Work in accordance with the Contract even though the submittals showing the variations may have been approved.

b. Submit the required submittals promptly so delays in performing the Work of the Contract are avoided.

c. Supplemental submittals initiated by the Contractor for consideration of corrective procedures must contain sufficient data to allow the Construction Manager to make an informed review and decision.

2. Number of Copies to Submit:

a. If the item is submitted electronically, only 1 "copy" needs to be submitted; if the nature of the item is not conducive to submittal electronically, follow the alternate requirements of Subparagraph 1.05.C.2.b.

b. For each submittal, submit the number of copies of the information as indicated below for the appropriate type of submittal or re-submittal:
   1) For Product Data, certificates, design calculations, technical data, and test reports submit at least 6 copies of each item.
   2) For Shop Drawings and Working Drawings, submit at least 1 reproducible and 5 prints of each.
   3) For color selection charts and samples, submit 6 sets of each.
   4) For Samples, submit at least the number of Samples specified in the Section specifying the requirement for the Samples; or, if no number is indicated there, submit at least 2 non-returnable Samples.
   5) For submittal requirements regarding Contract closeout submittals, contact Metro-North.
   6) For submittal requirements regarding Operation and Maintenance (O&M) Manuals, contact Metro-North for details.
   7) For submittals returned with a RETURNED FOR CORRECTION disposition after review by the Construction Manager, re-submit a minimum of 6 corrected copies.
   8) For submittals returned with a NOT APPROVED disposition after review by the Construction Manager, submit at least 6 copies of completely new submittals that show the non-conformances responsible for the rejection of the previous submittal have been eliminated.

c. Final Shop Drawings:
   1) Within 10 days after receipt of the Construction Manager's approval, submit 1 copy of each mylar reproducible in a mailing tube and 2 prints of final shop drawings to the Construction Manager.
      a) Mark each copy with the words "This drawing was approved by the Construction Manager on [*date*]."
      b) Include space on the reproducible for Metro-North's drawing numbers and title blocks.
      c) Folded mylar reproducible are unacceptable.

D. Review and Disposition of Submittals:
   1. Construction Manager's Review:
      a. Following receipt of a submittal from the Contractor, the Construction Manager will review the general content of the submittal for conformance to the requirements of the Contract Drawings and Specifications.
         1) Review and approval of submittals by the Construction Manager is only for conformance with the Contract's design concept and for compliance with the information given in the Contract Documents.
         2) The review and approval of a separate item does not indicate approval of an assembly in which the item functions.
         3) Review and approval of a submittal by the Construction Manager does not relieve the Contractor of his responsibility for the accuracy of the submittal, for conformity of the submittal to the requirements of the Contract Drawings and Specifications, for compatibility of the described product with contiguous products and the rest of the system, for proper fit, or for completion of the Contract in accordance with the Contract Drawings and Specifications.
            a) The Contractor is responsible for providing materials and work required by the Contract that may not have been indicated on the submittal when it was approved.

b) The Construction Manager is not responsible for coordinating submittal information, such as the size and location of equipment; openings for piping, ducts and conduits; locations and sizes of concrete pads and anchor bolts; and similar Contract interfaces.

b. The Construction Manager's review and approval of submittals does not extend to the means, methods, techniques, sequences, or procedures of construction except where a specific means, method, technique, sequence, or procedure of construction is indicated in or required by the Contract Documents, or to facilitate mandated safety precautions or programs incident thereto.

c. Where a submittal pertinent to some part of the Work is required by the Specifications, and the part of the work related to that submittal is performed prior to the Construction Manager's review and approval of the submittal, such work is performed at the Contractor's risk and is the sole responsibility of the Contractor.

2. Construction Manager's Disposition of Submittals:

a. After review by the Construction Manager, submittals will be returned marked with one of the following Review Status dispositions:

1) APPROVED:

a) When submittals are returned with an APPROVED disposition, it is understood that the submittals have been found to be in conformance with the Contract Documents.

b) Approval by the Construction Manager of submittals does not relieve the Contractor from responsibility for errors or discrepancies in such submittals or for compliance with the Contract Documents; neither does it relieve the Contractor of the responsibility for providing adequate quality control measures nor relieve the Contractor of the responsibility for providing proper and sufficient materials, equipment, and labor to complete the approved Work in accordance with the Contract Documents.

2) APPROVED WITH CHANGES NOTED:

a) When submittals are returned APPROVED WITH CHANGES NOTED disposition, it is understood that the submittals have been found to be in conformance with the Contract Documents, provided the changes noted by the Construction Manager are incorporated into the submittals.

b) Submittals returned with an APPROVED WITH CHANGES NOTED disposition do not require resubmission of the corrected information.

3) RETURNED FOR CORRECTION:

a) When submittals are returned noted with a RETURNED FOR CORRECTION disposition, it is understood that the Contractor must make the required corrections and resubmit corrected submittals to the Construction Manager before the submittal can be approved.

4) NOT APPROVED:

a) When submittals are returned with a NOT APPROVED disposition, it is understood that the Contractor must prepare completely new submittals and resubmit these submittals to the Construction Manager for approval before the item can be approved.

b. Unless otherwise stated in the Contract Documents, do not commence any portion of the Work requiring approval of submittals until these submissions have been approved by the Construction Manager.

1) Should, for any reason, the Contract not be awarded, the Contractor will not be entitled to reimbursement for work performed prior to the Contract award.

2) Subsequent to award of the Contract, the Contractor will not be entitled to reimbursement for changes to submittals made necessary due to changes made

to the Contract Documents unless the changes to the Contract Documents occur after approval of the submissions.

c. Unless otherwise stated in the Contract documents, review of submittals will begin only after the submission of a complete set of information required to complete a discrete item of work.

1) The review process will allow 2 work days for each drawing submitted or a minimum of 10 days, unless stated otherwise in the Contract Documents.

2) Do not submit materials directly to a reviewing unit unless prior approval of the Construction Manager is obtained.

3) Furnish complete copies of all submissions to the Construction Manager.

3. Number of Copies Returned to the Contractor:

a. Whenever possible, the Construction Manager will return 1 "copy" of submittal dispositions electronically.

1) When the nature of the submittal is not conducive to being returned electronically, such as material Samples, the physical item will be returned as otherwise specified herein.

b. When it is not possible to return submittal dispositions electronically the Construction Manager will return at least 2 copies of reviewed submittals to the Contractor under the following conditions or provisos:

1) If more than 2 reviewed copies are required, submit an additional number of copies above the number normally required equal to the additional number of copies desired be submitted to the Construction Manager.

a) Provide additional copies of prints from reproducible, catalog cut sheets, and other types of submittals if needed for distribution to suppliers or Subcontractors.

b) The Construction Manager is responsible for providing copies to the field engineers, inspectors, and the Owner from the normally required copies.

2) For submittals that require a reproducible to be submitted, the approved or corrected reproducible will be returned to the Contractor.

3) For construction progress documentation submittals, refer to Section 01 32 00, Construction Progress Documentation, regarding the number of copies returned.

4) For Operation and Maintenance (O&M) Manual submittals, contact Metro-North, regarding the number of copies returned.

4. Re-submittal Requirements:

a. Amend and resubmit all submittals that are not approved by the Construction Manager.

1) Following receipt of submittals with a Construction Manager's Review Status disposition that requires a resubmission of the product, make the corrections to the submittals as required by the Construction Manager and return the number of copies of the corrected submittal information that are as specified in Subparagraph 1.04.C.2 as applicable, and submit new Samples as required, for review and approval.

b. Direct the attention of the reviewer to revisions, other than the corrections required by the Construction Manager on previous submittals, by specifically annotating them in writing.

5. Closeout Submittals:

a. At Project Closeout, make submittals in accordance with the procedures as required by Metro-North.

E. Contractor's Certification Statements:

1. Prior to formally sending each submittal to the Construction Manager for approval, perform the following checks and reviews:

a. Verify the materials, dimensions, catalog numbers, shop fits, field connections, related field measurements and field construction criteria, product availability in the quantities that are required, and similar data.

b. Review information that is available that has a direct effect on the products being submitted.

1) Check and coordinate each item with applicable, approved submittals from this Contract and, if applicable, from other related contracts and subcontracts.

2) Review the submittal information for accuracy, completeness, and compliance with the Contract requirements.

3) Review the submittal information for compatibility with the work of affected trades and subcontracts.

c. After performing the above checks and reviews, affix the following signed Certification Statement to each submittal to certify that the Contractor has checked the information contained in the submittal and found it to be satisfactory for meeting the requirements of the Contract Documents, and further that there will be no difficulty in erecting or installing the submitted items or completing the Contract as agreed:

"By this submittal, I hereby represent that I have determined and verified field measurements, field construction criteria, materials, dimensions, catalog numbers, and similar data; and I have checked and coordinated each item with the Contract Drawings, Specifications, other applicable approved Shop Drawings, and Contract requirements."

d. Failure of the Contractor to note his approval on a submittal is reason for the Construction Manager to return such submission to the Contractor un-reviewed.

e. If submittals appear not to have been properly checked by the Contractor even though the Contractor's approval has been noted thereon, the submittal will be returned to the Contractor un- reviewed.

F. Master Submittal List:

1. Submit the following information to the Construction Manager for approval in accordance with the requirements of this Section:

a. Master Submittal List

1) Within 30 Days after the award of the Contract, submit a Master Submittal List of proposed submittals to the Construction Manager for approval.

a) Indicate the submittal number for each submittal in accordance with Subparagraph 1.04.B.2.b and identify the products, systems, or services submitted in accordance with Subparagraph 1.04B.2. c.

b) Indicate the proposed date of each submission, and the quantity or number of copies for the various types of submittals, in this list.

c) Assign the submission dates in a sequence that is in accord with the importance of the Work to the progress of construction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SITE QUALITY CONTROL

A. Mandatory Submittal File:
   1. Maintain a submittal file in the project field office that contains all current, up-to-date submittals.

B. Conforming Work to Approved Submittals:
   1. Contract Work, materials, fabrication, and installation must conform to approved Contract submittals.
      a. Do not allow any portion of work requiring an approved submittal to be started or materials to be fabricated or installed prior to receiving approval or qualified approval of the item.
      b. Do not make changes to approved submittals unless those changes have been accepted and approved in writing by the Construction Manager.
      c. Distribute approved submittals to Subcontractors and, if applicable, other Contractors to make product information available for identifying and correcting conflicts before they adversely affect construction.
         1) Should conflicts occur, first obtain the Construction Manager's approval of necessary revisions and adjustments to eliminate the conflicts, and then perform the revisions and adjustments to the work at no additional cost to the Owner.
   2. Fabrication performed, materials purchased, or on-site construction accomplished that does not conform to approved submittals is at the Contractor's risk.
   3. Rejection of any submittal required by this Section is not an acceptable basis for any claim for delay.
   4. The Owner is not liable for expenses or delay due to corrections or remedies required to accomplish conformity.

END OF SECTION

[This Page Left Intentionally Blank]

SECTION 01 33 60
SAFETY, HEALTH, & ENVIRONMENTAL CONTROL

TABLE OF CONTENTS

SECTION 01 33 60
SAFETY, HEALTH, & ENVIRONMENTAL CONTROL

PART 1 - GENERAL

A. Safety and security of customers, passengers, Railroad employees, employees of the Contractor and its subcontractors, and other persons, as well as protection of property and the environment, shall be a primary responsibility and concern of the Contractor. Precautions shall be exercised at all times for the protection of person and property. The Contractor shall assume the full responsibility and obligation to provide a safe working environment at all times and shall maintain a safe, clean, and healthy worksite. The Contractor shall supply, install, and maintain all safety apparatus and equipment necessary to protect the welfare of his employees, the public, customers, and Railroad employees.

B. The Contractor shall comply with this specification section, Metro-North Railroad Operating Procedures and General Safety Instructions, and all applicable federal, State, and local laws, rules, regulations, codes, statutes, ordinances, and provisions including but not limited to, the Occupational Safety and Health Administration, the Federal Railroad Administration, the Environmental Protection Agency (Federal), New York State Department of Environmental Conservation (State), Department of Environmental Protection (City), the National Fire Protection Association (NFPA), the National Electrical Code, the New York State Industrial Code, the New York State Uniform Fire Prevention and Building Code, and requirements of the local municipality in which the Work is performed.

C. Notwithstanding any remedies for maintaining a safe, clean, secure and healthy work site, in the event that the Contractor's work environment chronically provides a site such that, there are significant safety or security concerns, this may constitute an Event of Default in accordance with Article 7.01 of the Contract Terms and Conditions.

D. PROJECT INCIDENCE RATES

1) Metro-North maintains a database of injuries occurring to Contractor employees, customers, and Railroad employees. Metro-North calculates Recordable and Lost Time injury incidence rates for comparison to the industry average rates maintained by the Bureau of Labor Statistics. These rates are updated monthly. Metro-North utilizes the industry classification of Specialty Trade Contractors (NAICS 238) for comparative analysis. The safety record of a project is based upon comparison of the calculated project incidence rate to the latest national average incident rate for Specialty trade Contractors.

2) Incidence rates are calculated utilizing the following formula. The Contractor shall review the project incidence rates with the work force during Worker Safety Meetings.

$$\text{Incidence Rate} = \frac{\text{Number of Recordable or Lost Time Injuries} \times \text{200,000 (100 workers x 40 hours x 50 weeks)}}{\text{Actual Hours Worked}}$$

(NOTE: Work hours are tallied from the WF-257 Work Force Utilization Reports submitted by the Contractor)

PART 2 - SAFETY & HEALTH REQUIREMENTS

2.01 EMPLOYEE CONDUCT & RESPONSIBILITY

A. The Contractor shall be responsible for the implementation and enforcement of safety and security rules and requirements.

B. To promote safety the Contractor shall hold regular safety meetings, ensure its and all Subcontractor employees are properly trained, and monitor job site safety via inspection at the start and completion of each shift as well as monitoring the job site for this purpose throughout the day. The Contractor shall correct and report any safety violations and convene investigative meetings, as directed by the Engineer.

C. Any Contractor personnel who in the Engineer's opinion violates or is not in conformance with the safety requirements may be prohibited from working on Railroad property. Metro-North will maintain records of such prohibitions and the individual will also be prohibited from working on all other Metro-North projects for the duration of this contract.

D. The Engineer reserves the right to refuse access to the Site or require immediate removal from the Site any individual violating, or alleged to have violated, site safety or security regulations and Contractor agrees to obtain consent of its subcontractors to a similar provision, and Contractor agrees to hold the Railroad harmless for taking such actions.

2.02 BAN AGAINST INTOXICANTS / FITNESS FOR DUTY - SAFE AND PROPER CONDUCT OF CONTRACTOR PERSONNEL

A. While on Metro-North property or otherwise performing work for the Contract employees and Consultants of the Contractor and its Subcontractors shall conduct themselves in a safe and businesslike manner, conducive to the safe and efficient operation of the Railroad. The Contractor shall meet the requirements of the Federal Railroad Association (FRA) 49 CFR 219 'Control of Alcohol and Drug Use' for regulated, Maintenance of Way and or Roadway Worker as defined by FRA. Questions regarding this FRA regulation are to be directed to the FRA, Drug and Alcohol Program Manager, Office of Safety Enforcement, Federal Railroad Administration in Washington DC.

B. The Contractor shall prohibit the possession and use of alcoholic beverages and intoxicants by all Contractor and Subcontractor personnel. Any Contractor or Subcontractor personnel determined by Metro-North, in its sole discretion, to be in violation of the provision, including but not limited to those determined by Metro-North to have violated the ban against intoxicants, will be prohibited from working on the Contract for its duration.

C. The Contractor shall not permit a worker whose ability or alertness is impaired because of drugs, fatigue, illness, intoxication, or other conditions to work at the Site. The Contractor shall ensure that its supervisory staff and the supervisory staff of each subcontractor perform a fitness for duty inspection on each worker reporting for work and throughout the day. The Contractor shall have a substance abuse program, pre-employment drug testing, and testing for cause.

2.03 METRO-NORTH CONTRACTOR SAFETY ORIENTATION

A. All contract personnel working on Metro-North Railroad (MNR) Property or on a MNR project are to complete the computer based training class entitled 'Metro-North Railroad Contractor Safety Training'. It is the Contractor's responsibility to schedule training and ensure workers complete the computer based training (CBT) prior to the start of work. Contractor personnel will not be permitted to commence work until they present documentation demonstrating each worker has completed the training. CBT cost will be at the Contractor's expense at an approximate cost of $25.00 per person [this fee is not paid to MNR and is subject to change without notice].

B. Once the Contractor's Supervisory Staff, Safety Engineer, Safety Supervisor, **Safety** Manager or other qualified management representative is on site they are required to attend a 'MNR Site Orientation' with an MNR Roadway Worker (MNR RW) prior to the commencement of work. The Contractor is then responsibility to provide 'Employee Site Safety Orientation'.

C. Documentation evidencing completion of the OSHA 10 hour or 30 hour Construction Safety course within five (5) years of the contract award date shall be provided as a prerequisite for attending Metro-North's Roadway Worker Procedures for Contract Employees Working on Metro-North Property or project. Workers to provide documentation of OSHA training at initial MNR site orientation.

D. The requirements covered by this training are a condition of working on Metro-North Railroad property, Project or Contract.

E. The training is valid for a period of one (1) year from the date of training. The training must be refreshed annually on or before the initial date of training. It is the Contractor's responsibility to ensure the training of its workforce is current and will be at the contractor's expense.

2.04 METRO-NORTH SPECIFIC SAFETY REQUIREMENTS

A. The Contractor is hereby notified that the Railroad contains hazards not typical of other construction sites, including but not limited to, moving rail equipment and hazardous energy (i.e Third Rail 750 volts DC, Overhead Catenary 12.5 kV to 25 kV AC). Employee awareness and management's vigilance are crucial to maintaining safety in this environment. The presence of a Metro-North Conductor-Flagman (if any) shall not relieve the Contractor of responsibility for taking all proper precautions, especially in the vicinity of tracks and high voltage electrical circuits.

B. Communication is paramount to safety, especially in the railroad environment. Where any language barrier exists with respect to other Contractor or Subcontractor employees, the Contractor will provide a qualified interpreter(s) who will be present whenever needed, in the opinion of the Engineer, to enforce safe conduct of the Work including but not limited to, at each work site and during meetings and safety classes. The Contractor shall provide at least one (1) individual that is fluent in the English language and able to communicate effectively with the Engineer and/or Conductor Flagman and translate between non-English speaking or comprehending individuals and the Engineer and/or Conductor Flagman. This individual must be able to effect communication between the work force and the Engineer and/or Conductor Flagman. Should the Engineer and/or Conductor

Flagman deem the communication ineffective, or has a potential to jeopardize the safety of the work force, the Engineer and/or Conductor Flagman has the right to stop the work until the Contractor can provide effective communication, the cost of any resulting delays to be borne by the Contractor.

C. Mobile telephones and other electronic devices shall not be used while on or about the tracks, and/or while operating machinery or equipment. Mobile telephones and other electronic devices may not be used while in areas of risk, such as on ladders, or while actively engaged in the work. Refer to General Safety Instruction 300.3 and Operating Rule D6 for specific requirements.

D. Audio devices such as radios, stereos, personal music players, or other audible devices are prohibited from use on Metro-North property. This includes audio devices within construction equipment.

E. All ladders shall meet or exceed OSHA requirements. Commercially available ladders used during the work shall be limited to those of fiberglass construction. Job site constructed ladders may be of wood construction.

F. All stairways and passageways shall be maintained free of obstructions unless G. specifically necessitated by the work and approved by the Engineer.

G. Eyewash stations shall be provided, maintained, and readily accessible at all construction sites regardless of the presence or use of corrosive materials. Large sites, or projects having remote work locations, shall have additional eyewash stations as necessary.

H. Should know or suspect hazardous materials be unearthed, uncovered, or otherwise discovered during the course of the work, the work in that area shall cease and the Engineer shall be immediately notified. Work impacting the known or suspect hazardous material shall not resume without the direction of the Engineer.

I. All materials, whether to be used for temporary or permanent construction, shall be fire resistant or fire retardant treated. Materials shall have the manufacturers labeling evidencing such. Materials shall come from the manufacturer pretreated. Application of fire retardants on the project site is prohibited.

2.05 SPECIFIC REQUIREMENTS FOR WORK IN GRAND CENTRAL TERMINAL

A. The following requirements are specific to work being performed within Grand Central Terminal (GCT) from 42nd Street to 57th Street and Madison Avenue to Lexington Avenue.

B. The Contractor shall notify the Metro-North Project Manager and Construction Manager of their intent to work in GCT. At no time shall the Contractor enter GCT without the knowledge of the Metro-North Project Manager, Construction Manager, and Station Master's Office. The Contractor shall provide a schedule identifying the days, dates, shift times, locations of the work, and companies/subcontractors that will be on site.

C. The Contractor shall assign one individual the responsibility of Designated Emergency Contact. The Designated Emergency Contact (DEC) shall be an individual that is on site and at the location of the work activity. An alternate DEC shall be assigned whenever the

primary DEC is not on site. The DEC shall be responsible for implementation of the Emergency Action/Evacuation Plan if necessary. The DEC shall be familiar with the Emergency Action/Evacuation Plan, which includes the primary and alternate evacuation routes and GCT emergency numbers (i.e. Station Master's Office, Fire Command Center, Operations Command Center, MTA Police).

D. The Contractor shall include the following numbers in the Emergency Contact List for projects within GCT.

MTA Police	(212) 878-1001 (888) 682-9117 (888) MTA911PD
Security Command Center (SCC)	914 461-0525
Fire Command Center (FCC)	212 340-3191 /3192
Station Master's Office (SMO)	212 340-2583
Transportation Office (Track 25)	212 340-2325/2329
Operations Control Center (OCC)	212 340-2050 (800) 724-3004

E. The Contractor shall provide the following information to the Station Master's Office at the start of each work shift: the name and phone number(s) of the DEC, a list of names of all contractor personnel working within GCT, a description of the location of the work, the shift start and end times.

F. Equipment and materials shall only be stored in areas designated by GCT building management. Storage areas shall be kept neat and orderly, and free from accumulations of debris.

G. Passenger elevators shall not be used for the transportation of construction materials without the prior approval of GCT building management. Transport of construction equipment, tools, and materials via escalators is strictly prohibited.

H. Care shall be taken for the transportation or movement of construction equipment, tools, and materials via rolling dollies, pump jacks, or other wheeled equipment throughout GCT. Such are prohibited on ramps or other inclined surfaces unless adequate controls are implemented to prevent run-away of the wheeled equipment. Unless otherwise approved by GCT building management, transportation or movement of construction equipment, tools, and materials is limited to off hours.

I. All materials, whether to be used for temporary or permanent construction, shall be fire resistant, and when possible, non-combustible materials shall be chosen over combustible materials (i.e. steel framing instead of wood framing, gypsum board instead of plywood). Each temporary structure shall be constructed of fire resistant or fire retardant treated material. All materials (i.e. lumber, plywood) shall be fire retardant treated and contain the manufacturer's stamps evidencing such. If the stamps are illegible or otherwise not

provided, the material shall be immediately removed from the premises and replaced at no additional expense to Metro-North. On site application of fire retardants by the Contractor is prohibited, except when the material is not commercially available pretreated from the manufacturer.

J. Temporary barriers used to segregate work areas from non-work areas shall be constructed as to provide a two (2) hour fire rating.

K. The storage of flammable materials within GCT shall be pre-approved by the Metro-North Office of Fire Prevention in Grand Central Terminal. Flammable materials shall be stored in approved containers in accordance with NFPA and FDNY guidelines and requirements. Flammable materials that will be stored on site shall be stored in approved containers, within flammable storage cabinets, located in areas equipped with fire suppression.

2.06 SAFETY SUBMITTALS

A. The Contractor shall provide the following submittals:

1) Safety, Health, and Environmental Control Plan (SHECP) [reviewed at a minimum annually]
2) Emergency Contact List [to be up dated at a minimum quarterly]
3) Subcontractor's Notice of Intent to Comply with Project SHECP
4) Record of Metro-North Roadway Worker Safety Training [submit records monthly]
5) Record of Employee Safety Orientation
6) Safe Work Plans [To be done for each Task]
7) Daily Safety Reports
8) Monthly Site Safety Audit Reports
9) Resumes & Qualifications of Safety Engineer and Safety Supervisor
10) Forms and reports for the documentation and investigation of Incidents, Accidents, and Injuries
11) Record of Employee Safety Meeting (i.e. Tool Box Meetings)
12) Evidence of Employee Training (i.e. OSHA 10 hr Construction Safety, Fall Protection, Confined Space Entry & Attendant, Scaffold Erection & User)
13) Fall Protection Plan
14) Safety Data Sheets (SDS)
15) Employee Roster / Daily Employee Sign In/Sign Out Log
16) Crane, Lifting Equipment, Rigging, Hoisting Plan
17) Copies of Citations, Suits, or Complaints

2.07 SAFETY KICKOFF MEETING

A. The Contractor's Project Manager, Safety Engineer, and Safety Supervisor(s) shall attend a Safety Kickoff Meeting which will be convened by the Engineer within 45 calendar days of Award.

2.08 SAFETY, HEALTH, AND ENVIRONMENTAL CONTROL PLAN (SHECP)

A. The Contractor shall develop and maintain a written, Contract specific, Safety, Health, and Environmental Control Plan (SHECP) to:

- Protect the lives and health of all persons,
- Provide employees with information to enable them to work safely
- Prevent damage to property and environment
- Identify hazardous conditions and unsafe work practices
- Provide a system for auditing work site safety and compliance with the established safety program
- Avoid work interruptions or any delay to train services due to accidents

B. Within fifteen (15) days of the date of Award, the Contractor shall submit the SHECP to the Railroad. Work on the Site shall not be permitted to start until the full written plan, covering all required items, has been submitted and accepted, and Safe Work Plans (SWPs) for the upcoming construction activities meeting the requirements of Section 2.16 are submitted, reviewed, and revised accordingly.

C. The Safety Engineer shall be involved in the preparation and review of the SHECP as evidenced by their signature on the cover page of the document.

D. Failure of the SHECP to address the safety concerns specific to the contract and its scope of work, and contain the information required by this section, shall be grounds for immediate rejection of the submittal

E. The ***Contractor shall utilize the provided SHECP Checklist*** to prepare the SHECP. The Contractor shall complete the SHECP Checklist and attach it to the SHECP upon submittal. Failure of the SHECP submittal to contain a completed SHECP checklist shall be grounds for rejection of the submittal.

F. The SHECP shall be a written plan laying out the management organization and strategy to assure high levels of job site safety for all performed tasks. It shall define the personnel responsible for developing and assuring safe work practices for each major item of work or subcontract.

G. The Contractor shall revise and resubmit the SHECP based upon comments returned from the Engineer. As to facilitate the SHECP review process, should comments be returned to the Contractor, the Contractor shall address each comment individually and separately from revisions to the SHECP itself. ***A cover letter identifying each of the reviewer's comments and the Contractor's responses shall accompany the revised and resubmitted SHECP.***

H. The Contractor shall take immediate action to prevent the recurrence of each incident, accident, or injury. In addition, the Contractor shall review the SHECP based on such an occurrence and revise as necessary. Upon any changes in work conditions, the Contractor

shall also revise the SHECP. The Contractor shall submit each revision of the SHECP to the Engineer for review.

I. The Contractor shall maintain a copy of the SHECP within the project field office. The Contractor's SHECP including each ***Subcontractor's Notice of Intent to Comply*** with the Contractor's SHECP shall be readily available for review by the Railroad.

J. The Contractor shall ensure that all Subcontractors and Suppliers comply with the Contractor's SHECP, or submit their own programs that the Contractor shall be required to approve. Each subcontractor shall comply with the Contractor's SHECP, and shall ***provide written notification of its intent to adopt and comply with the Contractor's SHECP***. If the Subcontractor elects to submit its own SHECP, it shall demonstrate that their program meets the requirements of this Section, be approved by the Safety Engineer, and be incorporated into the Contractor's SHECP. The Subcontractor's SHECP shall be submitted and approved prior to the start of the Subcontractor's work on the Site. The Contractor shall review the Subcontractor's and Supplier's agreements to ensure the flow down of all applicable safety requirements.

K. The following are the minimally required elements of the SHECP. The SHECP shall contain the following. Failure of the SHECP to contain the following information shall be grounds for rejection of the submittal. The Contractor may include information beyond what is required herein, but shall limit it to information applicable to the contract scope of work.

1) Cover page with Name of Contractor, Title of Contract, and Contract Number. Include plan revision number, date of revision, name and signature of Safety Engineer responsible for the maintenance and enforcement of the SHECP.

2) Table of Contents that provides section numbers, title or description of the section contents, the page number of the section, and identification of the revision number and revision date of each section.

3) Safety Policy Statement signed by an Officer of the Contractor.

4) Organizational chart of Contractor and Subcontractor personnel responsible for implementing the SHECP and their duties and responsibilities. The chart shall show the reporting relationship and integration of the Safety Engineer with all personnel, including top-level managers, responsible for implementing the SHECP.

5) Description of the relationship between the Prime and Subcontractor(s) and the responsibility for management of site safety.

6) Identification of the Safety Engineer including their duties and responsibilities.

7) Identification of the Safety Supervisor including their duties and responsibilities.

8) Identification of the Competent Person(s) for each of the respective construction disciplines or specialties.

9) A statement regarding the responsibility of all employees to work safely, to not engage in unsafe behavior, and abide by safety rules.

10) A comprehensive description of the project and scope of work under the contract. This section shall be of sufficient detail so that those not directly involved in the project, including reviewers of the SHECP, may attain sufficient knowledge to judge the applicability and adequacy of the SHECP contents.

11) A listing of the known and anticipated hazards to be encountered during the work.

12) A detailed Employee Safety Orientation Plan for all Contractor and Subcontractor personnel (see Section 2.12). The Contractor shall include a Record of Employee Safety Orientation form for employee acknowledgement / sign-off of having received such safety orientation.

13) Requirement for Worker Safety Meetings (i.e. Tool Box Meetings). Include Record of Worker Safety Meeting form to be used to document meetings. At a minimum, the Record of Worker Safety Meeting shall identify the date, topic(s) of discussion, and attendees.

14) Requirement for Safe Work Plans. Include example of Safe Work Plan form.

15) A description of the how the contractor intends to monitor the work site and ensure that employees are following established policies, procedures, and work practices. Requirement for Daily Site Safety Inspections. Daily inspections for each work shift and inspections being recorded in a Daily Safety Report. Include a copy of the proposed Daily Safety Report as an attachment.

16) Requirement for Monthly Site Safety Audits. Include a copy of the example Monthly Site Safety Audit Report to be utilized.

17) Procedures for the Identification and Handling of Unsafe Conditions

18) A section dedicated to Slip, Trip, Fall hazards and abatement

19) Employee Fitness for Duty including monitoring of employee fitness, and handling of employees deemed unfit for duty.

20) Incident/Accident Response - Procedures for Handling and Reporting Injuries, Incidents, Accidents, and Near Misses. Include an Accident Investigation Procedure including a decision chart for identifying root causes. Include Accident Investigation Report form(s). Include a generic action plan for review, analysis and immediate action necessary to prevent recurrences of all accidents or incidents (near misses). The Contractor shall review and if necessary, revise the SHECP based on the occurrence of serious accidents, incidents, injuries, or near misses, and upon any changes in job conditions, or as required by the Engineer.

21) An Emergency Preparedness and Response Plan to include the following:

    a. An Emergency Contact List which shall identify the proper numbers to call for all emergencies including fire, police, medical (hospital, clinic, ambulance), disruptions of train service, and the release of contaminants into the environment, in addition to the phone numbers of all involved parties including the Metro-North contacts and Contractor / Subcontractor Contacts. Identify the location of phones to be used for emergency notification.

b. A plan for the safe and effective response to medical emergencies for Contractor and Subcontractor personnel. Emergency medical services shall include first-aid treatment (including all necessary first aid supplies), and ambulance service (or other standing arrangement) for the immediate transport of injured workers to medical treatment.

c. Include emergency phone numbers for fire and life-safety emergency contacts.

d. Include the name, address, phone number, and driving directions and map(s) of local routes to the hospitals and/or other medical treatment facilities nearest to the project site.

e. An Evacuation Plan that identifies the emergency escape routes or available means of egress during an evacuation, designates the primary and secondary assembly (i.e. muster) areas for personnel, and a system by which each individual can be accounted for in the event of an evacuation, fire, or other such emergency. Include copy of the Employee Roster form or Daily Sign-in/Sign out Log.

f. Include requirement for an annual emergency preparedness drill(s).

g. The identification of potential environmental accidents and emergencies associated with site-specific construction activities. And the response procedures to construction site environmental accidents and emergencies and for the prevention and mitigation of the environmental impacts that may be associated with them.

h. Site security and control: The Contractor shall outline its plan for site security including prevention of unauthorized entry onto the project site and prevention of vandalism. The plan shall include all contractually required security items. This plan shall include where necessary: use of fencing, temporary enclosures, concrete barricades, surveillance cameras, guard service and worker identification.

i. Notification to Engineer and all appropriate agencies.

j. Annual reviews and revisions of the Emergency Preparedness and Response Plan, in particular after the occurrence of environmental accidents and emergency situations.

22) Outline of general safety rules and procedures for the performance of the Work. The Contractor shall ensure that all applicable safety regulations are addressed and included in this section. Examples for inclusion in this section are as follows:

a. Hazardous Communication (HAZCOM) Program,

b. Protection of Existing Public and Private Utilities (Utility Identification, Call Before You Dig)

c. Fall Protection Program,

d. Lock Out / Tag Out,

e. Arc – Flash Protection,

f. Hearing Conservation Program,

g. Respiratory Protection Program,

h. Confined Space Program,

i. Burning & Welding / Use and storage of compressed gases,

j. Powder Actuated Tools

k. Hand & Power Tools

l. Ladders & Scaffolds

m. Handling, Containerization, & Storage of Flammable Materials/Liquids

23) Outline of site-specific safety rules and procedures for the performance of the Work. Examples for inclusion in this section are as follows:

a. Plans for safe ingress and egress,

b. Fall Protection Plan

c. Maintenance & Protection of Traffic / Traffic Control Plans

d. Protection of the Public, and Metro-North Customers and Employees,

e. Plans for fire protection and emergency response, and

f. Plans for Lead and Asbestos Abatement.

24) Employee Conduct, Handling of Employees / Subcontractors Failing to Abide By Safety Requirements, and Disciplinary Procedures for Violations of Safety Rules.

25) Procedure for identification and labeling of products, control of products and materials containing hazardous components, including provisions for maintenance of Safety Data Sheets (SDS).

26) Environmental protection to be implemented by the Contractor during the performance of the Work, including but not limited to, noise control, prevention and/or control of air and water pollution, erosion and siltation control, removal of waste materials, storage of construction materials, protection against fire, minimum disturbance to pedestrian and vehicular traffic, maintaining use of public facilities, protection against fugitive emissions / dust control, on site storage of fuels/petroleum products, spill prevention, leak containment, and clean-up.

27) Procedures for the periodic review and revision of the SHECP.

28) Procedures for the organization and maintenance of safety related documentation

29) Any other related safety information.

2.09 SAFETY ENGINEER (FULL TIME)

A. The Contractor shall provide and assign a full time Safety Engineer to this project within fifteen (15) days of Notice of Award until physical completion of the work. Within ten

(10) days of Notice of Award, the Contractor shall submit a resume documenting the qualifications of the proposed candidate to the Engineer for approval. The individual serving in this capacity is often referred to as the Site Safety Engineer, Safety Manager, Site Safety Manager, Site Safety Officer, Health & Safety Officer, On Site Safety Manager but shall be clearly identified as the "Safety Engineer" throughout all documentation. (Only one Safety Engineer is needed for Contract 1000106733)

B. The authority and responsibility of ***Safety Engineer shall be assigned to a single*** individual ***who is full time on the project and is on the project site while work is actively underway***, qualified as described herein, and a management representative of the Contractor. The Safety Engineer's responsibility shall be limited to managing and monitoring site safety, site security, and environmental protection. The Contractor may subcontract this position to a qualified safety consultant.

C. Upon demonstration by the Safety Engineer, the ability to satisfactorily manage site safety, other supervisory and technical tasks may be assigned to this individual, but his/her first duty is to provide for project safety as described in these specifications. Prior to assigning the Safety Engineer additional responsibilities, the Contractor shall submit in writing to the Engineer, a request to allow the Safety Engineer to assume additional responsibilities. If such approval is granted, Metro-North reserves the right to revoke the same in the event site safety is not being maintained.

D. Metro-North reserves the right to require the Contractor to replace the individual serving in the capacity of the Safety Engineer, at any time, for failure to perform the duties outlined in this section. The lack of accidents or employee injuries on a project shall not be utilized as the sole means of evaluating satisfactory performance of the Safety Engineer.

E. The Safety Engineer shall be present at the locations where the work is actively being performed. The Safety Engineer's regular work shift shall be the work shift with the greatest work activity or the shift with the most hazardous work activity. This may require the Safety Engineer to be present for day, evening, night or weekend shifts. The Safety Engineer may be required to be present for multiple shifts if high hazard or high-risk work is occurring during multiple shifts. Failure to have a Safety Engineer or Safety Supervisor at a work area may result in a stoppage of work at that work area.

F. The Safety Engineer shall be given the authority to alter and implement changes to the contractor's means and methods as necessary to benefit the safety of operations. In the event of an Unsafe Condition, the Safety Engineer shall have the authority to order the work to be stopped in the affected area until the Unsafe Condition is corrected.

G. The Contractor shall not change the approved Safety Engineer without prior written consent of the Railroad.

H. The responsibilities and duties of the Safety Engineer shall include the following:

1) Development of the Safety, Health and Environmental Control Plan (SHECP) and revise as required,

2) Implementation of the SHECP,

3) Monitoring of the Contractor's and each subcontractor's implementation of and adherence to the SHECP,

4) Development and review of Safe Work Plans, and monitor the implementation of the same in the field

5) Ensure that all employees on site have completed the requisite Metro-North training and any other training as may be required by regulation

6) Conduct Employee Site Safety Orientations

7) Conduct Worker Safety Meetings and manage Subcontractor's Worker Safety Meetings

8) Conduct regular inspections of the work site(s) throughout the work shift to identify unsafe work practices and conditions, and monitor implementation of controls and use of proper protective equipment. One (1) of these inspections shall be conducted at the beginning of the shift; within one (1) hour of shift commencement. Such inspections shall be structured to identify unsafe employee work practices and conditions, and implement corrective actions. The findings and corrective actions shall be documented on the Daily Safety Report.

9) Prepare Daily Safety Reports (see Section 2.19)

10) Coordinate and participate in Monthly Site Safety Audits and Monthly Safety Meetings

11) Attendance at all safety related project meetings

12) Conduct incident/accident investigations, prepare and distribute associated reports and documentation, and review to ensure completeness

13) Maintain all safety related documentation

I. Qualifications

1) Required qualifications include the following:

a. The Safety Engineer shall have not less than five (5) years of construction safety or construction safety related experience. The Safety Engineer must be familiar with the work being performed. The resume must include for a five (5) year period, a description of the duties, responsibilities, accomplishments, and safety record of preceding assignments from which the candidate has gained construction safety experience. Experience in construction and/or construction management does not satisfy the requirement for experience in construction safety.

b. A sound working knowledge of Railroad, State, and Federal occupational safety and health regulations.

c. Training in and working knowledge of the use of all necessary health and safety monitoring equipment.

d. American Red Cross or equivalent standard first aid and adult cardiopulmonary resuscitation (CPR).

e. OSHA 40-hour Hazardous Waste Operations & Emergency Response (HAZWOPER) training in hazardous materials safety and health as stipulated in 29 CFR 1910.120 e(3), 8 hours of supervisory training as described in 29 CFR 1910.120 e(4), and 8 hours of refresher training as described in 29 CFR 1910.120 e(8).

f. Successful completion of one (1) or more of the following:

i. An ABIH Certified Industrial Hygienist (CIH) or ASSE Certified Safety Professional (CSP), or

ii. A BCSP Construction Health and Safety Technician (CHST) or Occupational Health and Safety Technologist (OHST), or

iii. Certification as a Site Safety Manager by the New York City Department of Buildings, or

iv. OSHA #500 Trainer Course in Occupational Safety and Health Standards for the Construction Industry, or

v. OSHA #510 Occupational Safety and Health Standards for the Construction Industry, or

vi. OSHA 30 hour Construction Safety and Health Training completed within (3) years of the date of contract award by an OSHA Outreach Training Provider.

2.09 SAFETY ENGINEER (PART TIME) – NOT USED

2.10 SAFETY SUPERVISOR

A. Whenever the Safety Engineer is not present at the work, the duties and responsibilities of the Safety Engineer shall be assigned to a Safety Supervisor [i.e. if there are multiple work locations for a project, multiple shifts or Safety Engineer is sick or on vacation]. The Safety Supervisor's primary responsibility shall be the management of all safety matters under his/her jurisdiction. Failure to have a Safety Engineer or Safety Supervisor at a work area may result in a stoppage of work at that work area.

B. The Contractor shall submit to the Railroad the names and duty tours of the proposed Safety Supervisors.

C. Within fifteen (15) days of Notice of Award, the Contractor shall submit a resume documenting the qualifications of the proposed candidate(s) to the Engineer for approval.

D. Qualifications

1) Required qualifications include the following:

a. The Safety Supervisor shall be familiar with the work being performed, shall be competent to instruct others, and shall be familiar with the SHECP.

b. The Safety Supervisor shall have not less than five (5) years of construction safety or construction safety related experience. The Safety Supervisor must be familiar with the work being performed. The resume must include for a five (5) year period, a description of the duties, responsibilities, accomplishments, and safety record of preceding assignments from which the candidate has gained construction safety experience. Experience in construction and/or construction management does not satisfy the requirement for experience in construction safety.

c. A sound working knowledge of Railroad, State, and Federal occupational safety and health regulations.

d. Training in and working knowledge of the use of all necessary health and safety monitoring equipment.

e. American Red Cross or equivalent standard first aid and adult cardiopulmonary resuscitation (CPR).

f. Successful completion of one (1) or more of the following:

   i. An ABIH Certified Industrial Hygienist (CIH) or ASSE Certified Safety Professional (CSP), or

   ii. A BCSP Construction Health and Safety Technician (CHST) or Occupational Health and Safety Technologist (OHST), or

   iii. Certification as a Site Safety Manager by the New York City Department of Buildings, or

   iv. OSHA #500 Trainer Course in Occupational Safety and Health Standards for the Construction Industry, or

   v. OSHA #510 Occupational Safety and Health Standards for the Construction Industry, or

   vi. OSHA 30 hour Construction Safety and Health Training completed within (3) years of the date of contract award by an OSHA Outreach Training Provider.

2.11 EMPLOYEE TRAINING

A. The Contractor shall ensure the proper training of its employees and subcontractor's employees. Employee training required specifically by OSHA, NYSDOL, NYCDEP, NYCDOB, or other agency regulations shall be provided. Upon request of the Engineer, the Contractor shall submit evidence of such training.

B. All workers shall have completed the OSHA ten (10) hour Construction Safety Course within five (5) years of the contract award date. All management personnel, including Project Managers, Superintendents, Foremen, and Competent Persons shall have completed the OSHA thirty (30) hour Construction Safety Course within five (5) years of the contract award date. Only courses completed through OSHA recognized outreach

training providers shall be acceptable. Evidence of such training shall be submitted to the Engineer and shall be a prerequisite prior to attending Metro-North Site Safety Orientation.

2.12 EMPLOYEE SITE SAFETY ORIENTATION

A. Prior to working on Site, the Contractor's Supervisory Staff, Safety Engineer, Safety Supervisor, Safety Manager or other qualified management representative is to provide each employee with an effective 'Employee Site Safety Orientation'. The contents of the training shall include, but not be limited to, the following:

1) Introduction to the project site, scope of work, and key personnel;
2) Review of the company's Safety Policy;
3) Review of the SHECP and where it is maintained on site;
4) Review of plans supplemental to the SHECP (i.e. HAZCOM, Respiratory Protection Program, Fall Protection Program, Confined Space Entry Program)
5) Review of the safety rules and requirements with a copy distributed to each employee;
6) Employee fitness for duty and substance abuse policy to include 49 CFR 219;
7) Worker responsibilities and disciplinary procedures for violation of safety rules,
8) Review of the Metro-North specific safety requirements, and Grand Central Terminal specific safety requirements (as applicable), with a copy distributed to each employee;
9) Review of the Project Incidence Rates for Recordable and Lost Time Injuries inclusive of prior incidents, accidents, injuries, and near misses
10) Requirement for the immediate reporting of incidents, accidents, injuries, and near misses and follow up with root cause investigation, corrective action and implementation;
11) Site security procedures (i.e. photo ID, company logo/insignia on PPE, sign-in/sign-out log, "if you see something, say something", be aware of suspicious behavior, specific procedures for secured facilities);
12) Emergency Preparedness and Response Plan including identification of medically trained personnel, and location of First Aid and medical facilities, emergency phone numbers;
13) Evacuation Plan
14) Identification of the Safety Engineer and Safety Supervisor(s) and their duties and responsibilities;
15) Procedures in place for the identification and control of job site hazards (i.e. individual's responsibility to report unsafe conditions and work practices, daily safety inspections, safety audits)
16) Review of site-specific hazards, respective controls, and safe work practices;
17) Review of the public, customer, and Metro-North employee safety concerns, the separation and protection of work areas (i.e. signage, barricades, fencing, barriers)

18) Review of the availability and content of Safe Work Plans;

19) Attendance requirements for Daily Safety Briefings, and Weekly Worker Safety Meetings;

20) Personal Protective Equipment requirements;

21) Housekeeping requirements;

22) Fire prevention requirements;

23) Construction equipment and vehicle safety (i.e. seat belts, speed limit, equipment escort/flagging for movements)

24) Warning devices and safety postings.

B. The Contractor shall maintain written records of the Site Safety Orientation program and each individual's acknowledgement of having completed the orientation. As documentation of orientation, the Contractor shall provide a written Record of Employee Safety Orientation whereby each employee acknowledges having received such orientation. Upon completion of the employee's orientation, the employee shall complete the Record of Employee Safety Orientation form. An example of this form shall be included in the SHECP. Copies of the completed Record of Employee Safety Orientation shall be submitted to the Engineer within five (5) working days after the orientation. At a minimum, the record shall include the following:

1) An outline of the topics covered

2) The date the training was completed

3) A statement whereby the employee acknowledges having completed such orientation and agrees to abide by the safety requirements

4) The printed names and signatures of the following:

   a. Employee having received the orientation

   b. Safety Engineer or Safety Supervisor

   c. Individual providing the orientation (if other than the Safety Engineer or Safety Supervisor),

   d. Project Superintendent or Project Manager

2.13 DAILY SAFETY BRIEFING

A. An effective Safety Briefing shall be conducted at the start of each workday, or at any time during the work day when conditions change or new tasks are initiated. All individuals involved in the task shall attend the Safety Briefing. An employee failing to attend a Safety Briefing shall not be permitted to perform any work until the employee has received the same instruction.

B. The briefing is a two way communication tool to ensure that workers know what they will be doing, how it will be accomplished, have the ability to discuss better ways to do the job, and are alert and focused on the job.

C. Employees involved in the work shall be authorized and empowered to recommend changes to the means and methods to increase the safety of the operation. Employees should be encouraged to ask questions pertaining to things they are not confident about. The Contractor shall specifically inform employees of this authority.

D. The Safety Briefing should include:

1) A description of the job and basic steps involved

2) Assignment of tasks and responsibilities

3) A check that all involved are familiar with applicable Safe Work Plans

4) Existing and potential hazards applicable to that shift's work

5) Review of SDS

6) Required tools, equipment, and materials

7) Necessary safeguards and procedures, including specific personal protective equipment required

8) Special conditions to watch for

9) When to stop and re-brief

10) Feedback and questions

2.14 WEEKLY WORKER SAFETY MEETINGS

A. Worker Safety Meetings shall be held no less than one (1) time each week. Each employee of the Contractor and each Subcontractor working at the Site shall attend Worker Safety Meetings.

B. The Worker Safety Meeting shall be conducted by the Safety Engineer or a Subcontractor's Competent Person. The Safety Engineer shall approve the content of each subcontractor's Worker Safety Meeting.

C. The Worker Safety Meeting shall review safe working methods and applicable rules required for the safe performance of the work scheduled during the two (2) week period following the Worker Safety Meeting. Each Worker Safety Meeting shall include,

1) Instruction and discussion of Safe Work Plans applicable to the upcoming work,

2) Review of recent injuries, incidents, accidents, near misses

3) The Engineer reserves the right to direct the Contractor to cover additional information.

D. The Contractor shall notify the Engineer at least one (1) week in advance of each scheduled Worker Safety Meeting.

E. The Contractor shall prepare a written Record of Work Safety Meetings. An example of this form shall be included in the SHECP. Copies of the completed Record of Work E. Safety Meeting shall be submitted to the Engineer within five (5) working days after the Worker Safety Meeting. The record shall include the following:

1) The date and time the meeting was held

2) An outline of the topics discussed

3) The specific Safe Work Plans that were reviewed

4) The printed names and signatures of

   a. All attendees

   b. The individual chairing the meeting

   c. Safety Engineer or Safety Supervisor

2.15 MONTHLY SAFETY MEETING

A. On a monthly basis while on site work is underway, the Contractor shall chair a Monthly Safety Meeting. The Contractor shall inform Metro-North of the meeting schedule (2) weeks in advance. An agenda and minutes of the meeting shall be prepared by the Contractor and submitted to the Engineer within five (5) working days after the meeting.

B. All Contractor personnel responsible for project safety including, management officers that are responsible for developing and maintaining company safety standards and policies (i.e. Corporate Safety Director), the Safety Engineer, the Safety Supervisor, the Superintendent, Foremen, and Subcontractor's Competent Persons shall attend.

C. The agenda for the Monthly Safety Meeting shall minimally include the following:

1) Review of Incidents, Injuries, Accidents & Near Misses and Lessons Learned

2) Review of site safety audits and inspections completed since the last meeting

3) Review of the preceding month's Monthly Site Safety Audit

4) Review of work plans for upcoming operations (i.e. new processes or procedures, sharing of new means and methods, new equipment or products, those requiring special precautions and/or PPE)

5) Development and review of Safe Work Plans

6) Safety program implementation (i.e. review of safety related project documentation for completeness, Incident/Accident/Injury Reports, New Employee Orientation, OSHA 10 hr Construction Safety, OSHA required training such as Fall Protection, Scaffolds, Confined Space)

7) Dissemination of safety related information from Management to Work Force and vice versa (i.e. Safe Work Plans, Incident/Injury Reporting)

2.16 SAFE WORK PLANS

A. The Contractor shall prepare and submit a Safe Work Plan (SWP) for each of the primary construction tasks identified on the four (4) week Rolling Schedule. The SWP shall be structured to correlate with, and be integrated into, the four-week Rolling Schedule. By maintaining parallelism in document formats, a consistent, cohesive effort will effectively merge safety into the construction management process. (See example on following pages.)

B. The SWPs shall be transmitted to the Engineer one (1) week prior to the start of the work covered by the SWP. Failure to transmit SWPs may be grounds for not allowing the work to proceed and for withholding progress payments.

C. A SWP is a written work plan which identifies the tasks and corresponding sub-tasks to be completed, the method of work for performing each task, the hazards associated with the work, and the corresponding equipment and methods that will be used to control the hazards and prevent accidents. The SWP shall define a plan of action for each identified hazard including comprehensive prevention methods for exposures to workers, the public, property, and the environment. Access/egress and setup/breakdown under all expected environmental conditions shall be included.

D. SWP's shall address all foreseeable exposures to the work force, the public, and property. Absence of an applicable standard or regulation does not preclude the Contractor from providing appropriate controls within an SWP. Specific references in the SWP to codes standards and regulations are not necessary.

E. When controls are compliance based, such as for confined space entry, all applicable compliance information shall be included or appropriately referenced. Of particular concern are training items that will be required to educate the employees about exposures such as Worker Safety / Tool Box Meetings held to discuss the hazard and accident prevention methods. More formal off site training (fall protection, confined space, trenching, competent person, etc) should be listed and documentation referenced or provided.

F. Work shall not begin until the SWP has been presented to and accepted by the Engineer. If the SWP does not adequately address all expected, foreseeable hazards posed by the work, the Engineer will require clarification or additional planning to ensure that work proceeds safely. The Contractor's Competent Person involved, shall demonstrate knowledge of the Competent Person responsibilities as defined by OSHA and how the plan will be effectively implemented, to the satisfaction of the Engineer.

G. The SWP shall include the following information and be prepared in accordance with the example shown on the following pages.

1) General Project Information (Contract, General Contractor, Contractor Performing Task)

2) SWP Number (i.e 1, 2, 3), Date, Revision (i.e 01, 02, 03)

3) Primary Task - Describe the scope of work

4) Method of Construction

5) List of equipment and products to be utilized, with product data sheets, material specifications, and Material Safety Data Sheets attached

6) Development Team (Preparers and Reviewers)

7) Competent Person(s) assigned to the task

8) Work Element(s)/Sub Tasks - Describe sub-tasks and activities of the Primary Task, as appropriate. Identify the equipment and methods of construction for the Work Element.

9) Hazard Description - Describe each foreseeable hazard for the Work Element

10) Hazard Control/Accident Prevention - Describe controls and procedures that will be implemented to reduce or eliminate each foreseeable hazard described above; reference attachments as necessary.

11) Training Required – Metro-North Roadway Worker Safety, Fall Protection, Scaffold Erector/Scaffold User, Confined Space, Equipment Operation (i.e. fork lift)

12) Specific PPE Required for Each Task – List the specific PPE required, beyond the standard minimally required PPE for all tasks (i.e. hard hat, safety vest, protective eyewear, work shoes)

13) Implementation / Review with Work Force

H. Priority should be given as follows in controlling hazards:

1) Substitution or change of method to eliminate hazard

2) Engineering controls

3) Provision of Personal Protective Equipment (PPE)

4) Management controls / training, such as a safety monitor for fall exposures.

I. Accident prevention procedures shall be based on industry standards including but not limited to:

1) OSHA Standards

2) Mine Safety and Health (MSHA) Regulations

3) National Institute for Occupational Safety & Health (NIOSH)

4) American National Standards Institute (ANSI)

5) National Fire Protection Association (NFPA)

6) American Conference of Governmental Industrial Hygienists (ACGIH).

SAFE WORK PLAN

SECTION 1 – General Information			
Contract / Project Description:	Croton Harmon Yard Improvements – Phase IV	**SWP No.:**	1
General Contractor:	ABC Constructors	**Date:**	01/21/10
Contractor Performing Work:	DEF Excavating	**Revision No.:**	01
Primary Task:	Installation of Oil Water Separator. Excavate a pit approximately (10) feet long by (10) feet wide and (8) feet deep in the northwest corner of the yard near Track 4 and install oil water separator.		
Method of Construction:	Standard cut and cover excavation		

Equipment / Materials (Product Data Sheets & SDS Attached):	
Cat 245 backhoe equipped with 1.5 yard toothed bucket and lifting hook will be used to excavate, place materials, and backfill	20 yard dump truck will be used to remove excavated material from the Work Area
An engineered shoring system will be used to protect against cave-in and to support the soil near the track bed on Track 4	Wire rope slings and shackles will be used to lower oil water separator and top section into pit
Gasoline powered tamper will be used to compact soil during backfilling	Shovels, rakes, and hand tools will be used for various tasks

SECTION 2 – Development Team					
Prepared By:	**Position/Title**	**Date**	**Reviewed By:**	**Position/Title**	**Date**
John Doe	Laborer	01/12/10	Jane Mayfield	Safety Engineer	01/19/10
Bob Catt	Equipment Operator	01/12/10			
Phil Spoil	Excavation Foreman	01/13/10			

SECTION 3 – Competent Person(s) Assigned			
Competent Person	**Discipline**	**Competent Person**	**Discipline**
Phil Spoil	Excavation	Bob Fume	Confined Space Entry
Clevis Shackle	Rigging		

SAFE WORK PLAN

SECTION 4 – Safety Analysis			
Work Element(s)/Sub Tasks:	**Hazard Description**	**Hazard Control/Accident Prevention**	**Specific Training & PPE Required**
Excavate - Dig pit for oil water separator Place Gravel - Place and level pea gravel in excavation	Potential collapse of excavation and related excavation hazards	Excavation will be shored utilizing a pre-engineered shoring system. Ladders will be provided for safe entry and egress. Ladder to extend 36" above excavation. A guardrail will be installed on top of the shoring system to protect against falls into the open excavation.	Fall Protection
	Hazards of moving vehicles.	The backhoe and dump truck are equipped with back up alarms. The swing area of the backhoe will be cordoned off with caution tape. A spotter will be provided while the truck is backing.	
Set Oil Water Separator - Lower precast unit in place and level Install Top Section - Set precast top section (manhole)	Crushing hazard while placing sections of oil water separator.	Tag lines will be used while lowering sections. Workers will not be permitted in pit until load had been safely landed. All wire rope slings and rigging has been specified for the lift and will be inspected daily.	
Connect Pipes - Connect concrete drain pipes to unit Inspection - Conduct final inspection and tests	Confined space exposures when entering oil water separator to make pipe connections and during final inspection.	Confined space procedures as outline in the Safety Health and Environmental Control Plan will be followed. Air monitoring will be performed prior to entry and throughout the course of work in the confined space. Rescue equipment will be maintained on site.	Confined Space Monitoring Confined Space Rescue Equipment
Waterproofing - Apply mop down asphalt waterproofing	Exposures to hazardous materials while working with gasket materials and waterproofing.	SDS sheets will be obtained on the materials and workers will be provided with the proper PPE as required in the SDS.	Face Shield Rubber Gloves Protective Clothing Respiratory Protection
	Exposures to burns from hot asphalt waterproofing.	Each worker performing waterproofing operations will be required to wear cotton work clothes including long sleeve shirts. Each workers handling buckets of material	

		and tending the kettle will be required to wear protective gloves and face shields.	
Backfill & Tamp - Restore site to finish grade	Hazards of moving vehicles.	The backhoe and dump truck are equipped with back up alarms. The swing area of the backhoe will be cordoned off with caution tape. A spotter will be provided while the truck is backing.	
All Tasks	Heat Exhaustion / Heat Stroke	Wear loose fitting, breathable clothing. Break periods and worker rotation may be necessary. Potable water will be provided and consumption encouraged via toolbox talk about heat stroke exposures.	
	Miscellaneous exposures	Hard Hats, safety glasses and safety vests are minimally required PPE	
		As summer progresses, proper clothing requirements will be enforced. (No shorts, proper shoes, short sleeve shirts, no tank tops)	

SECTION 5 – Implementation / Review with Work Force					
Print Name	**Signature**	**Date**	**Print Name**	**Signature**	**Date**

2.17 DAILY EMPLOYEE SIGN IN / SIGN OUT LOG

A. In support of the Contractor's Emergency Action Plan and Evacuation Plan, the Contractor shall maintain a sign-in / sign-out log of all employees working on Metro-North property. The log shall be completed daily. The log shall be submitted to the Engineer daily; on the next shift following the previous shift. (See example on following pages.)

B. The heading of the log shall include the following information: Contract number, Project description, Location of the work, Work shift hours, Name and Emergency Contact Information for Designated Emergency Contact (DEC), Superintendent, or Team Leader.

C. The body of the log shall include the following information: Employee Printed Name, Name of Employer, Date & Time Entering Work Site with Signature, Date & Time Leaving Work Site with Signature.

D. The logs must be available to the MTA Police and the Engineer within two (2) hours of the shift start time.

E. During an emergency situation or evacuation, the logs must be available to emergency services forthwith.

2.18 DAILY FINAL INSPECTION OF WORK SITE

A. At the completion of each work shift and prior to vacating the site, the Contractor shall conduct a final inspection of the project site. The purpose of the inspection shall be to ensure the site is adequately secured prior to being vacated. The Contractor shall notify the Engineer of having completed such inspection.

B. At a minimum, the inspection shall include the following:

1) The soundness, stability and security of equipment and material installed during the shift,

2) Housekeeping / cleanliness of site,

3) Removal of equipment, tools and materials from areas open to the public, customers, and employees,

4) Temporary protections to safeguard the public (i.e. fencing, barricades, signage),

5) Temporary and security lighting,

6) Potential fire hazards (i.e. equipment left running, electrical),

7) Securing of materials (i.e. materials that may be displaced by wind and/or water),

8) Securing of the site, including temporary facilities and equipment (i.e. storage areas, equipment, field offices, security gates)

CONTRACTOR EMPLOYEE SIGN IN / SIGN OUT LOG

Emergency Numbers	MTA Police	Operations Command Center / Rail Traffic Controller	GCT Station Master's Office / Fire Command Center
	(888) 682 - 9117 or (212) 878 - 1000	(212) 340 - 2050	(212) 340 - 3191 / 3192

Contract Number / Project Description		**Contractor (Prime)**	
Work Location *(Give this description to emergency services)*		**Field Office Location / Phone**	

	Day (circle)	Date	Time		Day (circle)	Date	Time
Start	M T W H F SA SU	05/24/10	2100	**Finish**	M T W H F SA SU	05/25/10	0500

Contacts	Contractor's Site Representative	Contractor's 24 hr Emergency	Metro-North Project Manager	Metro-North Representative
Name				
Cell Number				
Office Number				

Metro-North Authorization Print Name: _____ Signature: _____

Name (Print)	RW Training#	Company	Date	Time On Site	Signature	Date	Time Off Site	Signature

CONTRACT EMPLOYEE SIGN IN / SIGN OUT LOG

Name (Print)	RW Training#	Company	Date	Time On Site	Signature	Date	Time Off Site	Signature

2.19 DAILY SAFETY REPORT

A. A Daily Safety Report shall be completed for each work shift and work area by the Safety Engineer/Safety Supervisor and shall be transmitted daily to the Engineer. An example of the proposed format of the Daily Safety Report shall be provided in the SHECP.

B. The Daily Safety Report shall include, at a minimum, the following information:

1) A header providing the general project information;
   a. Contract Number
   b. Project Description,
   c. Date,
   d. Work shift times,
   e. Inspection times,
   f. Work area(s) inspected, and
   g. Weather conditions
2) Commendable actions or observations pertaining to worker safety
3) An entry for each safety deficiency that includes;
   a. Location and nature of deficiency,
   b. Time noted,
   c. Names of persons and firms that were notified* of the deficiency including time notified; and

      (*NOTE: Notification shall include at a minimum the parties exposed to the safety hazard, the parties responsible for creating the deficiency, and the parties responsible for correcting the deficiency.)

   d. Time and nature of corrective action(s)
4) An entry for each deficiency that was not corrected on the prior shift's Daily Safety Report until the deficiency is corrected;
5) A notation of each accident, incident, or injury reported including name of injured party or affected property owner; time of accident, incident, or injury, and description of accident, incident, or injury;
6) Notation of Safety Meetings conducted and attended including type of meeting and the name of each person in attendance;
7) A notation of visits by safety representatives of the Railroad, City, State or Federal Authorities, including name and phone number of representative, time of visit, and department or authority represented; and
8) Printed name and signature of person completing the report

2.20 MONTHLY SITE SAFETY AUDIT

A. For the duration of the project, ***the Contractor shall perform at least one (1) comprehensive site safety audit every month during which there is on site activity***. The Monthly Site Safety Audit shall be performed by a team of individuals of the Contractor, and Subcontractor(s) that are responsible for project safety, including but not limited to, management officers that are responsible for developing and maintaining company safety standards and policies (i.e. Corporate Safety Director), the Safety Engineer, the Safety Supervisor, the Superintendent, Foremen, and Competent Persons. The Contractor shall inform Metro-North Railroad and Third Party Construction Management of the meeting schedule (2) weeks in advance so they may attend. The Safety Engineer shall prepare a report of the findings of the audit (i.e. Monthly Site Safety Audit Report). A copy of the completed Monthly Site Safety Audit Report shall be submitted to the Engineer. The findings of the Monthly Site Safety Audit shall be reviewed during the Monthly Safety Meeting.

2.21 INCIDENT, INJURY, ACCIDENT, & NEAR MISS NOTIFICATION & REPORTING

A. In the event of any incident, accident, employee injury, or near miss, the Contractor shall adhere to the following notification and reporting requirements.

B. The Contractor shall instruct all of its employees and Subcontractor's employees that they are required to immediately notify their Supervisor of ALL incidents, injuries, accidents, illnesses, and near misses related to the work, no matter how insignificant they seem at the time.

C. INITIAL NOTIFICATION REQUIREMENTS

1) The Contractor shall immediately notify the Engineer of all incidents, injuries, accidents, and near misses involving personal injury, causing damage to property or the environment, affecting the safe movement of trains, or illnesses related to the work. The injured person's immediate supervisor, a representative of the third party construction management firm, or other person who directly observes the incident, shall provide immediate telephone notification to Metro-North Construction Management. Telephone notification shall be provided to the following:

   a. The Metro North Construction Manager and/or Project Manager, or Third Party Construction Management Firm, and

   b. The Manager of the Owner Controlled Insurance Program (OCIP), as applicable

2) Resident Engineers on projects managed by third party construction management firms may be designated as the first point of contact for the notification of incidents. A protocol must be established for the immediate notification of Metro-North Construction Management and/or Project Management by the Resident Engineer / third party construction management firm.

3) Near misses shall be reported to the Engineer and a Lessons Learned session shall be convened. Any Near Miss incident involving rail equipment requires a full investigative report.

4) If this contract is covered under the Owner Controlled Insurance Program (OCIP), refer to OCIP specifications for additional information.

D. REPORTING REQUIREMENTS

1) **Contractor Employee Injury**

a. In the event an employee of the Contractor or an employee of a subcontractor is injured on the Site, follow the reporting procedures below. The following applies to ALL injuries, whether deemed OSHA Recordable, or not:

b. The injured employee must immediately report the injury to the Contractor.

c. The Contractor must immediately report the injury to the Engineer and the OCIP Administrator (as applicable).

d. The Contractor must provide the information listed below to the Engineer within two (2) hours of the incident, or by the end of the work shift during which the incident occurred, whichever is earlier. Metro-North Construction Management requires this information in order to complete the Metro North IR-1 Initial Report of Incident.

i. Date and Time of Incident

ii. Reason for Incident Not Being Reported Immediately (if applicable)

iii. Location of Incident

iv. Brief Description of Incident

v. Name, Home Address, Daytime Phone, Evening Phone, and Date of Birth of Injured Person (Social Security Number not required)

vi. Employer of the Injured Person

vii. Description of Injury and Disposition

e. The Contractor shall transmit the following to the Engineer (and OCIP Administrator if the project is covered under the OCIP) within twenty-four (24) hours of the incident:

i. C-2 Employer's Report of Work Related Injury/Illness

NOTE: The employer of the injured employee must complete the applicable workers' compensation claim form (C-2 in New York, C-10 in Connecticut). If the project is covered under the OCIP, the appropriate form shall be submitted to the On-Site Insurance Administrator within 24 hours. The On-Site Administrator will notify the appropriate Insurer, who will notify the Workers Compensation Board. Penalties are sanctioned to insurance carriers when reports to the Workers Compensation Board exceed 10 days.

ii. Contractor's Accident/Injury Investigation Report, or OCIP Form 5 – Supervisor's Accident Investigation Report

f. All reports must be submitted within twenty-four (24) hours of each accident.

g. The Contractor shall make every effort to prevent further injury to others and to secure accident evidence and witness information. The Contractor shall provide the following supporting documentation, if available.

i. Addendum to OCIP Form 5 - Witness List and Statement Form

ii. Photographs of the accident site, machinery, and/or equipment involved in the accident

iii. Description of the machinery or equipment involved in the accident

iv. Police reports

v. Evidence of a suspicious claim

vi. Other relevant information

2) **Employee Requiring Medical Attention**

a. The Contractor has the primary responsibility to accompany the injured employee to the nearest Hospital Emergency Room or Urgent Care Facility.

b. The attending physician should be instructed to give the injured employee a note indicating one of the following:

i. The employee is cleared to return to work

ii. The employee requires additional medical treatment and will be disabled for a specified number of days.

c. The Contractor shall provide the following additional information pertaining to injuries as it becomes available.

i. Description of the Medical Treatment Provided (if divulged by employee)

ii. Diagnosis by Physician / Medical Practitioner (if divulged by employee)

iii. Medication Prescribed & Dosage (including over the counter medications)

iv. If the injury will result in lost work days (i.e. Lost Time Injury)

v. If the individual will be placed on Restricted Duty.

3) **Serious Injuries or Fatalities to Employees**

a. "Serious Injuries" or fatalities to employees must be reported immediately by the Contractor via telephone to the Engineer and the OCIP Administrator (as applicable)

b. Serious Injuries include, but are not limited to:

i. Fatalities, or injuries that can cause death

ii. Spinal Cord injuries

iii. Burns to 10% of more of the body

iv. Amputations or crushing injuries

v. Eye injuries causing partial or full loss of sight

vi. Severe head injuries

vii. Exposure to toxic substances

viii. Any occupational disease

ix. Any single occurrence involving hospitalization

4) **Reporting Procedures for Incidents Involving Third Party Injury, Property Damage, Environmental Pollution or Builders' Risk**

a. "Serious Injuries" or fatalities to third parties must be reported immediately via telephone to the Engineer and the OCIP Administrator (as applicable).

b. The Contractor shall report all incidents, regardless of injuries sustained or property damage claimed, within twenty-four (24) hours to the Engineer and OCIP Administrator (if applicable).

c. The Contractor shall provide a completed Accident Investigation Report to the Engineer and OCIP Administrator (if applicable) (Form 5 - Supervisor's Accident Investigation Report for OCIP projects).

d. If the project is covered under the OCIP, the OCIP Administrator will report the claim to the appropriate Insurer.

e. The following documents must accompany the Accident Investigation Report or Form 5 - Supervisor's Accident Investigation Report (OCIP projects):

i. Photos of accident site

ii. Witness Statements (Addendum to Form 5)

iii. Police report, if applicable

5) **Distribution of Correspondence**

a. Correspondence pertaining to an injury, accident, incident, or near miss shall be distributed to the following:

i. Resident Engineer

ii. Metro-North Capital Programs Senior Director

iii. Metro-North Project Manager

iv. Metro-North Project Manager's Departmental Director

v. Metro-North Construction Manager

vi. Metro-North Construction Manager's Departmental Director

vii. Metro-North Construction Manager's Departmental Deputy Director

viii. Metro-North Manager, Construction Safety

ix. Metro-North Safety Department

b. If the project is covered under the Owner Controlled Insurance Program (OCIP), correspondence distribution shall be extended to the individuals shown in the OCIP Administration Directory.

****COPIES OF ALL REPORTS ARE TO BE RETAINED IN THE CONTRACTOR'S RECORDS.**

2.22 POST INCIDENT REVIEW

A. The Contractor shall conduct a Post Incident Review for all incidents that resulted in Recordable Injuries, $5,000 or more in property damage, and Near Misses that could have resulted in injury or property damage. The primary purpose of the Post Incident Review is to learn from the accident, determine the cause of the accident, and actions to be taken to prevent a recurrence of such an accident. The Contractor shall notify the Engineer of the meeting schedule to permit the Railroad to attend.

2.23 UNSAFE CONDITIONS

A. An Unsafe Condition is a condition that gives rise to the imminent possibility of injury to workers or the public, of serious damage to property or the environment, or of effecting the safe movement of trains.

B. The Contractor shall instruct its employees and Subcontractor's employees to immediately inform their Supervisor of any and all Unsafe Conditions.

C. When an Unsafe Condition exists at the Site, the work shall be stopped in the affected area until the Unsafe Condition is corrected. If the Contractor does not take corrective action immediately or within the time period specified by the Engineer, the Engineer reserves the right to take whatever action is required to correct the hazard or unsafe condition and back charge the Contractor for the costs associated with the remedial work.

2.24 MAINTENANCE OF SAFETY RECORDS

A. The Contractor shall maintain the following Safety Records for a period of not less than six (6) years after Construction Completion:

1) Safety, Health, and Environmental Control Plan;
2) Safe Work Plans;
3) Daily Safety Reports;
4) Monthly Safety Audit Reports;
5) Records of Worker Safety Meetings;
6) Records of Employee Training (i.e. Roadway Worker Safety, OSHA 10 Hour Construction Safety, Employee Site Safety Orientation, OSHA required training)
7) Competent Person Designations;
8) Material Safety Data Sheets;
9) OSHA Forms 300, 300A, and 301
10) Contractor's Accident/Injury Investigation Report, C-2 Employer's Report of Work Related Injury/Illness, Form 5 Supervisor's Accident Report, Witness Statements/Addendum to Form 5;

11) Any permits required;

12) Written notice of Citations, Suits, or Complaints; and

13) Other compliance records as required by City, State, and Federal Agencies.

2.25 PROTECTION OF THE PUBLIC

A. The Contractor shall provide, erect, and maintain substantial, durable, and effective protective devices including but not limited to, guardrails, barricades, protective enclosures, fences, bridging, sidewalk sheds, platforms, ramps, floor coverings, road plates, sidewalks, guide rails, lights, traffic control devices, warning signs and signals, pedestrian detour signs, pedestrian information signs, cones, traffic barrels, and other protective devices as required by the Work or elsewhere in the Contract to adequately protect the Work and all individuals against injury to their person or damage to their property.

B. Protective devices shall be designed to protect the public and others on or adjacent to the Site from potential exposures created by the work. Such protective devices shall include but not be limited to; the use of welding screens to protect against welding flash, the use of solid barricades or tarps to protect against flying objects or debris created by cutting, chipping or grinding, or the use of fully sealed enclosures to protect against exposures to hazardous vapors, fumes, or dusts.

C. The Contractor shall promptly replace any of the foregoing that must be removed temporarily during the progress of the Work. If replacement is not properly made, the Engineer shall have the right to effect such replacements at the expense of the Contractor.

D. Protective devices shall be designed to withstand the reasonably anticipated forces in or around the work area including but not limited to wind, vibration, runoff, and other natural or man-made conditions.

E. Protective devices shall be maintained in a clean and smooth condition so as not to cause cuts, nicks, splinters, or snag clothing. The use of double headed nails is prohibited.

F. Each protective device shall be dismantled and removed from the site by the Contractor when the device is no longer required and prior to demobilization.

G. Each protective device shall be constructed of properly identified fire rated materials. Combustible materials shall be fire retardant treated and contain markings evidencing such.

H. The Contractor shall provide boundary fencing around the perimeter of the construction site and staging areas. The boundary fencing shall be constructed as to segregate work areas from non-work areas. Boundary fencing shall be of chain link type and a minimum of eight feet (8') in height. The Contractor shall install access gates or removable fence sections as necessary to maintain access to, and emergency egress from, the work area. The number and location of access points shall be determined by the Contractor and submitted to Metro-North Railroad for review. Additional access/egress points shall be added as necessary to maintain site safety and accessibility.

I. Locations of intermittent or short duration work may be protected by barricades and/or fences a minimum of four feet (4') in height. Barricades or fences eight feet (8') or higher shall be provided along work areas with moderate to heavy pedestrian traffic or along work

areas where site security is required. Barricades and fences shall be rigid and capable of preventing unauthorized entry into the work area. Barricades and fences shall be maintained in a continuous unbroken line along the work area. Fencing shall be supported at regular intervals as to maintain its integrity. Caution tape or unsupported fencing shall not be considered a rigid barricade.

J. Covers, plates, and bridging used to protect holes shall be constructed so as to reduce potential slip and trip hazards. All covers, plates, and bridging shall be secured against movement. Covers, plates, and bridging shall be installed in accordance with ADA Accessibility Guidelines for Buildings and Facilities (Appendix A to 36 CFR Part 1911). All such covers, plates and bridging shall be solid and coated with slip resistant materials so that the surface is at least as slip resistant as the surrounding walking surfaces. The perimeter of floor covers and plates shall be painted yellow or another contrasting color approved by the Railroad.

2.26 SIGNAGE

A. All signs installed under this project or required by the work, including but not limited to those used for traffic control, traffic detour, pedestrian detour signs, pedestrian information signs, and general warning signs, shall meet DOT requirements for size, reflective sheeting, lettering, etc. in accordance with the Manual of Uniform Traffic Control Devices (MUTCD).

B. The Contractor shall install and maintain safety signage for the duration of the on site work. Signage shall meet the requirements of 29 CFR 1910.145. Signage shall be installed along construction fencing, the outer boundaries of the project site, or at entrances to work areas. Signs shall be installed at intervals not to exceed one hundred lineal feet (100'). Signs shall be secured via mechanical fasteners in clearly visible locations.

C. A minimum of two (2) signs shall be required. One sign shall read "DANGER – CONSTRUCTION SITE – AUTHORIZED PERSONNEL ONLY", or approved similar language. One sign shall read "CAUTION – PERSONNEL PROTECTIVE EQUIPMENT REQUIRED BEYOND THIS POINT", or approved similar language. Signs shall be weatherproof and a minimum size of fourteen inches in length by ten inches in width (14" L x 10" W).

2.27 STORAGE AND OFFICE TRAILERS

A. Trailers shall be fully chocked and tied down to prevent overturning in high wind conditions. Storage and office trailers shall be equipped with auxiliary supports at each corner.

B. Office and storage trailers shall be electrically grounded.

C. Identification and emergency signage shall be installed on the exterior of office and storage trailers. Signs shall be constructed of weatherproof material, have a white background with black lettering, and shall be a minimum of five feet in length by three feet in width (5' L x 3' W). Signs shall identify the entity occupying the facility, the site address, and a telephone number to contact in the event of an emergency.

D. Office and storage trailers shall be equipped with the following Fire-Life Safety devices and equipment:

1) Office Trailers

a. Fire Alarm Panel (FAP) equipped with a dialer programmed to call MTA Police, RTC's at GCT, and the local fire department

b. Smoke detectors (tied into the FAP)

c. Pull stations (tied into the FAP) at all exit doors

d. Horn strobe

e. Fire extinguisher – 20 lb ABC type

f. Battery back-up emergency exit lights

g. Evacuation plan

h. Fire suppression system (i.e. sprinkler), within GCT only

i. Emergency contact list posted

2) Flammable & Combustible Storage

a. Smoke detectors (tied into the FAP)

b. Fire extinguisher – 20 lb ABC type

c. Battery back-up emergency exit lights

d. Fire suppression system (i.e. sprinkler), within GCT only

e. Exterior strobe light

3) Dry Storage (Tools, Nonflammable, & Noncombustible Materials)

a. Smoke detectors (tied into the FAP)

b. Fire extinguisher – 20 lb ABC type

c. Battery back-up emergency exit lights

d. Fire suppression system (i.e. sprinkler), within GCT only

e. Exterior strobe light

2.28 TEMPORARY CONSTRUCTION

A. All materials, whether to be used for temporary or permanent construction, shall be fire resistant, and when possible, incombustible materials shall be chosen over combustible materials. Each temporary structure shall be constructed of fire resistant or fire retardant treated material. All materials (i.e. lumber, plywood) shall be fire retardant treated and contain the manufacturer's stamps evidencing such. If the stamps are illegible or otherwise not provided, the material shall be immediately removed from the premises and replaced at no additional expense to Metro-North. On site application of fire retardants by the Contractor is prohibited, except when the material is not commercially available pretreated from the manufacturer.

B. Temporary construction barriers within occupied facilities used to segregate work areas from non-work areas shall be constructed as to provide a minimum of a two (2) hour fire rating. Should local codes be more stringent, the more stringent code shall apply.

C. Temporary construction shall be properly, sturdily and securely constructed as necessary to serve its intended purpose. Unless otherwise directed, temporary construction shall be designed and constructed to withstand a one hundred mile per hour (100 mph) wind load. Temporary construction shall be maintained throughout the work as not to pose a hazard to workers and the public. Temporary construction shall be properly braced, secured, and tied down as necessary to prevent displacement.

D. Temporary construction shall be dismantled and removed from the site by the Contractor when the device is no longer required and prior to demobilization.

E. The use of screw fasteners / bolts shall be the preferred method of joining in locations subject to wind stress (i.e. platforms).

F. Protection consisting of physical guards, covers, foam padding, etc. shall be provided on or around protruding objects (i.e. bolts). The use of double headed nails, or other fastening devices that create an unnecessary snag or impalement hazard, are prohibited from use unless properly guarded to eliminate the hazard.

2.29 PRODUCTS / MATERIALS CONTAINING HAZARDOUS AGENTS

A. When choosing between equally performing materials and/or products, the Contractor shall make every effort to use products that are less deleterious to worker health and those that are environmentally friendly. When equally performing products are available, waterborne products shall be chosen over solvent borne materials.

B. Care shall be taken when using products containing volatile organic compounds (VOC's) such as aromatic solvents. In addition to implementing proper worker protection, the Contractor shall provide adequate ventilation and separation of areas where VOC containing products are being used.

C. All products and/or materials containing hazardous agents shall be submitted to the Engineer for review. Products and/or materials containing hazardous agents shall not be used or incorporated into the work until reviewed and accepted by the Engineer.

D. The Contractor shall submit product data sheets, material specifications, and Material Safety Data Sheets for review. Physical samples shall be submitted upon request. The submittals shall be received well in advance of the scheduled usage or incorporation of the product as to allow sufficient time for review.

2.30 MATERIALS SUSPECT OF CONTAINING ASBESTOS, LEAD, PCB, MERCURY, OR OTHER TOXICS

A. The Contractor shall not disturb any materials suspect of containing asbestos, lead, PCB, mercury, or other toxic materials without the prior approval of the Engineer. If during the work, the Contractor identifies or otherwise uncovers such materials, the Contractor shall immediately notify the Engineer. The Contractor shall clear personnel from the area and cease work in the location of the suspect material until an assessment by qualified persons can be performed.

2.31 SAFETY DATA SHEETS

A. The Contractor shall submit to the Engineer current Safety Data Sheets (SDS) for all materials to be stored, incorporated into, or used in the Work. Hard copies of SDS shall be on file and at the ready at all times at the jobsite. SDS shall be organized and/or catalogued as to facilitate reference during an emergency condition. The SDS shall be readily available whenever required, in a convenient location, in close proximity to where the materials are used on the project. The Contractor's safety personnel and competent persons shall have ready access to the SDS.

2.32 MATERIAL HANDLING, LABELING, STORAGE, USE & DISPOSAL

A. All materials brought onto the jobsite shall be labeled. Labeling shall include but is not limited to, identification of the material and manufacturer, caution labels, hazard labels, warning/danger labels, use and instruction labels, servicing instructions, medical attention labels.

B. When bulk material is transferred from large storage containers to smaller point of use containers, at a minimum, the point of use containers shall be identified as to contents.

C. Products shall not be transferred into containers that are not designed to carry the product, or that are unsuitable for, or incompatible with, the product. At no time shall food containers (i.e. water bottles) be used for product containers.

D. The Contractor shall ensure that each hazardous material is clearly marked, labeled in accordance with either the NFPA 704 Hazard Warning System (NFR Diamond) or the color bar format (HMIG labels) as specified in the OSHA Federal Hazard E. Communication Standard (29 CFR 1900.1200). Each Hazardous material shall be stored in accordance with manufacturer's recommendations, NFPA Standards, OSHA Standards, and all other storage provisions of this Contract.

E. Flammable materials shall be stored in approved containers, within flammable storage cabinets, and in accordance with NFPA guidelines.

F. The Contractor shall provide details on the handling, use, and storage of flammable solvents and solvent containing products, corrosive or acidic products, toxic chemicals, and other hazardous products.

2.33 FIRST AID, MEDICAL TREATMENT & MEDICALLY TRAINED PERSONNEL

A. The Contractor shall provide first aid equipment, supplies and competent administering of first aid as may be reasonably prescribed by good practice or as may be required by any law for the care of injured personnel.

B. The Contractor shall provide an individual(s) that is certified in administering First Aid, Cardio Pulmonary Resuscitation (CPR), and use of an Automatic External Defibrillator (AED).

C. The Contractor will not be allowed to commence Work until there is a sufficient supply of first aid equipment, medically trained personnel (i.e. first aid, CPR, and AED), and an operable Automatic External Defibrillator (AED) as determined by the Engineer, at all work locations for its employees and all Subcontractors. Any resultant delay will be charged to the Contractor.

D. First Aid stations of adequate size and contents shall be provided by the Contractor. Such shall be located within reasonable proximity to the work site. Large work sites may require multiple First Aid stations be established throughout the project. The Contractor shall conduct a hazard assessment to determine the appropriate contents and locations of the First Aid stations.

E. The Contractor shall provide, and make arrangements with local hospitals, medical clinics, or other medical facilities, for the medical treatment of persons that are injured or become ill during the work. Such facilities shall be clearly identified in the Contractor's Emergency Action and Evacuation Plan and include the addresses, phone numbers, and maps with driving directions to said facilities.

2.34 PERSONAL PROTECTIVE EQUIPMENT (PPE)

A. The Contractor shall provide, make readily available, and ensure the use of all Personal Protective Equipment (PPE) required or recommended for the work. Personal protective equipment as required shall include, but not be only limited to, the appropriate/approved hard hats, safety shoes, gloves, goggles, eye/face shield protection, safety belts, harnesses, respirators, hearing protection, traffic safety vests, etc.

B. The Contractor shall have the responsibility for monitoring and enforcing compliance by all employees, including subcontractors, with these provisions regarding the wearing and proper use of personal protective equipment. No person will be allowed on Railroad property, or the job site if off Railroad property, without the necessary PPE, including proper work clothing and work shoes/boots. Any Contractor employee not in compliance with having the appropriate personal protective equipment (PPE) will be forbidden to be on all Metro-North premises. Any resultant delay will be charged to the Contractor.

C. The Contractor shall enforce Metro-North's requirement for the use of the following Personal Protective Equipment. Unless otherwise directed, the following is the standard PPE that shall be worn at all times while within the construction work area, on or about the tracks, on or along the right-of-way, in train yards, or in maintenance facilities and shops.

1) Work Clothing – Work clothing shall be suitable for heavy construction work and at a minimum, consist of long pants and a short sleeve shirt (no tank tops or short trousers of any type). Long sleeve shirts shall be worn as necessary.

2) Foot Protection – Work boots with safety toe and ankle coverage. Work boots shall be at least six inches (6") high, and be completely laced or buckled. The shoe shall have definite heels that are no more than one inch (1") in height.

3) Hard Hats - Hard hats shall be SEI Certified as meeting the ANSI Z89.1-2009 requirements for Type I Class E protection.

4) Eye Protection – meeting ANSI Z87.1

5) Safety Vests - Safety Vests shall be flame retardant, 360-degree reflective, high visibility orange, and 100% tear away. The contractor's company name, logo, insignia or the word "Contractor" shall be permanently printed on or sewn into the vest.

6) Hand Protection (Gloves) – Unless the finger dexterity required by the task precludes the use of gloves, hand protection (i.e. work glove) shall be required. Gloves shall be appropriate for the type of work.

D. Hard hats and safety glasses are mandatory at all times within construction work sites, on or about tracks, on or along the Right-of-Way, in maintenance facilities, shops, or yards, or on or about roadways.

E. Safety vests are mandatory at all times when on or about tracks, on or along the Right-of-Way, in maintenance facilities, shops, or yards, or on or about roadways.

F. In addition to the previously listed PPE, the Contractor shall provide, and require use of, other PPE (i.e. hearing protection, face protection, respiratory protection) as required by safety and health standards, recommended by product Material Safety Data Sheets, or recognized as standard protection for the task being completed.

G. The Contractor will not be allowed to commence work until there is a sufficient supply, as determined by the Engineer, of PPE for its employees and its Subcontractors on the job site. Additionally, the Contractor shall maintain, at the job site, a sufficient supply of extra PPE that can be issued as a replacement should a worker's PPE become damaged or otherwise unusable.

2.35 SANITATION

A. The Contractor shall provide sanitary facilities for all employees on this project. The number of facilities provided shall be commensurate with the size of the work force. Facilities shall be located within a reasonable proximity to the work site. Facilities may have to be mobile or sited at multiple locations for projects involving transient operations or work spread over multiple sites. Locations of facilities shall be reviewed with the Engineer prior to placement. Facilities shall be kept in a clean and sanitary condition, and properly screened from public observation to the satisfaction of the Engineer. Same shall be removed when so directed.

2.36 HOUSEKEEPING

A. The Contractor shall provide for the regular housekeeping of all areas within the project limits. The Contractor is responsible for the regular cleaning of the site to maintain its appearance and safety of the workers and the public throughout the construction. This includes removal of all wastes resulting from the construction, rubbish, and debris whether it was generated by the contractor or not.

B. The removal of general refuse such as food wrappers, drinking containers, newspapers, etc. shall be included in the housekeeping of the site.

C. The Contractor shall provide proper receptacles for waste disposal, whether they be roll-off containers for bulk disposal of construction wastes or smaller waste cans/barrels for common refuse.

D. Combustible debris shall be removed regularly and as necessary to prevent accumulations that may pose a fire hazard.

E. Specific care shall be taken to prevent impalement/puncture hazards created by lumber with protruding nails/screws. Such shall be removed or hammered flat.

F. Work areas shall be pre-cleaned of existing debris that may pose hazards prior to the start of construction work (i.e. organic debris such as leaves and newspapers that may cover broken bottles, sharps, etc. under platforms).

G. Equipment and materials shall be stored in a neat and orderly fashion and properly secured when not in use.

H. Walkways and walking surfaces shall be continuously monitored for objects and materials that may pose tripping and slipping hazards and shall be maintained free and clear of the same.

I. Employees performing housekeeping shall be provided proper personal protective equipment.

2.37 PROTECTION OF UNDERGROUND FACILITIES & UTILITY IDENTIFICATION

A. Refer to Metro-North Specification 01_18_01 Protection of Metro-North Underground Utilities

B. Excavation shall be conducted in accordance with 16 NYCRR Part 753. In conformance with 16 NYCRR Part 753, the Contractor must notify the local One Call Center to allow member agencies to mark locations of underground utilities prior to commencing excavation. The Contractor shall take all necessary precautions to identify, locate and avoid contact with existing public utilities.

C. The Railroad maintains its own network of power, phone, signal, and gas utilities. In addition to public utilities, the Contractor shall provide for the location of Metro-North's utilities in accordance with Metro-North's Utility Location Protocol. The Contractor shall notify the Engineer a minimum of one (1) week in advance prior to excavating to allow for the identification of the Railroad's utilities.

D. Should the Contractor uncover, unearth, or otherwise identify a utility that was not previously identified, work impacting the utility shall cease until the utility is identified.

E. Existing utilities shall be taken out of service (i.e. deenergized, depressurized) and tested to verify the same, prior to being spliced into, demolished, removed, or otherwise disturbed.

F. The Contractor shall implement a means of positively identifying existing utilities to be disturbed during the work. A means of identifying the utility as "in service" or "out of service" shall be implemented and made known to project personnel.

G. All new buried utilities shall be properly identified with warning tapes specifically designed and manufactured for subgrade utility identification. Warning tapes shall run the entire length of the utility, and shall be located above the buried utility.

1) The Contractor shall install a warning tape located a minimum of twelve inches (12") inches (300 millimeters) above all conduits, wires, cables, utility pipes, drainage pipes, underdrains, or other facility, unless the excavation's depth, other underground facilities, or other engineering considerations make this minimum separation unfeasible. The warning tape shall be of durable impervious material, designed to withstand extended underground exposure without material deterioration or fading of color. The tape shall be of the color assigned to the type of facility for surface markings and shall be durably imprinted with an appropriate warning message. The tape shall also comply with the specific requirements of the utility that owns the facility.

2) All tapes, unless otherwise directed by the specific utility, shall be detectable to a depth of at least three feet (3') with a commercial radio-type metal locator.

3) Assigned colors are:

   a. Green—Storm and sanitary sewers and drainage systems, including force mains and other non-hazardous materials

   b. Blue—Water

   c. Orange—Communication lines or cables, including, but not limited to, those used in, or in connection with, telephone, telegraph, fire signals, cable television, civil defense, data systems, electronic controls and other instrumentation

   d. Red—Electrical power lines, electrical power conduits and other electrical power facilities, traffic signals and appurtenances and illumination facilities

   e. Yellow—Gas, oil petroleum products, steam, compressed air, compressed gases and all other hazardous material except water

   f. Brown—Other

   g. Purple—Radioactive materials

2.38 EXCAVATION & TRENCHING

A. Excavation shall be conducted in accordance with New York State Code Rule 753 and Section 2.37.

B. Excavations shall be benched and/or sloped as necessary to protect against cave-in or collapse. When the site is not conducive to sloping or benching, appropriate shoring methods shall be implemented.

C. The Contractor shall provide an engineered shoring design to the Engineer. Shoring for excavations within proximity to the tracks shall be designed to meet Cooper E80 loading.

D. Excavations, including trenches, remaining open or inactive for more than one work shift shall be protected. The perimeters of excavations, including trenches, shall be surrounded by high visibility temporary construction fencing. The fencing shall be maintained as necessary throughout the work. Excavations, trenches, and holes within pedestrian or vehicular travel ways that must remain accessible during the work shall be protected by bridges or cover plates. Cover plates shall be secured against displacement. (See Section 2.25 Protection of the Public for requirements).

E. Excavations six feet (6') or greater in depth with slopes steeper than 45 degrees shall also be provided with fall protection.

2.39 BLASTING

A. Prior to blasting all necessary precautions shall be exercised by the Contractor as required by the applicable ordinances, rules and regulations of the authority having jurisdiction. The Contractor shall obtain all necessary permits from the Fire Department of the City of New York for blasting within New York City.

2.40 ELECTRICAL

A. In accordance with 29 CFR 1926.417, the Contractor shall implement Lockout / Tagout procedures.

B. Temporary electrical power and lighting shall be installed in accordance with latest National Electric Code and 29 CFR 1926 Subpart K. Temporary electrical apparatus shall be installed as to not create a hazard to the work force or general public.

C. All temporary electrical power and lighting shall be equipped with Ground Fault Circuit Interrupter (GFCI) protection. All other power sources, including portable generators (regardless of wattage), as well as extension cords plugged into permanent power sources, shall be protected by GFCI at the source.

D. All splices shall be contained within NEMA approved junction boxes.

E. Extension cords shall be inspected regularly for damage (i.e. compromised insulation, missing ground prongs). Damaged cords shall be immediately removed from service and tagged as such or otherwise rendered unusable.

F. Assured grounding shall not be allowed as a means of electrical protection.

G. Energized electrical apparatus shall be adequately segregated, isolated, shielded, or otherwise protected.

2.41 POWDER ACTUATED TOOLS

A. All operators of powder-actuated tools (i.e. Hilti, Ramset) shall be trained in their use by the tool manufacturer. Certificates or other evidence of such training shall be maintained in the field office.

B. The main store of power loads shall be kept in a locked metal ammunition box.

C. The box must bear a permanent sign having the words "DANGER AMMUNITION" in two inch (2") wide letters on a red background

D. At least one (1) 20 lb portable fire extinguisher shall be provided in the storage area

E. The following applies to work within the New York City limits.

1) The Contractor shall obtain a permit from FDNY to store and use power loads at construction sites.

2) Power loads shall be stored in accordance with FDNY requirements

3) Any employee storing, handling, and using power loads must hold a valid E-21 Certificate of Fitness.

2.42 CRANE AND LIFTING EQUIPMENT OPERATION

A. The Contractor shall submit Crane Erection Plans and Lifting Equipment Plans for all construction requiring rigging and lifting and booming of materials and/or equipment, including but not limited to, hoisting and setting of steel members, prefabricated materials, structural panels, and precast concrete. These plans shall be of sufficient in detail and include drawings, calculations, product data sheets/specifications, and identification of components.

B. Cranes shall meet the requirements of the most current ANSI B-30.5 Standard.

C. When a crane or other lifting type of equipment is operated in such a location that any part or its load in any position of boom or swing may come within ten (10) feet of a live power line or contact rail then:

1) The power line or contact rail shall be de-energized,

2) The power line or contact rail shall be insulated or isolated,

3) The crane shall be grounded with Number 2 AWG or larger single conductor, 600 volt covering, and resistance of 25 ohms or less, and

4) The power line and contact rail shall be protected from damage in an approved manner.

D. The Contractor shall notify the Engineer and transmit copies of the following documentation seven (7) days prior to bringing a crane on site:

1) Current Certification of Inspection,

2) License of crane operator,

3) Crane or Lifting Equipment Manufacturer's Load Chart for the Model and configuration of the crane, and

4) Certification (approved by P.E.) of ground support and submittal of grillage and design of ground support.

E. Contractor shall not hoist over a building without notification and permission of the building owner.

F. Modifications or additions, which affect the safe operation of a crane, shall not be made without the manufacturer's written permission.

G. All cranes assembled at the Site shall be inspected and tested by the crane supplier or qualified personnel with proof of inspection and testing transmitted to the Engineer. All lifting devices shall be engineered and tested in the configured working load. The Contractor shall permanently attach or affix, clearly and visibly, the capacity chart of the lifting device.

H. Any welding performed on crane components shall be performed in accordance with the American Welding Society standards or the manufacturer's written specification.

2.43 ERECTION & RIGGING

A. The Contractor shall submit an Erection & Rigging Plan for all construction requiring the rigging and lifting of materials and/or equipment, including but not limited to, hoisting and setting of steel members, prefabricated materials, structural panels, and precast concrete. The plan shall be of sufficient detail and include drawings, calculations, product data sheets/specifications, and identification of components.

B. All rigging shall meet the requirements of the most current ANSI B30.9 Standard.

C. Only qualified riggers shall be employed.

D. Contractor's wire rope, chains, and fiber slings shall have their manufacturer's safe working load identified and attached to each item. The Contractor shall have each sling inspected and certified as prescribed by law and regulations. Slings shall be inspected by a competent person prior to each use. Defective slings shall be taken out of service. Slings exhibiting visible damage, including but not limited to cuts, abrasion, chemical exposure, shall be deemed defective and removed from service. Safety latches shall be used.

E. Only Alloy lifting chains of Grade 8 or better shall be used for lifting purposes.

2.44 WELDING AND THERMAL CUTTING & GRINDING

A. Welding and cutting equipment and operations shall meet the requirements of the most current ANSI Z49.1 Standard, and the requirements of this section. Welders shall retain certifications from the American Welding Society (AWS) and if required, the local entity having jurisdiction.

B. Gas welding and cutting equipment shall be listed by Underwriters Laboratories, (UL) or by Factory Mutual Laboratories, (FM).

C. Prior to any work that generates sparks such as welding, cutting, and burning or grinding the Contractor shall obtain a Hot Work Permit from the Metro-North Office of Fire Prevention. Depending on the location a Permit may be required to be issued *Daily,* per Task or require a *'Daily Signature'* by MNR office of Fire Prevention. See Section 2.46 Fire Protection & Prevention for requirements.

D. In accordance with 1926.354, prior to thermal cutting or welding, existing coatings shall be removed.

E. The Contractor shall transmit a list of certified operators who will be performing cutting and welding, with evidence of their training and certification. Welders and torch operators within New York City shall retain Fire Department of New York (FDNY) Certificates of Fitness.

F. Welding apparatus and equipment shall be inspected daily, prior to use. Defective apparatus and equipment shall not be used and shall be removed from service until repaired or replaced.

G. Prior to the start of work, flammable and combustible materials shall be removed from the area of the hot work. When such materials cannot be removed, or are otherwise fixed, they shall be isolated from heat, flame, sparks, and molten metal by fire retardant materials.

H. Whenever the operator leaves the work area, the cylinder valves shall be closed. Torch valves shall be checked for leaks at the start of each shift. Only friction lighters or other approved devices shall be used to light torches.

I. Splices or repaired insulation on arc welding cables shall not be permitted within ten feet (10') of the electrode holder. Cables shall be positioned so as not to interfere or create obstructions on walkways, scaffolds, stairs or ladders. Splices shall be equal to or greater than the original insulation on the cable.

J. Portable welding screens or shields shall be used to protect other workers and/or the public in the immediate area.

K. Local exhaust and/or mechanical ventilation shall be installed and maintained as necessary to prevent accumulation of fumes within the work area and contamination of adjacent occupied areas.

2.45 COMPRESSED GAS CYLINDERS

A. All compressed gas cylinders shall be stored, used, and handled in accordance with the Compressed Gas Association guidelines, NFPA Standards, the requirements of the Metro-North Office of Fire Prevention, and the requirements of this section. Prior to on site storage, the Contractor shall inform the Metro-North Office of Fire Prevention of their intent to store compressed gas on site.

B. Each compressed gas cylinder shall be considered to be either in transport, storage, or use. The following conditions apply:

1) Gas cylinders shall be clearly identified as to contents.

2) Compressed gas cylinders shall be transported and used in portable welding carts with the cylinders securely chained or clamped to the cart. An operable dry chemical fire extinguisher, rated not less than ten pounds (10 lbs) of chemical shall be mounted on each portable welding cart in use.

3) Manifolds shall be removed when the cylinders are not in use.

4) Valve protector caps shall be screwed on in place except when the cylinders are in use.

5) Compressed gas cylinders shall be protected from sources of heat.

6) Cylinders shall be secured upright on a firm base and against toppling via a chain, steel cable, or non-combustible material that is capable of withstanding fire/open flame without burn through.

7) No more than five (5) cylinders of each gas type shall be stored on site. All gas cylinders not in actual use, or proposed for immediate use, shall be removed from the site and stored off site. Excessive or unreasonable storage of cylinders on the site is prohibited. Improperly stored cylinders shall be immediately removed from the work area. Empty gas cylinders shall be removed prior to or at the same time replacement cylinders are brought on site.

8) Compressed gas cylinders in storage (full or empty) shall be stored in cylinder cages or sheds constructed of noncombustible materials specifically designed for such purpose. Storage areas shall be well ventilated and without electric lights or fixtures and shall be located as far from other buildings as is practicable.

9) The cylinder cages/sheds shall be secured (ie. padlocked) as to prevent theft or tampering with the cylinders.

10) Storage areas shall be labeled.

11) Different types of gases shall not be stored together, or without proper separation, except when in use and when such proximity is required.

2.46 FIRE PROTECTION AND PREVENTION

A. The Contractor is responsible for providing all labor, material, and equipment for fire protection during the work including trained and qualified fire watches, fire extinguishing equipment, shields, screens, and protective blankets. The Contractor shall maintain fire protection equipment throughout the project.

B. All materials, whether to be used for temporary or permanent construction, shall be fire resistant, and when possible, non-combustible materials shall be chosen over combustible materials. Each temporary structure shall be constructed of fire resistant or fire retardant treated material. All materials (i.e. lumber, plywood) shall be fire retardant treated and contain the manufacturer's stamps evidencing such. If the stamps are illegible or otherwise not provided, the material shall be immediately removed from the premises and replaced at no additional expense to Metro-North. On site application of fire retardants by the Contractor is prohibited, except when the material is not commercially available pretreated from the manufacturer.

C. Temporary barriers within occupied facilities used to segregate work areas from non-work areas shall be constructed as to provide a two (2) hour fire rating.

D. Combustible wastes/debris shall be removed on a regular basis as to not pose a fire hazard. The frequency for removal shall be based upon the rate of accumulation, but at no time shall exceed weekly removal from the premises.

E. The on site storage of flammable materials is prohibited without the prior authorization of the Metro-North Office of Fire Prevention. Flammable materials shall be stored in approved containers in accordance with NFPA guidelines and requirements of the local fire authority. Flammable Liquids shall be stored in Factory Mutual (FM) approved safety cans equipped with self-closing lids and flame arrestors. Flammable or combustible liquids shall be stored within approved containers within closed, approved flammable storage cabinets. Flammable materials that will be stored on site in exterior locations shall be stored in approved containers, within flammable storage cabinets. Flammable materials to be stored within facilities shall be stored in approved containers, within flammable storage cabinets, located in areas equipped with fire suppression.

F. Smoking is prohibited within all Metro-North facilities, including construction work areas.

G. Open flames and smoking shall be prohibited within one hundred feet (100') of explosive or flammable materials.

H. The Contractor shall retain a Hot Work Permit, available through the Metro-North Office of Fire Prevention, for all work that generates heat, sparks, molten metal/slag, or requires an open flame. Such work includes but is not limited to, grinding, brazing, soldering/sweating, gas and electric welding, cadwelding, torch cutting/burning, and temporary heat.

I. The Contractor shall provide appropriately trained personnel to act as Fire Guards or Fire Watches. Fire Guards/Watches within New York City shall retain Fire Department of New York (FDNY) Certificates of Fitness. Fire Watches shall be familiar with hazards that exist in the work area, and be trained in the operation of each type of fire extinguisher on the work site. Fire Watches shall remain at the site of the hot work for the duration of the work and a minimum of sixty (60) minutes after completion of the hot work. The Contractor shall transmit a list of certified fire watch personnel, and evidence of their training and certification.

J. Fire extinguishers rated at 20 lbs ABC or larger shall be in the immediate area whenever welding or cutting is being carried out. In addition, water shall be used to pre-dampen combustible materials prior to the start of the hot work. If available, a hose connected to a suitable water supply shall be maintained at the ready adjacent to the area of hot work. In the absence of a water supply, a pressurized water fire extinguisher shall be provided.

K. In addition to notifying the Engineer, the written permission of the water utility shall be obtained before shutting off water servicing a fire hydrant.

L. The Contractor shall not block roadways, hydrants, post indicator valves, or access to firefighting equipment without the prior notification and approval of the Metro-North Office of Fire Prevention, the local agency having jurisdiction over fire prevention/protection, and the Engineer.

M. Work stoppage and shutdown of equipment shall be mandatory upon alarm of fire. Personnel shall report to the designated assembly area(s).

2.47 SCAFFOLDS

A. Scaffolds to be utilized during the work shall comply with the requirements of 1926 Subpart L and/or the local governing body having jurisdiction (i.e. NYCDOB); the more stringent requirements shall apply. The Contractor shall be responsible for retaining all permits and licenses and associated fees for scaffold erection and use.

B. Scaffolds shall be designed and constructed in accordance with the intended use. The Contractor shall provide a submittal for all scaffolds to be constructed on site. Site constructed scaffolds shall be designed, signed and stamped by a professional engineer. Scaffolds shall be constructed in accordance with the design submittal. The submittal shall include the design parameters such as duty rating, live and dead loads, and wind load, plan, elevation, and section views of the system, identification of components, and foundation, baseplate, and anchoring systems. Modifications required due to field conditions shall be reviewed and approved by the designer.

C. Scaffolds shall be equipped with protective devices suitable for the type of work being performed. This may include shields, barriers, mesh, netting, etc. as to contain dust, debris, and provide protection from falling objects. The design of the scaffold shall take into

account the protection of non-project personnel and property, including but not limited to, the public, customers, railroad employees, adjacent properties and structures, and vehicular and railroad equipment.

D. Scaffolds erected over and/or adjacent to the railroad shall be constructed as to provide protection of railroad equipment operating below and/or adjacent to the scaffold. Unless otherwise directed or local requirements are more stringent, scaffolds erected over and/or adjacent to the railroad shall be constructed as to withstand a one hundred mile per hour (100 mph) wind load.

E. In accordance with 29 CFR 1926.454(a), persons erecting and utilizing scaffolds shall have completed training in the subject area. Documentation evidencing such training shall be submitted to the Engineer.

F. Persons erecting and/or using scaffolds within New York City shall have completed the applicable Department of Buildings training. Documentation evidencing such training shall be submitted to the Engineer.

2.48 FALL PROTECTION

A. The Contractor shall provide fall protection for all work exposing persons to an unprotected fall greater than six feet (6'), including steel erection. Excavations six feet (6') or greater in depth with slopes steeper than forty-five degrees (45^{o}) shall also be provided with fall protection. In the event that providing this protection is not feasible or creates a greater hazard, the Railroad may at its discretion allow for a task specific variance from this policy. Requests for a task specific variance shall be transmitted in writing with justification for relief. The Railroad's acceptance must be received in writing prior to starting the specific task under the variance.

B. The Contractor shall provide a site specific Fall Protection Plan. The plan shall identify the method(s) of fall protection to be implemented at the site and shall be congruent with the nature of the work and anticipated usage. The Contractor shall provide a submittal including product data/catalogue cut sheets, engineering calculations, a procedure detailing the installation, and a procedure for its usage. Personal fall arrest systems (i.e. anchorages, horizontal and vertical lifelines) shall be designed and stamped by a professional engineer.

C. For work on railroad bridges the fall protection requirements of 49 CFR 214.101 shall be followed.

D. In accordance with 29 CFR 1926.503(a), persons exposed to fall hazards shall have completed training in the subject area. Documentation evidencing such training shall be submitted to the Engineer.

2.49 CONFINED OR ENCLOSED SPACES

A. The Contractor shall adhere to all requirements for entering a Confined Space as listed in OSHA 29 CFR 1910.146 & 1926.1207. Enclosed Spaces as defined in 29 CFR 1910.268-.269 shall be treated as Confined Spaces.

B. The Contractor shall prepare a Confined Space Entry Program identifying the confined spaces to be entered and procedures to be followed. The program shall be submitted to the Engineer for review prior to engaging in confined space entry.

C. Persons entering confined spaces (i.e. entrants) and/or persons monitoring confined space entry (i.e. attendants), shall be trained in accordance with the OSHA standard. Documentation evidencing such training shall be provided to the Engineer prior to engaging in confined space entry tasks.

2.50 MOTOR VEHICLES, TRACK VEHICLES / HI-RAIL EQUIPMENT & CONSTRUCTION EQUIPMENT

A. Company identification shall be clearly displayed on each vehicle.

B. Vehicles shall not block access for emergency equipment.

C. Pedestrians shall have the right of way at all times. The speed limit on Railroad property is 5 MPH unless otherwise posted.

D. The Contractor is to have all High-Rail equipment inspected in accordance with Metro-North Railroad (MNR) Maintenance of Way Department (MOW) requirements. The engineer will provide the inspection requirements. This inspection is to occur prior to MNR's onsite High-Rail inspection conducted at Metro-North Railroad North White Plains MOW Facility, and prior to use on MNR tracks. The Contractor shall notify the Engineer a minimum of three (3) weeks prior to its scheduled use. The Contractor shall coordinate inspection of the high-rail vehicle at the North White Plains Maintenance Facility. The equipment shall not be used on track until passes inspection. This inspection is required quarterly or as directed by the Engineer.

E. Submit a copy of the Manufacture Specifications and Operations and Maintenance Manual for both Hi-Rail Gear and Equipment.

F. Modification of equipment affecting its safety shall not be performed unless approved in writing by the manufacturer.

G. All motor vehicle and construction equipment operators shall be trained for the type of vehicle or equipment they operate. Upon request, evidence of such training shall be provided to the Engineer.

H. Vehicles shall be equipped with backup lights and a reverse signal alarm. The alarm shall produce a 0.2 to 0.5 second audible warning within the initial three feet of backward movement of the vehicle on which it is mounted and at regular intervals thereafter of not more than three seconds, throughout the backward movement. The alarm shall automatically cut out when backward movement ceases. Sound intensity shall range from 90 to 100 dbs. at a distance of five feet from the alarm. Actuation shall be automatic by direct connection to any part of the equipment that moves or acts in a manner distinctive only of rearward movement of the vehicle, with no manual controls between the source of actuation and the alarm.

I. Glazing within cabs of construction equipment shall be intact and free from cracks or other defects. Equipment with broken glazing shall be removed from service until repaired. Glass shall be cleaned as necessary to maintain operator's visibility.

J. Only properly identified contactor work vehicles, and equipment that are necessary to directly support the construction activities shall be permitted adjacent to the actual construction operations.

K. Construction employees shall park personal vehicles only in designated areas of the work site and shall enter the site only at points specifically designated by the Engineer. Personal vehicles will not be permitted adjacent to, or allowed to pass through, the areas of construction without Engineer's special permission and proper identification.

L. Vehicle and equipment operators shall inspect and test essential controls, safety equipment, and safety devices before placing the vehicle or equipment in use. The Contractor shall conduct daily safety and equipment inspection of motor vehicles, hi-rail and construction equipment. The Contractor is to use the 'Contractor Daily Hi-Rail Vehicle Inspection' provided by the Engineer or found in the **'Work Effecting the Railroad'** Specification. Equipment, whether owned, leased, or rented, is to be removed from service if unsafe.

M. High-Rail equipment operators shall be trained in the operation of the vehicle and Hi-Rail Gear. Submit a list of Qualified Operators for the project with credentials, to include but not limited to:

   a. CDL (Commercial Driver's License)

   b. Previous experience working with Hi-Rail equipment (list RR's with Hi-Rail experience, date of work, type of equipment trained to operate).

   c. Document Training or Instructions given by 'House Mechanic' if equipment is owned or instruction received from the Rental Equipment Vendor Mechanic.

   d. Operator to be responsible to ensure Hi-Rail Gear is fully engaged.

N. High-Rail equipment shall be operated in accordance with Metro-North Railroad's Operating Rules and General Safety Instruction applicable to operation of track equipment. A Metro-North Railroad Pilot / Conductor Flagman must always be present during the movement and operation of High-Rail equipment. Contractor's Safety Engineer or Competent Person will lead a Hi-Rail Job Safety Briefing with all operators of rail mounted equipment. The safety briefing will be documented on the provided "Contractor Daily Hi-Rail Job Safety Briefing" provided by the Engineer or found in the **'Work Effecting the Railroad'** Specification. Equipment, whether owned, leased, or rented, is to be removed from service if unsafe.

PART 3 - MATERIAL

Not Used

PART 4 - EXECUTION

Not Used

PART 5 - MEASUREMENT AND PAYMENT

5.01 MEASUREMENT

No measurement will be made for this work.

5.02 PAYMENT

A. No separate payment will be made for the work described in this specification. The costs associated with this work shall be included in the lump sum.

END OF SECTION

Metro-North Railroad

Safety, Health, & Environmental Control Plan (SHECP)
SUBMITTAL OUTLINE & CHECKLIST

The following outline and checklist is presented as an aid to assist Contractors in preparing their Safety Health and Environmental Control Plan (SHECP). Please refer to the specifications for details on SHECP requirements. ***This checklist shall be completed by the Contractor and submitted with the SHECP. Failure of the Contractor to complete this checklist and submit it along with the SHECP shall be grounds for rejection of the submittal.***

Contract Number / Project Description	
Contractor	

(Check One)	☐ Initial Submittal ☐ Revised Submittal	Revision Number Revision Date	

	Description	Included-Page #	Not Applicable	Comments / Notes Identify Revised Sections-Revision Number & Date
GENERAL				
☐	Cover page including name of contractor, contract number, contract title, revision number, revision date, and name and signature of Safety Engineer			
☐	Table of Contents providing section numbers, title or description of the section contents, the page number of each section, list of attachments, and the revision number and revision date of each section.			
☐	A summary of the scope of work to be completed under the contract			
☐	A listing of the known and anticipated hazards to be encountered during the work *(NOTE: This section is intended to be general in nature. It is intended that the Job Hazard Analyses/Safe Work Plans will identify the specific construction activities, associated hazards, controls, and the PPE and specific training required)*			
☐	A Safety Policy Statement signed by company officer			
☐	The company's policy pertaining to the periodic evaluation, improvement and revision of the Safety Program			
ROLES & RESPONSIBILITIES				
☐	Organizational chart of Contractor and Subcontractor personnel responsible for implementing the SHECP. Identify the duties and responsibilities of managers, supervisors, and employees			
☐	Description of the relationship between the Prime and Subcontractor(s) and the responsibilities for management of site safety			
☐	Description of how the company promotes employee involvement and participation in the Safety Program			
☐	Identify the responsibilities of individuals/employees (i.e. to comply with safety rules and requirements, to work safely/follow safe work practices, to use appropriate protective equipment properly, responsibility, to report unsafe practices and conditions, to report injuries and illnesses immediately)			

Safety, Health, & Environmental Control Plan (SHECP)
SUBMITTAL OUTLINE & CHECKLIST

	Description	Included-Page #	Not Applicable	Comments / Notes Identify Revised Sections-Revision Number & Date
☐	Identification of the Safety Engineer including duties and responsibilities			
☐	Identification of the Safety Supervisor including duties and responsibilities			
☐	Identification of the Competent Person(s) for each of the construction types or specialties			
☐	Description of the Disciplinary Procedures for Violations of Safety Rules, Procedures for Handling of Employees / Subcontractors Failing to Abide By Safety Requirements			
☐	Submittal of Alcohol and Drug Program to FRA for approval and copy to MNR			
EMPLOYEE TRAINING & INFORMATION				
☐	Description of how the company trains its employees in accordance with the specific training requirements set forth in the OSHA standards			
☐	Identify how the company trains employees to work safely and use proper protective equipment			
☐	Requirement for OSHA 30 hr Construction Safety training for all management and supervisory staff within the last (5) years			
☐	Requirement for all laborers, mechanics, and craftsmen to have completed the OSHA 10 hr Construction Safety training within the last (5) years			
☐	Requirement for all on site employees to complete Metro-North Roadway Worker / Contractor Safety Orientation Training			
☐	Description of the company's Drug & Alcohol Policy and how the company intends to comply with Metro-North's Fitness for Duty clause as per FRA.			
☐	Provide Drug & Alcohol Plan submitted to FRA under the 49 CFR 219 Reg. [copy of approval once received]			
☐	Description of the Site / Project Safety Orientation to be provided to each employee (include outline and record of training to be signed by each employee)			
☐	Daily Job Safety Briefings			
☐	Weekly Worker Safety Meetings (i.e. Tool Box Meetings)			
SAFETY RULES & PROCEDURES				
☐	Review / highlight Metro-North Specific Safety Requirements			
☐	Review / highlight the specific requirements for work in Grand Central Terminal (for projects within GCT only)			
☐	Description of Metro-North's minimally required PPE			
☐	Warning, Caution, & Informational Signage			
☐	A description of the procedures to be implemented to protect non-project personnel (i.e. general public,			

Safety, Health, & Environmental Control Plan (SHECP)
SUBMITTAL OUTLINE & CHECKLIST

	Description	Included-Page #	Not Applicable	Comments / Notes Identify Revised Sections-Revision Number & Date
	Metro-North employees and customers) including, flagging/escorting moving equipment, separation of work areas from non-work areas, establishing exclusion and controlled access zones, construction fencing, barricades, and barriers			
☐	Policies pertaining to the use of Cell Phones, PDA's & Personal Devices			
☐	Work Site Access & Egress			
☐	Housekeeping			
☐	Slip/Trip/Fall Hazards and Abatement			
☐	Maintenance of Walking Surfaces for Snow & Ice			
☐	Hazard Communication (HAZCOM) / Chemical Safety - Procedure for identification and labeling of products, control of products and materials containing hazardous components, including provisions for maintenance of Material Safety Data Sheets (MSDS)			
☐	Procedures for the identification / uncovering of suspect hazardous materials (asbestos, lead, PCB)			
☐	Overexertion, Soft tissue & Back related injuries			
INCLUDE SECTIONS ON THE FOLLOWING AS APPLICABLE TO THE WORK				
☐	Protection of Underground Facilities (12 NYCRR Part 753 - Call Before You Dig, Metro-North Utility Identification Protocol)			
☐	Marking, Placarding & Labeling			
☐	Sanitation			
☐	Clearing & Grubbing			
☐	Demolition			
☐	Heavy Equipment & Material Handling Equipment			
☐	Motor Vehicles			
☐	Hi-Rail Vehicle(s)			
☐	Excavation & Trenching			
☐	Blasting			
☐	Pile Driving			
☐	Concrete & Masonry / Reinforcing Steel			
☐	Steel Erection			

Safety, Health, & Environmental Control Plan (SHECP)
SUBMITTAL OUTLINE & CHECKLIST

	Description	Included-Page #	Not Applicable	Comments / Notes Identify Revised Sections-Revision Number & Date
☐	Lock Out / Tag Out			
☐	Temporary Electric			
☐	Temporary Lighting			
☐	Arc – Flash Protection			
☐	Traction Power - 3rd Rail / Catenary			
☐	Cranes, Hoists, & Lifting			
☐	Rigging			
☐	Hand Tools			
☐	Power Tools			
☐	Powder Actuated Tools			
☐	Ladders & Stairways			
☐	Scaffolds			
☐	Fall Protection			
☐	Confined Space Entry			
☐	Ventilation			
☐	Air Pollution / Dust Control			
☐	Silica			
☐	Respiratory Protection			
☐	Hearing Conservation			
☐	Painting			
☐	Asbestos & Lead Abatement & Health Protection			
☐	Fire Prevention & Protection			
☐	Handling, Containerization, & Storage of Flammable Materials/Liquids			
☐	Metro-North Hot Work Permitting Procedures			
☐	Burning & Welding			
☐	Compressed Gases			
☐	Temporary Heat			
☐	Marine Operations			

Safety, Health, & Environmental Control Plan (SHECP)
SUBMITTAL OUTLINE & CHECKLIST

	Description	Included-Page #	Not Applicable	Comments / Notes Identify Revised Sections-Revision Number & Date
☐	Underwater & Dive Operations			
☐	Working Over Or Near Water			
☐	Personal Protective Equipment (PPE)			
☐	Hi-Rail Vehicle Information			
RISK ASSESSMENT / HAZARD ANALYSIS				
☐	Description of the system, process, or set of procedures that will be implemented for hazard identification / assessment and prevention / control			
☐	Description of the Safe Work Plans / Job Hazard Analysis process (ie. preparation and implementation)			
☐	Daily Site Safety Inspections – Description of the system for regular inspection/auditing of work areas for hazards and implementation of controls			
☐	Daily Final Inspection of Work Site			
☐	Monthly Site Safety Audits			
☐	Identification and Handling of Unsafe Conditions			
SITE / PROJECT SECURITY				
☐	Procedures for Identification of Project Personnel			
☐	Provisions for accounting for on site personnel (i.e. Sign In / Sign Out Log)			
☐	Provisions for Accessing Secure Sites			
☐	Special provisions for work in GCT, sign-in/sign-out with the Station Masters Office			
☐	Provisions for Site Security (i.e. fencing, barricades, guard service)			
☐	Procedures to prevent unauthorized personnel from entering the site			
☐	Prevention of vandalism and theft			
EMERGENCY PREPAREDNESS				
☐	Emergency Contacts – Project (comprehensive listing to include all project personnel and involved parties)			
☐	Emergency Contacts – Site (police, fire, medical, hospital, Metro-North, MTA Police, Operations Command Center/Rail Traffic Controllers, etc. for posting on site and use by on site project personnel)			
☐	Include site specific information (i.e. project address) that will be provided to 911 emergency dispatch / first responders to assist them in being able to quickly locate the site			

Safety, Health, & Environmental Control Plan (SHECP)
SUBMITTAL OUTLINE & CHECKLIST

	Description	Included-Page #	Not Applicable	Comments / Notes Identify Revised Sections-Revision Number & Date
☐	Hospital / Medical Facility Information (addresses, phone numbers, maps, driving directions for nearest hospitals)			
☐	Procedures for Responding to Medical Emergencies			
☐	Provisions for First Aid, CPR, AED			
☐	Procedures to protect against Bloodborne Pathogens			
EVACUATION PLANNING				
☐	A procedure for initiating and managing evacuations			
☐	Identification of the available means of egress			
☐	Establishment of primary and secondary assembly (i.e. muster) areas			
☐	A system by which each individual can be accounted for in the event of an evacuation (i.e. Sign In / Sign Out Log)			
☐	A procedure for re-entry			
INCIDENTS, ACCIDENTS, & INJURIES				
☐	Procedures for the Handling and Reporting of Incidents, Accidents, and Injuries (*reference Metro-North Capital Programs Incident Reporting)*			
☐	Description of the process to be used to investigate Incidents, Accidents, and Injuries including a process for identifying Root Cause(s)			
☐	Description of the procedure for handling Near Misses / Close Calls			
☐	Recordkeeping & Reporting Injuries & Illnesses (29 CFR 1904)			
RECORDKEEPING				
☐	Procedures for the periodic review and revision of the SHECP.			
☐	Procedures for recordkeeping including the organization and maintenance of safety related documentation			
SITE SPECIFIC SAFETY PLANS AS APPLICABLE TO THE WORK				
☐	Asbestos Abatement			
☐	Lead Abatement			
☐	Protection of Metro-North Employees, Customers, and the General Public			
☐	Scaffold Plan			
☐	Fall Protection Plan			
☐	Confined Space Entry / Permitting			

Safety, Health, & Environmental Control Plan (SHECP)
SUBMITTAL OUTLINE & CHECKLIST

	Description	Included-Page #	Not Applicable	Comments / Notes Identify Revised Sections-Revision Number & Date
☐	Crane, Rigging & Lifting Plans			
☐	Maintenance & Protection of Traffic (MPT) / Traffic Control Plans			
SUPPORTING DOCUMENTATION				
☐	Emergency Contact List (Project)			
☐	Emergency Contacts (Site)			
☐	Record of Subcontractor Acceptance of SHECP			
☐	*Roadway Worker Procedures for Contract Employees* (Metro-North Document)			
☐	Record of Metro-North Roadway Worker Safety Training			
☐	Evidence of Employee Training (OSHA 10 hr, Fall Protection, Scaffold Erection & Use, Confined Space)			
☐	Resume(s) / Qualifications of Safety Engineer & Safety Supervisor			
☐	Record of Employee Site/Project Safety Orientation			
☐	Daily Sign-in/Sign out Log			
☐	Safe Work Plan			
☐	Record of Worker Safety Meeting (date, topic(s) of discussion, and attendees)			
☐	Daily Safety Report			
☐	Monthly Site Safety Audit Report			
☐	Reports / Forms for documentation and investigation of Incidents, Accidents, and Injuries			
☐	*Capital Programs Incident Reporting* (latest revision) (Metro-North Document)			
☐	Material Safety Data Sheets			
☐	Record of Employee Misconduct / Notice of failure to abide by safety requirements			

Prepared By:

Printed Name: _____ **Signature:** _____ **Date:** _____

SAFE WORK PLAN

SECTION 1 – General Information			
Contract / Project Description:		SWP No.:	
General Contractor:		Date:	
Contractor Performing Work:		Revision No.:	
Primary Task:			
Method of Construction:			

Equipment:	

SECTION 2 – Development Team					
Prepared By:	**Position/Title**	**Date**	**Reviewed By:**	**Position/Title**	**Date**

SECTION 3 – Competent Person(s) Assigned			
Competent Person	**Discipline**	**Competent Person**	**Discipline**

SAFE WORK PLAN

SECTION 4 – Safety Analysis				
	Work Element(s)/Sub Tasks:	**Hazard Description**	**Hazard Control/Accident Prevention**	**Specific Training & PPE Required**
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

SECTION 5 – Implementation / Review with Work Force					
Print Name	**Signature**	**Date**	**Print Name**	**Signature**	**Date**

Metro-North Railroad

Contract Employee Sign In / Sign Out Log

Page _____ of _____

Emergency Numbers	MTA Police	Operations Command Center / Rail Traffic Controller	GCT Station Master's Office / Fire Command Center
	(888) 682 - 9117 or (212) 878 - 1000	(212) 340 - 2050	(212) 340 - 3191 / 3192

Contract Number / Project Description	**Contract #: ????? / Project Name: ?????**	**Contractor (Prime)**	**Or Consultant in the field**
Work Location *(Give this description to emergency services)*	**Provide Access Location if no Address**	**Field Office Location / Phone**	

	Day (circle)	Date	Time		Day (circle)	Date	Time
Start	M T W H F SA SU			**Finish**	M T W H F SA SU		

Contacts	Contractor's Site Representative	Contractor's 24 hr Emergency	Metro-North Project Manager	Metro-North Representative
Name				
Cell Number				
Office Number				

Metro-North Authorization Print Name: _____ Signature: _____

Name (Print)	MNR RW Card #	Company	Date	Time On Site	Signature	Date	Time Off Site	Signature
MNR Conductor Flag				MNR Conductor Flag				
Reporting Location for Next Shift:								

Metro-North Railroad

Contract Employee Sign In / Sign Out Log

Page _____ of _____

Name (Print)	MNR RW Card #	Company	Date	Time On Site	Signature	Date	Time Off Site	Signature

CAPITAL PROGRAMS
MONTHLY PROJECT SAFETY AUDIT WORKSHEET

Project Name: _____

Date: _____ **Contract No.:** _____

Audit Team:
Contractor: _____ ***3rd Party Const. Mgmt.:*** _____

Metro-North:_____

		YES	NO	NA
	ADMINISTRATIVE			
1.	The contractor's Health & Safety Plan is maintained in the project office and available for inspection			
2.	Have all subcontractors currently working on the project provided written acknowledgement / acceptance of the project SHECP?			
3.	Have all contractor personnel that are physically working at the project site completed Metro-North's Contractor Roadway Worker Safety Orientation? [documented]			
4.	Are Worker Safety Meetings (i.e. Tool Box Meetings) being completed at least weekly and are records of the same maintained in an organized manner (i.e. file or binder in chronological order)?			
5.	Are Sign-in / Sign-out Logs being transmitted to the Engineer on a regular (i.e. daily, weekly or monthly) basis?			
6.	Safe Work Plans / Job Hazard Analyses on site signed and available for review?			
7.	OSHA Poster			
8.	OSHA 300 and 300A Logs are posted			
9.	NYSDOL Postings			
10.	OSHA 10 Hr Construction Safety Up to date for workers [documented]			
11.	Project Emergency Contact List posted in field office & at Job Site			
12.	Emergency Phone Numbers posted on job site for work force			
13.	Emergency Phone Numbers posted at multiple locations throughout project site to facilitate quick and easy identification by work force			
14.	Evacuation locations posted or noted on SWP's			
15.	Contractor employees are being provided a Site Safety Orientation upon commencing work at the site			
16.	Records of the work force having completed Site safety Orientations are being maintained			
17.	Records of Worker Safety Meetings / Tool Box Meetings are being maintained			
18.	Worker Safety Meetings / Tool Box Meetings are being held at least once a week			
19.	Personnel on site have completed Metro-North Roadway Worker Procedures for Contract Employees within a year of today			
20.	The work force is being provided effective Job Safety Briefings at the beginning of each shift or as conditions / tasks change			
21.	All accidents and injuries are being appropriately recorded on the OSHA 301 forms			
22.	Emergency Locations established & reviewed			
	FIRST AID / CPR / AED			
23.	An individual trained in first aid is present on the jobsite during all working hours			
24.	An individual trained in cardio pulmonary resuscitation (CPR) is present on the jobsite during all working hours			

CAPITAL PROGRAMS
MONTHLY PROJECT SAFETY AUDIT WORKSHEET

		YES	NO	NA
25.	An individual trained in the use of the automatic external defibrillator (AED) is present on the jobsite during all working hours			
26.	An AED is present on the jobsite			
27.	The AED is being checked and maintained by the contractor			
28.	First aid kit is available on the project site			
29.	Based upon the size of the project site, are an adequate number of first aid kits deployed			
30.	First aid kit is adequately sized to the work force			
31.	First aid kit(s) is adequately maintained (i.e. maintained in good condition, supplies are replenished, expiration dates on supplies have not exceeded)			
	HAZCOM / SDS			
32.	Safety Data Sheets (SDS) are available for products currently on the project site			
33.	SDS are organized as to allow quick and easy identification in the event of an emergency Or attached to the SWP.			
34.	Regulated/Haz. Waste is labeled and stored properly			
	SANITATION			
35.	Toilet facilities are provided at jobsite			
36.	The number of toilet facilities provided is commensurate with the size of the work force			
37.	Toilet facilities are being maintained in a sanitary condition / are adequately serviced			
38.	An adequate supply of potable water is provided at the jobsite (wash station)			
39.	Containers (i.e. disposable cups) are provided for drinking water			
40.	Adequate containers are provided for personal garbage, food wastes, drink containers			
41.	Personal garbage, food wastes, drink containers are removed from the jobsite at regular intervals as to not attract vermin and/or insects			
42.	Lavatory facilities are provided for employees working with materials, products or chemicals where regular washing is required or recommended			
43.	Lavatories are supplied with an adequate supply of tepid water			
44.	Lavatory facilities are being maintained in a sanitary condition / are adequately serviced			
	HOUSEKEEPING			
45.	Work site is being maintained clean and free of dangerous waste and material			
46.	Combustible wastes are being removed from the site on a regular schedule as to limit fire load (temp storage of combustibles to be protected, i.e. fire blankets)			
47.	Scrap materials are discarded in appropriate containers or stored in an orderly fashion			
48.	Containers are provided for construction wastes			
49.	Containers for construction wastes are being empty / replaced as necessary to prevent overfilling / overflowing			
50.	Hallways, stairways, walkways, pathways, and work areas are being maintained free of materials, scrap lumber, rebar, pipe, hoses, cables, wires, tools, garbage or other debris			
51.	No spills of liquids, oils, grease, or other slippery materials			
52.	Nails, screws or other protruding objects that may pose snag, puncture or impalement hazards are being removed or rendered non-protruding			
53.	Nails removed from scarp lumber			
54.	Bolts, nuts, or other protuberances on temporary construction are adequately protected / padded			
	SPILL PREVENTION & RESPONSE			
55.	Spill Prevention and Response Plan maintained within project field office			
56.	A spill control/containment kit is available on the jobsite			
57.	The spill control/containment kit is adequately maintained			
58.	Spills are quickly and adequately cleaned up			
59.	Pipe threading cuttings and lubricant are being collected/contained			

CAPITAL PROGRAMS
MONTHLY PROJECT SAFETY AUDIT WORKSHEET

		YES	NO	NA
60.	Liquids stored on jobsite are stored in sealed containers			
61.	Secondary containment provided for liquids stored on site			
	LIGHTING			
62.	Work areas are adequately illuminated			
63.	If existing site lighting was disconnected as a result of construction activities, sufficient temporary lighting has been provided			
64.	Temporary lighting is GFCI protected			
65.	Light bulbs are shielded within fixtures or enclosed within cages (i.e. stringers)			
66.	Temporary wiring is suspended by ceramic or other insulators			
	FIRE PREVENTION			
67.	Work force has been trained in the emergency procedures in the event of a fire			
68.	Work force has been trained in the proper use of fire extinguishers			
69.	Work force knows the locations of fire extinguishers throughout work areas			
70.	20 lb 2A fire extinguisher is provided for every 3,000 sqft of space for interior work areas			
71.	20 lb 2A fire extinguisher is within 100 feet of all work areas			
72.	Firefighting equipment is readily accessible and maintained in good condition			
73.	Hot Work Permit is provided for all work involving use of an open flame, temporary heat, welding, torch cutting, grinding, or other spark generating activity & HWP Posted			
74.	Temporary heating devices are not of the resistive element type			
75.	Portable heaters are being used safely and away from combustibles			
76.	Designated fire guard is present during hot work operations			
77.	Fire guards hold current FDNY Certificate of Fitness (within New York City limits only)			
78.	Torch operators hold current FDNY Certificate of Fitness (within New York City limits only)			
79.	Smoking prohibited in fire hazard areas			
80.	Flammable and combustible liquids are marked / identified			
81.	Flammable and combustible liquids are stored within self closing safety cans			
82.	Flammable and combustible liquids are secured against vandalism within flammable material cabinets during non-work periods			
83.	Placards posted on exterior of tool storage sheds/containers for flammables stored within			
84.	Rags soaked with oil, solvents, or other flammables possible of spontaneous combustion are properly containerized or disposed of			
85.	Have fire drills for workers been held.			
	EXCAVATION			
86.	Excavations protected by guardrails, fences, or barricades if not readily seen due to plant growth or other visual barriers			
87.	Competent person with knowledge of excavation hazards, pertinent OSHA regulations, and soil analysis on hand			
88.	Excavation inspected daily by a competent person before workers enter			
89.	Are employees trained in recognition of hazards			
90.	Materials and spoil piles are stored at least two feet from trench or excavation			
91.	Equipment is a safe distance from edge of trench/excavation			
92.	Ladders provided every 25 feet in trench			
93.	Excavations are shored or sloped back for excavations greater than five feet deep			
94.	Proper utility services identifications and locations made			
	FALL PROTECTION			
95.	Fall Protection Training records for employees [for employees using FP – and readily available for review]			

CAPITAL PROGRAMS
MONTHLY PROJECT SAFETY AUDIT WORKSHEET

		YES	NO	NA
96.	Holes and openings are protected and marked appropriately			
97.	Safety rails/cables are secured properly			
98.	Employees exposed to fall hazards are protected from falls			
99.	Fall protection equipment is appropriate for working height			
100.	Employees below protected from falling objects			
	PERSONAL PROTECTIVE EQUIPMENT (PPE)			
101.	Adequate supplies of PPE are being maintained on the jobsite			
102.	Hard hats			
103.	High visibility traffic vests			
104.	High visibility traffic vests are equipped with tear away closures			
105.	Protective eyewear			
106.	Face shields in use when danger of harmful chemical or physical contact exists			
107.	Work shoes / boots			
108.	Gloves			
109.	Hearing protection			
110.	Respiratory Protection Training for employees [for employees requiring RP – records to be kept & readily available for review]			
111.	Respiratory Protection Program maintained within project office			
112.	Individuals wearing respirators have documentation evidencing medical clearance to wear a respirator			
113.	Respiratory protection in accordance with SDS or appropriate for type of exposure (i.e. HEPA or N95 for particulates, organic vapor for VOC's)			
114.	Non-disposable respirators are properly cleaned, stored & maintained			
	THERMAL CUTTING / WELDING			
115.	Welders / Burners are equipped with tinted faceshields, leather gloves with gauntlets, welding jacket, respiratory protection			
116.	Paint removed prior to burning or welding (1926.354)			
117.	Cut resistant gloves used by those working with sharps			
	ENGINEERING CONTROLS			
118.	Dust suppression methods appropriately implemented (i.e. wetting, ventilation)			
119.	Implementation of Silica Dust Controls as per OSHA 1926.1153			
120.	Employees training in the Silica Dust Standard [records to be maintained]			
	LADDERS AND SCAFOLDING OVER 10 FEET			
121.	Training records for employees kept available for Audit [NYC Requires user certificate]			
122.	Extend 36" above landing			
123.	Secured (tied off)			
124.	Solid rungs			
125.	Proper angle – 1;4 working length of ladder			
126.	Provide at breaks in elevation 19" or more			
127.	Top & midrail toe board			
128.	Supported on solid base			
129.	Cross bracing properly overlap			
130.	Fully planked & properly overlap			
131.	Working are fee of debris			

CAPITAL PROGRAMS
MONTHLY PROJECT SAFETY AUDIT WORKSHEET

		YES	NO	NA
	MANUAL MATERIAL HANDLING			
132.	Mechanical lifts used when practical			
133.	Material stage to minimize lifting and carrying			
134.	Rigging equipment in good condition			
135.				
	DEMOLITION			
136.	Evidence of written engineering survey, Guardrail systems in place where needed			
137.	Debris stored properly – ie floors that can hold the load			
138.	Proper use of mechanical equipment , Competent person inspection as needed			
	BARRICADES AND RAILINGS			
139.	Floor openings protected			
140.	Stairways railings/steps filled			
141.	Open sided floors protected			
	TOOLS, HAND & POWER			
142.	Proper tools for each job - right tool being used for job at hand			
143.	Inspection and maintenance			
144.	Hand tools in good condition			
145.	Tool cords/plugs in good condition (strain relief)			
146.	Proper instruction in use			
147.	Employees are using power tools properly			
148.	Guards in place on machines/equipment			
149.	Guards on machines/equipment in good condition			
150.	When powder-actuated tools are used is proper PPE being worn (eyes, face, ears and hands)			
151.	Power tools protected by GFCI			
152.	Laser operators' proof of qualifications			
153.	Laser warning placards posted			
154.	Operators of powder-actuated tools are authorized			
	HOIST , CRANES, DERRICKS			
155.	Adequate clearances			
156.	Load capacities & proper usage			
157.	Clearances to energized equipment			
158.	Rigging,			
159.	Hand/voice communications: Crane Cab			
	EMERENCY ITEMS			
160.	Emergency evacuation map posted near work area?			
161.	Emergency phone numbers posted and known by all?			
162.	Emergency eyewash and/or shower units accessible?			
163.	First aid kit available at work site			
164.	First aid trained competent person available?			
165.	BBP kit available/BBP trained individual on site?			
166.	Fire extinguishers readily available (not blocked)?			
167.	Fire extinguishers inspected monthly/yearly as needed?			
	MOTOR VEHICLES/EARTH MOVING EQUIPMENT			
168.	Alarm/spotter if obstructed view to the rear			
169.	Seatbelts being worn			
170.	Bi-directional machines have operative horn			

CAPITAL PROGRAMS
MONTHLY PROJECT SAFETY AUDIT WORKSHEET

		YES	NO	NA
	MANUAL MATERIAL HANDLING			
171.	Mechanical lifts used when practical			
172.	Material stage to minimize lifting and carrying			
173.	Rigging equipment in good condition			
	WORK ZONE			
174.	Signs good condition/non-conflicting/clear view/proper position			
175.	Message sign – appropriate message/proper position			
176.	Arrow panel – auto dim/bulbs out/proper position			
177.	TCD's in good condition/proper number and spacing/proper taper length			
178.	Flaggers certified/visible/properly positioned/flagging correctly/advanced warning signs			
179.	Impact attenuator properly positioned/maintained			
180.	Pavement markings – remove/repair/need additional			
181.	Misc-adequate buffer/material and equipment properly stored/ work area protected/ evidence of accidents			
	ENVIRONMENTAL/SAFETY			
182.	Spill Kit(s) availability			
183.	Dewatering activities appropriate and in proper position			
184.	Wetland/waterways checked			
	SITE SECURITY			
185.	Warning signs in - place			
186.	Open ditches/hole protected			
	ADMINISTRATIVE	**YES**	**NO**	**NA**
187.	Drop-offs protected			
188.	Equipment secured			
189.	Utility ditches flagged or barricaded			
	GENERAL INSPECTION			
190.	Posters and safety signs/warnings posted			
191.	Safety meetings held periodically			
192.	First aid kit available and adequately stocked			
193.	Accident reporting procedures established/inplace			
194.	Substance abuse policy in-place			
195.	Injury records being kept			
196.	New employee orientation completed			
	ORDERLINESS AND MATERIAL STORAGE			
197.	General orderliness			
198.	Regular disposal of waste and trash			
199.	Trash containers			
200.	Nails removed or bent down			
201.	Spills cleaned up promptly			
202.	Drinking water available			
203.	Sanitary facilities			
204.	Stability of materials in storage			
205.	Fire lines maintained			
206.	Control of combustibles			
207.	Men lifting properly			
208.	Correct use of material handling equipment			
209.	Dust protection			
	CONFINED SPACE PROCEDURE			

		YES	NO	NA
210.	Confined Space entry training conducted			
211.	Signs posted to identify confined spaces			
212.	Personal protective equipment specified			
213.	Standby person			
214.	Emergency equipment for standby person			
215.	Permit required precautions taken			
216.	All required signatures for entry/testing			
217.	Permits posted prior to start of work			
218.	Permits retained a minimum of two years			
	LEAD REMOVAL/ABESTOS REMOVAL/STEEL ERECTION			
219.	Permit as required – displayed?			
220.	Compliance with approved plan?			
221.	Full face mask/half face mask used all time per approved plan?			
222.	Air sample monitored?			
223.	Portable wash and eye wash station near work area?			
224.	Work area secured from visitor? Lead/Asbestos sign installed?			
225.	Waste drum nearby? Labeled properly?			
226.	Are taglines attached to suspended materials?			
227.	Factor of safety for lifting should be 150% - drawings approved?			
228.	Work area clean at end of shift? (No garbage or debris – trip hazard)			
229.	Debris stored properly and cautioned tape around? Removed in timely manner?			
230.	Is work area secured and safe?			
231.	Emergency door locked at end of shift?			
232.	Gasoline, diesel fuel etc. must not be stored within GCT. The workers are to fuel up their equipment and then remove the cans from the building.			

CAPITAL PROGRAMS
MONTHLY PROJECT SAFETY AUDIT WORKSHEET

	ADMINISTRATIVE	YES	NO	NA
	ELECTRICAL			
233.	Electrical cords being used are proper size of wire			
234.	Extension cords with bare wires taken out of service			
235.	Extension cords with missing ground prongs taken out of service			
236.	Lockout/tagout devices are available/being used			
237.	Circuit breakers/disconnects are properly identified (labeled) and accessible			
238.	Energized panels/devices are covered			
239.	Terminal boxes equipped with required covers			
240.	GFCI Protection provided on temporary power and power tools			
	HI-RAIL EQUIPMENT			
241.	Equipment has been inspected within (3) months & Inspection Sticker on inside of door.			
242.	Operator CDL available			
243.	Hi-rail daily inspection form completed			

Comments:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Subcontractors on site (list name and trade):

_____
_____
_____
_____
_____
_____
_____

Signature(s):_____

SECTION 01 35 29 - HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 74 00 - Cleaning and Waste Management.

1.3 SUMMARY

A. This Section specifies requirements for:
   1. Safety procedures.
   2. Safety Supervisor.
   3. Health and Safety Plan (HASP).
   4. Emergency response procedures.

1.4 REFERENCES

A. Abbreviations and Acronyms:
   1. ACM: Asbestos containing material.
   2. LEED®: Leadership in Energy and Environmental Design.
   3. MSDS: Material Safety Data Sheet.
   4. PCBs: Polychlorinated Biphenyls.
   5. RACM: Regulated asbestos containing material.
   6. RCRA: Resource Conservation and Recovery Act.

B. Definitions:
   1. Asbestos: The asbestiform varieties of serpentine (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite- tremolite.
   2. Asbestos Containing Material (ACM):
      a. Category I Nonfriable Asbestos-Containing Material: Asbestos- containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos as determined using the Polarized Light Microscopy method specified in Appendix E of 40 CFR 63.
      b. Category II Nonfriable Asbestos-Containing Material: Any material, excluding Category I nonfriable asbestos-containing material, containing more than 1 percent

asbestos as determined using the Polarized Light Microscopy method specified in Appendix E of 40 CFR 63, that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

3. Confined Space: A space large enough and configured so an employee can enter and perform assigned work, has limited or restricted means of entry or exit and is not designed for continuous human occupancy, such as pits, wells, excavations or vaults.
4. Contaminated Site: A site at which hazardous, toxic, or pollutant substances occur at concentrations above background levels and where assessment indicates it poses or is likely to pose an immediate or long- term hazard to human health or the environment.
5. Friable: Material that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.
6. Friable Asbestos Material: Material containing more than 1 percent asbestos as determined using the Polarized Light Microscopy method specified in Appendix E of 40 CFR 63.
7. Lockout/Tagout: Placing a lock and/or tag on an energy-isolating device to protect employees by either indicating the device separates a machine or piece of equipment that employees are currently working at from the energy source or preventing the energy source from being energized to the machine or piece of equipment.
8. Polychlorinated Biphenyls (PCBs): Any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contains such substance, including, but are not limited to: dielectric fluids; solvents; oils; waste oils; heat transfer fluids; hydraulic fluids; paints or coatings; sludges; slurries; sediments; dredge spoils; soils; materials containing PCBs as a result of spills; and other chemical substances or combinations of substances, including impurities and byproducts and any byproduct, intermediate, or impurity manufactured at any point in a process.
9. Regulated Asbestos Containing Material (RACM): Any of the following categories of asbestos:
    a. Friable asbestos material.
    b. Category I non-friable asbestos containing material (ACM) that has become friable.
    c. Category I non-friable asbestos containing material (ACM) that will be or has been subjected to sanding, grinding, cutting, or abrading.
    d. Category II non-friable asbestos containing material (ACM) that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on it during regulated demolition or renovation operations.

C. Reference Standards:
1. Municipalities:
    a. Town of North Salem General Construction Code.
2. State of New York:
    a. New York Code, Rules and Regulations (NYCRR):
        1) The New York State Department of Environmental Conservation (NYSDEC):
            a) 6 NYCRR Part 201 General Provisions.
            b) 6 NYCRR Part 203 Indirect Sources of Air Contamination.
            c) 6 NYCRR Part 231 Implementation Guidance.
    b. New York State Energy Research and Development Authority (NYSERDA):
        1) New York State Executive Order No. 111 – "Green and Clean" State Buildings and Vehicles Guidelines.
    c. Official Compilation of the Rules and Regulations of the State of New York (NYCRR).
        1) 12 NYCRR Part 23 - Protection in Construction, Demolition and Excavation Operations.
        2) 12 NYCRR Part 56 – Asbestos.

3) 16 NYCRR Part 753 - Protection of Underground Facilities.

3. United States Government:
   a. Americans with Disabilities Act. (Pub. L. 101–336, 104 Stat. 327, 42 U.S.C. 12101–12213 and 47 U.S.C. 225 and 611) [ADA].
   b. Department of Justice:
      1) 2010 ADA Standards for Accessible Design,
      2) 28 CFR 35 - Nondiscrimination on the Basis of Disability in State and Local Government Services
      3) 28 CFR 36 – Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities.
   c. Environmental Protection Agency (EPA):
      1) 40 CFR 61 National Emission Standards for Hazardous Air Pollutants.
      2) 40 CFR 63 National Emission Standards for Hazardous Air Pollutants for Source Categories.
      3) 40 CFR 112 Oil Pollution Prevention.
      4) 40 CFR 745 Lead; Renovation, Repair, and Painting Program.
      5) 40 CFR 761 Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions.
   d. Occupational Safety and Health Administration (OSHA):
      1) 29 CFR 1903 - Inspections, Citations, and Proposed Penalties.
      2) 29 CFR 1904 - Recording and Reporting Occupational Injuries and Illnesses.
      3) 29 CFR 1910 - Occupational Health and Safety Standards.
      4) 29 CFR 1926 - Safety and Health Regulations for Construction.
   e. United States Code (U.S.C.):
      1) 15 U.S.C. Section 2601 et seq.
         a) Federal Toxic Substances Control Act, Public Law 99-519, as amended.
      2) 42 U.S.C. Section 6901 et seq.
         a) Resource Conservation and Recovery Act (RCRA), Public Law 94-580.
4. United States Green Building Council (USGBC):
   a. LEED 2009 for New Construction and Major Renovations, http://www.usgbc.org.
   b. LEED Reference Guide for Green Building Design and Construction, 2009 Edition.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Facility Services Coordination:
      a. The Contractor and his Subcontractors are responsible for coordination of the Work of this Contract with the appropriate local utilities, whether or not they are listed in the Contract Documents to prevent accidents.

B. Meetings:
   1. Preconstruction Conference:
      a. At the Preconstruction Conference specified in Section 01 31 00, Project Management and Coordination, the laws, codes, traffic regulations, permit requirements, and other public agencies' safety regulations applicable to this Contract will be discussed.
      b. The Contractor's responsibility for making arrangements for safety, first aid, emergency actions, security, and a full-time safety representative will be defined.
      c. The Contractor's responsibility for developing and implementing a Safety Program and Safety Plan, Surveillance and Security Control Program, and Site Security Plan will be discussed.

d. Metro-North construction safety and security representatives will be introduced.

2. Progress Meetings:
   a. During the weekly Progress Meetings specified in Section 01 31 00, Project Management and Coordination, ensure that health and safety is an agenda item discussed and documented.
3. Safety Meetings:
   a. The Contractor is responsible for holding and conducting weekly safety meetings and for holding and conducting tool box/lunch box meetings as required.
      1) The Construction Manager may attend and conduct the Safety Meetings.
      2) Document the subject and attendance of the Safety Meetings and submit a copy to the Construction Manager for a Project Safety File.
      3) Safety Meeting agendas should at a minimum include discussion of accidents and near misses at the Site, safety and work performance, the nature of hazards observed, and upcoming work and potential hazards.
   b. Periodic meetings may be held to evaluate incidents and determine if formal changes to the approved Health and Safety Plan (HASP) specified herein may be required.

1.6 REGULATORY REQUIREMENTS

A. Strictly enforce the safety rules and regulations imposed by the City of New York, Town of North Salem, City of Yonkers, the State of New York, the Occupational Safety and Health Administration (OSHA), Metro-North, and others having jurisdiction.
   1. The Metro-North is the final judge of protections necessary for safe operations at its facilities.

B. Occupational Safety and Health Administration (OSHA) Rules and Regulations:
   1. Comply with applicable Occupational Safety and Health Administration (OSHA) rules and regulations as specified in 29 CFR 1904, 29 CFR 1910, and 29 CFR 1926, and with the State of New York, City of New York, City of Yonkers, Town of North Salem safety regulations, including 12 NYCRR Part 23.
      a. Keep a copy of the OSHA rules and regulations at the Site at all times.
      b. Keep a copy of applicable Material Safety Data Sheets (MSDS) for the materials stored and used at the Site at the Site at all times.
   2. Occupational Safety and Health Administration (OSHA) Compliance Inspection:
      a. If an OSHA area compliance officer arrives at the Site and requests to see the person in charge to get permission to perform an inspection and evaluation of work place conditions, cooperate with and assist the OSHA area compliance officer.

C. Americans with Disabilities Act (ADA):
   1. Provide access to all citizens and employees using designs, specified products, and construction methods meeting or exceeding the Americans with Disabilities Act (ADA) requirements as specified in 2010 ADA Standards for Accessible Design, 28 CFR 35, and 28 CFR 36.
      a. Provide ramps with handrails at field offices.

D. Drug and Alcohol-Free Workplace:
   1. When illegal drug activity or involvement, or public drunkenness, is discovered in the workplace, notify law enforcement officials.

1.7 CONSTRUCTION HEALTH AND SAFETY REQUIREMENTS

A. Safety Supervisor:
   1. Designate a full-time onsite person to act as Safety Supervisor.
   2. The Safety Supervisor is responsible for supervising the safety of persons on or about the Work, and the property affected thereby.
   3. Once the Safety Supervisor has been designated, do not change the individual without the permission of the Metro-North.

B. Health and Safety Plan (HASP):
   1. Develop a Contract-specific Health and Safety Plan (HASP) that complies with the requirements for accident prevention, safety training and education, reporting, first-aid, fire protection, and housekeeping specified in 29 CFR 1926; and State occupational safety guidelines related to the worker and the public.
   2. The Contract's Health and Safety Plan must at a minimum include or address the following:
      a. The names, titles, and emergency telephone numbers for the Contractor's Project Manager, Safety Representative, and Project Superintendent.
      b. Emergency contact information, including phone numbers and methods of communicating with emergency services and others.
         1) The Metro-North is responsible for providing a construction "hotline" telephone number which will be answered by Metro-North representative during regular working hours, or by an answering service during other times, for the Contractor to use for emergency communications with the Metro-North.
      c. Safety training and education, including new employee orientation and hazard awareness briefing.
      d. Investigating and reporting incidents, including employee and non- employee injuries, accidents, and statistics.
      e. Medical and first-aid resources, including doctors, hospitals, and ambulance services.
      f. Fire protection, including extinguishers, onsite fire crew, and local fire departments.
      g. Security and other emergency services which may become necessary, such as local police departments, Metro-North security, or hazmat services.
      h. Housekeeping, including clean-up, temporary electrical service, and trash removal.
      i. Sanitation, including potable water, toilets, work areas, and wash facilities as needed.
      j. Personal protective equipment (PPE).
      k. Specific safety programs such as fall protection, excavation, steel erection, hazardous waste operations, confined space entry, and similar type programs.
      l. Hazardous materials and contaminated materials handling and disposal.
      m. Emergency procedures:
         1) Methods of communicating.
         2) Site-specific safety rules and procedures for dealing with the types of risk expected to be encountered on the Site.
      n. Routine inspection schedules for verifying compliance with applicable laws and regulations.
      o. Security procedures to prevent theft, vandalism, and other losses at the Site.
   3. Submit the Health and Safety Plan to the Construction Manager at the Preconstruction Conference for review and further discussion at the initial Safety Meeting.
      a. Revise the Health and Safety Plan in response to comments generated at the initial Safety Meeting.
   4. Do not commence work at the Site until the Health and Safety Plan has been approved.

C. Project Safety File:

1. The Construction Manager will establish and maintain a Project Safety File and perform related recordkeeping.
2. The Project Safety File will include an OSHA Form 300 Log of Work-Related Injuries and Illnesses, safety meeting minutes and attendance logs, accident/incident investigation reports, and any other relevant safety, health, or environmental records.
3. Cooperate with the Construction Manager by providing documents for the Project Safety File as required.

1.8 SAFETY PROCEDURES

A. Posting Emergency Procedure Guidelines:
1. Prior to the initiation of actual construction, post copies of the emergency procedure guidelines at the Site.
   a. Include directions to and from the nearest hospital.
2. In accordance with 29 CFR 1903.2, post the Occupational Safety and Health Administration (OSHA) poster informing employees of the protection and obligations provided for in the OSHA Act at each field office.
3. Post local labor law postings and other necessary local postings at each field office.

B. Personal Protective Equipment (PPE):
1. Require all workers in construction areas on the Site to wear OSHA- approved hard hats, and when appropriate, approved high visibility warning garments, steel toe work shoes, and safety eye-ware as specified in 29 CFR 1926.
2. Provide additional Personal Protective Equipment (PPE) required for specific tasks, such as hearing protection, specialized eye and face protection, respiratory protection, protective clothing, gloves, radiation badges, safety belts, lifelines, or safety nets.

C. First Aid Station:
1. Provide and fully equip a first aid station at the Site, for furnishing first-aid service to anyone who may be injured in the progress of the Work and have standing arrangements for the transportation and hospital treatment of any employees or others who may be injured or who may become ill.
   a. Maintain an approved first aid kit in each field office.
   b. Provide an exterior sign on the field office indicating the location of each first aid kit.
   c. Maintain a list of qualified first aid providers at the Site.
2. Ensure that first aid supplies and equipment such as eye wash stations, emergency showers, and first aid kits are provided and maintained in good working order, are kept free from obstruction, and available for immediate use.
   a. Check supplies on a monthly basis and replenish supplies as they are used up.
3. Maintain and post the names, telephone numbers, and addresses of local hospital emergency rooms and emergency services on the jobsite bulletin board or in the field office(s); and include directions to the local hospital emergency rooms.
4. If injuries involve bleeding wounds, use Personal Protective Equipment (PPE) and properly disinfect areas spattered with blood to neutralize bloodborne pathogens.

D. Fire Protection and Control:
1. Provide easily accessible fire extinguishers at each field office and throughout the Site.
   a. Identify each fire extinguisher and maintain it in operating condition.
   b. Whenever an extinguisher is used, tag it with a label having the word “USED”, the date it was used, and the date it was recharged.

2. Flammable/Combustible Materials:
    a. Store all flammable/combustible materials in approved containers, and identify their contents using appropriate labels.
    b. Post "NO SMOKING" signs as necessary.
    c. Enforce "NO SMOKING" rules whenever there is fueling, storage, or use of volatile materials.
    d. Ensure that drums containing flammables are grounded and equipped with an automatic shutoff valve.
3. Welding Safety Precautions:
    a. Welding Enclosures:
        1) Perform all welding and flame-cutting operations in protected areas with full consideration to safety and fire hazards.
            a) Properly ventilate the closed spaces while welding or cutting is being done.
        2) Where arc-welding operations might be viewed within harmful range by persons other than the welding operators and inspectors, maintain suitable protection against the rays of the electric arc.
    b. Flammable Materials:
        1) Take proper precautions to avoid risk of fire or explosion, and do not store flammable or explosive materials in the vicinity of welding or cutting operations.
    c. Welding and Cutting:
        1) Only wet cutting of concrete, concrete block, and asphalt will be permitted.
        2) Perform gas and electric cutting, burning, or welding in accordance with the guidelines of the NFPA 51B.
            a) Post spark shields and keep a fire watch when performing gas and electric burning operations.
            b) Keep a supply of water readily available during these operations.
        3) For cutting, burning, or welding steel that is coated with lead- based paint, employ personnel certified in accordance with 40 CFR 745.
4. Standpipes:
    a. In buildings in which standpipes are required by the Town of North Salem Fire Code, install the standpipes as construction progresses, so they are always ready for Fire Department use to the top and lowest most floor of construction that has been erected to date.
        1) Provide one or more outlets with valves on each floor as the standpipe rises.
    b. Provide Fire Department connections on the outside of building at street level for the standpipes, and a lighted red light and sign to identify them.
    c. Provide connections and fittings designed to fit the Town of North Salem Fire Department equipment.

E. Public Safety and Traffic Control:
1. Provide adequate fencing, barricades, warning signs, and lighting so risk to the public is minimized.
2. Inform appropriate law enforcement agencies of possible traffic problems and obtain their assistance to provide traffic control if needed or required.

F. Overhead Safety:
1. Notify public utilities operating overhead power lines whenever construction operations are within clearance envelopes established by statute.
2. Submit sketches defining the operations of all cranes used in support of construction and, if requested, similar information for other equipment in use and capable of encroachment into overhead areas.

a. Show planned locations and movements of the equipment on the sketches, calculations demonstrating the adequacy of the capacity of the crane for the loads, the interface between the footprint of the equipment and the movement of the boom and loads relative to the existing structures and surrounding buildings, the support grillages, the protection of existing utilities and facilities, and any other pertinent details required.

3. For all hoisting operations adjacent to train operations, submit the following data prepared and sealed by a Professional Construction Manager licensed in the State of New York:
   a. Plans and sections showing the locations of cranes, both horizontally and vertically, their operating radii, delivery and disposal locations, and the location of adjacent transit structures.
   b. Crane rating sheets showing that the cranes are capable of lifting 125 percent of the actual weight being lifted.
      1) Submit a complete set of crane charts, including crane, counterweight, and boom nomenclature.
   c. A location plan showing all obstructions such as wires, poles, adjacent structures, and similar structures, and that the proposed lifts are clear of these obstructions.
   d. Data sheets listing the types, sizes, and arrangement of slings, shackles, or other connecting equipment.
   e. Include catalogs or information sheets for specialized equipment.
   f. A complete procedure indicating the location and order of lifts, and any repositioning or re-hitching of the crane or cranes.
   g. Temporary support of any components, including details; and intermediate stages.
   h. A time schedule for each of the various stages, and a schedule for the entire lifting procedure.

G. Excavation Safety:
   1. It is the responsibility of the Contractor for making excavations for this Contract in a safe manner.
   2. Comply with applicable requirements of OSHA, the State of New York statutes, especially NYCRR 16 Part 753 regarding Underground Utilities, and the Town of North Salem General Construction Code.
      a. At least 2 to 10 days prior to the start of digging or excavation Work not counting the day of the call prior to the start of digging or excavation Work, contact Dig /Safety. New York at 1-800-962-7962 or 811 to arrange for underground utility owners to locate and mark their underground utilities.
         1) Notify utilities prior to all excavations.
      b. If unexpected active underground facilities are encountered during the performance of the Work, immediate notify the Construction Manager.
      c. Cooperate fully with the owners of underground and overhead utilities when utility removal or rearrangement operations are in progress to ensure reasonable progress, minimize duplication of operations, and eliminate unnecessary interruption of services.
   3. Temporary Supports:
      a. Safeguard and protect excavations until permanent support has been provided so danger to life and limb is avoided.
      b. Where necessary to retain excavations, construct temporary retaining walls, sheet-piling and bracing, or other approved methods to support the adjoining earth.
   4. Provide suitable protection against bodily injury.

H. Confined Spaces:
   1. Do not allow untrained and unqualified workers or others to enter confined spaces.

2. Furnish the necessary safety equipment such as air monitoring equipment, ventilation system, harness, tripod, and similar items for personnel entering confined spaces.

I. Contaminated Site:
1. This Project's existing Site may be contaminated with lead paint and asbestos at various locations.
2. Take appropriate measures to protect workers, the public, and the environment from harm during construction, abatement, and remediation activities involving the contaminated materials.
3. Toxic Substances:
a. Control toxic substances, hazardous, and contaminated materials, and harmful nuclear and x-ray radiation in a safe manner.
b. Comply with the Toxic Substance Control Act, P.L. 94-469 (TSCA) (15
c. U.S.C. §2601, et seq).
1) Do not use toxic chemical substances, mixtures, equipment, containers, sealants, coatings, or dust-control agents except in accordance with all provisions of the Toxic Substances Control Act (TSCA) as interpreted by the rules and regulations of 40 CFR 761 for polychlorinated biphenyls (PCBs).
2) Immediately report in writing any toxic chemical substance, mixture, equipment, container, sealant, coating, or dust-control agent found stored within the Contract area and stop work in the area until arrangements for the removal of the toxic materials have been made, after which the Contractor may continue to work in the area.
4. Hazardous Air Pollution Control:
a. The United states Environmental Protection Agency (EPA) has delegated implementation and enforcement of the National Emission Standards for Hazardous Air Pollutants (NESHAP) codified in
b. 40 CFR 61 and 40 CFR 63 to the New York State Department of Environmental Conservation (NYSDEC), Department of Air Resources.
c. Comply with the requirements of NYSDEC Department of Air Resources.

J. Lockout/Tagout Requirements:
1. Only allow authorized employees to apply or remove locks and/or tags.
2. Do not allow one employee to remove a lock and/or tag placed by another employee.
3. Do not use lockout/tagout locks for purpose other than employee safety.

K. Housekeeping:
1. Maintain good housekeeping at the Site at all times.
a. Provide adequate and proper tool, equipment, materials, and waste storage.
1) Remove or secure ladders; and barricade, cover, or otherwise identify to the public all excavations.
b. Furnish sufficient waste containers, and ensure they are emptied each day or as otherwise stipulated in Section 01 74 00, Cleaning and Waste Management.
c. Furnish and maintain adequate sanitation facilities and lavatories in accordance with the requirements specified in 29 CFR 1926.51 Sanitation.

1.9 EMERGENCY RESPONSE PROCEDURES

A. Establish procedures to deal with emergencies, and submit written guidelines discussing procedures for the following to the Construction Manager for approval:

1. Fire emergencies.
2. Injury to employees.
3. Injury to the general public.
4. Property damage, including damage to utilities such as gas, water, sewage, electrical facilities, telecommunications, or pedestrian and vehicle routes.
5. Hazardous/toxic material spills or discharges.
6. Site evacuation.
7. Providing emergency access and egress lanes.

B. Spill Prevention, Control, and Countermeasure (SPCC) Plan:
   1. In accordance with the requirements specified in 40 CFR 112, prepare and implement an approved Spill Prevention, Control, and Countermeasure (SPCC) Plan applicable to facilities storing, transferring, distributing, using, and/or consuming oil and oil products and which could discharge harmful quantities of oil into or on navigable waters or their adjoining shorelines near the Site.
      a. The SPCC Plan must detail the equipment, workforce, procedures, and steps to prevent, control, and provide adequate countermeasures to a discharge; and must include the physical layout of the facility and a facility diagram.
      b. The SPCC Plan must describe the type of oil in each fixed, mobile, and portable container and its storage capacity.
      c. The SPCC Plan must detail discharge prevention measures including procedures for routine handling of products such as loading, unloading, and facility transfers.
      d. The SPCC Plan must describe discharge or drainage controls such as secondary containment around containers and other structures, equipment, and procedures for the control of a discharge.
      e. The SPCC Plan must detail countermeasures for discharge discovery, response, and cleanup of both the facility's capability and those that might be required of a Contractor.
      f. The SPCC Plan must describe the methods of disposal of recovered materials in accordance with applicable legal requirements.
      g. The SPCC Plan must include a contact list and phone numbers for the facility response coordinator, National Response Center, cleanup Contractors having an agreement for response, and appropriate Federal, State, and local agencies who must be contacted in case of a discharge.
      h. The SPCC Plan must be certified by a registered Professional Construction Manager and may be required to be submitted to and approved by the Environmental Protection Agency's Regional Administrator.
   2. Submit copies of the Spill Prevention, Control, and Countermeasure (SPCC) Plan to the Construction Manager for information.

C. Fire/Police Rapid Entry System:
   1. Provide temporary fire/police rapid entry system key boxes to facilitate entry to the Site by police and/or fire services until the permanent fire/police rapid entry system is installed, operational, and accessible to fire and police agencies.
   2. Prominently display the address of the Site as required by the Town of North Salem Fire Department to identify the Site during emergencies.

D. The Contractor is responsible for moving any equipment or materials expeditiously to provide access for emergency vehicles to adjacent properties at any time at no increase in the Contract Price.

E. Reporting:

1. Accident Reporting:
    a. Report all on-the-job injuries to the Metro-North's representative, the Safety Supervisor, and the Construction Manager within 24-hours of the incident; and submit all paperwork pertaining to such injuries as required.
        1) Report all accidents, injuries, and illnesses, no matter how slight.
        2) Report employee and non-employee injuries, such as injuries to customers, Subcontractors, trespassers, and similar persons, occurring on Metro-North property or arise from Metro-North operations.
        3) The Safety Supervisor must ensure that the personal injuries are properly investigated and reported.
            a) Each week submit copies of accident reports for all accidents that week to the Construction Manager for information.
    b. Provide immediate medical treatment as needed for job-related injuries or illnesses.
    c. Have the affected person or their immediate supervisor complete an accident/incident report.
        1) Have the supervisor investigate and complete the accident/incident report within 24 hours of the accident/incident and submit it to the Construction Manager.
2. Non-Conformance Reporting:
    a. If the Construction Manager notices major safety violations, unsafe practices, and/or hazardous conditions during the course of performing normal duties in non-conformance to the Health and Safety Plan, the nearest Contractor's supervisor will be notified that corrective actions must be taken immediately, or their work and payment will be stopped.
        1) Reports of such incidents will be placed in the Project Safety File.

F. Hazardous/Toxic Material Spills or Discharges:
1. When a hazardous material spill or leak occurs, determine the details of the incident and immediately notify Safety Supervisor, the Construction Manager, and the Metropolitan Transportation Authority Police (MTA) Police (1-888-682-9117).
    a. Provide as much detail as possible concerning the location of the emergency or incident and the nature of the emergency or incident, including the hazardous material involved.
    b. Obtain the following information from placards, which are required on vehicles and containers that contain hazardous materials:
        1) The condition of containers, whether intact, leaking, burning; and number of the containers involved.
        2) If the spill or discharge occurs during delivery, obtain the name of the carrier, the vehicle number, and telephone numbers located on the delivery vehicle.
            a) The material carrier is primarily responsible for responding to the emergency and should be fully trained in handling and responding to emergencies and incidents involving every hazardous material they transport.
    c. Cooperate fully with the authorities, including the following:
        1) Appropriate carrier authority.
        2) Metropolitan Transportation Authority Police.
        3) State and local officials and police.
        4) Other emergency personnel.
    d. Follow the authorities' instructions for evacuating the area, handling the material, giving first aid, and similar actions.

1.10 QUALITY ASSURANCE

A. Qualifications:
   1. Safety Supervisor's Qualifications:
      a. The Safety Supervisor must have a working knowledge of all U.S. Department of Labor (OSHA) regulations, specialized training and substantial experience in construction safety supervision, andhave the ability to develop and conduct safety-training courses.
      b. The Safety Supervisor must be familiar with industrial hygiene equipment and testing as required for the protection of allemployees.
      c. Submit the name and qualifications of the Safety Supervisor to the Construction Manager for approval.
         1) The Safety Supervisor must be acceptable to the Construction Manager and Metro-North, and his performance will be reviewed on a continuing basis.
         2) The Metro-North reserves the right to revoke the approval of the Safety Supervisor and require a replacement.

B. Sustainability Standards Certifications:
   1. In accordance with New York State Executive Order No. 111, the Project must achieve LEED certification as described in LEED 2009 for New Construction and Major Renovations and the LEED Reference Guide for Green Building Design and Construction, 2009 Edition.
      a. Comply with the requirements specified in Section 01 81 13, Sustainable Design Requirements, to earn the points for thisLEED credit as part of housekeeping activities and obtain approval forthe Project to claim this credit.

1.11 SUBMITTALS

A. Action Submittals:
   1. Submit the following to the Construction Manager for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:
      a. Special Procedure Submittals:
         1) Weekly accident reports.
      b. Qualification Statements:
         1) Safety Supervisor's Qualifications.

B. Informational Submittals:
   1. Submit the following to the Construction Manager for information in accordance with the requirements of Section 01 33 00, Submittal Procedures:
      a. Special Procedure Submittals:
         1) Spill Prevention, Control, and Countermeasure (SPCC) Plan.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Occupational Safety and Health Administration (OSHA) safety and construction regulations related to the transportation, delivery, and unloading of materials as specified in 29 CFR 1910 and 29 CFR 1926, paying special attention to those related to occupational health and environmental control; hazardous materials; personal protective equipment; materials handling and storage; toxic and hazardous substances; illumination; ventilation; hazard communication; cranes, derricks, hoists, elevators, and conveyors; and retention of DOT markings, placards, and labels.

B. Packaging Waste Management:
   1. Comply with the approved Waste Management Plan required in Section 01 74 00, Cleaning and Waste Management.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

[This Page Left Intentionally Blank]

SECTION 01 35 43 - ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The Contractor is responsible for protection of the environment and the preservation of natural resources within the project boundaries and outside the limits of permanent work. The Contractor is to restore to an equivalent or improved condition upon completion of work. Confine construction activities to within the limits of the work indicated or specified. Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages. Where such use of attached ropes, cables, or guys is authorized, the Contractor will be responsible for any resultant damage. Protect existing trees which are to remain, and which may be injured, bruised, defaced, or otherwise damaged by construction operations.

B. These requirements are to be adhered to throughout the duration of the Work.

C. Protection of the environmental is to include but not limited to; Dust and Air Monitoring Controls, Noise Control, Management and disposal of debris and other environmentally regulated materials, Spill Prevention and Response, Sediment and Erosion Control.

D. The Contractor must protect and preserve public and private property within and adjacent to the work site and use every precaution to prevent damage, injury, pollution or destruction. Precautions should be made to protect trees and other plants that are to remain.

1.2 RELATED SECTIONS

A. Section 01 33 60 Health and Safety

B. Section 01 74 19 Construction and Waste Management

C. Section 02 61 00 Removal and Disposal of Contaminated Soils

D. Section 02 83 19 Lead Abatement

E. Section 02 82 13 Asbestos Abatement

F. Section 02 84 30 Universal Waste and Miscellaneous Hazardous Materials

G. Section 31 20 00 Earth Moving

1.3 SUBMITTALS

A. Spill Prevention Plan

B. Dust and Air Monitoring Control Program

C. Noise Surveys: To be done prior to the start of construction activities for the daytime and evening construction.

D. All plans and programs and surveys are to be submitted within thirty (30) calendar days after receipt of Notice of Award, the Contractor shall submit a Plan to the Engineer for approval. The plan should detail all measures and procedures to be under taken by the Contractor 30 days prior to starting construction activities.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with all applicable Federal, State, laws, ordinances and regulations pertaining to environmental protection to include but not limited to the programs in the New York State Department of Environmental Conservation (DEC) Division of Environmental Remediation (DER) and Commissioner Policies (CP).

B. The Contractor must ensure that all other Contractors, Subcontractors and other personnel performing work are fully aware of all permit conditions, plans and programs.

C. Equipment with factory-installed, anti-pollution and noise control devices should be proper maintenance and in working order prior to use.

D. All permits pertaining to the job and a copy of the final construction plans are to be kept on site and made available for inspection by the Engineer or any regulatory representatives. Regulatory representatives with the appropriate credentials and identification should be allowed on site at reasonable times to ensure compliance with all applicable laws and regulations. The Engineer is to be notified of any regulatory representatives visiting the work site.

E. The Contractor shall dispose of all waste, demolition, excavation material at a site approved for the disposal of such material in accordance Section 01 74 19.

3.2 NOISE CONTROL

A. All work must be in compliance with regulatory requirements for noise levels due to construction work. All practicable precautions and noise abatement measures must be implemented to reduce public exposure to noise.

B. The Contractor must conduct periodic noise surveys to verify compliance with construction noise lot line limits for both instantaneous (L_{max}) and 20-minute averages noise readings (L_{20}). The noise surveys must be conducted at the following frequency:
   1. Background conditions just prior to the start of construction
   2. At a representative period during the first month of site grading/excavation activities
   3. During at least two other periods during construction
   4. As warranted whenever noise levels are continuous and excessive, complaints are filed, or evidence of non-compliance is apparent.

C. Noise surveys are to be performed prior to the start of construction activities for the day, during daytime construction activities, and in the evening when construction planned activities are expected to produce excessive noise levels. Noise surveys must be measured using a calibrated general-purpose sound level meter. Measurements must be taken at the lot-lines facing surrounding residential locations (noise sensitive), commercial areas and industrial areas.

D. In the event that noise levels exceed limits, the noise abatement procedures are to be implemented to include but not limited to:
   1. Shields or physical barriers to restrict transmission of noise
   2. Soundproof housings or enclosures for noise-producing machinery
   3. Use of electrically operated hoists unless otherwise permitted by the Engineer
   4. Maximum sized intake and exhaust mufflers on internal combustion engines
   5. Concrete crushers or pavement saws to assist with concrete deck removal, demolitions, or similar construction activity
   6. Line hoppers and storage bins with sound-deadening material
   7. Conducting the operation of dumping rock or other material and carrying it away in trucks so that noise is kept to a minimum
   8. Routing of construction equipment and vehicles carrying rock, concrete, or other materials over streets that will cause the least disturbance to noise-sensitive locations.

E. Demolition, construction and renovation activities are to be done in a manner to prevent and minimize critical nuisance vibration conditions. Activities are to be scheduled and conducted in a manner that will minimize the disturbance to the public areas adjacent to the work and occupants in the vicinity of the construction sites. The following mitigative measures should be implemented:
   1. Use of deep saw-cuts to minimize the transmission of vibrations from pavement- breaking operations to foundations of nearby structures
   2. Use of concrete cutters to assist with demolition of pavement, where practical
   3. Use of vibratory or sound dampened impact drivers rather than conventional impact pile drivers where feasible for installation of retaining walls and other structural elements
   4. Routing of truck traffic and heavy equipment to avoid impacts to sensitive receptors
   5. Conducting vibration monitoring during highly disruptive construction activities

3.3 DUST AND AIR MONITORING CONTROLS

A. Dust and Air Monitoring Control Program: The Contractor shall develop and implement a program to control dust, particulates, odors and volatile organic compounds (VOCs). The Program should:
   1. Control and monitor airborne particulates (i.e. dust) and migration of the same from the work site all times to protect worker and public health and safety.
   2. Controls are to be implemented during work hours, non-working hours, weekends, and holidays. Keep dust down in areas disturbed by operations and materials stockpiled for the project.
   3. Inspect all vehicles for dirt prior to their leaving the work site. Dirt, soils and rubble likely to be dislodged during transit is to be removed from the trucks and other vehicles prior to leaving site.
   4. Dry power brooming will not be permitted. Vacuuming, wet mopping, wet sweeping, or wet power brooming to be used.

B. The Contractor shall consider the use of the following dust control measures identified:
   1. Applying water on haul roads.

2. Wetting equipment and excavation faces.
3. Spraying water on buckets during excavation and dumping.
4. Hauling materials in properly tarped or watertight containers.
5. Restricting vehicle speeds to 10 mph.
6. Covering excavated areas and material after excavation activity ceases.
7. Reducing the excavation size and/or number of excavations.

C. Air blowing will be permitted only for cleaning off non-particle debris, such as that from reinforcing bars. Sandblasting will not be permitted except as otherwise specified. Only wet cutting of stone, concrete, and asphalt will be permitted.

D. Dust and Air monitoring and control measures shall at all times comply with the requirements Health and Safety Plan.

E. Materials generated by any activity of the Work must not be burned on or off the site. This shall include but not be limited to land clearing material and demolition material.

F. On designated projects and sensitive cases, a separate Site-Specific Community Air Monitoring Plan may be required. The Contractor must address the need for downwind breathing zone (i.e., worker) and downwind support/clean zone boundary (i.e., community) monitoring to protect worker and public health and safety and to comply with the requirements of the NYSDEC DER-10, Appendix 1A, 'Air Monitoring Plan' and Appendix 1B "Fugitive Dust and Particulate".
   1. The Contractor shall provide all necessary sampling devices, pumps, collection media and support equipment to perform the area and personnel air sampling recommended above. The sampling devices and pumps must be approved for use in combustible or flammable atmospheres.
   2. The laboratory selected for sample analysis must be accredited by the AIHA for the analysis required. Sampling and analytical methods of NIOSH or OSHA must be used preferentially when such methods are available for the samples collected, and all appropriate QA and QC provisions regarding sampling collection, transport and holding times must be followed.
   3. The Contractor shall submit, in writing, all data resulting from daily air monitoring to the Engineer, at a minimum, at the end of the work week. If at any time the instrumentation indicates an adverse change in conditions, the Health and Safety Officer must notify the Engineer immediately and follow up this report in writing by the close of business on that day. Changes made to Engineering and Work Practice Controls, Personnel Protective Equipment or Levels of Protection shall be described in this written report.

3.4 RODENT AND INSECT CONTROL

A. Collect and remove from work site, refuse and garbage that attract and foster the breeding of rodents.

B. Provide rodent-proof refuse containers; ensure proper use by construction workers. Dispose of food, food wrappings, and food containers within work site.

C. Monitor site conditions and implement controls to prevent the proliferation of insects such as mosquitoes, water bugs, cockroaches. Controls include but are not limited to, grading to prevent standing water, pumping of standing water, treatment via licensed exterminators, removal of food residue, dampness.

D. Perform rodent and insect control measures as ordered by the Engineer

3.5 DISCONNECTION OF ON SITE PIPING

A. The Contractor shall provide notification to the Engineer and Metro-North's Department of Environmental Compliance and Services prior to the disconnection of any piping, piping system or tank system. Notification is in effort is to minimize any potential for spills associated a tank or bulk storage of petroleum or any storm or sanitary piping or systems.

B. Pipelines that are not in service or are on standby service for extended periods must be properly capped, blank-flanged, and marked.

C. Notification is to be given in advance of any and all disconnections (both temporary and permanent) of any storm, sanitary, petroleum storage/delivery, or remedial system piping. At least one of the following individuals is to be contacted as soon as information is obtained indicating that such a disconnection is going to take place. Karen Timko at 917-225-6250; timko@Metro-North.org; Joanne Reilly at 917-371-5845; reilly@Metro-North.org; Ken McHale at 917-930-9637; mchale@Metro-North.org.

D. Information to be provided:
   1. Project name and Contractor contact information
   2. Type of piping being disconnected
   3. Location of disconnection
   4. Date and time of proposed disconnection and expected duration
   5. Reason for disconnection
   6. Plan for shutting off flow, providing diversion piping, etc.

3.6 ENVIRONMENTAL PROTECTION REQUIREMENTS

A. Provide and maintain, during the life of the Contract, environmental protection as defined. The Contractor is to plan for and provide environmental protective measures to control pollution that develop during normal construction practice. The Contractor is to provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with Federal, State, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

B. Excavated Soil must follow requirements in Section 02 61 00 Testing, Removal and Disposal of Soil. Soil is to be sampled in-situ and/or moved directly to the stockpiling area for sampling. All excavated soils are to be tested and classified prior to removal and/or directly loaded for removal into a transport vehicle. The Contractor will comply with the following:
   1. Contractor shall submit, in detail, the proposed areas, procedures to avoid commingling of soils and different materials from different excavations or soil/material that is removed after a classification sample is collected.

C. On-site stockpiled soil and material shall not impact the work of any other Contractor.
   1. Stockpiles of excavated soil or material shall be constructed to include:
      a. A chemically resistant geo-membrane liner. Liners shall be scrim reinforced, having a minimum weight of 40 pounds per 1,000 SF, and a permeability coefficient less than 10^{-8}cm/sec. The ground surface on which the membrane is to be placed shall be free of rocks greater than ½ inch in diameter and any other items that could damage the membrane.

b. A geo-membrane cover to control dust and to prevent precipitation from entering the stockpile. Scrim reinforced membranes shall have a minimum weight of 26 pounds per 1,000 SF. The cover shall be anchored to prevent it from being removed by wind. Stockpiles shall be covered during non- working hours and during periods of no construction activity.

c. The temporary storage of excavated soil or other material in stockpiles shall comply with the dust monitoring and control requirements defined in the NYSDEC TAGM #4031, "Fugitive Dust Suppression and Particulate Monitoring Program" and in Section 01351 (Health, Safety and Emergency Response).

2. Stockpiles shall be surrounded by a berm, a minimum of 12 inches in height. Vehicle access points shall also be bermed.
3. Provide silt fencing and hay bales around stock piled soil or material in accordance with Section 01 50 00 Temporary Facilities and Controls.
4. No liquids shall be allowed to collect on this stockpile.

D. Transportation of excavated materials off site require the Contractor to provide transport vehicles that comply with requirements for hauling materials as outlined in NYSDEC regulations (i.e. 6 NYCRR Part 360 and 364). The Contractor is responsible for vehicles to have required permits and approvals.

1. All loaded transport vehicle must be cleaned prior to departure of the site to reduce the risk of losing soil and/or debris on public roads. Cleaning to include but not limited to: Wheels, tires, and under carriages.

E. Waste Manifest or Bill of Lading:

1. The Contractor shall provide manifest or bill for the transport and disposal of materials from the project. The name of the generator, transporter and disposal facility is to be listed on each form. All other pertinent information shall be included on the manifest. A copy of the partially completed manifest or bill of lading including the above information shall be submitted to the Engineer for approval prior to commencement of removal.
2. Formal waste manifests with duplicate copies are mandatory for transport and disposal of hazardous waste. For other non-hazardous regulated soils or material, a clear, informative bill of lading in a format pre-approved by Metro-North is acceptable.
3. The Engineer will sign the manifest and receive a Final copy of the partially completed form. The manifest will be signed by the transporter and carried to the approved disposal facility and completed when the disposal facility accepts the waste. A Certificate or Documentation of Disposal must be sent to the Engineer along with the completed manifest once the soil has been properly treated and/or disposed of.
4. The Contractor is responsible to prepare transportation vehicles with manifests or bill of ladings necessary for transporting all soil and materials. Each manifest or bill of lading will be signed by the Engineer. The Transporter must comply with all pertinent Federal, State and Local regulations regarding the transport of soils.

3.7 SPILL PREVENTION AND RESPONSE PLAN

A. The Contractor must take all necessary precautions to prevent and control the spill and spread of fuel and oil and must comply with the provisions of the approved Spill Prevention and Response Plan. See the Appendix A at the end of this specification for a sample 'Spill Prevention & Response Plan. The following requirements must be incorporated into the Spill Prevention and Response Plan submitted by the Contractor and approved by the Engineer.

B. Within thirty (30) calendar days after Notice of Award, the Contractor must submit a Spill Prevention and Response Plan for approval by the Engineer. The Plan must detail all site-specific measures and procedures to be undertaken by the Contractor to prevent a release to the environment of oil and other substances defined as contaminates or hazardous by Federal and State agencies. In addition, to the plan must identify available on-site equipment and Contractor personnel who will be responsible for implementation of the plan:

1. Notification Procedures (Project Manager, Regulatory Agencies, NYSDEC).
2. Spill Prevention (Control and Countermeasures) Procedures
3. Spill Response (Containment and Cleanup) Procedures
4. Spill Response Equipment
5. Spill Response Coordination
6. Inspections and Records
7. Personnel Training
8. Post Spill Reporting - To address at a minimum:
    a. Estimate of the amount of hazardous material spilled
    b. Site plan showing the location of the spill area
    c. Summary of the measures implemented to contain, cleanup and remove the spill area
    d. Date and time when the spill occurred and was cleaned up
    e. Extent and depth to which soils were excavated for off-site management
    f. Results of any "post removal" soil sampling
    g. Documentation for the appropriate off-site management of all wastes generated as a result of and in response to the spill
    h. Documentation for the off-site management of the impacted soils
    i. Other available supporting documentation

C. The Plan will also address, at a minimum, the following Pollution Prevention requirements:

1. All hazardous or polluting substances brought onto the job site shall be accompanied by a Material Safety Data Sheet (MSDS).
2. The recommendations of the MSDS will be followed in all respects, particularly with respect to storage requirements.
3. Provisions shall be made to prevent the migration or spillage of hazardous liquids such as fuels, solvents, or oils
4. Implement measures necessary to prevent oil and other environmentally regulated substances from entering the ground, drainage areas and piping systems. Precaution is to be taken during the dispensing or other handling of liquids at storage areas shall be implemented:
    a. Use approved dispensing devices for the substances involved
    b. Drip pans shall be used underneath all drum-pouring spouts.
    c. Self-closing valves, dispensing devices
    d. Pumps to minimize the possibility of spillage

D. The Plan must include a map of the site with locations of surface waters. The Plan must describe measures to orient and train personnel on measures to comply with the Plan. The Plan must also identify all agencies to be notified in the event of a spill, emergency contact phone numbers must be included for all agencies listed.

1. Discharge of fuel and oil from equipment or facility into public waters or onto land or water body shall not be permitted.
2. All fuel storage containers must be stored in designated areas that are secure and away from traffic hazards. Any petroleum storage tanks used temporarily by the Contractor must meet all of the NYS requirements and NFPA standards. Every effort must be taken to minimize the chance of spills. Machinery will be required to be refueled only in areas designed in the Plan, spill clean-up material must be readily available.

3. Tanks must comply with NYSDEC NYCRR Part 614.8 and meet or exceed design and manufacturing standards of UL No. 142. All tanks to be labeled and color coded, provided with secondary containment (means to drain if required), spill catchment basins for fill port, tank gauge for overfill protection, provided with cathodic protection if tank bottom is to be provided if resting directly in contact with soil. Tank to be inspected weekly throughout the duration of the work.
4. The Contractor shall maintain at an Emergency Spill Kit at the project site. The spill kit must be congruent with the potential size of a spill and compatible with the type of product that it will be used to contain. The spill kit(s) must be readily accessible and able to be quickly deployed. Large project sites, or sites with satellite work locations, may require more than one spill kit. The spill kit contents shall be maintained and replenished as necessary throughout the term of the Contract. Contractor personnel must be made of the Spill Kit(s) location(s). Personnel shall use such materials to contain a spill and absorb spillage and shall do everything possible to prevent the entry into drains or waterways
5. All Contractor personnel shall be made aware of the location of Emergency Spill Kit and in the event of a spill, shall use such to contain the spill, absorb the spillage, and shall do everything possible to prevent the entry of oil into drains or waterways.
6. Fuel hose, oil drums etc., must be checked regularly for drips or leaks, and shall be maintained and stored properly to prevent discharges. Proper security shall be maintained to discourage vandalism.
7. The Contractor shall immediately notify the Spill Prevention and Response Plan Administrator. In the event of a spill, release of hazardous material, dusts, fumes or vapors into the atmosphere; any fire involving hazardous materials; or the discovery of hazardous materials on the site.
8. The Plan Administrator and/or Contractor will implement the spill response procedure notifying all agencies and Metro-North's Department of Environmental Compliance and Services and Services immediately or the Metro-North Rail Traffic Controller during off-hours.
9. Any reportable spill caused by a Contractor is to be reported to the NYSDEC by the Contractor, listing the Contractor as the spiller on Metro-North property. This call is to occur within two (2) hour of the spill. The Contractor is to notify Metro-North's Department of Environmental Compliance and Services immediately or Metro-North Rail Traffic Controller during off-hours.
10. The Contractor is responsible to respond to and clean up spills in accordance with the NYSDEC DER-10, NYSDEC CP-51, NYCRRR regulations. See Section 02 61 00, Testing Removal and Disposal of Soils. Contractor is responsible for final closure report. Final Closure Report is to be submitted to METRO-NORTH Environmental Compliance and Services for approval prior to submittal to NYSDEC or governing regulatory agency.

E. The Plan must address the disconnection of sanitary, storm or petroleum storage/delivery systems
1. The Contractor shall notify the Engineer prior to disconnection of any petroleum storage or delivery, storm, sanitary or remedial system piping or tank system (excluding fill ports when fueling a tank).
2. Pipelines that are not in service or are on standby service for extended periods must be properly capped, blank-flanged, and marked/labeled. This effort is to minimize any potential for spills.
3. The Contractor shall provide the following information to the Engineer:
    a. Type of piping being disconnected
    b. Location of disconnection
    c. Date and time of proposed disconnection and expected duration
    d. Reason for disconnection
    e. Plan for shutting off flow, providing diversion piping, etc.

F. Spill Clean-up

1. The Contractor shall be responsible for reporting and shall bear all costs for immediate clean–up and disposal of spilled materials or liquids. The Contractoris responsible to respond to and clean up spills in accordance with the NYSDEC and NYCRRR regulations. The Contractor shall provide the Metro-North Department of Environmental Compliance and Services with all spill numbers and other pertinent information.
2. The Contractor is responsible for the Final Closure Report. The Final Closure Report is to be submitted to METRO-NORTH Environmental Compliance and Services for approval prior to submittal to NYSDEC DER-10 and governing regulatory agency.
3. Metro-North Department of Environmental Compliance and Services reserves the right to take over such cleanup of spills at the Contractor's expense if not performed in a reasonable and timely manner (within two weeks depending on spill size). Remediation of spills will be performed by Metro-North's On-Call Spill Clean-Up Contractor subject to the Terms and Conditions of the Contract. All of the costs of the remediation shall be borne by the Contractor including removal, transportation, and disposal of the contaminated materials.

APPENDIX A:
(Sample of Spill Prevention & Response Plan) See next page

APPENDIX A:
(Sample of Spill Prevention & Response Plan)

SPILL PREVENTION & RESPONSE PLAN

The purpose of this plan is to ensure that adequate pollution control and spill prevention will be provided for the above project. This plan provides information on the policy and procedures in the event of a hazardous material or petroleum spill or leak. (INSERT NAME OF CONTRACTOR) will comply with all applicable rules and regulations in preventing, containing, controlling, reporting and cleaning up any spills.

Special measures will be used to prevent contamination of the ground from the storage and movement of fuel, gasoline, oils, cleaning fluids, form oil, and other petroleum products and hazardous materials used during the project.

A. Liquids:

Nothing is to be disposed into a manhole or catch basin and no piping or sanitary or stormwater connections or disconnections are to be made without specific written permission from the Resident Engineer and Metro-North Environmental Compliance Department.

The potential avenues for release for liquid materials include, but are not limited to:

1. Leaks in storage tanks and containers.
2. Leaks in hoses used during pumping operations.
3. Leaks resulting from disconnection of piping, piping system, or tank system.
4. Accidental spills occurring at the beginning or end of pumping operations residual liquids remaining in pumps and hoses.
5. Overspray from various processes.

Holding tanks, pumps, hoses, drums, containers and connections will be inspected for leaks prior to usage. Additionally, operators must complete a daily equipment checklist prior to use of all equipment and machinery. Any equipment or machinery that is not functioning properly must be removed from service and returned only after all necessary repairs have been made. For example, if a hose leak develops, pumping operations will be stopped until the situation is corrected. If a tank leak develops, tank contents will be pumped into a second holding tank and the leaky tank repaired or replaced.

Holding tanks will be placed on polyethylene sheeting to contain any spilled materials. The edges of the liner will be draped over a wooden frame to create a catch basin capable of holding 110% of total contents within the bermed area.

Drums will be placed on containment pallets or wood pallets on a polyethylene sheeting and then covered to protect against inclement weather or standing water.

During pumping or handling of liquids, when there is a potential for spillage, measurers will be taken to contain potential spills using drip pans, polyethylene sheeting,

or absorbent materials. Pumps and hoses will be placed on polyethylene sheeting to collect any spills during pumping operations. Pumping operations will be conducted carefully and monitored continually for leaks and spills.

Prior to any disconnection (both temporary and permanent) of any storm, sanitary, petroleum storage/delivery, or remedial system piping, advance notification will be given to Metro-North. Pipelines that are not in service or are on standby service for extended periods will be properly capped, blank-flanged, and marked.

Absorbent booms and materials will be available to contain the release of liquids in the event that the polyethylene containment is inadequate.

Used spill collection material (i.e. absorbent booms, polyethylene sheeting, ground cloths, etc.) will be disposed of in fifty-five (55) gallon drums. The fifty-five (55) gallon drums will then be disposed of as per applicable State and Federal regulations and in accordance with the Contract documents using transporters and disposal sites on Metro-North's approved list.

B. Equipment Maintenance:

Equipment maintenance will be performed over ground cloths or polyethylene sheeting to prevent contamination during routine maintenance.

C. Environmental Monitoring:

Visual site inspections will be conducted daily by the superintendent to assess the condition of the site. The perimeter of the site will be inspected to check for defects in the construction fence or sediment control devices, if present. If any defects are noted, the problem will be corrected immediately.

Liquid containers and secondary containments will be inspected to assure that the containers have not leaked and are continually capable of containing the materials.

Surface and ground water will be monitored visually for surface sheens indicating petroleum contamination. There is no anticipation of encountering ground water, but in the event that ground water is encountered, it will be tested before being discharged and all necessary permits will be obtained, and protective measures put in place before dewatering will begin.

D. Spill Response Procedures:

Spill protection and proper safety procedures will be employed if a spill occurs on site. All employees working at the site will be trained with respect to:

1. Worker awareness

2. Spill response

3. Maintaining sufficient materials to handle a spill

At a minimum this training will include instruction in the following areas:

1. Movement to Safe Locations

2. Assessment of the Spill

3. Requesting Assistance

4. Sealing off the Spill

5. Identifying Potential Hazards (Material Safety Data Sheets are to be kept on site for all materials and are to be consulted for purposes of identifying appropriate clean up procedure).

6. Notification to Metro-North and Regulatory Agencies

8. Preparing a Plan of Action

9. Containing the Spill (if it is safe to do so)

10. Cleaning up the Spill

All field personnel are trained for spill control and emergency response and are familiar with the use and operation of PPE, respirators, first aid and fire protection equipment

E. Initial Response:

1. In the event of a spill, all work in the immediate area near the spill will stop.
2. All possible sources of ignition, including anything that could produce a spark, flame or static electricity must be turned off.
3. The MSDS sheet for the spilled material should be consulted for cleanup procedures. If the MSDS is not available, then the spilled material should be considered hazardous.
4. Emergency phone numbers to use in the event of a spill are provided on the last page of this plan. All spills will be immediately reported to Metro-North, Karen Timko – (914) 461-0592 (office), (917) 225-6250 (cell), and then to the Resident Engineer. All spills on Metro-North property must be reported to the Resident Engineer and the Metro-North Department of Environmental Compliance & Services within one and a half (1 ½ hours). The Metro-North Department of Environmental Compliance and Services is to be advised of all spills regardless of size.
5. If a spill occurs off the jobsite, and it goes into or has the potential to enter navigable waters, the National Spill Response Center will be notified.
6. NYSDEC requires that all releases of petroleum must be reported to the NYSDEC Spill Hotline unless ALL of the following conditions are met:
    i. The spill is known to be less than five (5) gallons; and
    ii. The spill is contained and under the control of the spiller; and

iii. The spill has not and will not reach water or land; and

iv. The spill is cleaned up within two (2) hours of discovery.

v. In such cases documentation that all of these conditions were met must be prepared with a copy supplied to the Resident Engineer and the Metro-North Department of Environmental Compliance & Services.

F. Site Evaluation and Personal Protection:

1. Prior to any action, an initial site evaluation will be performed to determine if emergency protective measures are necessary. The initial site evaluation if a relatively rapid screening process. The evaluation should consider the urgency of the situation, type of incident, proximity to waterways, availability of resources, and the level of protection required for personal safety.

2. Based on the available information the initial determinations will include:

i. Imminent or potential hazard to public health and the environment.

ii. Immediate need for protective actions to prevent or reduce the impact on public health and environment

iii. Actions required to protect the health and safety of the site personnel.

3. Of particular concern are the dangers of fire, explosion, oxygen, deficient atmosphere and contamination of waterways, airborne contaminants, or pooled hazardous substances that could affect workers during subsequent operations.

4. The levels of protection are based upon the degree of protection provided:

i. *Level A* - worn when the highest degree of skin, eye, and respiratory protection is required.

ii. *Level B* – selected when the highest level of respiratory protection is required but a lesser degree of skin protection is required

iii. *Level C* – used when the type of airborne substance is known, the concentration is measured, and the criteria for using an air-purifying respirator is met

iv. *Level D* – used when there is no skin or respiratory hazard

5. The level of protection selected will be based primarily upon:

v. The type and concentration of the substance in the ambient air and its Toxicity.

vi. The potential for exposure to airborne substances, liquid splashes, or other direct contact with the material due to the work being performed.

6. Materials on this project will be sampled and analyzed to be characterized for proper disposal. This will allow for the determination of the proper level of protection and special equipment.

G. Monitoring, Containment and Clean-up:

1. The immediate concerns of site personnel in physical or atmospheric conditions that could affect their safety. After careful evaluation of these conditions, priorities for monitoring the potential hazards will be established. Instruments used for performing normal project operations will be utilized for monitoring air conditions. These include personal and perimeter air monitors. One or more of the following instruments will be used: Photoionization Device – HNU, Triple Detector – MSA 361, and Escort Elf Air Sampling Pump.

2. A supply of spill containment products will be maintained on site. These materials will include:

i. Absorbent booms, mats, materials

ii. Containment booms

iii. Pipe and tank bandages and plugs

iv. Polyethylene sheeting

3. In addition to using specific spill containment products noted above, standard health and safety supplies, and heavy equipment used during the normal operation of work will be utilized as necessary. These items include pumps, pneumatic tools, and heavy equipment such as excavators, backhoes and bulldozers.

H. Spill Containment:

b. In a spill occurs, workers will take immediate action to stop the leak or spill if safe to do so and make sure it poses no danger to human health and safety. Absorbent booms and materials will be deployed to contain the spilled materials on land or water. Excavation equipment will be used to prepare dikes and berms if necessary.

c. Containment of a release will include consideration of any conditions that will render the containment ineffective or unsafe. These include weather, local drainage, man-made conditions such as wells or storm drains, leakage from the containment devices and deployment of the devices.

I. Spill Clean-up:

d. Liquids will be pumped into holding tanks or NYSDOT approved salvage drums until the material can be analyzed for disposal.

(Note: use explosion proof pumps for flammable liquids).

e. Any visibly contaminated soil or other materials (e.g. ballast) will be removed, stockpiled on polyethylene sheeting, and covered to prevent any runoff from rainfall. The material will be sampled to characterize it for proper disposal.

J. Spill Report:

f. All spills will be documented in the field notes and reports in the daily reports. A spill report will be prepared and submitted to the Engineer and Metro-North Department of Environmental Compliance & Services within 24 hours.

g. The report will include:

i. Description of the material spilled (including identity, quantity, MSDS)

ii. Exact time, location, and a description of the area involved

iii. Receiving stream or waters

iv. Cause of the incident, equipment and personnel involved

v. Injuries or property damage

vi. Duration of discharge

vii. Containment procedures initiated

viii. Summary of any outside contact other than with the Engineer (e.g. with news media, government agencies, etc.)

ix. Description of the clean-up procedures employed or to be employed including the disposal location of contaminated materials

x. Description of the actions taken to prevent a recurrence, including a detailed investigation of cause

xi. A Spill Closure Report provided to Metro-North for review prior to submittal to the regulatory agency.

EMERGENCY PHONE NUMBERS

(NOTE: THIS SECTION HAS TO BE ADJUSTED TO PROVIDE APPROPRIATE LOCATIONS AND CONTACT NUMBERS FOR THE SPECIFIC PROJECT, THE FOLLOWING ARE JUST EXAMPLES)

Fire, Police and Ambulance	911	
MTA Police	(888) 682-9117 (888) MTA-911PD (212) 878-1000 X6911 (from in house phones only	
(INSERT LOCAL FIRE DEPARTMENT)	**(INSERT NUMBER)**	
(INSERT LOCAL POLICE DEPARTMENT)	**(INSERT NUMBER)**	
(INSERT LOCAL EMS)	**(INSERT NUMBER)**	
METRO-NORTH	**Main / Office Number**	**Cell Number**
Operations Control Center	(212) 340-2050	
Environmental Compliance Services, Karen Timko	(914) 461-0592	(917) 225-6250
Metro-North Resident Engineer, **(INSERT NAME)**	**(INSERT NUMBER)**	**(INSERT NUMBER)**
Metro-North Project Manager, **(INSERT NAME)**	**(INSERT NUMBER)**	**(INSERT NUMBER)**
SPILL CONTRACTOR	**Main / Office Number**	**Cell Number**
(INSERT SPILL CONTRACTOR INFORMATION)	**(INSERT NUMBER)**	**(INSERT NUMBER)**
POISON CONTROL		
Poison Control Center	(800) 343-2722	
Chemtrec	(800) 424-9300	
AGENCIES		
NYSDEC Spill Hotline	(800) 457-7362	
National Spill Response Center	(800) 424-8802	
EPA Emergency Response Team	(908) 321-6660	
HOSPITAL		
(INSERT LOCAL HOSPITAL INFORMATION & ATTACH DRIVING DIRECTIONS)	**(INSERT NUMBER)**	

END OF SECTION

SECTION 01 41 00 - REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 RELATED SECTIONS

A. Section 01 81 13 - Sustainable Design Requirements.

B. Section 01 31 00 - Project Management and Coordination.

C. Section 01 33 00 - Submittal Procedures.

1.3 SUMMARY

A. This Section specifies regulatory requirements for:
   1. Town of North Salem permits, inspections, and approvals.
   2. Construction Management Meeting.
   3. Storm Water Pollution Prevention Plan (SWPPP).
   4. Construction Management Plan.
   5. Temporary Construction Permit.
   6. Town of North Salem Building Permit.
   7. Electrical Permit and Certificate of Inspection.
   8. Erosion Control Plan.
   9. Demolition Permit.
   10. Flammable and Combustible Liquids Permits.
   11. Encroachment approvals.
   12. Sprayed Insulation Permit.
   13. Certificate of Use and Occupancy.
   14. Air Pollution Control Ordinance permits and certificates.
   15. Licensed tradesmen.
   16. Excavation and grading bonds.

B. State of New York permits, inspections, and approvals.
   1. Storm Water Management Program.
   2. Hazardous air pollution control.
   3. Lead abatement.
   4. “Green and Clean” State buildings.

C. United States Government permits, inspections, and approvals.
   1. Periodic OSHA compliance inspections.
   2. Controlling toxic substances and hazardous materials.

D. Obtaining legal agreements for patented devices, materials, and processes.

1.4 REFERENCES

A. Abbreviations and Acronyms:
1. ACM: Asbestos containing material.
2. ADA: Americans with Disabilities Act.
3. ADAAG: Americans with Disabilities Act Accessibility Guidelines.
4. AHERA: Asbestos Hazard Emergency Response Act.
5. ACM: Asbestos containing material.
6. BMPs: Best management practices.
7. CFR: Code of Federal Regulations.
8. EPA: Environmental Protection Agency.
9. IBC: ICC International Building Code
10. ICC: International Code Council.
11. NESHAPs: National Emission Standards for Hazardous Air Pollutants.
12. NPDES: National Pollutant Discharge Elimination System.
13. OSHA: Occupational Safety and Health Administration.
14. PACM: Presumed asbestos containing material.
15. PCBs: Polychlorinated Biphenyls.
16. RACM: Regulated asbestos containing material.
17. RCRA: Resource Conservation and Recovery Act.
18. ROW: Right-of Way.
19. SWPPP: Storm Water Pollution Prevention Plan.
20. U.S.C.: United States Code.
21. VOC: Volatile organic compounds.

B. Definitions:
1. Asbestos: The asbestiform varieties of serpentine (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite- tremolite.
2. Asbestos Containing Material (ACM):
   a. Category I Nonfriable Asbestos-Containing Material: Asbestos- containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos as determined using the Polarized Light Microscopy method specified in Appendix E of 40 CFR 63.
   b. Category II Nonfriable Asbestos-Containing Material: Any material, excluding Category I nonfriable asbestos-containing material, containing more than 1 percent asbestos as determined using the Polarized Light Microscopy method specified in Appendix E of 40 CFR 63, that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.
3. Authority Having Jurisdiction (AHJ): Building Code officials, zoning officials, inspectors, and government and regulatory agencies given the authority to protect the public's health, safety, and welfare.
4. Friable: Material that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.
5. Friable Asbestos Material: Material containing more than 1 percent asbestos as determined using the Polarized Light Microscopy method specified in Appendix E of 40 CFR 63.
6. Operating Engineer: A person who works for a company that occupies all or the major part of a building in the Town of North Salem and is responsible for the operation high pressure steam or hot water boiler(s) or engine(s) in which the safety valve(s) are set higher than 15

psi and the developed equipment rating is more than 30 HP, or refrigeration or equipment generating chilled water of over 50 tons capacity, or air compressor(s) rated at more than 75 HP.

7. Polychlorinated Biphenyls (PCBs): Any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contains such substance, including, but are not limited to: dielectric fluids; solvents; oils; waste oils; heat transfer fluids; hydraulic fluids; paints or coatings; sludges; slurries; sediments; dredge spoils; soils; materials containing PCBs as a result of spills; and other chemical substances or combinations of substances, including impurities and byproducts and any byproduct, intermediate, or impurity manufactured at any point in a process.
8. Regulated Asbestos Containing Material (RACM): Any of the following categories of asbestos:
    a. Friable asbestos material.
    b. Category I nonfriable asbestos containing material (ACM) that has become friable.
    c. Category I nonfriable asbestos containing material (ACM) that will be or has been subjected to sanding, grinding, cutting, or abrading.
    d. Category II nonfriable asbestos containing material (ACM) that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on it during regulated demolition or renovation operations.
9. Right-of Way: Land expressly reserved for vehicle/pedestrian traffic or utilities.
10. Volatile Organic Compounds (VOC): Generally meant to refer to organic chemical compounds that have high enough vapor pressures under normal conditions to significantly vaporize and enter the atmosphere.
    a. The U.S. Environmental Protection Agency has composed the following definition for regulatory, not necessarily scientific, purposes: "VOC means any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions (and then lists several other exemptions)."

C. Reference Standards:
1. Town of North Salem:
    a. Town of North Salem Construction Management Protocol.
    b. Department of Public Works:
        1) Standard Construction Details.
        2) Town of North /th Salem Specifications.
    c. Municipal Code of the Town of North Salem, New York; http://localbuildingcode.com/PurdysNewYorkBuildingCode
    d. The Town of North Salem Supplemental Building Code,
        1) The Town of North Salem Building Code – Administration and Enforcement.
        2) The Town of North Salem General Construction Code.
        3) The Town of North Salem Mechanical Code.
        4) The Town of North Salem Electrical Code.
        5) The Town of North Salem Fire Code.
        6) The Town of North Salem Smoke Control Code.
        7) The Town of North Salem Property Maintenance Code.
    e. Phase II Storm Water Management Program.
    f. Traffic Ordinance of the Town of North Salem.
    g. Zoning Ordinance of the Town of North Salem.
2. Illuminating Engineering Society of North America's (IES):
    a. The Lighting Handbook.
3. State of New York:

a. New York State Department of Environmental Conservation (NYSDEC):
   1) Regulations. http://www.dec.ny.gov/regulations/regulations.html
      a) State Pollution Discharge Elimination System (SPDES):
         (1) Permit No. GP-0-10-001 - SPDES General Permit for Stormwater Discharges from Construction Activity.
         (2) Permit No. GP-0-10-002 - SPDES General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4s).

b. New York State Department of State:
   1) Division of Code Enforcement and Administration, http://publicecodes.cyberregs.com/st/ny/st/index.htm:
      a) Building Code of New York State.
      b) Residential Code of New York State.
      c) Existing Building Code of New York State.
      d) Fire Code of New York State.
      e) Mechanical Code of New York State.
      f) Energy Conservation Construction Code of New York State.
      g) Property Maintenance Code of New York State.

c. New York State Department of Transportation (NYSDOT):
   1) NYSDOT Standard Specifications (U.S. Customary Units). https://www.dot.ny.gov/main/business- center/engineering/specifications.
   2) New York State Standard Sheets (U.S. Customary Units). https://www.dot.ny.gov/main/business-center/engineering/cadd-info/drawings/standard-sheets-us.
   3) New York State Supplement to the Manual on Uniform Traffic Control Devices for Streets and Highways (2009 Edition). https://www.dot.ny.gov/divisions/operating/oom/transportation- systems/traffic-operations-section/mutcd.

d. New York State Energy Research and Development Authority (NYSERDA):
   1) New York State Executive Order No. 111 – "Green and Clean" State Buildings and Vehicles Guidelines.

e. Official Compilation of the Rules and Regulations of the State of New York (NYCRR).
   1) The New York State Department of Environmental Conservation (NYSDEC):
      a) 6 NYCRR Part 201 General Provisions.
      b) 6 NYCRR Part 203 Indirect Sources Of Air Contamination.
      c) 6 NYCRR Part 231 Implementation Guidance.
   2) The New York State Department of Health (NYSDOH):
      a) 10 NYCRR Part 67 - NYS Regulations for Lead Poisoning Prevention and Control.
   3) The New York State Department of Labor (NYSDOL):
      a) 12 NYCRR Part 23 - Protection in Construction, Demolition and Excavation Operations.
      b) 12 NYCRR Part 56 – Asbestos.
   4) The New York State Department of Public Service (NYSDPS):
      a) 16 NYCRR Part 753 - Protection of Underground Facilities.

4. United States Government:
   a. Department of Justice:
      1) 2010 ADA Standards for Accessible Design,
      2) 28 CFR 35 - Nondiscrimination on the Basis of Disability in State and Local Government Services

3) 28 CFR 36 – Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities.

b. Environmental Protection Agency (EPA):
1) 40 CFR 123 and 124 - National Pollutant Discharge Elimination System Permit Application Regulations for Storm Water Discharges; Final Rule.
2) 40 CFR 9, 122, 123, and 124 - National Pollutant Discharge Elimination System—Regulations for Revision of the Water Pollution Control Program Addressing Storm Water Discharges; Final Rule
3) 40 CFR 61 National Emission Standards for Hazardous Air Pollutants.
4) 40 CFR 763 Asbestos-Containing Materials in Schools; Final Rule and Notice.

c. Federal Highway Administration (FHWA):
1) Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) with New York State Supplement.

d. Federal Transit Administration (FTA):
1) 49 CFR 661 Buy America Requirements.

e. Occupational Safety and Health Administration (OSHA):
1) 29 CFR 1910 Occupational Health and Safety Standards.
2) 29 CFR 1926 Safety and Health Regulations for Construction.

f. United States Code:
1) 15 U.S.C. Section 2601 et seq.
a) Federal Toxic Substances Control Act [P.L. 94-469, P.L. 99- 519, as amended].
b) Asbestos Hazard Emergency Response Act (AHERA).
2) 33 U.S.C. Section 1251 et seq.
a) Water Quality Act of 1987 [P.L. 100-4].
b) Clean Water Act of 1977 [P.L. 95-217].
c) Federal Water Pollution Control Act Amendments of 1972 [P.L. 95-500].
3) 42 U.S.C. Section 2000e et seq.
a) Equal Employment Opportunity:
(1) Civil Rights Act of 1964 [P.L. 88-352 (Title VII - Equal Employment Opportunity)], as amended.
4) 42 U.S.C. Section 6901 et seq.
a) Resource Conservation and Recovery Act (RCRA) [P.L. 94- 580].
5) 42 U.S.C. Section 7401 et seq.
a) Air Pollution Prevention and Control.
(1) Clean Air Act [P.L. 95–95], as amended.
6) 42 U.S.C. Sections 12101–12213.
a) Equal Opportunity for Individuals with Disabilities.
(1) Americans with Disabilities Act of 1990 (ADA)[P.L. 101-336].
(2) ADA Amendments Act of 2008 [P.L. 110–325].
7) 47 U.S.C. Section 225.
a) Telecommunications Services for Hearing Impaired and Speech-impaired Individuals.
(1) ADA Amendments Act of 2008 [P.L. 110–325, P.L. 104– 104, Pub. L. 111–260]
8) 47 U.S.C. Section 611.
a) Closed-captioning of Public Service Announcements.
(1) Americans with Disabilities Act (ADA) [P.L. 98-549, P.L. 101–336].
9) 49 U.S.C. Section 5323(j).
a) Buy America Act [P.L. 103–429].

10) 49 U.S.C. Section 5333(b).
a) Federal Transit Act

1.5 ADMINISTRATIVE REQUIREMENTS

A. Town of North Salem Construction Management Meeting:
1. Before the Town of North Salem will issue building or excavation permits the Contractor must meet with the Town of North Salem Commissioners of Building, Public Safety, Public Works, Traffic, and Planning; and the Environmental Officer, to review the Construction Management Plan for the Project described in the Town of North Salem Construction Management Protocol.

B. Preconstruction Conference:
1. At the Preconstruction Conference specified in Section 01 31 00 Project Management and Coordination, regulatory requirements will be discussed, including but not limited to:
a. Equal Employment Opportunity (EEO) and affirmative action requirements.
b. Requirements of labor provisions stipulated by the U.S. Department of Transportation (DOT) as required.
c. Laws, codes, traffic regulations, permit requirements, and other public agencies' regulations.
1) Buy America Act requirements.
2) New York State Executive Order No. 111.
3) Other laws, codes, regulations, and requirements.

1.6 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Obtain, pay for, and comply with all necessary local, State, and Federal permits, licenses, and inspections.
2. Metro-North:
a. Certificate of Use and Occupancy:
1) New buildings in the properties of Metro-North may not be used or occupied in whole or in part until a Certificate of Use and Occupancy has been issued by Metro-North.
a) This certificate will certify legal use and occupancy and the purpose(s) for which the building or structure may be used.
b) The Certificate of Use and Occupancy will specify the use group, the fire grading, the maximum live load on all floors, the occupancy load in the building and all parts thereof, and any special stipulations and conditions of the building permit.
3. Town of North Salem Permits, Inspections, and Approvals:
a. Storm Water Pollution Prevention Plan (SWPPP):
1) Each Contractor and Subcontractor identified in the SWPPP who will be involved in soil disturbance and/or storm water management practice installation must sign and date a copy of the following certification statement before undertaking any land development or redevelopment activity: "I certify under penalty of law that I understand and agree to comply with the terms and conditions of the Storm Water Pollution Prevention Plan. I also understand that it is unlawful for any person to cause or contribute to a violation of water quality standards."

2) The certification must include the name and title of the person providing the signature, address and telephone number of the contracting firm; the address or other identifying description ofthe site; and the date the certification is made.
3) Keep a copy of the SWPPP at the Site during construction from the date of initiation of construction activities to the date of final stabilization and submit a copy to the Engineer for information.

b. Construction Management Plan:
1) This Project is subject to the Town of North Salem Construction Management Protocol, which requires a Construction Management Plan for development that involves exterior site disturbance and construction, and this Plan must include strict controls for the following:
a) Construction related impacts to adjacent properties such as hours of operation of construction vehicles and construction work on the site, hours of deliveries to the site, location of deliveries, requirements for loading/unloading and storage of materials on the Site.
b) Length of time public street travel lanes will be encumbered, and public sidewalk closings or pedestrian diversions to ensure the safety of pedestrians.
c) Controls on the impact of run-off from the site on the City and County storm drainage system and adjacent properties, such as from the wash down of delivery vehicles departing the Site.
(1) Delivery vehicles departing the Site must be cleaned on pads located on the Site, and the wash-down water drainage must be properly filtered.
d) Noise.
e) Pest control.
f) Street cleaning and control of "fugitive dust" air pollution.
g) Site security.
h) Scheduling of periodic meetings with residents and City staff to coordinate project construction and keep residents advised.
2) Include as part of the Construction Management Plan, a Parking Plan for construction workers prepared in coordination with the Town of North Salem.
3) Include as part of the Construction Management Plan, a Fugitive Dust Plan for protecting adjacent properties.
4) Coordinate the hours permitted for construction with the Town of North Salem Commissioners of Building, Public Safety, and Public Works.
5) Submit the Construction Management Plan to the Town of North Salem Commissioners of Building, Public Safety, Public Works, Traffic, and Planning; and to the Environmental Officer for approval and send a copy of the approved Construction Management Plan to the Engineer for information.

c. Temporary Construction Permit:
1) In accordance with The Town of North Salem General Construction Code, prior to commencing construction operations, submit plans and specifications indicating the design and construction of sidewalk sheds, truck runways, foot bridges, guard fences, and similar temporary devices required by the operation to the Town of North Salem Building Department as required by the Town of North Salem General Construction Code for approval.
2) Do not commence operations until the approval of the plans and specifications by the Town of North Salem Building Commissioner is received and submit a copy of the plans and specifications and their approval to the Engineer for information.

a) Town of North Salem Building Permit:

(1) In accordance with The Town of North Salem Supplemental Building Code, work associated with underpinning including excavation, construction, addition, repair, alteration, removal or demolition cannot be commenced; topsoil, earth, gravel, or other substance cannot be removed from or added to the premises; the location, occupancy, use or maintenance of any wall, building, or structure cannot be changed; and installation, repairs or alterations regulated by the Code cannot be made to any plumbing, gas piping, electric wiring, elevators, refrigeration, air conditioning, ductwork, or fire- suppression equipment until a permit for this work has been applied for and obtained from the Town of North Salem Building Commissioner.

b) It is unlawful to use such equipment on City property until accepted and authorized for such use by the Town of North Salem Building Commissioner.

3) The Town of North Salem Building Commissioner will receive applications, including copies of plans and specifications, and issue permits for the erection and alteration of adjacent buildings and structures, including underpinning, examine the premises for which such permits have been issued, and enforce compliance with the provisions of The Town of North Salem Supplemental Building Code.

a) Posting of Permit and Site Plans:

(1) Keep a copy of the building permit open to public inspection on the site of operations during the entire time of prosecution of the work and until completion of the work and submit a copy of the Building Permit to the Engineer for information.

(2) If separate permits are required for mechanical, plumbing, or electrical work, copies of such permits must also be kept open to public inspection on the site of operations until final authorization is obtained.

b) Notice of Start:

(1) At least 24 hours prior to the start of work under a building permit give notice to the Town of North Salem Building Commissioner.

4) Submit a copy of the Building Permit to the Engineer for information.

d. Fire Suppression Permits:

1) Apply for a Fire Suppression Permit to the Commissioner on notarized forms and pay the associated fees at no increase in the Contract Price.

a) Submit plans and specifications for the installation, extension, modification, alteration or removal from service of automatic fire, alarm and detection systems to the Division of Fire Prevention and the Department of Building prior to the commencement of the work.

2) Submit copies of the Fire Suppression Permit to the Engineer for information.

e. Erosion Control Plan:

1) Furnish storm water management and erosion control conforming to the requirements of the Town of North Salem Phase II Storm Water Management Program.

2) Prior to commencing construction work involving disturbance of land on the Site, submit an Erosion Control Plan complying with the requirements specified in the Town of North Salem General Construction Code to the Town of North

Salem Building Department for approval, and submit a copy of the Erosion Control Plan and its approval to the Engineer for information.

f. Flammable and Combustible Liquids Permit:
   1) In accordance with The Town of North Salem Fire Code, a permit is required for storing or handling of more than 55 gallons of corrosive liquids; or more than 500 pounds of oxidizing materials; or more than 500 millicuries of radioactive material; or more than 2000 cubic feet of flammable compressed gas; or 10 pounds or more of organic peroxides; or 500 pounds or more of ammonium nitrate; or any amount of highly toxic material or poisonous gas.
   2) Apply for a Flammable and Combustible Liquids Permit from the Town of North Salem Commissioner of Public Safety, and pay the fees associated with the Permit at no increase in the Contract Price.
   3) Submit a copy of the Flammable and Combustible Liquids Permit to the Engineer for information.

g. Encroachment Approvals:
   1) In accordance with The Town of North Salem General Construction Code, sidewalk sheds, underpinning, and other temporary protective guards and devices may only project beyond the interior and street lot lines if approval is obtained from the Town of North Salem Building Commissioner, and if necessary the approval of the affected adjacent property owner.
   2) Do not encroach beyond the interior and street lot lines until the approval by the Town of North Salem Building Commissioner and affected property owners is received and submit a copy of the approvals to the Engineer for information.
   3) A permit from the Town of North Salem is required by Metro-North for underpinning activities outside of the properties ofMetro-North.

h. Air Pollution Control Ordinance Permits and Certificates:
   1) Comply with the Town of North Salem Air Pollution Control Ordinance appearing in Municipal Code of the Town of North Salem, New York, which requires maintaining a reasonable degree of purity of the air resources of the City consistent with applicable Federal, State and City law.
   2) Permits, operating certificates, registration certificates, or certificates of instruction required by the Town of North Salem Air Pollution Control Ordinance must be displayed in a clean, transparent cover and posted in a prominent place in the vicinity of the equipment on the premises designated in the permit or certificate, or in the vicinity of the equipment which will be operated or supervised.

4. State of New York Permits, Inspections, and Approvals:
   a. The United States Environmental Protection Agency has delegated authority to the New York State Department of Environmental Conservation (NYSDEC) to issue permits for many sources subject to New Source Performance Standards (NSPS) or National Emission Standards for Hazardous Air Pollutants (NESHAPS) in accordance with Part 201 of the NYSDEC Regulations.
   b. Storm Water Management Program:
      1) In compliance with the NYSDEC regulations, the Town of North Salem has established a Phase II Storm Water Management Program.
      2) Connections to the Town of North Salem' municipal separate storm sewer system (MS4), and the regulation of non-storm water discharges to the MS4 to the maximum extent practicable, are regulated by the Municipal Code of the Town of North Salem, New York as required by federal and state law.

3) Methods for controlling the introduction of pollutants into the MS4 have been established in order to comply with requirements of the New York State Department of Environmental Conservation's (NYSDEC) SPDES General Permit (GP-02-02) for municipal separate storm sewer systems.

4) Persons subject to a construction activity SPDES storm water discharge permit must comply with the provisions of the permit, and proof of compliance with the permit may be required in a form acceptable to the city engineer prior to the allowing of discharges to the MS4.

c. Hazardous Air Pollution Control:

1) The United states Environmental Protection Agency (EPA) has delegated implementation and enforcement of the National Emission Standards for Hazardous Air Pollutants (NESHAPs) codified in 40 CFR 61 and 40 CFR 63 to the New York State Department of Environmental Conservation (NYSDEC).

2) Asbestos Abatement:

a) For work involving the removal, encapsulation, enclosure, repair, or disturbance of friable or non-friable asbestos, or handling of asbestos material that may result in the release of asbestos fibers, comply with the requirements of 12 NYCRR Part 56.

(1) Comply with the OSHA asbestos regulations that protect private sector workers, and public employees in States with OSHA-approved State plans.

b) At least 10 calendar days prior to commencement of regulated asbestos abatement operations to prepare work areas and construct enclosures, notify the Asbestos Control Bureau and occupants in writing or using the online form, unless waived in writing by the Commissioner or his or her duly authorized representative.

(1) Pay applicable fees.

(2) Only asbestos Contractors licensed for the particular task can legally perform the work.

c) If the station building or structure to be demolished or renovated has not been inspected during the past year by an building inspector certified in accordance with the requirements specified in the Asbestos Hazard Emergency Response Act (AHERA) Model Accreditation Plan (MAP), have a currently AHERA-certified building inspector inspect the building or structure to be demolished or renovated and prepare a Phase I asbestos survey.

(1) In either case, obtain a copy of the inspection survey report to determine if asbestos is present; and, if so, to determine the amount of friable asbestos containing material (ACM) present.

(2) Submit a copy of the Asbestos Inspection Report prepared by the currently AHERA-certified building inspector to the Engineer for information.

d) If the asbestos survey determines the building/structure that is to be demolished, renovated, remodeled, or have repair work contains ACM, presumed asbestos containing material (PACM), suspect miscellaneous ACM assumed to be ACM, or asbestos material impacted by the work, have a licensed asbestos abatement Contractor remove the asbestos.

(1) Remove regulated asbestos containing material (RACM) before demolition or renovation activity begins that would break up, dislodge, or similarly disturb the material or preclude access to the material for subsequent removal.

(2) RACM does not need to be removed before demolition if:
   a. It is Category I nonfriable ACM that is not in poor condition and is not friable.
   b. It is on a facility component that is encased in concrete or other similarly hard material and is adequately wet whenever exposed during demolition.
   c. It was not accessible for testing and was, therefore, not discovered until after demolition began and, as a result of the demolition, the material cannot be safely removed. If not removed for safety reasons, the exposed RACM and any asbestos-contaminated debris must be treated as asbestos-containing waste material and adequately wet at all times until disposed of.
   d. They are Category II non-friable ACM and the probability is low that the materials will become crumbled, pulverized, or reduced to powder during demolition.

(3) When a component that contains, is covered with, or is coated with RACM, is being removed as a unit or in sections:
   a. Adequately wet the RACM exposed during cutting or disjoining operations; and
   b. Carefully lower each unit or section to the floor and to ground level, not dropping, throwing, sliding, or otherwise damaging or disturbing the RACM.

(4) When RACM is stripped from a facility component while it remains in place in the facility, adequately wet the RACM during the stripping operation unless the following conditions exist:
   a. The owner or operator has obtained prior written approval from the Administrator based on a written application that wetting would unavoidably damage equipment or present a safety hazard; and
   b. The owner or operator uses a local exhaust ventilation and collection system designed and operated to capture and remove the particulate asbestos material produced by the stripping, and it exhibits no visible emissions to the outside air.

d. Lead Abatement:
   1) For work involving the assessment and abatement of conditions conducive to lead poisoning, or handling of lead material, comply with the requirements of 10 NYCRR Part 67.
   2) Have an approved laboratory examine paint and any other environmental samples according to generally accepted scientific methods specified by the Commissioner and report the results of the lead analyses to the designated representative in whose jurisdiction the samples were collected and submit a copy to the Engineer for information.
   3) Do not commence lead paint abatement in any designated area of high risk prior to issuance of a written notice and demand for discontinuance of conditions conducive to lead poisoning.
   4) Risk reduction efforts may proceed prior to receipt of a notice and demand.
   5) Upon receipt of a notice and demand for discontinuance of conditions conducive to lead poisoning, such conditions must be abated.

a) The extent of abatement and method(s) used will be determined by the Commissioner or his designated representative, in accordance with applicable laws or rules and regulations.

5. United States Government Permits, Inspections, and Approvals:
   a. Perform the Work of this Contract to at all times be in compliance with OSHA regulations in order to pass OSHA inspections which may be performed.

B. Qualifications:
1. Licensed Tradesmen:
   a. Certain work may only be performed by licensed tradesmen who hold a valid County of Westchester license.
      1) Plumbing:
         a) A Master Plumber licensed by the Westchester County Board of Plumbing Examiners and registered with the Commissioner is required for any work requiring water piping, waste, vent and drain systems, and gas piping and gas appliance installations.
         b) An automatic sprinkler system may be installed without a plumbing permit and by other than a licensed MasterPlumber.
      2) Electrical:
         a) A licensed Master Electrician is required for any work involving electrical wiring, fixtures and appliances (more than 50 volts).
   b. Certain work may only be performed by licensed tradesmen who hold a valid Town of North Salem license.
      1) Hoisting:
         a) In accordance with The Town of North Salem Building Code – Administration and Enforcement, persons or corporations engaged in the business of hoisting are required to hold a valid Town of North Salem license.
      2) Operating Engineers:
         a) In accordance with The Town of North Salem Building Code – Administration and Enforcement, operating engineers are required to be tested, pass inspection, and hold a valid Town of North Salem license issued solely by the Operating Engineer/Refrigeration Operator Examining Board of The Town of North Salem.

1.7 SUBMITTALS

A. Informational Submittals:
1. Submit the following to the Engineer for information in accordance with the requirements of Section 01 33 00, Submittal Procedures:
   a. Test and Evaluation Reports:
      1) Paint and any other environmental samples test report.
   b. Special Procedure Submittals as required:
      1) Storm Water Pollution Prevention Plan (SWPPP).
      2) Construction Management Plan.
         a) Parking Plan.
         b) Fugitive Dust Plan.
      3) Approved Temporary Construction Permit plans and specifications.
      4) Building Permit.
      5) Electrical Permit.

6) Mechanical Permit.
7) Fire Suppression Permit.
8) Approved Erosion Control Plan.
9) Demolition Permit.
10) Flammable and Combustible Liquids Permit.
11) Encroachment approvals.
12) Sprayed Insulation Permit.
13) Asbestos Inspection Report.
14) Copies of excavation and grading bonds.
15) Certificate of Inspection of Heating Equipment.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements:
1. Hazardous Materials:
a. Do not handle or store hazardous materials without notifying the Fire and Police Departments.
2. Readily Combustible Materials:
a. In accordance with the requirements of The Town of North Salem Fire Code, store readily combustible materials in a compact and orderlymanner.
b. Do not store combustible materials closer than 2 feet to electric motors.
c. Do not pile or store combustible material against smoke pipes, flues furnaces, steam pipes, or similar hot items.
d. Store oily waste, rags, or greasy material in metal cans with metal covers.
e. Store painters' drop cloths, linseed oil, turpentine, thinners, open cans of paint, paint brushes soaking in any flammable liquid, and similar combustible coating materials in an approved paint locker or approved storage room.
f. Do not fill, store, or transport Class I or II flammable liquids in glass bottles, jugs, or containers.

B. Packaging Waste Management:
1. Readily Combustible Materials:
a. At the close of each day, bale and stack shavings, excelsior, rubbish, sacks, bags, litter, hay, straw, and combustible waste materials; and remove them from the building, or orderly store them in suitable vaults, or in metal or metal-lined, covered, receptacles or bins in accordance with the requirements of The Town of North Salem Fire Code.
1) Within buildings, do not store readily combustible materials within 2 feet of the ceiling, sprinkler head, or girder, whichever may be lowest; or where exit from the building could be endangered.
2) In the open, do not store readily combustible materials more than 20 feet high, or less than 50 feet from the nearest building.

1.9 WARRANTY/BONDS

A. Bonds:
1. Excavation and Grading Bonds.
a. Before a local Building Permit will be issued for excavation, other than for construction of walls, buildings, and parts of buildings; or before a Building Permit will be issued for the removal of any topsoil, sand, gravel, rock, earth, or other

substance; the Contractor must obtain a performance and indemnity bond for the Permit issued by a surety company or surety, executed, and filed with the City Clerk of the various municipality holding jurisdiction over that individual station as required in a sum required; approved by all required stakeholders.

b. Submit copies of the excavation and grading bonds to the Engineer for information.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. Regulatory Requirements:

1. Metro-North:
   a. Explosives and Blasting:
      1) Explosives and blasting are not allowed by Metro-North in the performance of the Work of this Project.
2. Town of North Salem:
   a. Comply with the Codes, regulations, and ordinances of the Town of North Salem, including but not limited to:
      1) Town of North Salem Construction Management Protocol.
      2) Municipal Code of the Town of North Salem, New York.
      3) The Town of North Salem Supplemental Building Code.
      4) Traffic Ordinance of the Town of North Salem.
      5) Zoning Ordinance of the Town of North Salem.
   b. The Town of North Salem Standard Construction Details and Specifications supersede other conflicting details or specifications in the Contract Documents.
3. State of New York:
   a. Comply with the applicable Codes, regulations, and ordinances of the State of New York, including but not limited to:
      1) Department of State's Codes.
      2) New York State Department of Transportation (NYSDOT) Standard Specifications, Standard Sheets, and Supplement to the Manual on Uniform Traffic Control Devices for Streets and Highways.
      3) Applicable Rules and Regulations of the State of New York (NYCRR).
4. United States Government:
   a. Buy America Act:
      1) Except for those products which are exempt under the specific statutory waivers stipulated in 49 CFR 661, all other products supplied under this Section must comply with the requirements of the Buy America Act.
   b. Equal Employment Opportunity (EEO) and Affirmative Action Requirements.
      1) In compliance with the Civil Rights Act of 1964, do not engage in workplace employment discrimination on the basis of race, color, religion, sex, national origin, status as a qualified individual with a disability, or protected veteran.
   c. Toxic Substances:
      1) Control toxic substances, hazardous materials, and harmful nuclear and x-ray radiation at the Site.
      2) Comply with the Toxic Substance Control Act (TSCA).
         a) Do not use toxic chemical substances, mixtures, equipment, containers, sealants, coatings, or dust-control agents except in accordance with the provisions of the Toxic Substances Control Act (TSCA) as interpreted

by the rules and regulations of 40 CFR 761 for polychlorinated biphenyls (PCBs).

b) Immediately report in writing any toxic chemical substance, mixture, equipment, container, sealant, coating, or dust- control agent found stored within the Project area and stop work in the area until arrangements for the removal of the toxic materials have been made, after which the Contractor may continue to work in the area.

5. Patented Devices, Materials, and Processes:
   a. If designs, devices, materials, or processes covered by patents or copyrights are employed to perform the Work, provide for their use by arranging suitable legal agreements with the patentee or owner of the items.
   b. Defend and hold harmless the Metro-North, and any affected third party from any and all claims for infringement by reason of the use of any such patented designs, devices, materials, or processes, or any trademark or copyright; and indemnify Metro-North (METRO-NORTH) for any costs, expenses, and damages which it may be obliged to pay by reason of any infringement at any time during the prosecution or after completion of the Work.

B. Sustainability Requirements:
   1. New York State Executive Order No. 111:
      a. The Metropolitan Transit Authority (MTA), of which Metro-North is a part, is required to comply with New York State Executive Order No. 111 "Green and Clean" State Buildings and Vehicles Guidelines.
      b. The specific requirements for compliance with New York State Executive Order No. 111 are specified in Section 01 18 13, Sustainable Design Requirements, and in general require the following:
         1) Achieving at least a 20 percent improvement in energy efficiency performance compared to the levels required by the Energy Conservation Construction Code of New York State, as amended.
         2) Designing and constructing new facilities so the building complies with the criteria for a United States Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED®) certification rating, although official application for LEED® certification is not required.
         3) Complying with the criteria specified in New York State Tax Law Section 19 Green Building Tax Credit and 6 NYCRR Part 638, including the following sections:
            a) Section 638.7(d)(1) - Indoor Air Quality Testing.
            b) Section 638.7(d)(2) - Indoor Air Quality Management Plan During Construction.
            c) Section 638.7(d)(3) – Operations and MaintenanceManagement Plan.
            d) Section 638.8 – Commissioning.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:

1. In accordance with the various municipality Construction Code requirements for each station, protect existing and adjacent public and private property from damage incidental to construction operations.

B. Demolition / Removal:
   1. Service Connections:
      a. In accordance with the various municipality Building Code requirements for each station, before demolishing or removing a building notify all utilities having service connections within the building, such as water, electric, gas, sewer and other connections.
      b. The Demolition Permit to demolish or remove a building will not be issued until a release is obtained from the utilities, stating that their respective service connections and appurtenant equipment, such as meters and regulators, have been removed or sealed and plugged ina safe manner.

3.2 ERECTION, INSTALLATION, AND APPLICATION

A. Comply with all local, State, and Federal laws, codes, rules, and regulations applicable during construction activities.
   1. Comply with the applicable OSHA workplace regulations and requirements.
   2. Excavation:
      a. Comply with applicable requirements of OSHA; the State of New York statutes, especially 12 NYCRR Part 23 regarding excavation and NYCRR 16 Part 753 regarding underground utilities; and the Town of North Salem General Construction Code.
   3. Illumination:
      a. Provide and maintain exterior lighting furnishing adequate illumination of driveways and lanes.
         1) Minimize glare and light spillage onto adjacent properties.
         2) Provide illumination foot candle levels prescribed by the Illuminating Engineering Society of North America's (IES) The Lighting Handbook for the particular application.
         3) Illumination is not required for parking areas fenced and barricaded and not used between sunset and sunrise.
   4. Snow Removal:
      a. Clean snow, ice, dirt, debris, and other foreign matter from sidewalks in front of or abutting or adjoining any public street, alley, park, or place within the city; and keep them free from these materials.
         1) If the snowfall ceases or the foreign matter ceases to be deposited in the daytime, and he abutting or adjoining lot or premises is a place of business, or is within a "B," "BR," "CB," "UR," "OR," "CO" or "LI" District of the zoning ordinance, complete the removal within the 2 hours after the fall or deposit
         2) If the snowfall ceases or the foreign matter ceases to be deposited in the daytime, and the abutting or adjoining lot or premises is within any other district of the zoning ordinance, complete the removal within 10 hours.
         3) If the snowfall ceases or the foreign matter ceases to be deposited in the nighttime, and the abutting or adjoining lot or premises is a place of business, or is within a "B," "BR," "CB," "UR," "OR," "CO" or "LI" District of the zoning ordinance, complete the removal before 10:00 the next morning,

4) If the snowfall ceases or the foreign matter ceases to be deposited in the nighttime, and the abutting or adjoining lot or premises is within any other district of the zoning ordinance, complete the removal before 12:00 noon.

b. If the snow and ice on the sidewalk is frozen so hard that it cannot be removed without injury to the sidewalk, distribute ashes, sand, or some other approved abrasive material onto the sidewalk, and as soon as the weather permits, thoroughly clean the sidewalk.

c. Only place the fallen snow that has been removed from the sidewalk area in the gutter.

3.3 SITE QUALITY CONTROL

A. Site Inspections:

1. Periodic Inspection:

a. In accordance with the various municipality Building Codes, a building official may periodically inspect existing work areas for compliance with the law with respect to posting.

1) Alternatively, an inspection report from an authorized licensed professional engineer or architect may be accepted if the inspection and report specify violations of the requirements of the Code with respect to the posting of floor load, fire grading, occupancy load, and use group of the building.

b. Periodic OSHA compliance inspections may be performed.

1) If an OSHA area compliance officer arrives at the Site and requests to see the person in charge to get permission to perform an inspection and evaluation of work place conditions, cooperate with and assist the OSHA area compliance officer.

2. Mandatory Inspections:

a. In accordance with the various municipality Building Codes, a building official will perform the following minimum quantity of inspections:

1) Foundation Inspection: Made after footing trenches are excavated and the necessary forms erected.

2) Mechanical, Plumbing, Fire Protection, and Electrical Inspection: Made after all pipes, ducts, and wiring are in place.

3) Frame and Masonry Inspection: Made after all framing, masonry walls, electrical, mechanical, firestopping, and bracing is in place.

4) Final Inspection: Upon completion of the building, structure, or facility, but before issuance of the Certificate of Use and Occupancy, a final inspection will be made.

B. Non-Conforming Work:

1. Stop-Work Order:

a. Upon notice by Stop-Work Order from Metro-North or any various municipality managers that work on any station that is being prosecuted contrary to the provisions of various Building Code, or in an unsafe and dangerous manner, immediately stop work.

b. The stop-work order will be in writing and will be given to the owner of the property involved, or to the owner's agent, or to the person doing the work; and will state the conditions under which work may be resumed.

END OF SECTION

Section 01 43 00
METRO-NORTH QUALITY MANAGEMENT SYSTEM REQUIREMENTS FOR CONTRACTORS

CONTENTS

Section 01 43 00
METRO-NORTH QUALITY MANAGEMENT SYSTEM REQUIREMENTS FOR CONTRACTORS

PART A. GENERAL

A.1. DESCRIPTION AND SCOPE

A. The Contractor, its subcontractors, and suppliers of critical equipment and systems shall be able to demonstrate, at any time during the procurement period, that their responsibilities under this contract are accomplished through an effective and verifiable quality management system and systematic quality control at all locations of production or processing of items covered under this contract.

B. The Contractor shall ensure, through its own procurement requirements, that suppliers and subcontractors implement applicable elements of its quality management system commensurate with the significance and complexity of the services each provides.

C. The Contractor shall:

1. Generate verifiable evidence of compliance or conformance with approved requirements
2. Conduct internal assessments and management review to determine if the quality system is adequately implemented and effective, and
3. Provide clear direction to its own organization, suppliers, and sub-contractors to implement these Quality Management System Requirements and provide systematic and verifiable corrective action and preventive measures when patterns of nonconformity or product unsuited for the purpose intended are identified. Within the Contract period, such direction and status of implementation shall be reported to The Railroad periodically, until corrective/preventive action plans result in the acceptable level of quality.

D. Results of work may be deemed unacceptable if carried out prior to Railroad approval of submittals relevant to satisfying contract technical requirements and these Quality Management System Requirements.

E. These requirements are complimentary, not alternative, to the requirements specified in the contract. Any conflict should be brought to the attention of the Engineer.

F. References:

1. American National Standards Institute (ANSI)/American Society for Quality (ASQ[1]) Standard Q9001-2008 *Quality Management Systems* –

[1] ASQ - American Society for Quality, 600 North Plankinton Avenue Milwaukee, WI 53203 USA or P.O. Box 3005 Milwaukee, WI 53201-3005 USA North America Tel.: 800.248.1946 (http://www.asq.org/).

Requirements

2. Building Code of New York State, sections 1701 – 1704, *Structural Tests & Special Inspections*

3. NY State Dept. of State, Div. of Code Enforcement and Administration, Technical Bulletin January 1, 2003, 19 NYCRR 1221 - Building Code of New York State (BCNYS), Sections 1701-1704, *Structural Tests & Special Inspections*

4. ASTM-E329-11c, *Standard Specification for Agencies Engaged in Construction Inspection, Resting, or Special Inspection*, published Jan.-20122

5. The Metro-North Code Compliance Manual[3]

6. Institute of Electrical and Electronics Engineers (IEEE) 1558-2004, *Standard for Software Documentation for Rail Equipment and Systems*

A.2. DEFINITIONS

For the purposes of this Quality Management System Requirements, the definitions given in the American National Standards Institute, ANSI/ISO/ASQ Q9001-2008 (or newer versions) *Quality Management Systems– Requirements* (henceforth called ISO-9001), and the following definitions apply:

1. The terms "Quality Assurance Program", "Quality Management System" (QMS), and "Quality System" are interchangeable.

2. **The Quality Management System manual** (Quality Manual) is the document that establishes a Contractor's company commitment to quality, objectives for quality, a description of the system, identifies stakeholder organizations and their responsibilities within the system, and policies for the systematic attainment of its quality objectives, including the use of documented requirements for accomplishing work.

3. **Contract Quality Plan** is the document that describes the processes and arrangements established to assure that products delivered and services rendered meet contract criteria and standards. This document addresses contract- or customer-specific clarifications or processes different from the Contractor's company quality system that are necessary to meet contract terms and requirements.

4. **Quality Management System implementing procedures** (or simply

[2] ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. United States

[3] Latest copy may be obtained from the Metro-North Code Compliance Group, Construction Management Department, and Capital Programs Div.

"procedures") are specific instructions for carrying out policies, processes, and arrangements established in the Quality Manual and Contract Quality Plan.

5. **Acceptance criteria** are the agreed-upon standards against which select observable characteristics in a product or process are compared to determine acceptance of results. Examples are:

   - Construction contract Drawings and Specifications,
   - Construction contractor's shop drawings, samples, work instructions and procedures, and inspection and test results,
   - Regulatory, industry, and generally-accepted professional standards,
   - the Contractor's own internal standards, and
   - Other acceptance criteria agreed to with the Railroad.

6. BCNYS; *Building Code of New York State*

7. CEO, Code Enforcement Office; the Metro-North Code Compliance Group

8. RDP, a New York State Registered or Licensed Design Professional

9. CS&I Consultant, the Railroad's Construction Supervision & Inspection Consultant

10. SI Consultant, the agency providing the services of the SI Inspector; for the purpose of this specification, the CS&I Consultant is also the SI Consultant.

11. SI Inspector, Building Code Special Inspections compliance inspector(s)

12. Designer-of-Record, the Railroad's Registered Design Professional responsible for the Contract Technical Provisions

13. SI, Special Inspection(s), verification activity required by the BCNYS Section 1702 of the materials, installation, fabrication, erection and placement of components and connections requiring special expertise to ensure compliance with approved construction documents and referenced standards.

14. **For software and Software Quality Assurance, t**he definitions in IEEE 1558-2004, *Standard for Software Documentation for Rail Equipment and Systems* (henceforth called IEEE 1558) and its other referenced standards shall apply.

A.3. SUBMITTAL

A. **Pre-Award**:

The Contractor shall submit the following with its proposal or as directed by the Railroad's contracting office, if specific direction is provided:

1. The Contractor's Quality Manual.

2. If available, the independent ISO registrar's certification that the quality system, as implemented, conforms to the requirements of ISO-9001.

B. **Post-Award**:

Submit the following to The Railroad:

1. 30 days after contract award
   - Contract Quality Plan approved within the Contractor's project team
   - Contract Software Configuration Management Plan approved within the Contractor's project team (if systems to be installed contain software that may require field updates or with settings and adjustments that apply only to Metro-North)
   - Contract Inspection And Test Plan (I&TP) with entries for inspections and test due within the 1st 90 days after Notice of Award.
2. Monthly, submit the Inspection and Test Plan updates, adding inspections or tests due within a 90 day forward-looking window of time
3. Prior to performance of special process and acceptance inspections and tests designated as "Hold" or "Witness" points by the Railroad
   - personnel qualification records for personnel who will be performing special process inspections or tests
   - proof of valid calibration of measuring or test equipment to be used in the field shall be submitted to the Railroad's Construction Manager

A.4. RAILROAD'S QUALITY ASSURANCE

A. The Railroad will monitor compliance with the processes established in the QSM and CQP and assess the effectiveness of the system in driving the Contractor's team in achieving quality goals for the contract.

In addition to conducting independent materials testing and Building Code Structural Tests and Special Inspections, at its option, the Railroad may perform audits and other forms of oversight and assessments.

B. The Contractor shall provide access to its facilities, personnel, information, products, and other objective evidence at all reasonable times.

C. The Contractor shall ensure through the Contractor's procurement documents that similar access is allowed by suppliers, sub-contractors, testing agencies, and consultants.

D. Information, products, and other objective evidence in any condition, in-process or finished, acceptable or nonconforming, shall be made available to ensure a

complete view of the state at which the Contractor has implemented its QSM and CQP.

E. The Railroad will notify the Contractor of any deficiencies identified during these activities in writing. If deficiencies are noted, the Contractor must ensure prompt and documented corrective action, including in that corrective action other items or processes similarly affected. The Contractor shall identify root cause and revise, amend, or clarify its CQP or procedures or those of its subcontractors, suppliers and testing agencies, as applicable, also incorporating preventive measures.

F. The Railroad's quality assurance activities shall not negate, delete, lessen, or act instead of the Contractor's quality assurance responsibilities.

A.5. MATERIALS TESTING

A. Independent testing of construction materials is the responsibility of the Railroad's Construction Supervision & Inspection Consultant.

The Contractor and its subcontractors and suppliers shall support implementation of the Railroad's independent materials testing responsibilities.

B. Where the contract requires materials test results for other than testing related to BCNYS Special Inspections, the following information shall be provided:

1. Name and address and contact information of the laboratory where the test was conducted
2. Qualification documentation (i.e. - State license to conduct business as an independent testing agency, information from a U. S. testing laboratory accrediting body (see A.5.C, Qualifications of Testing Laboratories)
3. Identification of the individual who conducted the test
4. Identification of the laboratory supervisor who validated the test and its results
5. The date the test was conducted
6. The test equipment and measuring instrument used
7. The test standard or procedure used and acceptance criteria applied
8. The data obtained by test, leading to the conclusion reported
9. The overall conclusion reached by the testing agency (i.e. – Pass or Fail)
10. The laboratory management personnel who authorized the release of the test report

C. Testing Laboratory Qualifications

1. Throughout their period of engagement, laboratories shall satisfy the requirements of ISO/IEC-17025, *General requirements for the competence of testing and calibration laboratories*, as determined by a U. S. testing laboratory accrediting body[4,5].

2. Throughout their period of engagement, environmental laboratories shall be accredited by the state governmental agency that serves as accreditation body under the National Environmental Laboratory Accreditation Program (NELAP)[6].

A.6. BUILDING CODE SPECIAL INSPECTIONS

A. The Railroad has direct responsibility for Building Code Structural Tests and Special Inspections. Building Code Special Inspections will be conducted by the Railroad, through its Construction Supervision & Inspection Consultant.

The Railroad's Construction Supervision & Inspection Consultant will provide a Registered Design Profession (RDP), licensed and registered in the State where the construction work is located, who shall be responsible for the Railroad's Building Code Structural Tests and Special Inspections and Building Code Compliance inspections. This professional is hereinafter referred to as "The Building Code Compliance Inspector".

B. The Contractor and its subcontractors and suppliers shall support implementation of the Railroad's independent materials testing responsibilities.

PART B. PRODUCTS

1. The Contractor's Company Quality Manual
2. Contract Quality Plan
3. Contract Inspection And Test Plan(for general construction quality control)
4. Personnel qualification and/or certification for those who perform special processes (e.g. – non-destructive examination or testing) in the field
5. Calibration records for measuring or test equipment used in the field for special process and acceptance inspections and tests

---

4 National Voluntary Laboratory Accreditation Program, Laboratory Accreditation- NVLAP, 100 Bureau Drive, Stop 2140, Gaithersburg, MD 20899-2000; Email: nvlap@nist.gov Phone: (301) 975-4016, http://ts.nist.gov/standards/scopes/programs.htm and the National Cooperation for Laboratory Accreditation (NACLA) (http://www.nacla.net/).

5 OSHA Nationally Recognized Testing Laboratory (NRTL) Program (https://www.osha.gov/dts/otpca/nrtl/)

6 In NY State, the accreditation body is the NY State Dept. of Health's Environmental Laboratory Approval Program (ELAP, **URL:** www.wadsworth.org/labcert/elap/elap.html)

PART C. EXECUTION

C.1. THE QUALITY MANUAL

A. The Contractor's Quality Management System documentation shall conform to the requirements of the American National Standards Institute's ANSI/ISO/ASQ Q9001-2008 Standard (also referred to as ISO-9001), *Quality Management Systems – Requirements*.

B. The Quality Manual shall also:

1. Identify its applicability to the location(s) where products and services to be provided in this contract are manufactured or headquartered,
2. State the Consultant's policies regarding the control of development and/or installation of deliverable software and provide references, should details of this information exists in a separate document,
3. Include a roster or chart of personnel responsible for implementing the company's quality policies,
4. List or reference to implementing procedures governing activities important to the management of quality, such as:
    a. Control of Records
    b. Nonconformance Control
    c. Action to correct Quality Management System deficiencies
    d. Action to prevent Quality Management System deficiencies
    e. Internal audit
5. Bear evidence of approval by the authority in charge of the business unit.

C. Prior to award, the Consultant shall obtain the Railroad's agreement with amendments, exceptions, or modifications to the Consultant's company quality management policies and Software Quality Assurance Plan that are necessary for this Contract. These shall be incorporated into the Consultant's Contract Quality Plan.

D. **Optional Quality Manual Template**

At the end of this Section 01 43 00, QUALITY MANAGEMENT SYSTEM REQUIREMENTS is a template for preparing a Quality Manual. Contractors that do not have a documented Quality Manual or that have a manual reflecting a quality system that does not meet ISO 9001 may opt to use the template. Note: No representation is made regarding the acceptability outside Metro-North Railroad of a manual developed using this model.

C.2. CONTRACT QUALITY PLAN (CQP)

The Contractor shall implement a Contract Quality Plan to ensure that its work is adequately planned, coordinated, and in accordance with this Contract and the professional standard of care committed to by the Contractor's company management. At a minimum, it shall address:

A. ADJUSTMENTS TO THE COMPANY QUALITY MANAGEMENT POLICIES APPLICABLE ONLY TO THE CONTRACT

B. PROJECT ORGANIZATION AND MANAGEMENT
   1. Include a roster or chart of personnel responsible for implementing the Contract Quality Plan's requirements.
   2. Include a list of any Customer-specific procedures applicable to the Contract

C. USE OF WRITTEN PROCEDURES
   Internal procedures for control over the quality of design documents and technical submittals (e.g. – inter-discipline review, review, design change process, process for release of design documents for submittal to the Railroad, record keeping, internal audits, field inspections and surveys, correspondence control, etc.)

D. PROCUREMENT CONTROL
   1. Sub-contract quality management system requirements
   2. Sub-contract quality oversight

E. DOCUMENT CONTROL
   1. Requirements documents shall bear evidence of approval by the authority
   2. Contract Correspondence Control
   3. Tracking of RFIs and Change Requests
   4. Internal review of technical submittals
   5. Shop Drawing Approval Process Tracking
   6. Control of approved construction documents (including changes) at the Jobsite

F. CONTROL OF FIELD CHANGES

G. QUALITY CONTROL AT THE JOBSITE
   1. Contractor's own work
   2. Subcontractor work
   3. Inspection and test records
   4. Quality of materials in storage
   5. Housekeeping

H. NONCONFORMANCE CONTROL (including processing of rejected materials)

I. INTERNAL QUALITY SYSTEM AUDITS

J. RECORDS RETENTION WHILE WORK IS IN PROGRESS
   1. Loss prevention

2. Disaster recovery
3. Information pertinent to as-built records

K. FORMS or template/format for quality management to be used on the contract (e.g. - Inspection Reports, Test Reports, and Nonconformance Reports).

C.3. CONTRACTOR'S INSPECTION AND TEST PLAN

The Contractor's Inspection and Test Plan shall cover verification of conformance to the technical specifications and construction quality control. It shall provide the following information:

1. List all inspections and testing required in the Contract, including those required by referenced Codes and Standards.
2. The schedule of when the activity is expected to be carried out
3. The source of the inspection or test criteria (e.g. - drawings, specifications, inspection or test procedure),
4. The status of these criteria documents (e.g. - approved, in process, etc.),
5. The party responsible for conducting the inspection or test
6. The Railroad's participation (e.g. - witness or conduct the inspection or test),
7. The status of the item after inspection or test (e.g. - passed, with open items pending, or failed), and
8. The status of final records (e.g. – In-progress, release transmittal ID/date of issue).

C.4. BUILDING CODE SPECIAL INSPECTIONS

A. Responsibilities Of The Construction Contractor

1. *Notify the SI.* The holder of the building permit or their duly authorized agent shall notify the SI of individual inspections required. Adequate notice to the SI shall be provided so that all prerequisites (e.g. – Railroad-accepted design documents, and Railroad-approved shop drawings, utilities and services) are in place or have been completed and the SI has time to become familiar with the specific items and acceptance criteria.
2. *Provide safe access to the work to be inspected.*
3. *Provide support for the efficient and safe performance of SI activities.* Provide jigs, fixtures, handling equipment, lighting, and other equipment.
4. The Contractor shall ensure that its jobsite activities do not interfere with or negate completed Structural Tests and Special Inspections. Change to a tested or inspected item, may be reason to retest or re-inspect. The authority for such determination shall be the Railroad's Project Manager or designee.
5. *Field discrepancies*. The Contractor shall implement approved remedial measures to noncomplying items. The Contractor shall obtain CEO approval of remedial measures for items that do not comply with previously-approved drawings prior to implementing these remedial measures.

6. *Changes to Design Documents and Shop Drawings*. The Contractor shall obtain the approval of the Railroad's Designer-of-Record and CEO to proposed changes to previously-approved drawings prior to implementing these changes.
7. *Provide access to the approved Structural Tests and Special Inspections criteria.* The contractor/construction manager shall provide the SI with direct access to the Structural Tests and Special inspection criteria agreed to with the Railroad.

B. Cognizant representatives from the following organizations shall be present during Special Inspections:

1. The construction contractor's and affected sub-contractor's site supervision and construction inspectors
2. Authorized field service representatives of suppliers of major equipment with safety-related functions.

C. Building Code Special inspections shall be coordinated with the Contractor's contract Inspection & Test Plan for general construction quality control as well as its commissioning and systems integration plan.

D. Upon completion of the inspection, all authorized representatives shall:

1. Go over exception items, identifying those that are product or installation nonconformance, as appropriate
2. Act in good faith to reach agreement regarding disposition and correction of nonconforming conditions,
3. Identify open items, determine the next step, identify the responsible party, and establish action due date towards resolving the open items, and
4. Acknowledge participation and understanding of the Nonconformance Reports and Open Action Items summary by signing each record.

E. At their option, Metro-North Code Compliance and other responsible oversight organizations may elect to participate in any Special Inspection activities.

F. The Contractor, its sub-contractors, and suppliers shall provide support for Building Code Compliance activities.

C.5. BUILDING CODE SPECIAL INSPECTION RECORDS

A. Once all Nonconformance Reports have been closed and Open Action Items completed, The Building Code Compliance Inspector shall release the final inspection records in accordance with the Metro-North Code Compliance Manual (Ref. 3). The Metro-North Code Compliance Group issues Certificates of Occupancy also in accordance with the Metro-North Code Compliance Manual (Ref. 3).

B. These records shall also be retained in files intended for transmittal to the Railroad's project long-term records retention.

C.6. SOFTWARE QUALITY ASSURANCE

A. The level of Railroad involvement in software development is established by the designated agency Engineer. Through the contract technical specifications or directive provided during the contract period, the Engineer may modify the applicability of the requirements of IEEE 1558 in a manner appropriate for the scope and criticality of the work to safety or agency needs.

The Contractor shall implement Software Configuration Management during procurement, receipt, installation and commissioning of systems shall be addressed.

B. Prior to placing software in service, the Contractor shall test software for operability and that it functions as expected.

C. **Configuration Control**

1. An appropriate document and data control methods shall be established to ensure that software products in development are identifiable and kept separate from software products intended for installation in a Railroad system.

NOTES:

i. Software in development that is released for testing on equipment or systems prior to final release shall be identifiable and contain appropriate statements within the software code to indicate its release status to users.

ii. Software in development that is released for testing on Railroad equipment or systems prior to final release shall be:

- Authorized in writing by the Engineer,

- Replaced with the final, released version, with documentation complying with the appropriate type of implementation.

iii. An appropriate document and data control methods shall be established to ensure that the latest set of released-for-installation software products are identifiable and are the only products available for installation.

2. These configuration control requirements are in addition to any other requirements for software identification and traceability to hardware prescribed in other parts of the technical specifications.

3. The Consultant shall update these documents periodically until the end of the contract period.

D. **Commercial-Off-The Shelf (COTS) Equipment with Software**

When software is included as part of Commercial-Off-The Shelf (COTS) equipment, software documentation shall conform to the requirements in IEEE-1558-2004 for Type 1 procurement:

1. Details regarding the software identification, version and level shall be provided to the Railroad.

2. User's Manuals and all other documentation from the original source of software shall be provided to the Railroad.

End of Section 01 43 00

PART D. ATTACHMENTS

D.1. OPTIONAL QUALITY MANUAL TEMPLATE

FOREWORD

INTRODUCTION

A quality management system is intended to assure that construction services are provided safely, as specified, on schedule and at the agreed cost.

This Model Quality Management System Manual **(Model QMS Manual)** is a template designed for use by Consultants that want to develop their own company Quality Management System Manual **(Company QMS Manual).** This Sample QMS Manual is patterned after ISO 9001-2000 Quality Management System Requirements. However, this Sample QMS Manual is in no way intended to restrict the format of Quality Manuals submitted to Metro-North. You may develop your Company QMS Manual in any format that satisfies the requirements of ISO 9001-2000.

The interpretations of ISO 9001- 2000 requirements in this Sample QMS Manual are general in nature: Metro-North Railroad makes no representation regarding its acceptability, accuracy and correctness outside Metro-North. In addition, you must evaluate its contents as they apply to your own organizational structure. If you intend to use this sample as the basis for Third Party registration, the opinion of your registrar or reviewing agency takes precedence.

CONTRACT QUALITY PLANS

The quality management policies in your Company QMS Manual may need to be amended, or modified in some suitable way for specific contracts to accommodate special Customer requirements, and to define organizational and administrative interfaces between The Company and The Customer. It is typical to call these amended or modified Quality Manuals "Contract Quality Plans". There have been a number of common practices regarding Quality Plans. Some practices have been to:

- Incorporate the modifications into a contract-version of the Company QMS Manual,
- Issue the Company QMS Manual with an attached amendment containing the modifications applicable only to a specific contract, or
- Issue a separate document called "Contract Quality Plan" containing only the modifications and referencing a specific version of the Company QMS Manual as the base document, and transmitting the base version of the Company QMS Manual with the Contract Quality Plan.

USE OF GENERIC TITLES

The title "Chief Operating Officer" (COO) refers to the position of the highest-ranking individual responsible for the day-to-day operation of the entire company. You may substitute the appropriate title for your company (e.g. - President).

The title "Construction Contract Officer" refers to the position of the highest-level individual responsible for the successful conclusion of a Construction Contract and satisfaction of the customer. You may substitute the appropriate title for your company (e.g. - Project Manager).

The title "Designated Responsible Officer" refers to the position of an individual at a Construction job site responsible for successful conclusion of construction work and satisfaction of the Customer. You may substitute the appropriate title for your company (e.g. - Site Superintendent).

In some cases, an explanation of the requirements of ISO 9001-2000 is given for clarity and to aid understanding. The explanation is in Italics and is not part of sample text.

We hope you find the Sample QMS Manual a useful step in your journey to achieve a high level of customer satisfaction and a more profitable future.

- oOo -

(Insert company name here)
(Insert company headquarters street address here)
(Insert City/Town, State and Postal Zip-code here)

QUALITY POLICY AND QUALITY MANAGEMENT SYSTEM DESCRIPTION
OR
CONTRACT QUALITY PLAN
OPTIONAL TEMPLATE

_____ _____
PRESIDENT DATE

_____ _____
(indicate actual company title) DATE
Senior management representative for quality

REVISION NO.____
EFFECTIVITY DATE _____

TABLE OF CONTENTS

SECTION 1 - QUALITY MANAGEMENT SYSTEM

(This QMS Section corresponds to Section 4 of the ISO 9001-2000 Standard. It describes the overall Quality Management System (QMS), and identifies those processes, procedures and other documents that ensure effective operation and control of processes.)

1.1 General Requirements

The ***(insert company name here)***, henceforth known as "The Company", is committed to establishing, implementing, maintaining and continually improving a QMS conforming with the requirements of the International Standard, ISO 9001-2000. This Manual documents the policies of that QMS.

The following are the key processes needed for the QMS to be effective and facilitate the production of a product or service that satisfies the customer. **(*Note this is not a complete list and should be modified to address your company structure and operations.)***

1. The Contracting Process

   This is process starts with the review of the Request For Proposal (RFP) or Information For Bidders (IFB), through proposal or bid development, Customer's award of the Contract or notification of no award, and ending with review of opened proposals or bids.

2. Design and Development

   This is the process of inter-discipline and inter-organizational effort of transforming the Customer’s contract Technical Provisions into design and construction documents such as Design Specifications, drawings, shop fabrication details, inspections and test procedures.

3. Shop Drawing Submittal, Review and Approval

   This process starts with the contract kick-off meeting. Describe the Consultant's process for obtaining Customer’s input to and approval of technical submittals and deliverables, such as construction details, shop fabrication drawings, workmanship standards, special process procedures, and inspection and testing procedures.

4. Production Planning

   This process consists of the development of the construction work breakdown structure, cost-loaded schedule, database and method for progress reporting, establishment of the system and rules for communication and coordination between the Company's project team and the Customer's project team.

5. Procurement

This process consists of identification, procurement, and traceability of materials, parts, components, equipment, and services, including the activities of selecting suppliers, sub-contractors, testing agencies and consultants.

6. Construction

This process includes all activities defined in the contract technical provisions, contract drawings, and Customer-approved shop drawings.

7. Monitoring and Measuring

This includes several processes: product inspection at source, construction work inspection, in process testing, post-construction pre-operational testing, control of nonconforming conditions, and Quality system internal audits.

8. Customer Satisfaction and Quality System Improvement

This is a set of processes that includes corrective and preventive actions, company management review of quality system effectiveness and suitability, and response to customer returns, complaints and feedback.

For each key process identified above, The Company will identify the criteria and methods to ensure the processes are effective, define the methods of monitoring measuring and analyzing these processes and establish commitment to their continuing improvement.

(*Note: The criteria and methods referenced above, may be included in the Company QMS Manual, a contract Quality Plan (See Foreword to this Sample QMS Manual) or, separately, in procedures, work instructions or process control documents.)*

1.2 Documentation Requirements

1.2.1. General

The Company has established the following documentation for its QMS.

(List the types of written or electronic information that provides direction, guidelines, acceptance standards, processing standards, and similar requirements. What follows are typical written requirements that may be applicable to your company's operation. Remove those that are not applicable and add those that apply but may not have been listed here)

a) This Quality Management System (QMS) Manual
b) Quality Management System Procedures (administrative)
c) Project Management Procedures (including interface and coordination with Customers and regulatory agencies with jurisdiction over jobsites)
d) Government regulations
e) Customer contracts, including contract specifications and drawings

f) Industry standards
g) Procurement specifications
h) Processing Instructions (including construction process instructions)
i) Construction Work Packages
j) Measuring and test equipment calibration procedures
k) Inspection and test procedures

Records that demonstrate implementation and effectiveness of the QMS are identified in quality system documentation.

1.2.2. Quality Management System Manual

This Company QMS Manual establishes the scope of the Quality Management System, defines the activities and functions over which it applies, and commits to complying (and any exclusion) with the International Standard ISO 9001-2000. It describes the sequence and interaction of the main administrative processes, which fall under the scope of the QMS and cites references to lower-tier quality system documents when more details are necessary.

The ***(insert the title of the individual who has primary responsibility for Company QMS Manual and for publishing and issuing copies to users)*** shall ensure that master version of the Company QMS Manual and copies sent to direct users are controlled documents. (See 1.2.3 "Control of Documents", following).

1.3 Control of Documents

A documented procedure has been established to control documents required for the QMS. The written procedure detailing the Company's document control practices is listed in Appendix 6.1 of this Company QMS Manual. This procedure implements the following policies:

a) Written requirements that make up QMS (see Quality System requirements documentation in 1.2.1) shall:

- Exhibit those characteristics necessary to establish that any available copy is the correct document, approved, complete, and current.
- Be reviewed and signed by authorized personnel prior to release.
- Be sent to each user or to locations readily accessible to each user
- Be maintained current and useable in any location where copies are stored.

b) Personnel who work in activities governed by the QMS shall use only the latest, authorized, controlled issues of QMS documents.

c) Superseded versions of these documents shall not be held or stored in areas where inspection, test, or construction work is in-progress. Wherever these other versions are stored, they shall be marked clearly as not authorized for use (e.g. - "void", "superseded").

1.4 Control Quality of Records

The applicable procedure, listed in Appendix 6.1 of this Company QMS Manual, to control the identification, review, approval, distribution, retention, and retrieval, protection, and disposition QMS records has been established. This procedure implements the following policies:

Records shall be verified for accuracy and completeness prior to final release and retention.

Records (e.g. - letters, memos) that require a response or action shall be directed to the individual authorized to respond or act.

The status of transmittals that require a response or action by shall be maintained.

Records shall be stored in a suitable environment to prevent damage or deterioration and to prevent loss. Records shall be filed according to the established File Index.

Access to records shall be controlled. Removal of Records to a location other than the immediate area where the file is located shall be restricted to authorized persons. Measures to identify removed files and their current location shall be maintained.

Retention time of QMS records shall be established in a written procedure.

- END SECTION 1 -

SECTION 2 - MANAGEMENT RESPONSIBILITES

(This QMS Section corresponds to Section 5 of ISO 9001-2000. It addresses commitment to quality, consideration of the customer, Quality Policy, planning work to deliver a quality product, administration of the Quality Program, and positioning for continuous improvement.)

2.1 Management Commitment

At its highest management levels, the Company is committed to the development and improvement of the QMS by:

a) Communicating the importance of meeting customer, regulatory and legal requirements.

b) Establishment of a quality policy and objectives.

c) Conducting management reviews in accordance with Paragraph 2.6 of this Company QMS Manual

d) Ensuring the availability of resources necessary to implement company policies and attain its quality objectives.

2.2 Customer Focus

The Company ensures Customer satisfaction by:

a) Reviewing and clarifying Customer's Contract Requirements against Customer's and The Company's expectations.

b) Establishing close coordination in a systematic way through a contract Quality Plan that provides necessary modifications to company standard operating procedures to accommodate Customer needs.

c) Assigning trained and qualified personnel to carry out project tasks, and continuously maintaining skill levels and qualification.

d) Breaking down work elements, budget and available time in sufficient detail to track real progress and meet cost, quality and schedule commitments.

e) Performing internal quality audits to encourage compliance with the QMS requirements and determine how effective these requirements are in assuring long-term profitability and Customer satisfaction.

f) Systematically identifying and resolving nonconforming conditions before they impact the Customer, and using that information together with Customer feedback to improve the Company's ways of doing business.

2.3 Quality Policy

The Company policy regarding the Quality of the goods and services we offer our customers is in Appendix 6.2 of this Company QMS Manual.

This Quality Policy is reviewed for relevancy and appropriateness of objectives; and communicated to those performing the work. The policy is posted at all work locations.

(Prepare a statement, called "Quality Policy", that is appropriate to your company's business objectives, include commitment to meeting Customer requirements, continuously improving the services provided, and the method of delivering these services. Attach that statement, as Appendix 6.2, to this company Quality Manual).

2.4 Planning

2.4.1 Quality Objectives

The Company's Quality Objectives are in Appendix 6.3 of this Company QMS Manual. The attainment of our Quality Objectives is part of our commitment to continuous improvement and Customer Satisfaction. The Quality Plan for any Construction Contract will identify quality objectives for that construction contract.

2.4.2 Quality Management System Planning

QMS planning is a yearly activity that occurs as part of the company's budget development process and results in obtaining management approval of staffing, budgets and schedule to carry out:

a) Necessary modifications to the written requirements documents to incorporate lessons learned from quality system audits, corrective/preventive action issues, and management review,

b) Reallocation of staff responsibilities and hiring of additional personnel in order to efficiently and completely accomplish quality system (including contract-related) activities, and

c) Procurement of necessary additional assets (e.g. - office space, equipment, service contracts, etc.) and services to maintain current assets in a state of good repair

d) Processes in this Company QMS Manual.

When conditions require change, the planning process allows change to occur in a controlled manner and integrity of the QMS is maintained. The COO authorizes changes to the QMS and assures the information is disseminated and adequate resources for implementation and control during the transition are available.

2.5 Responsibility, Authority and Communication

2.5.1 Responsibility and Authority

The Company is organized in the following manner. *(Include Appendix 6.4, the organization chart for the company). (Insert title)* is responsible for maintaining the company Organization Charts (Appendix 6.4). The contract Quality Plan will also include the Organization Chart for the Construction Contracted product or services.

The Company has assigned responsibilities and authority in the following manner.

(Use functional titles instead of names to reduce the number of Company QMS Manual revisions. Focus your description of activities on prevention of nonconforming conditions, problem identification, problem solution, verification of corrective action, and follow-up to ensure problem resolution. Correlate with the Organizational Chart.)

2.5.2 Management Representative

The Company has assigned a management representative for Quality. He/she shall ensure the Quality system is established, maintained, and implemented and shall report to top management on *a twice-yearly basis* and make recommendations for Quality System improvements. Reports shall be issued in writing to Top Management and maintained in an open status until the resolution of outstanding items. The management representative for Quality shall be independent of direct project supervisory activities and assure that for each Construction Contract assigned personnel are aware of customer requirements.

2.5.3 Internal Communication

The Company ensures effective communication including communication of the effectiveness of the QMS through one or more of the following:

Distribution and control of procedures, work instructions, flow diagrams, process diagrams, newsletters, and the establishment, monitoring and communication of quality goals and their status.

2.6 Management Review

2.6.1 General

The Company top management shall review the QMS, quality policy and quality objectives twice a year and more often as needs dictate to ensure its suitability, adequacy and effectiveness. Records of these reviews shall be maintained. The COO is responsible for the Management Review process.

2.6.2 Review Input

Management Reviews shall utilize:

a) Internal and external Quality Audit results
b) customer performance evaluations (feedback)
c) Process performance and product conformance results

d) Preventive and corrective action status
e) Follow up on actions from previous Management Reviews
f) Other changes (i.e. business climate, scope of work changes, etc) that could affect the QMS.

2.6.3 Review Output

Results of company management's review of the QMS shall be recorded and address the following, as appropriate:

a) Improvements in the QMS and its processes
b) Improvements in product related to customer requirements
c) Resource needs

Action items shall be followed up at subsequent management reviews to ensure closure.

- END SECTION 2 -

SECTION 3 - RESOURCE MANAGEMENT

(This QMS Section corresponds to Section 6 of ISO 9001-2000. Its purpose is to assure that sufficient staff and assets are assigned to the work governed by the QMS and that staff is adequately prepared to perform the assigned tasks.)

3.1 Provision of Resources

The Construction Contract Officer and Designated Responsible Officer are responsible for assessing organizational and project needs within their specified scope, including oversight functions. Each shall identify sufficient resources necessary to deliver construction services as required by contract and improve the QMS processes. When necessary, additional resources shall be provided.

3.2 Human Resources

3.2.1 General

The Company shall assign work to personnel who are competent on the basis of applicable education, training, skills and experience. The Construction Contract Officer is responsible to review requirements to determine any special competency needs for personnel assigned to a specific Construction Contract and ensure the assignment of personnel who meet the requirements.

3.2.2 Competence, Awareness and Training

The Company shall:

a) Identify competency needs for personnel performing activities affecting quality. The Company has developed position descriptions for those personnel performing activities affecting quality, which identify competency requirements*. (Identify the appropriate position in your company)* maintains the latest issue of such position descriptions.

b) Identify training needs, provide training to satisfy competency needs, and assure continuing training is provided as necessary *(Note training can be formal, informal, on the job, union classes, apprenticeship, etc).*

c) Evaluate the effectiveness of the training provided. Individuals who are responsible to supervise personnel performing the work will evaluate effectiveness. One or more of the following will correct any noted deficiencies: additional On-the-Job-Training, closer supervision, formal re-training, and reassignment.

d) Ensure employees are aware of how their work activities contribute to the achievement of quality objectives. Our Quality Policy is posted at all work locations. Employee orientation contains a section that describes the important role each employee plays in achieving both our corporate and Construction Contract quality objectives.

(Describe how you achieve this. Consider newsletters, performance evaluations, project Kick-off meetings, Project position descriptions, project organization charts and other means of awareness enhancement).

e) Maintain records of education, training skills and experience. Human Resources is responsible to maintain appropriate records including records of training activities and the subject matter.

3.3 Infrastructure

The Company provides a work environment suitable for it to achieve its business objectives and satisfy project requirements. The COO or designee is responsible to assure necessary facilities, equipment, hardware, software, support/administrative services are available to each employee in order to assure they can be successful in their work.

3.4 Work Environment

The Company has identified and is managing those factors of the work environment needed to assure work output is acceptable.

These factors may include, as applicable, safety plans and inspections, compliance with OSHA and applicable building codes, toolbox meetings, HAZMAT protective equipment, and specific requirements in Construction Contracts.

- END SECTION 3 -

SECTION 4 - PRODUCT REALIZATION (PLANNING AND PERFORMANCE OF WORK)

(***This QMS section corresponds to Section 7 of ISO 9001-2000. It describes those activities related to the production of a product to ensure that it meets customer requirements. Products can be physical (e.g. - structures, equipment, parts, and materials) or intellectual (e.g. - studies, analysis, design plans and specifications, and software). Intellectual product may be of direct use to the customer or incorporated into a final product or service for the customer****.)*

4.1 Planning of Product Realization

The Company shall plan and document the product realization process. The documentation for the realization process may be described in a Contract Quality Plan, product design, and production process documents.

The Quality objectives for the work are identified in the Construction Contract and represent the customer requirements or in product specifications for standard product.

The process, process controls, documentation, and resources necessary to complete the work successfully shall be established and implemented.

Verification and validation are incorporated into the planning process and are described in the contract Quality Plan or product testing documents. Acceptance criteria shall be developed, and product acceptance documented.

Records attesting to conformity of process and resulting product shall be maintained. Records will include:

- Monitoring and Measuring Records
- Internal Quality Audit results and closure
- Product Acceptance Records
- Records of Management Reviews

4.2 Customer Related Processes

4.2.1 Determination of Requirements Related to the Product

The Company will carry out construction in accordance with the Construction Contract (or produce industry-standardized items strictly in accordance with the applicable industry standard). Where written Customer requirements are not provided, the Company will document requirements provided verbally by the Customer, as well as any additional requirements, such as regulatory and legal requirements, necessary to build structures (or produce product) acceptable to the Customer.

4.2.2 Review of Requirements related to the Product

The Company will review Construction Contracts and other forms of written Customer requirements with the Customer to ensure that the expectations are clear and

understood. Relevant parts of the Customer's requirements will be reviewed with each party within the Company and subcontractors to ensure that and that the Company and its subcontractors have the capability of performing the work as specified.

Prior to signing a Construction Contract a review shall be performed to ensure any agreed to changes have been incorporated. The review shall be documented. The process is under the supervision of the COO or designee.

Changes to Construction Contracts shall be processed and controlled in the same manner as the original contract. Changes shall be documented and issued to all staff and subcontractors responsible for its execution.

These processes are under the supervision of the COO, Project Sponsor or designee. These reviews shall be documented.

4.2.3 Customer Communication

The Company will establish and maintain communication with the customer regarding the Construction Contract and the work activities. The COO will assign a responsible officer to be the point of contact and coordination for the Construction Contracts. A communication process will be established agreeable to both parties and shall be uniformly implemented. Those responsible for liaison with the Customer shall keep the Customer informed of progress and special conditions that arise. Customer survey data will be used for standard products.

Customer feedback/complaints shall be evaluated and response provided in writing.

4.3 Design and Development

(***Identify the planning tools for managing and coordinating design and development, such as - resource-loaded schedule, CPM, Bar Charts, Flow diagrams, etc).***

4.3.1. Design and Development Planning

The Company shall develop a plan to control the design and address staging, review, verification, and validation activities, personnel responsibilities and authorities, interfaces between discipline and any update in this plan during production.

During the planning, the organization shall determine

The design and development stages,
The review, verification and validation that are appropriate to each design and development stage, and
The responsibilities and authorities for design and development to ensure effective communication and clear assignment of responsibility.

4.3.2. Design and Development Inputs

Inputs relating to design requirements shall be determined and records maintained. These inputs shall include:

a. Functional and performance requirements,
b. Applicable statutory and regulatory requirements
c. Where applicable, information derived from previous similar designs, and
d. Other requirements essential for design and development.

The COO will assign a Contract Officer to review the Contract and determine functional and performance requirements, applicable statutory and regulatory requirements, investigate the applicability of a similar design, and any other requirements necessary to assure the contract can be successfully completed. For Standard items the COO will assign a Responsible Officer to determine appropriate design and development inputs.

These inputs shall be reviewed for adequacy and be complete, unambiguous and not in conflict. These inputs shall be in written form and, once reviewed and found acceptable, transmitted to the appropriate responsible designer.

4.3.3. Design and Development Outputs

Outputs are those deliverables required by the customer in the Contract or those specified for standard items or needed by our production department to manufacturer product and include, but are not limited to, studies, reports, analysis, scope development, designs and specifications.

Outputs of the design process shall be in a form that enables verification against design inputs and shall be approved prior to release.

The assigned Contract Officer or Designated Responsible Officer is responsible for ensuring that design and development outputs:

a. Meet the design input requirements,
b. Provide appropriate information for purchasing, production and servicing,
c. Contain or reference acceptance criteria for product or installation, and
d. Specify the characteristics of the product that are essential for its safe and proper use.

4.3.4. Design and Development Review

Design Documents are circulated for internal review and coordination of all units with input to the end product. The number of reviews is dependent on the complexity of the work and will be identified in the planning process.

The review process shall address the ability of the design to fulfill requirements and identify problem areas and proposed corrective actions.

Comments shall be addressed in written form, and records of resolution kept until completion of the Contract or per record keeping requirements for standard items. The

management team member responsible for the design effort will ensure closure for all comments

4.3.5. Design and Development Verification

The assigned contract officer or designee is responsible to assure the design output is consistent with the design inputs.

Verification will be performed to planned arrangements developed under 4.3.1. The contract specific QMSM will address Contract specific applications.

4.3.6. Design and Development Validation

The Company has developed a system to assess if the design was constructible or capable of being manufactured and met customer requirements and was suitable for its intended use.

The results of FAI may be used, if applicable, for validation.

The results of the validation effort are recorded and used as part of our Corrective and Preventive Activities Program.

4.3.7. Control of Design and Development Changes

General

Design and development changes shall be identified and records maintained. The changes shall be reviewed, verified and validated, as appropriate, and approved before implementation. The review of design and development changes shall include evaluation of the effect of the changes on constituent parts design already completed.

Requests from the construction site for clarifications and revisions to design documents shall be documented reviewed by the Designated Responsible Officer, the Contract Officer, and the Chief Estimator before being sent to the Customer for review and approval. Methods have been established to ensure revisions are reviewed to the same level as the original documents for the area of change. Records of these activities shall be maintained.

Upon receiving revised design documents, these documents shall be placed under document control to prevent inadvertent use. Superseded versions shall immediately be removed from controlled documents centers and specific work locations.

4.4 Purchasing

4.4.1 Purchasing Process

Prior to engaging suppliers or subcontractors to perform part of the Contract work or furnish materials, their capability to perform the assigned scope of services shall be evaluated. The performance of suppliers or subcontractors engaged to accomplish parts of the Contract work or furnish materials shall be monitored and assessed

(***Indicate the frequency of evaluation***). Records of these evaluations shall be maintained. Evaluation criteria shall be defined. The COO or Designated Responsible Officer shall oversee this process and is responsible for following up on identified areas of poor performance.

Records of supplier or subcontractor performance shall be maintained. Suppliers or subcontractors with a record of poor performance shall be excluded from future consideration.

4.4.2 Purchasing Information

Purchase Orders define product requirements (e.g. - performance, functional, physical, inspections and test in sufficient detail to ensure that the furnished item meets the purchase order requirements. Purchase Orders will include appropriate QMS requirements. The assigned Construction Contract Officer, Responsible Officer or designee will review all supplier/ subcontractor purchase orders prior to release.

4.4.3 Verification of Purchased Product

The Company has a program to verify that systems, components, parts, and materials provided by suppliers meet the Purchase Order requirements. The Purchase Order identifies verification to be conducted. A Contract Inspection and Test Plan will identify all milestone inspection and tests required by contract for suppliers of major equipment, components, or critical fabricated items.

4.5 Production (Construction) and Service Provision

4.5.1 Control of Production and Service Provision

The Company has established the following controls applicable to their work.

a) Activities are planned

b) Activities are scheduled

c) Acceptance criteria are defined

d) Adequate resources (tools, equipment, and trained personnel) are available to perform the work.

e) The work environment is safe and conforms to applicable Regulatory Requirements.

f) Methods are employed to monitor work against expected results

g) Applicable portions of the Construction Contract, procedures, work instructions, installation practices that are important to ensure quality work are available to the work force

h) Codes standards and other references are available to the work force

i) Standards of workmanship are defined

j) Where required, licensed or certified personnel are assigned to perform activities requiring such license or certification

k) A program to monitor the effectiveness of these process controls is in place and implemented.

l) Criteria for release, approval, or acceptance are established

4.5.2 Validation of Processes for Production and Service

The validation of certain processes can only be determined when it is operated. These processes will be identified in specific for each Contract as part of a contract Inspection And Test Plan.

The Company assures these processes can achieve planned results through one or more of the following:

a) Process qualification
b) Equipment and personnel qualification
c) Defined methods and procedures
d) Processing of production samples (i.e. - First Article Inspection)
e) ***(Others: Please state particulars regarding these).***

4.5.3 Identification and Traceability

The Company has developed and maintains a system to identify its fabricated products and purchased materials so that these remain traceable to the original batch of raw materials used and the specifications to which these were fabricated. Items specially intended for a specific customer as identifiable as such. To the extent traceability is a Contract legal or regulatory requirement, the Company will apply this system using unique identification of product or batches.

The Company shall also identify the status of the fabricated products and materials with regard to monitoring and measurement results during construction.

4.5.4 Customer Property

(Note: This section is not applicable to the contract Quality Plan, if no customer-supplied property is in the Contract.)

Customer property includes hardware (such as materials, parts, components and equipment), software and other items provided by the Customer for the express purpose of producing items under the Contract. This includes real property provided for work staging, temporary storage, shop fabrication, and office space The Company shall develop and maintain a system to receive, log, and maintain Customer property, as appropriate. The Customer will be advised of any items that are unsuitable for use, lost or damaged from the time they are received until such property has served its

intended purpose or returned to the Customer.

4.5.5 Preservation of Product

The Company shall establish, maintain and implement a program for handling, storage, packaging, and preservation of items while in its custody, and for delivery of materials and equipment to the Customer. In particular, records shall be available to demonstrate how handling equipment is maintained in safe working order,

4.6 Control of Monitoring and Measuring Devices

The Company shall establish, maintain and implement a program to identify, control and calibrate measurement and monitoring devices used to assure conformity of its products.

The Program shall contain the following elements:

a) Identification of equipment & instruments that require calibration to maintain capability
b) Listing of such equipment & instruments, frequency of calibration and evidence calibration took place
c) Availability and use of manufacturer's instructions, codes or national standards for calibration
d) A program of corrective action to repair or replace items which do not meet acceptance criteria.
e) A program to ensure measuring and monitoring devices are protected from damage deterioration and unauthorized alteration of settings.
f) A program of corrective action for previously accepted product, if defective equipment and instruments were used to inspect or test the product.
g) Confirmation that computer software used as a basis of product acceptance is acceptable for the intended application. Confirm prior to use and as necessary thereafter.
h) Records to demonstrate calibration and verification.

- END SECTION 4 –

SECTION 5 - MEASUREMENT, ANALYSIS AND IMPROVEMENT

(*This section corresponds to Section 8 of ISO 9001-2000. It addresses the methods used to measure, report and improve on both the performance and effectiveness of your processes and the ability of these processes to deliver products that satisfy the customer. It also addressed the need to collect and use data on customer satisfaction, nonconformance etc. to address improvement issues.)*

5.1 General

The Company has defined, planned and implemented measurement, monitoring, analysis and other activities needed to assure conformity, and achieve product and construction service improvement. These activities include:

a) Customer satisfaction surveys
b) Internal Audits
c) In process reviews/inspections/tests/statistical techniques
d) Control of nonconformance
e) Data analysis
f) Corrective, preventive and improvement activities

5.2 Monitoring and Measurement

5.2.1 Customer Satisfaction

The Company has developed methods to obtain data and monitor customer satisfaction and/or dissatisfaction. The assigned Contract Officer, Designated Responsible Officer or designee shall be responsible to assure the data is included as part of the Management Review.

5.2.2 Internal Audit

(Note: Reference to or inclusion of a documented procedure covering Internal Audit is required.)

The Company shall establish, maintain and implement an Internal Quality Audit Program to verify that quality activities and related results comply with planned arrangements and to determine the effectiveness of their Contract Quality Plan and associated procedures. Procedure, listed in Appendix 6.1 of this Company QMS Manual, has been issued covering the Internal Quality Audit Program. The program has the following attributes:

a) Internal quality audits shall be scheduled based upon status and importance of the activity to be audited.
b) Those conducting the Internal Quality Audits shall be competent to conduct audits.
c) A person(s) independent of those directly engaged in the audited activities shall conduct the Internal Quality Audits
d) Reports of the results of Internal Quality Audits shall be generated and issued. Company management, shall receive copies of the Reports.

e) The Audited party is responsible to correct deficient areas promptly
f) Corrective Action shall be monitored and brought to closure
g) Follow-up Internal Quality Audits shall be conducted, as appropriate, to ensure implementation of Corrective Action and the results reported to top management.
h) The activities of subconsultants/subcontractors working under this Company QMS Manual shall be included in the Internal Quality Audit Program.

The COO is responsible to assure implementation of the Internal Quality Audit Program.

5.2.3 Monitoring and Measurement of Processes

The product realization processes described in Section 4 of this Company QMS Manual necessary to achieve customer requirements are measured and monitored.

These methods shall confirm the continuing suitability of each process to satisfy its intended purpose. When planned results are not achieved corrective prevention actions shall be taken to assure conformity.

5.2.4 Monitoring and Measurement of Product

The Company shall establish, maintain and implement a program to monitor and measure the characteristics of its products to verify product requirements have been met. This shall be documented in a contract Inspection And Test Plan.

These efforts will take place at various stages of product development based upon a preplanned product production program. Monitoring and measuring data and records will be maintained. No product will be released until all planned arrangements are satisfactorily completed. Exceptions may be authorized by the Construction Contract Officer or Designated Responsible Officer and by concession of the customer. For standard product the customer shall be notified in writing of any exception. Records of exceptions shall be maintained.

5.3 Control of Nonconforming Product

(Note: Reference to or inclusion of a procedure addressing control of nonconforming conditions is required.)

The Company has a program to detect and correct nonconforming conditions relating to their product. This includes product provided by the Company or data, materials, sub-assemblies produced by others and incorporated into the product.

Nonconforming product will be identified to prevent unintended use or delivery. Corrected product will be subject to the same verification process as the original to demonstrate conformity to requirements.

The applicable procedure, listed in Appendix 6.1 of this Company QMS Manual, has been issued covering identification of nonconforming conditions, actions to

preclude use of nonconforming product, use of nonconforming product by concession, record keeping, and maintaining status until disposition.

The Customer shall be advised of any product nonconformance detected after it has been delivered or put into use, or as required by Contract.

The Contract Officer or Designated Responsible Officer is responsible to assure this notification is issued.

5.4 Analysis of Data

The Company collects and analyzes appropriate data to determine the suitability and effectiveness of its QMS and to identify where improvements can be made in the QMS.

The following data is gathered and analyzed:

- Customer satisfaction/dissatisfaction
- Conformity of product to requirements
- Measuring & monitoring data
- Trends of both positive and negative compliance
- Internal Quality Audit Data

5.5 Improvement

5.5.1 Continual Improvement

The Company facilitates continual improvement of the QMS by assessing and acting upon the following:

- Quality Policy changes
- Goal/objective changes
- Implementation of the results of management review
- Audit findings analysis of nonconformance
- Corrective and preventive actions implemented

5.5.2 Corrective Action

(Note: Reference to or inclusion of a documented procedure for corrective action is required.)

The Company has established a Corrective Action program to eliminate the cause of the nonconformity and thus prevent recurrence.

Corrective action will be appropriate to the severity of the nonconformity identified.

The applicable procedure, listed in Appendix 6.1 of this Company QMS Manual, addresses nonconformity identification (including customer complaints) cause determination, action to prevent recurrence, identifying and implementing the corrective action, recording results, determining if the corrective action was

implemented and effective in resolving the nonconformity.

5.5.3 Preventive Action

(Note: Reference or inclusion of a documented procedure for preventive action is required.)

The Company has a Preventive Action Program, which anticipates the potential causes of nonconformities and works to reduce or eliminate these potential causes.

The applicable procedure, listed in Appendix 6.1 of this Company QMS Manual, identifies potential nonconformities, their probable cause, determination of preventive action needed, and implementation of preventive action, determining if preventive action was implemented and effective in preventing nonconformity.

5.5.4 The COO or designee is responsible for assuring implementation of the QMS improvement requirements.

- END SECTION 5 -

SECTION 6 - APPENDICES

6.1 List of Company Quality Management System Implementing Procedures

6.2 Quality Policy

(Note: The Quality Policy should address such issues as:

- Company's commitment to satisfying Customers' needs means that there must be:
  - Free and effective communication with the Customer to achieve a clear understanding of environment into which the product will be applied
  - Elimination of nonconforming conditions
  - Production in adequate quantities
  - On time delivery
  - Timely and effective field service.
- A systematic management process must be applied to meet Customer needs.
- The Company's belief that the combination of
  - Adequately trained personnel
  - Working with documented procedures
  - Supported by adequately detailed product drawings and specifications,
  - Provided with the appropriate materials, facilities and tools
  - Is the basis for a system that will produce products and services meeting Customers' needs
- The Company's belief that management systems must be continuously examined and modified to ensure that it is effective in satisfying Customer needs in the midst of changes in business, regulatory, and social environments.
- That management systems must be sponsored and championed by the highest levels of the Company management in order to underline the priority the company places it.

6.3 Quality Objectives

6.4 Company Organization Chart

SECTION 01 45 29 - TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the requirements for services provided by an independent testing laboratory employed by the Contractor.

1.2 SELECTION AND PAYMENT

A. Contractor shall employ on behalf of Metro-North and pay for services of an independent testing laboratory to perform specified inspection and testing.

B. Employment of an independent testing laboratory shall in no way relieve the Contractor of the obligation to perform the work in accordance with the requirements of the Contract Document).

C. Contractor shall submit the names and qualifications of three independent testing laboratories to the Engineer for approval not less than 15 days prior to the date of testing. The Metro-North Engineer will select one of the submitted testing laboratories, assuming it meets all guidelines and requirements.

1.3 SUBMITTALS

A. Prior to start of Work, submit testing laboratory names, addresses, and telephone numbers and names of full-time registered Engineers and responsible officers to Engineer for approval.

B. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory National Bureau of Standards during most recent tour of inspection, with memorandum of remedies of any deficiencies reported by the inspection.

C. In addition to the testing laboratory discussed in this Section, the Contractor shall submit, to the Engineer, lab credentials and certifications for laboratories providing analysis of medical surveillance testing, and analysis of personal air monitoring cassettes. Both the independent laboratory for inspection and testing and the medical surveillance testing laboratory must be accredited by OSHA as well as New York State Department of Labor (DOL), and the Department of Health (DOH), and hold any other appropriate licenses and certifications.

1.4 QUALITY ASSURANCE

A. Laboratory shall maintain a full-time Engineer registered in the State of New York on staff to review services.

B. Laboratory shall be certified as engineering testing laboratory to operate in the State of New York.

C. Testing equipment shall be calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards (NBS) standards or accepted values of natural physical constants.

1.5 LABORATORY RESPONSIBILITIES

A. Test samples of concrete and mortar mixes submitted by Contractor.

B. Perform on site cast in place testing of concrete, as per ACI and Section 03 30 00.

C. Provide test results of in plant concrete and asphalt mix testing, including concrete testing of pre-caster.

D. Perform and provide results of compaction testing of fill materials and subbase materials, and of asphalt compaction.

E. Provide qualified personnel at site after due notice; cooperate with Engineer and Contractor in performance of services.

F. Perform specified inspection, sampling, and testing of products and materials in accordance with these specifications.

G. Perform inspection of welds by non-destructive methods (Liquid Penetrant, Magnetic Particle) as directed by the Engineer.

H. Ascertain compliance of materials and mixes with requirements of Contract Documents.

I. Promptly notify Engineer and Contractor of observed irregularities or non- conformance of Work or products.

J. Perform additional inspections and tests as required by Engineer.

1.6 LABORATORY REPORTS

A. After each inspection and test, promptly submit two copies of laboratory report to Engineer and to Contractor, include: date issued, project title and number, name of inspector, date and time of sampling of inspection, identification of product and specifications section, location in the project, type of inspection or test, date of test, results of tests, and conformance with Contract Documents. When requested by Engineer, provide interpretation of test results.

1.7 LIMITS OF TESTING LABORATORIES AUTHORITY

A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.

B. Laboratory may not approve or accept any portion of the Work.

C. Laboratory may not assume any duties of Contractor.

D. Laboratory has no authority to stop work.

1.8 CONTRACTOR'S RESPONSIBILITIES:

A. Deliver to laboratory at designated location adequate samples of materials proposed to be used which require testing, together with proposed mix designs.

B. Cooperate with laboratory personnel and provide access to work and to manufacturer's facilities.

C. Provide incidental labor and facilities to provide access to work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests inspections, and for storage and curing of test samples.

D. Notify Engineer and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

(This Page Left Intentionally Blank)

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 74 19 - Construction Waste Management and Disposal.

C. Section 31 10 00 - Site Clearing,

D. Section 32 17 23 - Pavement Markings.

E. Section 32 93 00 - Plants.

1.3 SUMMARY

A. This Section specifies:
   1. Requirements for furnishing, installing, operating, and removing temporary facilities and controls including:
      a. Temporary utilities:
         1) Temporary electricity.
         2) Temporary lighting.
         3) Temporary telecommunications.
         4) Temporary traffic Signals
      b. Construction facilities:
         1) Field offices and sheds.
         2) First aid facilities.
         3) Temporary sanitary facilities
      c. Vehicular access and parking:
         1) Haul routes.
         2) Temporary parking areas.
         3) Traffic control.
         4) Staging areas.
      d. Temporary barriers and enclosures:
         1) Temporary barricades.
         2) Temporary fencing.
         3) Temporary protective walkways.
         4) Temporary security barriers.
         5) Temporary tree and plant protection.

e. Temporary controls:
   1) Temporary erosion and sediment control.
   2) Temporary pest control.
   3) Temporary environmental controls.
   4) Temporary storm water pollution control.
   5) Site watering for dust control.

f. Project Identification:
   1) Temporary Project Signage.

1.4 REFERENCES

A. Abbreviations and Acronyms:
1. ADA: Americans with Disabilities Act.
2. DSL: Digital subscriber line.
3. GPS: Geographic positioning system.
4. H.I.D.: High Intensity Discharge.
5. MUTCD: Manual on Uniform Traffic Control Devices for Streets and Highways.
6. NYSDEC: New York State Department of Environmental Conservation.
7. NYSDOT: New York State Department of Transportation.
8. OSHA: Occupational Safety and Health Administration.
9. SMS/MMS: Short Message Service/Multimedia Messaging Service.
10. SMO: Storm Water Management Officer.
11. SPDES: State Pollution Discharge Elimination System.
12. SWPPP: Storm Water Pollution Prevention Plan.

B. Reference Standards:
1. American Society of Heating, Refrigerating, and Air-ConditioningEngineers, Inc. (ASHRAE):
   a. ANSI/ASHRAE 62.1-2007 – Ventilation for Acceptable Indoor Air Quality.
   b. ANSI/ASHRAE/IESNA 90.1-2007 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
2. American Society of State Highway and Transportation Officials (AASHTO):
   a. AASHTO M 80 - Coarse Aggregate for Portland Cement Concrete.
   b. AASHTO T 85 - Specific Gravity and Absorption of Course Aggregate.
3. American Society for Testing and Materials (ASTM):
   a. ASTM A 121 - Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.
   b. ASTM A 392 - Standard Specification for Zinc-Coated Steel Chain- Link Fence Fabric.
   c. ASTM F 1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
   d. ASTM D 3786 - Standard Test Method for Bursting Strength of Textile Fabrics - Diaphragm Bursting Strength Tester Method.
   e. ASTM D 4355 - Standard Test Method for Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
   f. ASTM D 4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
   g. ASTM D 4632 - Standard Test Method for Grab Beaking Load and Elongation of Geotextiles.
   h. ASTM D 4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile.
   i. ASTM D 4833 - Standard Test Method of Index Puncture Resistance of Geomembranes and Related Products.

4. Associated General Contractors of America, Inc. (AGC):
   a. Manual of Accident Prevention in Construction.
5. Town of North Salem:
   a. Phase II Storm Water Management Program.
   b. Traffic Ordinance of the Town of North Salem.
   c. Town of North Salem, New York, Code of Ordinances.
   d. Town of North Salem General Construction Code.
6. Council of Tree and Landscape Appraisers:
   a. Guide for Plant Appraisal.
7. National Fire Protection Association (NFPA):
   a. NFPA 1 – Fire Code.
   b. NFPA 10 – Standard for Portable Fire Extinguishers.
   c. NFPA 70 – National Electrical Code® (NEC).
8. State of New York:
   a. New York State Department of Environmental Conservation (NYSDEC):
      1) State Pollution Discharge Elimination System (SPDES):
         a) Permit No. GP-0-10-001 – SPDES General Permit for Stormwater Discharges from Construction Activity.
         b) Permit No. GP-0-10-002 - SPDES General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4s).
   b. New York State Department of State:
      1) Division of Code Enforcement and Administration, http://publicecodes.cyberregs.com/st/ny/st/index.htm:
         a) Building Code of New York State.
         b) Fire Code of New York State.
         c) Mechanical Code of New York State.
   c. New York State Department of Transportation (NYSDOT):
      1) NYSDOT Standard Specifications (U.S. Customary Units).
      2) New York State Standard Sheets (U.S. Customary Units).
      3) New York State Supplement to the Manual on Uniform Traffic Control Devices for Streets and Highways (2009 Edition).
9. Tree Care Industry Association (TCIA)/American National Standards Institute (ANSI):
   a. ANSI A300 (Part 1), Standards for Tree Care Operations - Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Pruning).
   b. NSI A300 (Part 2), Standards for Tree Care Operations - Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Fertilization).
   c. ANSI A300 (Part 3), Standards for Tree Care Operations - Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Support Systems – Cabling, Bracing, and Guying EstablishedTrees).
   d. ANSI A300 (Part 4), Standards for Tree Care Operations - Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Lightning Protection Systems).
   e. ANSI A300 (Part 5), Standards for Tree Care Operations - Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Management of Trees and Shrubs During Site Planning, Site Development, and Construction).
   f. ANSI A300 (Part 6), Standards for Tree Care Operations - Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Transplanting).
   g. ANSI A300 (Part 7), Standards for Tree Care Operations - Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Integrated Vegetation Management).
   h. ANSI Z133.1, Safety Requirements for Arboriculture.
10. Underwriters Laboratories, Inc. (UL):

a. UL Online Certifications Directory, http://www.ul.com/regulators/quickguide.html.

11. United States Government:
    a. Americans with Disabilities Act. (Pub. L. 101–336, 104 Stat. 327, 42 U.S.C. 12101–12213 and 47 U.S.C. 225 and 611) [ADA].
    b. United States Code:
        1) 33 U.S.C. Section 1251 et seq.
            a) Water Quality Act of 1987, Public Law 100-4.
            b) Clean Water Act of 1977, Public Law 95-217.
            c) Federal Water Pollution Control Act Amendments of 1972, Public Law 95-500.
    c. Department of Justice:
        1) 2010 ADA Standards for Accessible Design,
        2) 28 CFR 35 - Nondiscrimination on the Basis of Disability in State and Local Government Services
        3) 28 CFR 36 – Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities.
    d. Environmental Protection Agency (EPA):
        1) 40 CFR 123 and 124 - National Pollutant Discharge Elimination System Permit Application Regulations for Storm Water Discharges; Final Rule.
        2) 40 CFR 9, 122, 123, and 124 - National Pollutant Discharge Elimination System—Regulations for Revision of the Water Pollution Control Program Addressing Storm Water Discharges; Final Rule
        3) 40 CFR 61 National Emission Standards for Hazardous Air Pollutants.
    e. Federal Highway Administration (FHWA):
        1) Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD).
    f. Occupational Safety and Health Administration (OSHA):
        1) 29 CFR 1910 Occupational Health and Safety Standards.
        2) 29 CFR 1926 Safety and Health Regulations for Construction.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Notices:
    a. Not less than 20 work days before closing each street, notify the Construction Manager in writing of the closing.
    b. Not less than 14 days before prohibiting, stopping, and parking vehicles is required or work is to be performed on City streets, notify the, Town of North Salem, Traffic Department or Westchester County Transportation Engineer in writing; and submit a copy of each notice to the Construction Manager for information.
    c. Not less than 7 days before impairing access to buildings adjacent to the station sites and use of public ways thereto, notify individual owners, owners' agents, and tenants of in writing; and submit a copy of each notice to the Construction Manager for information.

1.6 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Town of North Salem:

a. Obtain and comply with all necessary local permits and inspections associated with establishing and maintaining the field offices and sanitary provisions.

b. Temporary Construction Permit:

1) Prior to commencing construction operations, submit plans and specifications indicating the design and construction of sidewalk sheds, truck runways, trestles, foot bridges, guard fences, and similar devices required in the operation as required by the Town of North Salem General Construction Code to the Town of North Salem Building Department for approval.

2) Do not commence operations until the approval of the Town of North Salem Building Commissioner is received and submit a copy of the plans and specifications and their approval to the Construction Manager for information.

c. Storm Water Management and Erosion Control:

1) Conform to requirements of the Town of North Salem Phase II Storm Water Management Program.

2) Prior to commencing construction work involving disturbance of land on the Site, submit an Erosion Control Plan complying with the requirements specified in the Town of North Salem General Construction Code to the Town of North Salem Building Department for approval, and submit a copy of the Erosion Control Plan and its approval to the Construction Manager for information.

d. Encroachments:

1) Sidewalk sheds, underpinning, and other temporary protective guards and devices may only project beyond the interior and street lot lines if approval to do so is obtained from the Town of North Salem Building Commissioner, and if necessary the approval of the affected adjacent property owner.

2. Westchester County – To be added

3. Orange County – To be added

4. State of New York:

a. Comply with the applicable rules, regulations, and programs of the New York State Department of Environmental Conservation (NYSDEC), particularly the following:

1) State Pollution Discharge Elimination System (SPDES).

a) Permit No. GP-0-10-001 - SPDES General Permit for Stormwater Discharges from Construction Activity.

b) Permit No. GP-0-10-002 - SPDES General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4s).

2) Obtain the necessary permits from the New York State Department of Environmental Conservation (NYSDEC) to construct the Work of this Contract.

a) Abide by the Metro-North prepared Stormwater Pollution Prevention Plan (SWPPP).

b) Submit the SWPPP to the Town of North Salem Planning Board or Storm Water Management Officer (SMO) for approval and submission to NYSDEC for approval.

c) Do not start the work until the proposed erosion and sedimentation control plan has been approved by NYSDEC, and a permit for construction has been issued.

3) Comply with the requirements specified in the State Pollution Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity, which governs the Work of this Section and prohibits the discharge to the waters of the State of any pollution materials whether from industrial or domestic sources.

4) Pay any fines assessed to the Contractor for violation of the regulatory rules, regulations, and programs at no increase in Contract Price.
5) Comply with the applicable rules, regulations, and programs of the New York State Department of Transportation (NYSDOT), Section 680 and Section 724 of the 2016 General NYCDOT Specifications.

B. Certifications:
1. Geotextile Certificates of Compliance:
a. For each proposed geotextile material, submit certificates demonstrating that the material conforms to the requirements of this Specification.

1.7 SUBMITTALS

A. Action Submittals:
1. Submit the following to the Construction Manager for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:
a. Product Data:
1) Products furnished for the Work of this Section.
2) List of pesticide, fungicide, and anti-desiccant materials, and application methods and documents proposed for use.
b. Shop Drawings:
1) Working Drawings showing the proposed temporary erosion and sediment controls.
2) Locations and details of protective fencing.
3) Temporary project signage message and layout.
c. Samples:
1) Geotextile fabric Samples.
d. Certificates:
1) Geotextile material certification.
e. Delegated Design Submittals:
1) Site Layout Plan.
2) Tree Protection Fencing Plan.
3) Evacuation Plan.
4) List of Emergency Contacts.
5) Traffic Control Plans (TCP) and updates.
6) Individual Lane and Sidewalk Closure Plans.
7) Tree Protection Fencing Plan.
8) Temporary Erosion and Water Pollution Control Plan.
9) Proposed field office layout.

B. Closeout Submittals:
1. Submit the following to the Construction Manager in accordance with the requirements of Metro-North:
a. Warranty Documentation:
1) Plant Warranty.
2) Temporary Tree and Plant Protection Warranty.

1.8 WARRANTY

A. Special Warranty:
   1. Furnish and submit a 90-day Temporary Tree and Plant Protection Warranty on the workmanship and materials provided under this Section to the Construction Manager.

B. Extended Correction Period:
   1. Furnish and submit an unconditional 2-year Plant Warranty for all plants repaired or replaced as required under this Section to the Engineer.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. Regulatory Requirements:
   1. Comply with the Laws, Codes, and Regulations pertaining to the work being performed at each station site.
   2. United States Government:
      a. All work is governed at all times by the applicable provisions of Federal Laws, including but not limited to, the following:
         1) Americans with Disabilities Act.
         2) Water Quality Act of 1987.
         3) Clean Water Act of 1977.
         4) Federal Water Pollution Control Act Amendments of 1972.
      b. Comply with the applicable regulations of the Occupational Safety and Health Administration (OSHA).
   3. State of New York:
      a. Comply with the applicable requirements of the New York State Department of Environmental Conservation (NYSDEC).
      b. Comply with the applicable requirements of the New York State Department of Transportation (NYSDOT).
      c. Comply with the applicable requirements of the Building Code of New York State.
      d. Comply with the applicable requirements of the Fire Code of New York State.
      e. Comply with the applicable requirements of the Mechanical Code of New York State.
   4. Town of North Salem, NY:
      a. Comply with the requirements specified in each municipality various Code of Ordinances.
   5. National Fire Protection Association (NFPA):
      a. Comply with the safety provisions of the NFPA 1 pertaining to the Work and, particularly, in connection with any cutting or welding performed as part of the Work.

2.2 MATERIALS

A. Submit Product Data for the Products furnished for the Work of this Section to the Construction Manager for approval prior to their use.

B. Burlap:
   1. Provide untreated burlap fabric.

C. Protective Fencing:
1. Fence Fabric:
a. Provide clean, new, and unblemished fence fabric with the following characteristics:
1) Height: 4 feet.
2) Material: Orange plastic fabric mesh.
b. Provide fence fabric in 50 feet long, minimum, continuous sections.
c. Provide the same type mesh fence fabric throughout the duration of the Contract.
d. Manufacturers:
1) Industrial Fabrics, Inc., HiVu® Barrier Fence, www.ind-fab.com.
2) Propex Fabrics, Inc., www.propexinc.com.
3) Tensar International, www.tensarcorp.com.
4) Approved equal.
2. Fence Posts:
a. Provide fence posts having the following characteristics:
1) Post Material: Painted lightweight steel (0.98 pounds per foot).
2) Type: Domestic tee stud with a metal flange at the bottom.
3) Length: 6 feet.
3. Fence Fabric Ties:
a. Provide ties consisting of 16 gage galvanized steel wire.

D. Heavy Duty Protective Fencing:
1. Provide heavy duty protective fencing.
a. Heavy duty protective fencing may include, but is not limited to, temporary chain link type fence, 6 feet high with precast concrete bases.

E. Pesticide, Fungicide, and Anti-Desiccant:
1. Provide materials approved by the governing regulatory agencies that are suitable for the identified needs.
2. Submit a list of pesticide, fungicide, and anti-desiccant materials proposed for use, and their application methods and documentation.

F. Topsoil:
1. Provide backfill as specified in Section 32 93 00, Plants, for backfill around plants as needed.

G. Silt Barrier Fence:
1. Geotextile Fabric:
a. Provide woven or non-woven fabric consisting of long chain, polymeric filaments or yarns, such as polypropylene, polyethylene, polyester, polyamide, or polyvinylidene-chloride, formed into a stable network so the filaments or yarns retain their relative position to each other.
b. Provide fabrics inert to commonly encountered construction chemicals or substances and having at a minimum the physical requirements specified in Table 01 50 00-1 for each property when tested according to the test method listed for the property.

Table 01 50 00-1 Physical Properties of Geotextile

Properties	Test Method	Minimum Requirements
Grab Tensile Strength, Pounds.	ASTM D 4632	90
Grab Tensile Elongation, Percent	ASTM D 4632	15, minimum

Burst Strength, psi	ASTM D 3786	140
Puncture, lbs, (5/16 Inch Flat-End Rod)	ASTM D 4833	40
Trapezoid Tear Strength, Pounds	ASTM D 4533	30
Apparent Opening Size, Sieve Number	ASTM D 4751	Number 20, maximum
Ultraviolet Resistance Strength Retention, 0/0	ASTM D 4355	70 at 150 hours

1) Wire Mesh Support:

c. Provide either galvanized or aluminized, 14.5-gauge wire mesh arranged in a maximum grid of 6 inches by 6 inches.

d. Alternatively, an acceptable, equivalent plastic mesh may be used.

2. Posts:

a. Provide 2-inch, minimum, square wood posts; 1-1/4 inch by 1-inch steel T-sections or equivalent; or acceptable plastic posts with an equivalent section.

3. Fasteners:

a. Provide either 1 1/2-inch long Number 9 staples, or 17 gauge galvanized or aluminized steel tie wires of the appropriate length.

H. Hay Bales:

1. Provide seed-free hay bales approximately 36 inches long by 26 inches wide by 18 inches high and bound with galvanized wire or nylon rope tied across the stem length.

I. Construction Entrances and Sediment Traps:

1. Aggregate:

a. Provide coarse aggregate conforming to the requirements for Size Number 1 as specified in AASHTO M 80.

J. Utility Materials:

1. Provide such materials as may be required for providing the temporary utility services specified herein.

K. Temporary Traffic Control Devices:

1. Furnish temporary traffic control devices that comply with the requirements specified in the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) and the New York State Supplement to the Manual on Uniform Traffic Control Devices for Streets and Highways (2009 Edition).
2. Temporary Concrete Barriers:
   a. Furnish precast "Jersey Barrier" sections.
      1) Concrete: 3,000 psi.
   b. Provide 1/2" joint opening between adjoining precast sections
3. High Rise Warning Flag Unit:
   a. Furnish high rise warning flag unit having 3 flags mounted 9 feet above the base.
4. Warning Lights and Flares:
   a. Furnish warning lights and flares capable of alerting approaching traffic to hazards, unsafe conditions, and variances to normal traffic patterns.
5. Signs:

a. Furnish signs as indicated on the Contract Drawings, in the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), and in the referenced NYSDOT Publications.

6. Flagmen signs:
   a. Furnish flagmen signs that are 24 inches across, octagonal in shape, and attached to a five-foot handle.
   b. Furnish flagmen signs that have a stop sign on one side, and a slow sign on the other side.
      1) Stop Signs:
         a) Provide stop signs having white reflectorized letters not shorter than 8 inches that spell "STOP" on a reflectorized, red, octagonal background.
      2) Slow Sign:
         a) Provide slow signs having black letters not shorter than 8 inches that spell "SLOW" on a reflectorized, orange, diamond background.
         b) Paint the area between the diamond and the edge of the flagmen sign black.
7. Pavement Marking Paint:
   a. Provide temporary pavement marking complying with the requirements specified in Section 32 17 23, Pavement Markings.

L. Other Materials:
   1. Provide other materials as required and approved by the Construction Manager.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Review the existing conditions at the Site and determine what else is necessary for the prevention of water pollution due to erosion.
   2. Prior to the start of construction, conduct on-site inspections of plants and vegetation with the Project Arborist, and identify and inventory the plants and vegetation that are to remain in place during this area tour.
      a. Field measure and stake Project improvements as needed for establishing the location of protective fencing.
      b. In areas where the protective fencing will be located at a fixed distance from proposed Project improvements, field survey and stake improvement sites prior to the area tour with the Project Arborist.

B. Evaluation and Assessment:
   1. In addition to performing the work described herein and indicated on the Contract Drawings, implement the additional measures determined necessary for the prevention of water pollution due to erosion discovered during the review of the Work Site.

3.2 PREPARATION

A. Protection of In-Place Conditions:
   1. Existing Surfaces and Facilities:

a. Take positive action to protect all existing surfaces and facilities from any damage resulting from construction operations unless modifications to the surfaces or facilities are required as part of the Contract.
b. Protect all paving, landscaping, and utility facilities from damage caused by mobile and stationary equipment, including vehicles delivering materials to the site.

B. Surface Preparation:
1. Clear Existing Vegetation:
a. In accordance with the requirements of Section 31 10 00, Site Clearing, clear and remove existing vegetation as required to install Final location stakes and to install fence posts and fence fabric for protecting tree and plant materials.
1) Keep clearing operations to the minimum needed for fence installation.
2) Do not clear tree and plant materials from within the area to be protected by the fence.
3) Perform clearing in a manner and to an extent approved by the Construction Manager.
b. Remove dead and damaged plants that the Project Arborists determine are a hazard or that are incapable of restoration.

C. Demolition / Removal:
1. Perform demolition and construction activities within protected areas in a manner that minimizes damage to tree roots and branches.
a. Use hand tools where necessary.
b. Make minimal use of construction equipment within the protected areas.
1) Use such equipment within the protected area only when approved and after consultation with the Project Arborist.
2) Provide 72 hours advanced notification prior to the use of the equipment within the protected areas.
3) Provide bridging materials, such as protective planking, in protected areas where such construction equipment operates.
c. When utilities must be installed within protected areas, bore under the protected areas whenever possible instead of digging open trenches through them.

3.3 TEMPORARY UTILITIES

A. Provide and pay for all temporary utilities required for this Contract including electrical power; traffic signal, and lighting; and if required, water, drainage and fire protection.
1. Include obtaining permits, providing the utility services, and connecting and disconnecting the utilities in the costs.
2. Unless otherwise specified, do not use Metro-North utilities.

B. Temporary Electricity:
1. Provide and maintain suitable temporary electrical systems and power facilities required for the proper performance of the Work until final completion and acceptance of the Work.
a. Provide UL-listed electrical equipment and wiring for temporary electricity.
b. Install temporary electricity in accordance with the requirements specified in NFPA 70 and of the Occupational Safety and Health Administration (OSHA)
2. Provide power service from temporary electric feeders from the local utility, from engine generators, or from the Owner's existing power service.

a. If using the Owner's existing power service, do not disrupt Owner's need for continuous service, take measures to conserve energy, and provide separate metering and reimburse the Owner for the cost of energy used.
b. Complement existing power service capacity and characteristics as required.

3. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required.
   a. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.
      1) Provide 20 Ampere duplex outlets, single phase circuits for power tools for every 500 square feet of active work area.
      2) Provide 20 Ampere, single phase branch circuits for lighting.
      3) Permanent convenience receptacles may not be used during construction.
   b. Provide flexible power cords as required.
4. Provide a main service disconnect and over-current protection at a convenient location, and meter.

C. Temporary Traffic Signals:
1. Provide and maintain existing pedestrian traffic signals and push-button controls to protect pedestrians when entering cross walks adjacent to the Crestwood station.
2. Follow New York State Department of Transportation 2016 Specifications, section 680 and Section 724 as required.

D. Temporary Lighting:
1. Provide and maintain lighting for the field offices that achieves a minimum uniform lighting level of 100 foot-candles at desk height in all areas within the offices.
2. Provide and maintain lighting for construction operations in accordance with the requirements specified in 29 CFR 1926.56, and that achieves a minimum lighting level of 2 Watts per square foot or 10 foot-candles.
   a. Provide UL-listed electrical equipment and wiring for temporary lighting.
3. Security Lighting:
   a. For exterior staging and storage areas, provide and maintain lighting for security after dark in accordance with the requirements specified in 29 CFR 1926.56, and having a minimum lighting level of 1 Watt per square foot.
   b. Provide and maintain HID lighting having a minimum lighting level of
   c. 0.25 Watt per square foot for interior work areas after dark.
4. Position and aim lighting equipment so it will not shine directly on passing trains, vehicular traffic, or commercial or residential premises adjoining the Site.
5. Provide branch wiring from a power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
   a. Provide UL-listed electrical equipment and wiring for temporary lighting.
6. Comply with the requirements of ANSI/ASHRAE/IESNA 90.1-2007.
7. Permanent lighting may be used during construction.
   a. The Metro-North will meter usage for payment by the Contractor.
8. Maintain the lighting and provide routine repairs.

E. Temporary Telecommunications:
1. Internet Access:
   a. Provide hi-speed digital subscriber line (DSL) internet access to and within the field offices.
      1) Actual locations for ports will be as directed by the Construction Manager with input from the Metro-North.

2) Provide a connection having at least T1 Speed.

b. Set up computers, color copiers, and scanning equipment as a hard-wired network with access to the Internet using the digital subscriber line (DSL) or cable connections for the duration of the Contract.

c. Provide routers as needed to allow wireless access to all computers and laptops used for the Contract.

d. Submit Product Data for the proposed smart phone and accessories to the Construction Manager for approval.

2. Land Lines:

a. Provide telephone land lines installed in the field office capable of handling at least six 2-line telephones.

b. Contractor shall provide at least six 2-line telephones.

F. Other Temporary Utility Services:

1. Determine the need for other temporary services as may be required to prosecute the Work and make arrangements with utility companies and municipal agencies for such service.

3.4 CONSTRUCTION FACILITIES

A. Site Layout Plan:

1. No later than 10 Days after the effective date of the award, prepare a proposed Site Layout Plan.

a. Include Working Drawings showing at a minimum the location of construction fences; roadways and entrances; locations and sizes of all field offices, shops, buildings, and sheds; locations and sizes of all staging, storage, and lay down areas; waste and recycling containers, security fencing, stationary equipment, temporary utilities, and similar facilities.

b. The location of stationary equipment and the location of miscellaneous mobile equipment are subject to approval.

2. Within the 20 Days after receipt of the Notice-To-Proceed, submit the Site Layout Plan to the Construction Manager for approval.

B. Field Offices and Sheds:

1. Provide one trailer or rental property for the use of the Construction Manager for the station enhancement project.

a. Provide a new, weather-tight and structurally sound, 12 feet wide by 60 feet long, Williams Scotsman trailer or approved equal, or rented office space (minimum of 720 square feet), having the following features:

1) Vinyl or linoleum flooring capable of withstanding live loads of 125 pounds per square foot.

2) Neatly painted or paneled wall surfaces.

3) Screened operable windows having security gratings on their exteriors.

4) Keyed and lockable exterior and interior doors, and deadbolt locks for exterior doors.

5) Exterior lighting located over entrance doors.

6) Uniform interior lighting.

7) Battery backup for the emergency exit lights.

8) Adequate air conditioning equipment.

b. Provide adequate lighting; electrical receptacles; telephone and computer outlets and support systems including conduit, wiring, panels, and similar items; heating, cooling,

and ventilating equipment; and sanitary facilities for 6 people until final completion and acceptance of the Work.

1) Obtain, connect, and pay for the utilities for the field office, including power, water, fuel, sewer, and telecommunications as required; sufficient to power and operate the lighting and other equipment in the field office.
   a) Obtain and pay for necessary related permits.
2) Provide ground fault circuit interrupters as required by NFPA 70 and OSHA regulations.
3) Provide convenience electrical outlets every 6 feet on interior walls.

c. Partition the field office to furnish 2 offices, 3 cubicles/open office area, a bathroom, a secretarial area, and a file area.
   1) Submit a proposed field office layout to the Construction Manager for approval.

d. If a trailer is provided, grade the site of the field office to provide drainage of the Site, deliver the trailers, set them level, and anchor them in accordance with applicable code requirements.

e. Provide pressure treated wood access stairs, ramps, and landings for ADA/handicapped access at each exterior door; and connections to all temporary utilities.

f. The trailers will remain the property of the Contractor at project completion.

2. Furnish, install, maintain, and pay for temporary telephone service, utilities, and furnishings.
   a. Provide the following furnishings:
      1) First aid kit.
      2) Fire extinguishers.
         a) Provide non-toxic dry chemical fire extinguishers meeting the approval requirements of Underwriters Laboratories, Inc. (UL) for Class A, Class B, and Class C fires with a minimum rating of 2A:10B: 10C.
            (1) Capacity: Provide 10-pound fire extinguishers.
         b) Provide one fire extinguisher in each room of the field office.
      3) Color Copier:
         a) Provide a Cannon Image Runner C2550 or approved equal all-in-one copier having copy, print, scan, and facsimile capabilities.
         b) Provide a color copier having the following features:
            (1) System memory of 1 GB.
            (2) Automatic reversing document feeder having a 50-sheet capacity.
            (3) Print speed for black and white prints of 15 pages per minute.
            (4) Print speed for color prints of 6 pages per minute.
            (5) Automatic duplex printing.
            (6) Capable of producing copies from 8-1/2 by 11 inches to 11 by 17 inches in size.
            (7) Fax resolution of 200 by 400/200/100 dots per inch (DPI).
            (8) Fax transmission speed of 3 seconds per page.
            (9) Fax memory of 100 pages. (10) Fax automatic dialing.
            (10) Scanning size of 8-1/2 by 11 inches, 8-1/2 by 14 inches, and 11 by 17 inches.
            (11) Scanning speed for black and white originals of 42 sheets per minute (SPM) at 200 dots per inch (DPI).
            (12) Scanning speed for color originals of 13 sheets per minute (SPM) at 200 dots per inch (DPI).
            (13) Universal Serial Bus (USB) connection.

(14) Built-in photo card slot for direct printing capability from a camera without needing a personal computer.
(15) Connecting cables.

c) Connect the color copier to the computer network for printing and scanning.
d) The color copier will become the property of the Contractor at Project Close-Out.

4) Six fully assembled ergonomic chairs.
a) Provide chairs having arms, 5 legs with casters, and a height adjustment from 17 inches to 23 inches facilitated by a pneumatic gas cylinder.
5) Six waste paper baskets having a capacity of at least 10 gallons.
6) Five bookshelves having 3 shelves.
a) The bookshelves will become the property of the Contractor at Project Close-Out.
7) Nine chairs.
8) One 3-foot by 6-foot plan table.
9) Six desks.
10) Five 4-drawer and five 2-drawer vertical letter size file cabinets.

b. All furniture and equipment must be approved by the Construction Manager.
c. Completely furnish the field offices so they are ready for occupancy no later than 10 Days after the effective date of the Notice to Proceed.

3. Evacuation Plan:
a. Develop an Evacuation Plan for the field office and for the Site and post it in the Metro-North trailer.
b. Submit the Evacuation Plan to the Construction Manager for approval.

4. Emergency Contacts:
a. Develop a List of Emergency Contacts including telephone numbers, contact names, and similar information; and post it in the Metro-North trailer.
b. Submit the List of Emergency Contacts to the Construction Manager for approval.

C. First Aid Facilities:
1. Identify local medical facilities serving the area of the Project, and post directions to their locations and their contact information in the field office.
2. Provide a first aid kit kept in the field office and stocked with appropriate first aid supplies at all times

D. Temporary Sanitary Facilities:
1. Provide temporary sanitary facilities at the Site in accordance with the requirements specified in 29 CFR 1926.51.

3.5 VEHICULAR ACCESS AND PARKING

A. Haul Routes:
1. Restrict construction vehicular traffic to the approved haul route.
2. Failure to comply with the haul route plan may make violators subject to legal action by governmental agencies, and where direct or indirect damage is done to public or private property will make the Contractor responsible to clean-up and repair the damage.

B. Temporary Parking Areas:

1. Grade the parking areas for drainage, and surface them with crushed stone if they are not already improved.
2. Provide 2 parking spaces directly adjacent to the Metro-North project trailer for use by Metro-North.
    a. Keep the spaces clear of snow similar to the trailer requirements.
    b. Do not park Contractor vehicles in the spaces, store materials in the spaces, or otherwise make these parking spaces inaccessible for use by Metro-North.

C. Traffic Control:
1. Prior to submitting the bid for this Contract, contact the various municipalities holding jurisdiction of each of the stations to determine their traffic control requirements.
2. Furnish, install, maintain, and subsequently remove temporary traffic control devices and temporary traffic striping and markings; furnish flagmen; control, warn, guide, and protect vehicular and pedestrian traffic on streets and sidewalks affected by construction of the Contract, and that adjacent to the worksite; ensure unimpeded access to building, adjacent to the worksite; close portions of streets and sidewalks and prohibit vehicles from stopping and parking of on streets adjacent to the Site.
    a. Ensure that construction operations will not impede vehicular and pedestrian traffic to the extent that public safety will be threatened, and passage of emergency vehicles will be restricted.
    b. Do not obstruct public ways, including streets, sidewalks, and accesses to public and private properties and bus stops.
    c. Do not reduce carrying capacity, except as indicated on reviewed and accepted Traffic Control Plans (TCP) specified herein.
    d. Maintain pavement surfaces in a smooth riding plane where vehicular and pedestrian traffic is routed.
    e. In excavated paved areas, backfill excavations and install temporary pavement immediately after the backfill has been placed.
        1) Restore each section of permanent pavement and sidewalk as soon as is practicable after completion of the Work for which that section of pavement and sidewalk is removed.
    f. Maintain existing traffic signal operation in continuous operation.
    g. Prevent pedestrian access to the Site using devices such as fences, barricades, and flagging and security personnel.
    h. During working hours, prevent vehicles from stopping and parking on streets adjacent to the portions of the Site where construction is being performed.
        1) Erect "NO PARKING" and "NO STOPPING" signs at intervals of not more than 50 feet along public streets adjacent to the Project, and include messages giving times and days of no parking and no stopping.
            a) At least 48 hours prior to the need for posting the signs, notify the Town of North Salem Traffic Department that the signs will be posted.
            b) Cardboard signs will not be permitted.
            c) Remove the signs at the end of the posted time limit.
            d) If additional work is required beyond the posted dates, change the signs to reflect the new dates and times.
            e) If for any reason the Work will not be performed as stated, change the dates and/or times on posted signs in a timely manner, and notify the various municipalities individual Traffic Departments and local police.
        2) If vehicles are parked within the posted restrictive area, have the vehicle removed and relocated to a place of non-interference with the construction work.

a) Provide licensed tow truck drivers to remove illegally parked, abandoned, or disabled vehicles.
   (1) Supervise and coordinate the tow truck operations.
b) Direct the tow truck driver to make and keep a list of all relocated vehicles showing the following information, and submit a written copy of the above information to the various municipality Traffic Departments for use in the vehicle retrieval process and to the Construction Manager for information:
   (1) Vehicle license number.
   (2) Vehicle make and color.
   (3) Location vehicle was parked.
   (4) Location vehicle was relocated to.
c) The Contractor and/or the owner/operator of the licensed tow truck must agree to indemnify, defend, and hold harmless the various local municipalities and all of its officers and subordinates from all suits and actions as a result of towing any vehicles.

3. Traffic Control Plans (TCP):
   a. Prepare a Traffic Control Plan (TCP) indicating proposed traffic control devices in accordance with the following:
      1) NYSDOT Standard Specifications (U.S. Customary Units).
      2) New York State Standard Sheets (U.S. Customary Units).
      3) Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)
      4) New York State Supplement to the Manual on Uniform Traffic Control Devices for Streets and Highways (2009 Edition).
   b. In the Traffic Control Plan (TCP), show and describe proposed locations and time durations of the following:
      1) Pedestrian and public vehicular traffic routing.
      2) Traffic blockage and lane reductions anticipated to be caused by construction operations.
      3) Allowable on-street parking within the immediate vicinity of worksite.
      4) Access to the building immediately adjacent to worksite.
      5) Driveways which will, and those which will not, be blocked by construction operations.
      6) Temporary traffic control devices required on streets and sidewalks affected by construction.
      7) Temporary commercial and industrial loading and unloading zones.
      8) Modifications to street light locations and operation.
      9) Modifications to traffic signal locations and operation.
      10) Proposed haul routes.
   c. Within 15 days of Notice to Proceed and before starting the Work, submit the Traffic Control Plan (TCP) to the various municipality Traffic Department of each station for approval, and as an application for permits to work in the public right-of-way; and submit another copy to the Construction Manager for information.
      1) Costs, direct or indirect, not reflected in the bid, resulting from failure to reasonably anticipate such costs, will not be considered for payment.
   d. Every time it becomes necessary to modify traffic operations or undertake a construction activity which creates a different traffic impact, prepare and submit an updated Traffic Control Plan (TCP) to the various municipality Traffic Department for approval; and submit another copy to the Construction Manager for information.
4. Street Closing Plans:

a. All streets adjacent to each station must remain operational at all times. No full street closures will be allowed.

5. Individual Lane and Sidewalk Closure Plans:
   a. Prepare an Individual Lane and Sidewalk Closure Plan indicating proposed traffic control devices that shows and describes the proposed location, hours and time duration of the closure, vehicular and pedestrian traffic routing and management, traffic control devices for implementing pedestrian and vehicular movement around the affected closure, dates the closure will start and be reopened, and details of barricades and protecting closure.
   b. Not less than 15 work days before the actual lane and sidewalk closing, submit the Individual Lane and Sidewalk Closure Plan to the various municipality Transportation Engineer for approval; and submit another copy to the Construction Manager for information.
   c. Only close streets and sidewalks in accordance with the Individual Lane and Sidewalk Closure Plan.
   d. Install sidewalk closure signs in an advanced location of the closed portion of the sidewalk in order to permit safe crossing of the street at a crosswalk.
6. Temporary Traffic Control Devices:
   a. Before diverting traffic, post temporary traffic control devices along traveled ways where construction activities occur where indicated on the approved Traffic Control Plan (TCP).
   b. Place and maintain temporary traffic control devices throughout the construction period in those locations which will enable traffic to enter, traverse, and leave project area without hazard, and without abrupt and unwarranted changes in direction.
      1) Place drums as indicated.
      2) Place cones on not more than 25-foot centers.
      3) Modify temporary traffic control devices as shown on updated plans and remove them as soon as construction activities have been completed.
   c. Warning Lights:
      1) If approaching traffic needs to be alerted to hazards, unsafe conditions, and variances to normal traffic patterns; place warning lights and operate them between sunset and sunrise.
   d. Warning Flag Units:
      1) Where motorists' visibility of existing and temporary warning devices, traffic signals, and pedestrian crosswalks will either be limited or obscured, place and maintain high-rise warning flag units.
   e. Barricades and Cones:
      1) If personnel and equipment will be working within 5 feet of the edge of a traffic lane which will be bearing traffic, place and maintain barricades, cones, and similar protective devices.
7. Traffic Signs:
   a. Support and protect traffic signs, including street name signs, bus stop signs, regulatory, and directional signs, unless otherwise shown on the Contract Drawings.
      1) Repair or replace traffic signs damaged by construction operations or as directed by the Construction Manager.
   b. Where removal of traffic signs is required during construction, remove, store, and ultimately reinstall signs using hardware approved by the appropriate agency.
8. Construction Signs:
   a. As required and directed by the Construction Manager, furnish, erect, move, and remove construction signs to adequately and safely inform and direct motorists and to satisfy legal requirements.

b. Keep construction signs clean, mounted at the required height on adequate supports, and placed in proper position and alignment so maximum visibility is provided both night and day.
   1) Paint wood supports and the backs of plywood sign panels with 2 coats of white paint.
   2) Furnish signs and markers that indicate actual existing conditions, and move, remove, relocate, or change them immediately as directed by the Construction Manager.
c. Mount construction signs in accordance with the referenced codes and standards.
   1) Mount signs at least 5 feet high.
   2) Under special conditions, signs may be mounted at a greater height to fit the situation on an approved TCP submission, or as directed by the Construction Manager.
d. All signs are the property of the Contractor, must be maintained in good condition for the duration of the Contract, and must be removed from the Site when the Contract is accepted.
e. Place the name of the Contractor someplace on the sign only for the purpose of identifying the sign's owner.

9. Flagmen:
   a. Where opposing vehicular traffic must be diverted onto single traffic lanes, where traffic must change lanes abruptly, where construction equipment either enters or crosses traffic lanes and sidewalks, where construction equipment may intermittently encroach on traffic lanes and unprotected sidewalks and crosswalks, where construction operations would affect public safety and convenience, and where traffic regulation is needed because of the rerouting of vehicles around the worksite, furnish flagmen having flagman signs.

D. Staging Areas:
   1. Provide staging areas for staging the materials and equipment not immediately required for the Work.
   2. Grade the staging areas for drainage, and surface them with crushed stone if they are not already improved.

3.6 TEMPORARY BARRIERS AND ENCLOSURES

A. Temporary Barricades:
   1. Provide temporary barriers and enclosures to protect existing facilities and adjacent properties from damage from construction operations.
   2. Provide barricades required by governing authorities for public rights-of- way.
   3. Always allow continued access for Metro-North patrons and its employees to access to and from each station platform during construction activities.

B. Temporary Fencing:
   1. Where indicated, completely encircle the work areas on the Site with temporary fencing and leave no gaps in the fence panels.
      a. Place temporary fencing a minimum of 4 feet away from any part of buildings or structures being secured unless doing so would create an encroachment upon, or damage to, adjacent private property.
      b. Trim or cut back small tree limbs and shrubs as necessary to insure proper installation of the fencing.

c. Always allow continued access for Metro-North patrons and its employees to access to and from each station platform during construction activities.

2. When required for security purposes, provide a 7-foot high temporary chain link fence consisting of 6-foot high fence fabric affixed to fence posts with one foot high extensions supporting 3 strands of barbed wire along the top edge of the fence to deter persons from climbing over the fence, and extending to within a few inches of the surface supporting the fence to prevent persons from crawling under the fence.
3. Wire Fabric:
   a. Wire: 11 gauge or heavier steel wire galvanized in accordance with the requirements specified in ASTM A 392.
   b. Mesh Size: 2 inches, minimum.
   c. Break load Strength: 850 pounds force, minimum.
4. Fence Posts:
   a. Material: Galvanized steel schedule 40 pipe complying with the requirements specified in ASTM F 1083.
   b. Nominal Outside Diameter: 2 inches, minimum.
   c. Height: As required for the size fence indicated.
5. Post Bases:
   a. Provide appropriate bases for the surface supporting the fence, generally flat galvanized steel plate welded to the bottom of the fence posts or concrete formed around the fence posts.
   b. Provide a means to adequately anchor the posts to the surface supporting the fence so the fence cannot easily be moved out of place.

C. Temporary Protective Walkways:
1. Provide covered walkways required by governing authorities for public rights-of-way.
2. Provide temporary pedestrian passageways as detailed on the Contract Drawings and where indicated or required.
3. Always allow continued access for Metro-North patrons and its employees to access to and from each station platform during construction activities.

D. Temporary Security Barriers:
1. Provide temporary barriers and enclosures to prevent unauthorized entry to construction areas, vandalism, and theft.
2. Padlocks and Hasps:
   a. Provide a heavy-duty padlock and hasp for securing temporary doors.
   b. Manufacturers:
      1) American Lock, Number A1305, www.americanlock.com.
      2) Abus Lock, www.abuslock.com.

E. Temporary Tree and Plant Protection:
1. Tree Protection Fencing Plan:
   a. Prepare a Tree Protection Fencing Plan indicating the locations, extent, and perimeters of the trees and other vegetation to be protected as shown on the Contract Drawings and determined by onsite inspections.
      1) Submit the Tree Protection Fencing Plan, including Shop Drawings showing the locations and details of protective fencing, to the Construction Manager for approval.
   b. Install protective fencing after receiving approval of the Tree Protection Fencing Plan but before starting other construction activities.

c. The Owner reserves the right to require the Contractor to provide more substantial "heavy duty" protective fencing when, the vegetation is damaged or endangered by the Contractor's or Subcontractor's actions, or failure to take measures to protect the subject vegetation.

2. Protection of Existing Vegetation:
   a. Identify, protect, and maintain existing vegetation within the protected areas indicated on the Contract Drawings during the Contract from the Notice-To-Proceed to Final Acceptance.
      1) Perform the Work of this Section in accordance with the standards of the Tree Care Industry Association (TCIA).
      2) Complete the installation of protective fencing prior to starting any other work in the vicinity of protected vegetation.
      3) Do not perform any work within the protected areas unless approved.
      4) Do not store materials within the protected areas.
      5) Do not permit vehicle parking, foot traffic, or other activity not approved in writing within the protected areas.
   b. Provide labor and new and undamaged materials that constitute "Best Practice" to meet the letter and intent of this Contract.
      1) Follow the safety requirements of ANSI Z133.1.
3. Lay Out Protective Fencing:
   a. In order to protect existing vegetation indicated as remaining in the Contract Drawings, lay out the location of protective fencing as suggested by the Project Arborist.
      1) Field measure and stake the locations of project improvements as needed to establish the locations of protective fencing.
      2) Prior to installing the tree protection fencing, lay out the proposed fencing locations as shown on the approved Tree Protection Fencing Plan submittal drawings with paint and/or stakes and string for review and approval.
      3) Make adjustments in the fence locations and alignments as directed by the Program/Project Manager.
4. Install Protective Fence Posts:
   a. Install metal fence posts plumb and evenly spaced a maximum of eight feet apart on center.
   b. Insert the fence posts 18 to 24 inches into the ground and ensure that the installed post height above grade is within four inches of adjacent post heights.
5. Install Fence Fabric:
   a. Use the longest continuous lengths of fence fabric possible for each application.
      1) Terminate the ends of the fence fabric lengths at fence posts; and provide 12 inches, minimum, of full height overlap at each fence fabric end.
   b. Stretch the fencing fabric tightly between fence posts.
   c. Fasten the fence fabric firmly to the fence posts with the specified ties two inches below the top of each post, at the mid-point of each post, and at the point on each post three inches above the finish grade.
6. Install Heavy Duty Protective Fencing:
   a. The conditions may require the substitution of more substantial heavy-duty protective fencing for the protective fencing at select locations.
   b. Install heavy duty protective fencing at the locations indicated by the Project Arborist.
7. Excavating Around Trees and Shrubs:
   a. Excavate around trees and shrubs within protected areas only where indicated on the Contract Drawings.

1) When work that may impact protected plants occurs, plan the work to assure minimal disturbance to the plants, follow good horticultural practices, and direct pruning and wound treatment in accordance with this Section.

8. Protecting Root Systems:
   a. Protect root systems from damage due to run-off or spillage of noxious materials in solution during storage or construction activities.
      1) Protect root systems from flooding or soil erosion.
      2) Provide a minimum of 2 layers of untreated burlap as a covering over exposed root face areas.
   b. Do not disturb or excavate protected root zone areas unless specifically authorized to do so.
      1) Where trenching for utilities is required within protected areas, excavate under or over roots by hand digging under the authority of the Project Arborist.
      2) If large roots are encountered, or if a condition potentially fatal to the plant is observed, provide notification prior to continuing or commencing work.
      3) Do not cut main lateral roots or taproots, those 2-1/2 inches in diameter or greater; however, smaller roots that interfere with the installation of new work may be cut.
         a) Cut smaller roots with sharp pruning instruments, but do not break or chop roots.
         b) Excavate root systems by hand in areas where new construction is required within protected areas.
         c) Use a narrow-tine spading fork to expose roots.
         d) Cut exposed roots back from the new construction.
      4) Do not permit exposed roots to dry out before permanent backfills is placed.
         a) Provide temporary earth cover, or pack the roots with peat moss, and wrap the roots with burlap.
         b) Water and maintain the roots in a moist condition, and temporarily support and protect them from damage until they are permanently relocated and covered with backfill.
      5) Provide imported topsoil backfill to cover exposed roots in soil cuts.
      6) Do not overload root zones by placing backfill above the existing grade.

3.7 TEMPORARY CONTROLS

A. Temporary Erosion and Sediment Control:
   1. Temporary Erosion and Water Pollution Control Plan:
      a. Prepare a Temporary Erosion and Water Pollution Control Plan indicating all proposed temporary erosion and water pollution controls to the Construction Manager for approval.
         1) Include Working Drawings showing the proposed temporary erosion and sediment controls.
      b. Submit the Temporary Erosion and Water Pollution Control Plan to the Construction Manager for approval.
   2. Provide temporary erosion and sediment control as required.
      a. Protect grades and slopes susceptible to erosion.
      b. Place seed free hay bales, construct silt barrier fence with geotextile fabric, and construct temporary berms, dikes, dams, or ditching and other control measures as may be required.

c. Subject to approval by the Construction Manager, install and maintain temporary erosion and sediment controls as indicated in the Contract Documents until permanent erosion control features are in place.

3. Hay Bale Installation:
   a. Install seed free hay bales to provide sedimentation control at the locations indicated on the Contract Drawings, at other locations throughout the work area as required to provide erosion protection, and as directed.
   b. Place bales as indicated on the Contract Drawings.
      1) If hay bale installation is not indicated, place hay bales in a row with the ends abutting one another.
      2) Anchor hay bales in place with 2 stakes driven through the bales and sunk a minimum of 1-1/2 feet into stabilized earth.
         a) Angle the initial stake to previously laid hay bales to force the bales together.
         b) Drive stakes to be flush with the top of the hay bale.
4. Silt Barrier Fence Installation:
   a. Construct silt barrier fence at the locations indicated or proposed on the Contract Drawings or Working Drawings.
   b. Construct the silt barrier fencing with or without wire-mesh support, and fasten the silt barrier to support posts as follows:
      1) Install posts and excavate a shallow trench on the protected side of the fence.
      2) Fasten the fabric securely to the top of the posts and wire-mesh, if applicable, at a maximum spacing of 30 inches.
         a) Make sure that sag of the fabric is kept to a minimum.
         b) Extend the fabric a minimum of 6 inches into the excavated trench, then backfill the trench with the excavated soil and compact.
5. Construction Entrance and Sediment Trap Construction:
   a. Construct each construction entrance and sediment trap as shown on the Contract Drawings and to the depths indicated.

B. Temporary Pest Control:
   1. Provide measures to control birds, vermin, and insect pests at the Site so they do not present a health hazard or nuisance.
   2. Provide rodent-proof refuse containers for “non-construction” refuse such as food waste and packaging materials.

C. Temporary Environmental Controls:
   1. Provide temporary environmental controls to facilitate construction.
      a. Provide equipment required to furnish proper ambient conditions for applying, curing, or preserving materials as specified in other Sections; such as dehumidifiers to adjust the humidity, fans to furnish ventilation, or portable heaters to adjust the temperature as specified in other Sections.
      b. Provide the temporary enclosures required for encapsulating environmentally sensitive areas containing lead, asbestos, PCBs, mold, or other toxic or hazardous materials as specified in other Sections that describe procedures for their remediation or abatement.
   2. Air Pollution:
      a. Prevent polluting the air in violation of the requirements specified in the Town of North Salem, New York, Code of Ordinances.
   3. Noise Control:

a. Ensure that noise produced by equipment and construction operations does not exceed established regulatory limits stipulated in the Town of North Salem, New York, Code of Ordinances.
b. Equip construction vehicles with operating noise control devices.

D. Temporary Storm Water Pollution Control:
1. During earthwork operations, take additional precautions as required and as directed by the Construction Manager to prevent water runoff from eroding completed work and to prevent surface water and sediment from leaving the Site, including the construction of retention basins, channels, or similar structures.
2. Clean paved areas of accumulated dirt and debris to prevent it being washed into low-lying areas or fouling storm sewers and catch basins.
3. Prevent concrete trucks being washed onsite.
4. Construct temporary drainage structure inlet filter protection as detailed on the Contract Drawings to prevent sediment from entering the drainage system by ponding water to allow sediment to fall out of suspension.
5. Surface water:
a. Do not allow water to collect on the Site.
b. Where required, provide positive means to remove water such as trenching or pumping.

E. Site Watering for Dust Control:
1. Control dust at all times.
a. Perform vacuuming, wet mopping, wet sweeping, or wet power brooming in lieu of dry power brooming or air blowing.
b. Perform only wet cutting of concrete block, concrete, and asphalt.
2. Treat material stockpiles and disturbed soil with dust suppressors, such as water or other palliatives, and/or provide covers to control dust.

3.8 PROJECT IDENTIFICATION

A. Temporary Project Signage:
1. Provide two field office signs each having a minimum of 70- c h a r a c t e r spaces, and lettering styles, colors, and proportions as directed by the Construction Manager.
a. Construct the field office signs from a single 8 feet wide by 4 feet high sheet of exterior A-B grade plywood securely bolt-mounted to 4-inch by 4-inch posts constructed from pressure treated construction grade lumber set at a minimum depth of 4 feet below grade.
b. Paint both sides of the field office signs with one coat of primer-sealer finished with two coats of white semi-gloss enamel.
2. Securely mount the field office signs where directed by the Construction Manager, and so they are resistant to vandalism and theft.
3. Submit Shop Drawings showing the temporary project signage message and layout to the Construction Manager for approval.

3.9 REPAIR/RESTORATION

A. Complete, or, if necessary, restore permanent work which may have been delayed because of interference with the temporary service or facility.

B. Repair damaged Work, clean exposed surfaces, and replace Work which cannot be satisfactorily repaired.
   1. Clean and repair damage caused by installation or use of temporary work.

C. Traffic Control:
   1. Restore obstructed public ways, including streets, sidewalks, and accesses to public and private properties, to public and private uses when obstruction thereto is no longer necessary for prosecution of the Project.

D. Landscaping:
   1. Restore all landscape areas and other surface improvements that were to remain in place, but that have been damaged by the Contractor's actions or omissions.
      a. Restore landscape areas as nearly as possible to the original condition.
   2. Repairing or Replacing Damaged Plants:
      a. Where damage to vegetation has occurred, prune plants in accordance with Tree Care Industry Association (TCIA) standards to remove branches from the work area, and where needed to maintain the health of the plant.
         1) Remove material in a manner that yields minimal impact and is approved.
      b. Remove plants that were identified by the Owner to remain in place, but that are damaged during the course of the work to an extent that they cannot be repaired; and replace the damaged plants with new plants of the same type and value.
         1) Remove and replace damaged plants as directed.
         2) Base the value of plants that are to be replaced on the criteria found in the Council of Tree and Landscape Appraisers' "Guide for Plant Appraisal", as evaluated by the Project Arborist.
      c. Remove and replace damaged plants at no increase in the Contract Price.
         1) Bear the cost of Consultants, administrative costs, coordination, permits and other fees associated with the removal, replacement, or repair of existing plants resulting from damage due to insufficient or improper protection.

3.10 RE-INSTALLATION

A. Restore or re-install permanent facilities, used during construction, to the condition specified.

3.11 SITE QUALITY CONTROL

A. Site Tests:
   1. The Construction Manager has the authority to order testing of the Contractor's construction plants and equipment; and to reject or condemn any plant, apparatus, or staging, which, in his opinion, is unsafe, improper, or inadequate.
      a. Whether the Construction Manager exercises this authority or not, the Contractor is not relieved of his responsibility for the safe, proper, and lawful construction, maintenance, and use of such plant, apparatus, or staging.

B. Site Inspections:
   1. Inspect the maintenance and protection of traffic (MPT) placed on a twice daily basis.
      a. Inspect the MPT devices first thing to verify their integrity, and again at the end of the shift for the same purpose.

2. Inspect the sediment and erosion control and storm water controls protections and devices not less than once per week.
3. Inspect the sediment and erosion control and storm water controls protections and devices prior to predicted storm events, and again after storm events.

C. Non-Conforming Work:
1. Immediately upon discovering defective maintenance and protection of traffic (MPT) items, remedy the deficiencies.
2. Repair or replace defection sediment and erosion control protections within 24 hours.
3. Rework condemned construction plants or equipment to an acceptable condition or remove them from the Site and replace them within five (5) Days from the date of instruction of the Construction Manager.

3.12 CLEANING

A. Furnish daily janitorial and housekeeping services at the Work Site and perform any required maintenance of facilities as deemed necessary by the Construction Manager.
1. Landscaping:
   a. Clean up the ground areas under plants remaining in place as directed.
   b. Wash off foliage that becomes soiled, or when directed to do so Project Arborist.
   c. Remove materials that fall or flow into protected areas.
      1) Provide protective barriers as needed or as directed by the Construction Manager or Project Arborist to prevent materials from falling or flowing into protected areas.
2. Construction Facilities:
   a. Clean the field office(s) daily or as required by the Construction Manager.
   b. Remove snow in and around the field trailers and adjacent parking areas.

B. At Substantial Completion, clean and renovate permanent services and facilities that have been used to provide temporary services and facilities during the construction period, including but not limited to the following:
1. Replace air filters and clean the outside of ductwork and housings.
2. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
3. Replace lamps in the lighting system that are burned out or noticeably dimmed by substantial hours of use.

C. Remove all temporary facilities and controls prior to Final Acceptance.
1. Upon completion of the Contract, remove all temporary facilities from the Site, except those designated to remain.
   a. Remove temporary utilities, equipment, facilities, and materials prior to submitting the Final Application for Payment.
   b. Remove any temporary underground installations to a minimum depth of 2 feet.
2. Temporary Utilities:
   a. Remove and dispose of the materials and equipment furnished for temporary utility services for this Contract as part of final cleanup, except as specified herein.
      1) All costs for this removal and disposal is the responsibility of the Contractor.
      2) Unless the Construction Manager requests that it be maintained for a longer period of time, remove each temporary service and facility promptly when the need for it or a substantial portion of it has ended, or when it has been replaced

by the authorized use of a permanent facility, but no later than substantial completion.

3. Construction Facilities:
   a. Upon completion of the Contract, the Field office becomes the property of the Contractor, and the Contractor is responsible for removal, dismantling, or otherwise disposing of the field office(s) at that time.
4. Temporary Barriers and Enclosures:
   a. Remove fencing and related materials as directed during the Final Acceptance process at the end of the Contract.
5. Temporary Controls:
   a. When the silt barrier fence is no longer needed, remove the fence and restore the area.
   b. Remove temporary traffic control devices as soon as construction activities have been completed.
6. Project Identification:
   a. Upon completion of the Work, remove and legally dispose of the temporary Project signage and posts, and backfill the post holes.
      1) Turn all other signs over to Metro-North (METRO-NORTH).
         a) The Contractor will be charged $250 for each sing not turned over to METRO-NORTH.

D. Waste Management:
1. Comply with the requirements of the approved Waste Management Plan specified in Section 01 74 00, Cleaning and Waste Management.
   a. Frequently clean up refuse, rubbish, scrap materials, and debris caused by operations so that the Site presents a neat, orderly, and workmanlike appearance.
   b. Provide daily collection of rubbish and clean up the Work and access areas.
   c. Load and cover trucks in a manner that will prevent dropping material and debris while in transit.
2. Provide for the disposal of waste products, trash, debris, and similar materials not required for the performance of the Work.
   a. Remove surplus materials, falsework, and other temporary structures including foundations.
   b. Make arrangements to legally dispose of the refuse, rubbish, scrap materials, and debris caused by operations off-site.
3. Gather and dispose of spoils and vegetative waste, including dead and damaged plants and the trimmings accumulated from the operations to clear and remove existing vegetation.
4. Dispose of spoils and vegetative waste off-site in conformance with the regulations imposed by the local authorities, and in an area approved for such disposal by the local authorities.

3.13 PROTECTION

A. Until final acceptance of the work by Metro-North**,** take charge and care of the temporary facilities and controls, and take reasonable precautions to protect them against injury or damage by action of the elements, theft, vandalism, or from any other cause, whether arising from the execution or from the non- execution of the Work.
1. Rebuild, repair, restore, and make good, to the satisfaction of the Construction Manager, injuries or damages to any portion of the Work occasioned by any of the above causes before Final Acceptance, and bear the expense thereof at no cost to Metro-North.

B. Provide and maintain security services for the field office during the entire Contract period.

3.14 MAINTENANCE

A. Maintenance for Field Offices:
   1. Furnish maintenance, a paper supply, and ink cartridges for the color copier.
      a. Provide the following initial supply of paper:
         1) 20 boxes of letter size (8-1/2 by 11 inches) paper.
         2) 10 boxes of legal size (8-1/2 by 14 inches) paper.
         3) 20 boxes of 11 by 17 inches size paper.
      b. Provide the following supply of paper weekly or as required by the Construction Manager:
         1) 4 boxes of letter size (8-1/2 by 11 inches) paper.
         2) 1 box of legal size (8-1/2 by 14 inches) paper.
         3) 1 box of 11 by 17 inches size paper.
      c. At a minimum, maintain a two-week supply of paper onsite at all times.
   2. Furnish a maintenance contract for the photocopier effective for the duration of the Contract.

B. Maintenance of Temporary Traffic Control Devices:
   1. Within 24 hours after temporary traffic control devices have been damaged, defaced, or otherwise rendered unfit, repair or clean those devices, or replace those devices with new devices.

C. Maintenance of Temporary Project Signage:
   1. Maintain the field office signs in good condition, free of markings and dirt, and free of obstructions.
      a. Replace damaged stickers as necessary.
      b. Clean signs using soap and water or with cleaning solvents that will not damage the surface of the signs.

D. Maintenance of Temporary Electricity and Temporary Lighting:
   1. Maintain temporary electrical and lighting equipment and wiring in a safe condition, and use it in a manner that does not constitute a hazard to persons or property.

E. Maintenance of Temporary Parking Areas and Pedestrian Access:
   1. Maintain temporary parking areas and pedestrian access throughout all seasons, including providing snow removal and salting.
   2. Maintain surfaces to always be safe and puddle free.

F. Maintenance of Vegetation:
   1. Care for and maintain existing vegetation within protected areas as indicated on the Contract Drawings.
      a. Provide water and labor as needed for plant health, growth, and for washing down soiled foliage.
      b. Provide fertilizer, deep root fertilization, pesticides, anti-desiccants, and other materials and labor as needed to maintain the existing plants in a healthy and growing condition.
      c. Provide plant maintenance for the duration of the Contract, until Final Acceptance.

G. Maintenance of Protective Fencing:

1. Replace damaged or non-compliant protective fencing as required.
    a. Remove and replace torn, deformed, or otherwise blemished mesh with sections of the minimum specified length.
    b. Repair or replace damaged fencing immediately after damage occurs.
2. Maintain tree protection fencing upright and in good condition throughout the Contract until Final Acceptance.

H. Maintenance of Field Offices and Sheds:
1. Maintain the temporary facilities in a proper, safe, and sanitary operating condition for the duration of the Contract.
    a. Continuously maintain the field office and provide janitorial services on a daily basis throughout the Contract.
    b. Keep toilet facilities equipped, clean, and sanitary at all times.

I. Maintenance of Temporary Erosion and Sediment Controls:
1. After installing silt barrier fence, satisfactorily maintain the barrier fence.
    a. The temporary erosion and sediment control fence fabric may require periodic cleaning, by tapping the dry fabric from the downstream side.
    b. Maintain hay bales until they are no longer needed.
2. Repair:
    a. Remove hay bales which deteriorate, and replace removed bales with new bales.
    b. When directed, remove and replace barrier fence not functioning due to clogging, damage, or deterioration.
3. Maintain the stored areas of the construction entrance and sediment trap areas by replacing or cleaning fouled areas as required and as directed by the Construction Manager.
4. Maintain temporary erosion protection and surface water runoff controls until cuts, fills, embankments, permanent erosion protection, and final grading are completed.
    a. Remove temporary sedimentation and erosion controls installed under this Contract when they are no longer required, when they interfere with construction, or when directed.
    b. Receive approval prior to removing any temporary sedimentation and erosion controls.

END OF SECTION

[This Page Left Intentionally Blank]

SECTION 01 71 00 - EXAMINATION AND PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 50 00 - Temporary Facilities and Controls.

C. Section 03 30 00 - Cast-In-Place Concrete.

D. Section 31 20 00 - Earth Moving.

1.3 SUMMARY

A. This Section specifies requirements for:
   1. Acceptance of conditions.
   2. Field engineering.
   3. Protection of adjacent construction.

B. Requirements for demobilization are specified in Section 01 7113, Mobilization.

1.4 REFERENCES

A. Reference Standards:
   1. ASTM International (ASTM):
      a. ASTM B36/B36M, Standard Specification for Brass Plate, Sheet, Strip, and Rolled Bar.
   2. New York State Department of Transportation:
      a. Land Survey Standards and Procedure manual (February 2009)
   3. Town of North Salem General Construction Code.
   4. Precast/Prestressed Concrete Institute (PCI)
      a. PCI MNL-116, Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Surveyor Crew's Qualifications:
   a. Employ a survey crew qualified and able to perform the surveying and layout tasks necessary to properly perform the Work of this Section.
      1) The survey crew must be available for use with as little as 4 hours advance notice for the duration of the Contract.
   b. Employ a Professional Engineer or Land Surveyor registered in the State of New York to be directly responsible for the survey work required by this Contract.
      1) Submit the qualifications of the registered Professional Engineer or Land Surveyor to the Construction Manager for information.

1.6 SUBMITTALS

A. Action Submittals:
   1. Submit the following to the Construction Manager for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:
      a. Shop Drawings:
         1) Concrete survey monuments.
      b. Delegated Design Submittals:
         1) Field engineering layouts.
      c. Qualification Statements:
         1) Land Surveyor qualifications.

B. Closeout Submittals:
   1. Submit the following to the Construction Manager in accordance with the requirements of Metro-North:
      a. Record Documentation:
         1) Survey field books and stakeout data, including documentation verifying the accuracy of field survey work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete:
   1. Provide concrete with a minimum compressive strength of 4,000 psi at 28 days in compliance with the requirements for Class A concrete as specified in Section 03 30 00, Cast-In-Place Concrete.

B. Materials required for mobilization that are not to be part of the completed Contract will be determined by the Contractor, except that they must conform to any pertinent local or State Law, regulation or code.

PART 3 - EXECUTION

3.1 PREPARATION

A. Demolition / Removal:
   1. Remove obstructions from lines of sight when requested to do so by the Construction Manager.

3.2 ACCEPTANCE OF CONDITIONS

A. The Contractor is responsible for visiting and examining each station Site to determine the conditions existing there prior to performing the Work, for inspecting areas where specific portions of the Work will be performed; and for notifying the Construction Manager of unsatisfactory conditions discovered during this inspection.
   1. Specific requirements to examine, inspect, and verify existing conditions prior to performing specific portions of the Work are specified in individual Specification Sections, and the Contractor is responsible for performing these field inspections.

B. Failure to notify the Construction Manager of unsatisfactory conditions at the various station Sites following the required inspections constitutes acceptance of the existing conditions as not a hindrance to performing the Work as contracted.
   1. Failure to execute the required field inspections, or to notify the Construction Manager of unsatisfactory conditions discovered, does not relieve the Contractor from performing the Work.

3.3 FIELD ENGINEERING

A. Verification of Conditions:
   1. Find the reference points that have been shown on the Contract Drawings at each station Site and re-established in the field.
      a. At his discretion, the Construction Manager may direct the Contractor to relocate or replace the established reference points in accordance with the applicable requirements for additional work outlined in the Contract Documents.
   2. Promptly notify the Construction Manager if it is found that any of the previously established reference points indicated have been destroyed or displaced.
      a. When directed by the Construction Manager, repair or replace previously established reference points, control monuments, and those primary control measurements that are damaged, destroyed, or displaced by the Contractor at no increase in Contract Price.

B. Furnish, install, monitor and subsequently remove survey points establishing the line and grade and other field stake-out engineering for construction.
   1. Furnish accurate surveyor instruments and other survey equipment suitable for performing the surveys required in accordance with recognized professional standards and maintain the survey equipment in proper condition and adjustment at all times.
   2. Locate, stake, furnish, and install new concrete monuments.
      a. Construct survey monuments at locations shown on the Contract Drawings, or as directed by the Construction Manager.
   3. Perform as-built surveys to comply with quality assurance, quality control, and acceptance testing requirements.
   4. Check all surveys and layouts and calculations.

C. Surveying:
   1. Temporarily cease construction activities which create hazards that may affect the work of the survey crew's personnel.
   2. Establish all survey control points and alignments required for control and guidance of construction operations.
      a. Perform the Work to the lines and grades shown on the Contract Drawings.
      b. Use approved local municipality approved identifications for existing benchmarks.
      c. Refer to the legal descriptions provided for developing other control points.
      d. The Surveyor is responsible for any lines, grades, or measurements which do not comply with the specified or proper tolerances, or which are otherwise defective, and for any resultant defects in the work.
   3. Provide any acceptance survey or surveys required for checking lines, grades, and measurements.
      a. Reference Points:
         1) Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work.
         2) Preserve and protect benchmarks and control points during construction operations.
      b. Record Log:
         1) Produce and maintain a log of layout control work.
         2) Record deviations from required lines and levels.
         3) Include beginning and ending dates and times of surveys, weather conditions, the name and duty of each party member, and the types of instruments and tapes used.
         4) Make the Record Log available for reference.
   4. Provide the Construction Manager with any assistance required for checking lines, grades, and measurements when requested to do so by the Construction Manager.
      a. The Construction Manager may at any time use line and grade points and markers established by the Surveyor.
         1) The Surveyor's surveys are a part of the Work and may be checked by the Construction Manager or representatives of the Construction Manager at any time.
            a) Conduct resurveys or check surveys to correct errors indicated by review of the field notes at no increase in the Contract Price.
         2) Provide assistance to the Construction Manager required for checking lines, grades, and measurements.

D. Layout of Work:
   1. Lay out the Work from the baselines and bench marks indicated on the Contract Drawings, making all measurements in reference to these baselines and bench marks.
      a. Furnish all monuments, stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the Work from the baselines and bench marks established.
      b. Assume full responsibility for the dimensions and elevations taken from bench marks and baselines, and for setting lines and grades.
         1) Stakeout property lines and corners required for establishing the location of fences and other items of the Work referenced to the property lines and corners.
         2) Stakeout the temporary, permanent, and existing easements.

E. Concrete Survey Monuments:

1. When directed to do so, replace damaged or destroyed control monuments and those primary control monuments that must be relocated in order to perform the Work of this Contract at no increase in the Contract Price, and as follows:
    a. Construct a survey monument at each location shown on the Contract Drawings, or as directed by the Construction Manager.
    b. Excavate a hole for each survey monument in accordance with the requirements of Section 31 20 00, Earth Moving, except that the equipment may consist of an approved type auger.
    c. In the presence of the Construction Manager, set the survey monument into the hole with the top surface of the monument horizontal and with the brass marker on top oriented in the exact position shown on the Contract Drawings, or as directed by the Construction Manager.
    d. Subsequent to placing the survey monument into the hole, backfill the space between the walls of the hole and the monument in accordance with the requirements of Section 31 20 00, Earth Moving.
    e. Set and backfill concrete monuments in the presence of the Construction Manager.

3.4 PROTECTION OF ADJACENT CONSTRUCTION

A. Protect buildings, foundations, bridges, and other structures located adjacent to the Site from damage.
    1. Protect existing and adjoining public and private property from damage incidental to construction operations in accordance with the various station location municipality Construction Codes.
    2. Where operations are adjacent to the property of railway, telegraph, telephone, water, sewer, electric, gas, cable, and other utilities; or adjacent to other facilities and property which if damaged might result in considerable expense, loss, inconvenience, injury, or death, do not commence the Work until necessary arrangements for protecting these facilities and property have been made.
    3. Prevent earthwork and trenching operations from damaging adjacent facilities.
        a. Unless authorized in writing by the Construction Manager, do not use water to settle backfill material in trenches adjacent to structures.

B. Safeguard and maintain conflicting utilities shown on the Contract Drawings, including overhead wires and cables and their supporting poles, whether or not they are inside or outside the trench.
    1. If a conflicting utility not shown on the Contract Drawings is discovered during the course of the Work, notify the Construction Manager as soon as possible.
        a. The Construction Manager will negotiate to have the owner of the conflicting utility relocate it, have others relocate the utility, change the alignment or grade of the trench to avoid the conflict, or declare the work to resolve the conflict as extra work.
    2. Provide permanent pipe supports for sewer, water, and other utility lines where shown on the Contract Drawings and at other locations as deemed necessary by the Construction Manager.
        a. Provide permanent pipe supports in accordance with the details shown on the Contract Drawings and local regulations.
    3. Adequately support electronic, telephonic, telegraphic, electrical, oil, and gas lines encountered; and avoid damaging plastic pipe, pipe-way, and conduits during foundation preparation, bedding placement and backfilling operations.
        a. Support plastic pipe and electrical conduit continuously along the bottom of the pipe or conduit.
        b. Support metal pipe and electrical conduit either continuously or suspend the pipe or conduit from nylon webbing spaced at intervals not more than 10 feet apart.

C. Unless otherwise indicated in the Contract Documents, maintain all underground and overhead utilities in continuous service throughout the duration of the Contract, and take responsibility and accept liability for damages or interruptions of service caused by the construction.
   1. If a utility or appurtenance is to be temporarily or permanently relocated or shut down, the Contractor is responsible for making the necessary arrangements and agreements with the owner of the utility and its reconstruction at no increase in the Contract Price.
      a. Reconstruct the utility or appurtenance and the property to itsprevious condition or better as soon as possible.
      b. The relocation or shutdown and restoration cycle is subject to inspection and approval by both the Construction Manager andthe owner of the utility.

D. Protect adjacent areas from damage resulting from installation, erection,or application of the Work.
   1. Protect the Work of other trades, whether being coated or not, against damage from painting and coating operations.
   2. Take the necessary measures to ensure that workers and work areasare protected from fire and health hazards resulting from handling, mixing, and applying coatings.

3.5 REPAIR/RESTORATION

A. At the conclusion of construction, remove temporary survey points no longer required for the progression of the Work or other contracts.

B. Upon completion of the Work, remove construction tools, apparatus, equipment, unused materials and supplies, construction plant, temporary facilities, and personnel from the Site.

3.6 RE-INSTALLATION

A. Re-install survey points removed to facilitate demolition orconstruction activities.

3.7 CLOSEOUT ACTIVITIES

A. Survey Field Books:
   1. Generate, maintain, and preserve survey field books, electronic files, and stakeout data used to record survey data until Final Acceptance ofthe Work.
      a. At Final Acceptance of the Work, have the registered Surveyor or Construction Manager sign and seal the record of survey or thesurvey field books and stakeout data, and submit them to theConstruction Manager in accordance with the requirements of Metro-North.
      b. The survey field books and stakeout data will become the propertyof the Metro-North.
   2. Allow the Construction Manager access to the survey field booksand stakeout data upon request during the course of the work.

3.8 PROTECTION

A. Control Monuments:
   1. Protect horizontal and vertical control monuments previously established and indicated on the Contract Drawings.

END OF SECTION

[This Page Left Intentionally Blank]

SECTION 01 71 13

MOBILIZATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Mobilization and preparatory work includes:

1. Mobilization of all construction equipment, materials, supplies, appurtenances and the like, manned and ready for commencing and continuing the Work.

2. The subsequent demobilization and removal from the site of said equipment, appurtenances, and the like upon completion of the Work.

3. Setting up of necessary general plant, including shops, storage areas, office and such sanitary and other facilities as are required by local or State Law or regulation.

4. Assembly and delivery to the site of general plant, equipment, materials and supplies necessary for the prosecution of the Work that is not intended to be incorporated in the Work.

5. The clearing off and preparation of the field office areas.

6. The complete assembly, in working order, of equipment necessary to perform the required work.

7. Personnel services required prior to commencing actual work.

8. Providing necessary bonds, insurance and prefinancing, as required.

9. All other preparatory work required to enable commencement of the actual work on construction items.

1.02 SUBMITTALS

A. Submit within 10 working days after the date of Award, a layout of the proposed general plant site including fences, roads, buildings and storage areas for the Engineer's approval.

1.03 MEASUREMENT AND PAYMENT

A. The line item price for mobilization, as required in the "Contract Terms and Conditions", Article 3.03 - Detailed Cost Breakdown for Lump Sum Items, shall not exceed 4 percent of the Gross Sum Bid.

B. Payment will be made progressively, up to 90 percent for the line item price for mobilization as agreed to in accordance with the “Contract Terms and Conditions,” Article 3.03. The payment will be made in the form of three (3) equal monthly payments. The first payment shall be made thirty (30) calendar days after the Design-Builder begins work. Subsequent payments will be made during each of the succeeding months. The final ten (10) percent will be paid at completion of demobilization, see article 1.01A.2.

C. Partial payments may be reduced by an amount determined by the Engineer if, in his

determination, any of the following conditions apply:

1. The plant and equipment at the site are insufficient or are not suitable for the performance of the work.

2. The plant and equipment brought on the project are not being utilized or sufficiently utilized for prosecution of the work.

3. The plant and equipment brought on the project and committed to the work are removed from the project without permission of the Engineer.

D. In the event of a reduction in partial payments as provided herein, the remainder of the partial payments which are unpaid at the date of such reduction, will be paid with subsequent progress payments as and when the conditions stated are rectified as specified by the Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Such materials as required for mobilization and that are not to be part of the completed Contract shall be as determined by the Design-Builder, except that they shall conform to any pertinent local or State Law, regulation or code.

2.02 PLANT AND EQUIPMENT

A. General plant and equipment shall be of the capacity, type, quality, function and in the quantity necessary for the timely prosecution of the work.

PART 3 - EXECUTION

3.01 GENERAL

A. General plant, equipment, materials, supplies, temporary buildings, facilities and other items necessary for mobilization shall be available at the work site at the time they are to be built, used, installed or operated.

B. The work required to provide the above facilities and service for mobilization shall be done in a safe and workmanlike manner and shall conform with any pertinent local or State Law, regulation or code. Good housekeeping consistent with safety shall be maintained.

3.02 PLANT

A. General plant location shall be approved by the Engineer, appropriately close to the portions of the work for which it will be used. The general plant, including equipment and personnel, shall have sufficient capacity, in the opinion of the Engineer, to permit a rate of progress which will ensure completion of the work within the time stipulated in the Contract. The Engineer shall have the right to reject general plant and apparatus which are, in his opinion, unsafe, improper, or inadequate. Rejected general plant and apparatus shall be brought to acceptable condition, or shall be removed from the job site.

3.03 DEMOBILIZATION

A. Upon completion of the work, remove general plant, equipment, materials, supplies, temporary buildings, facilities and other items necessary for mobilization, and leave area broom clean. The final 10% will be paid upon completion.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 74 00 - CLEANING AND WASTE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 33 29 - Sustainable Design Reporting.

D. Section 01 40 00 - Quality Requirements.

E. Section 01 50 00 - Temporary Facilities and Controls.

F. Section 01 74 19 – Construction Waste Management and Disposal

G. Section 02 82 00 - Asbestos Abatement.

H. Section 02 83 19 - Lead-Based Paint Abatement.

I. Section 01 81 13 – Sustainable Design Requirements

1.3 SUMMARY

A. This Section specifies requirements for:
   1. Maintaining a clean, orderly, and hazard-free work Site.
   2. Managing waste during construction operations.
      a. Manage non-hazardous construction and demolition waste and materials.
      b. Manage hazardous construction and demolition waste and materials.
      c. Protect the environment, both onsite and offsite.
      d. Prevent environmental pollution and damage.
   3. Performing a final cleaning prior to occupancy.

1.4 REFERENCES

A. Abbreviations and Acronyms:
   1. ACA: Ammoniacal copper arsenate, a leach-resistant waterborne wood preservative.
   2. CCA: Chromated copper arsenate, a leach-resistant waterborne wood preservative.

3. LEED: An acronym for the Leadership in Energy and Environmental Design Green Building Rating System™, a third-party certification program administered by the United States Green Building Council (USGBC), and the nationally accepted benchmark for the design, construction, and operation of high-performance green buildings.
4. MSDS: Material Safety Data Sheets.

B. Definitions:
1. Asbestos: The asbestiform varieties of serpentine (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite- tremolite.
2. Authority Having Jurisdiction (AHJ): Building Code officials, zoning officials, inspectors, and government and regulatory agencies given the authority to protect the public's health, safety, and welfare.
3. Clean: To remove dirt, grime, trash, debris, and similar materials to achieve a level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials.
4. Polychlorinated Biphenyls (PCBs): Any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contains such substance, including, but are not limited to: dielectric fluids; solvents; oils; waste oils; heat transfer fluids; hydraulic fluids; paints or coatings; sludges; slurries; sediments; dredge spoils; soils; materials containing PCBs as a result of spills; and other chemical substances or combinations of substances, including impurities and byproducts and any byproduct, intermediate, or impurity manufactured at any point in a process.
5. Waste: Excess or unusable construction materials, packaging materials for construction products, the products of demolition or removal, and other materials generated during the construction process but not incorporated in the Work.

C. Reference Standards:
1. ASTM International (ASTM):
   a. ASTM D5834 - Standard Guide for Source Reduction Reuse, Recycling, and Disposal of Solid and Corrugated Fiberboard (Cardboard) [*withdrawn 2003*].
   b. ASTM D5509 - Standard Practice for Exposing Plastics to a Simulated Compost Environment [*withdrawn 2002*].
   c. ASTM D6002 - Standard Guide for Assessing the Composability of Environmentally Degradable Plastics [*withdrawn*].
   d. ASTM E1609 - Standard Guide for Development and Implementation of a Pollution Prevention Program [*withdrawn 2010*].
   e. ASTM E1971 - Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings.
2. MTA Metro-North:
   a. Capital Programs Department/Operating Capital Projects Department:
      1) Guideline H.48 –Sustainable Design/Design for the Environment Generic Recommendations and Guidelines.
3. New York State Government:
   a. New York Code, Rules and Regulations (NYCRR):
      1) The New York State Department of Environmental Conservation (DEC):
         a) 6 NYCRR Part 638 - Green Building Tax Credit.
   b. New York State Energy Research and Development Authority (NYSERDA):
      1) New York State Executive Order No. 111 – "Green and Clean" State Buildings and Vehicles Guidelines.
   c. New York State Tax Law:
      1) Section 19 Green Building Tax Credit.

4. United States Government:
   a. Department of Labor:
      1) Occupational Safety and Health Administration (OSHA):
         a) 29 CFR 1910 Occupational Health and Safety Standards.
         b) 29 CFR 1926 Safety and Health Regulations for Construction.
5. United States Green Building Council (USGBC):
   a. LEED 2009 for New Construction and Major Renovations, http://www.usgbc.org.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate clean-up operations with the completion of the Work of other Specification Sections.
   2. Provide on-site instruction of staff regarding appropriate separation, handling, recycling, salvage, reuse, and return methods to be used by all parties at appropriate stages of the Contract.

B. Pre-Installation Meetings:
   1. At the Pre-Construction Conference specified under Section 01 31 00, Project Management and Coordination, discuss the proposed Waste Management Plan specified herein to develop a mutual understanding relative to the details of environmental protection and waste management required for this Contract.
   2. Prior to performing major demolition work as part of this Contract, discuss waste management issues related to the demolition activities at pre- demolition meetings which must be scheduled to discuss demolition, environmental, and waste management issues.

1.6 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Comply with the requirements specified in New York State Executive Order No. 111.

B. Qualifications:
   1. Testing and Inspection Agency's Qualifications:
      a. Employ an independent Testing and Inspection Agency having the qualifications specified in Section 01 40 00, Quality Requirements, and the following additional qualifications:
         1) Capable of performing the reviews, inspections, and testing required by this Section to verify compliance with the Contract Documents; including but not limited to the following:
            a) Inspecting, sampling, and testing proposed materials and production as required by the Construction Manager.
            b) Capable of securing and testing samples of materials from stockpiles during the course of the work.
      b. Submit the qualifications of the Testing and Inspection Agency to the Construction Manager for approval.
   2. Janitorial Firm Qualifications:
      a. Employ an experienced janitorial firm having at least 3 years demonstrated experience performing cleaning functions similar in scope to those required of it under this Contract.

b. Submit the qualifications of the janitorial firm to the Construction Manager for approval.

3. Waste Removal Firm Qualifications:
   a. Employ a waste removal firm, licensed by the local jurisdiction to remove waste from within the jurisdiction, and having at least 5 years demonstrated experience performing waste removal functions similar in scope to those required under this Contract.
   b. Submit the qualifications of the waste removal firm to the Construction Manager for approval.

1.7 SUBMITTALS

A. Action Submittals:
   1. Submit the following to the Construction Manager for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:
      a. Product Data:
         1) Cleaning products.
      b. Special Procedure Submittals:
         1) Waste Management Plan.
      c. Qualification Statements:
         1) Testing and Inspection Agency's qualifications.
         2) Janitorial firm's qualifications.
         3) Waste removal firm's qualifications.

B. Informational Submittals:
   1. Submit the following to the Construction Manager for information in accordance with the requirements of Section 01 33 00, Submittal Procedures:
      a. Manufacturer's Instructions:
         1) Cleaning product manufacturer's instructions.
      b. Site Quality Control Submittals:
         1) Waste and debris testing test reports.

C. Closeout Submittals:
   1. Submit the following to the Construction Manager in accordance with the requirements of Metro-North:
      a. Sustainable Design Closeout Documentation:
         1) Summary of Solid Waste Disposal and Diversion forms.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
   1. Recycling or Reuse Facility Requirements:
      a. Arrange with the appropriate recycling or reuse facility for collection by or delivery to their facility.
         1) Transport recyclable materials to recycling facilities and reusable materials to reuse facilities for further processing in accordance with the requirements of the recycling or reuse facility.
         2) Deliver materials in accordance with recycling or reuse facility requirements such as, but not limited to, being free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

b. The landfill facility has to be a firm on the Metro-North approved list.

2. Hazardous Waste Landfill Records:
   a. Submit documentation indicating the receipt and acceptance of the hazardous wastes by a landfill facility licensed to accept hazardous wastes for the record.

B. Storage and Handling Requirements:
1. Handling:
   a. Clean materials that are contaminated prior to placing them in collection containers.
   b. Handle hazardous materials and waste in accordance with the requirements specified in Section 02 82 13, Asbestos Abatement, Section 02 83 19.13, Lead-Based Paint Abatement, and with the applicable Federal, State, and local regulations.
2. Do not allow waste material to be dropped or thrown from structures.
3. Hazardous Waste and Hazardous Materials:
   a. Handle hazardous waste and hazardous materials in accordance with applicable regulations.

C. Storage and Protection:
1. Provide rodent-proof, covered refuse containers for non-construction refuse such as food, food waste, wrappers, and packaging materials to minimize attracting mammalian, reptilian, or insect pests.
   a. Empty the refuse containers daily, or more frequently as necessary to prevent the refuse from overflowing the containers.
   b. Remove the accumulated contents of the refuse containers from the Site daily.
2. Separate, store, protect, and handle recyclable and salvageable waste products identified at the Site in a way that maximizes recyclability and salvageability.
   a. Provide clearly and appropriately identified containers, bins, and storage areas to facilitate effective waste management.
   b. Provide non-hazardous barriers and enclosures around recyclable material storage areas.
   c. Locate the containers, bins, and storage areas out of the way of construction traffic, but where adequate space exists for pick-up and delivery of waste materials by subcontractors and others.
   d. Clean contaminated materials prior to placing them in collection containers.
   e. Keep recycling and waste bin areas clean and neat.
3. Store volatile wastes in covered metal safety containers having appropriate warning and identification labels.

D. Packaging Waste Management:
1. Remove shipping, blocking, and bracing materials.
   a. Remove the loose packing materials and protective wrapping such as shrink-wrap, wood crating, and packing from products as required.
2. Dispose of packaging waste in accordance with the requirements of the Waste Management Plan specified herein.

1.9 SITE CONDITIONS

A. Ambient Conditions:
1. If volatile and/or noxious substances are being used in spaces that are not naturally ventilated, provide artificial ventilation.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. Regulatory Requirements:
1. New York State Executive Order No. 111:
a. Comply with the requirements specified in New York State Executive Order No. 111.
1) Complete the LEED credits specified in LEED 2009 for New Construction and Major Renovations that would be required to qualify the Project for LEED Silver Level certification.
2) Comply with the requirements specified in 6 NYCRR Part 638.
3) Comply with the requirements specified in New York State Green Building Tax Credit regulations.
2. Hazardous Waste and Hazardous Materials:
a. Handle hazardous waste and hazardous materials in accordance with applicable regulations.
b. Only disposal sites and transporters on the Metro-North Department of Environmental Compliance and Services approved list can be used. Metro-North reserves the right to arrange for transport and disposal of the materials outside the Contract.
3. Metro-North:
a. Comply with the requirements specified in Metro-North Capital Procedures and Guidelines: Environmental Guidelines H.48.
4. Comply with the requirements of the applicable local and State dust control ordinances.
5. During the course of the Work, comply with the OSHA requirements specified in 29 CFR 1910 and 29 CFR 1926, paying special attention to those regarding hazardous and toxic materials and substances, ventilation and other environmental controls, and disposal of waste materials.
6. See Specification 01 74 19 Construction Waste Management and Disposal for additional requirements.

B. Sustainability Requirements:
1. See Specification 01 81 13 Sustainable Design Requirements.

2.2 MATERIALS

A. Cleaning Materials:
1. Furnish and apply the type of cleaning materials recommended by the manufacturer of the surfaces to be cleaned.
2. Furnish non-hazardous and biodegradable cleaning materials whenever possible.
3. Submit Product Data for each cleaning product furnished for use to the Construction Manager for approval.
4. Submit manufacturer's instructions for each cleaning product furnished for use to the Construction Manager for information.

B. Dust Suppressants:
1. Furnish environmentally safe, dust suppressants as specified in Section 01 50 00, Temporary Facilities and Controls.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Visit the Site to verify conditions at the Site prior to beginning the other onsite Work of this Contract.
   2. Notify the Construction Manager of unexpected conditions discovered by the on-site visit prior to beginning the other on-site Work for this Contract.

B. Evaluation and Assessment:
   1. Identify trash and other items at the Site which may need to be removed or abandoned in place prior to beginning the other Work of this Contract.
   2. Identify materials which must be tested for hazardous content prior to demolition and removal operations.
   3. Identify areas where waste receptacles and access corridors thereto may be located for the duration of this Contract.

3.2 PREPARATION

A. Protection of In-Place Conditions:
   1. Do not allow dust and other contaminants resulting from cleaning operations to precipitate onto newly painted surfaces and freshly placed concrete.
   2. Avoid disturbing the natural weathering of exterior surfaces, unless otherwise indicated.

B. Surface Preparation:
   1. Seal cracks and openings in substrates, and then clean the substrate surfaces prior to applying the next material or substance to the substrate.

C. Demolition / Removal:
   1. Remove demolition debris in accordance with the approved Waste Management Plan prior to applying, constructing, erecting, or installing new Work in the affected areas.
      a. Remove demolition debris and abandoned items from alteration areas.

3.3 REPAIR/RESTORATION

A. Repair, or remove and replace, items that are damaged.
   1. Replace broken glass.
   2. Touch-up damaged surfaces to the specified finish or to match the overall finish of the equipment or system component.

3.4 SITE QUALITY CONTROL

A. Site Tests:
   1. Waste and Debris Testing for Hazardous Materials:
      a. Have the Testing and Inspection Agency test solid waste and debris having the potential of being classified as hazardous waste at the point of generation of the

waste stream to determine if special procedures for handling and disposing of it are required.

1) Material Safety Data Sheets (MSDS) are by themselves insufficient documentation to make this determination.

b. Submit copies of the test reports for the solid waste and debris testing to the Construction Manager for information.

B. Site Inspections:

1. At least once a week, inspect the Site to verify that progress cleaning is maintaining the Site in a safe and healthy condition, and that the Waste Management Plan is being properly implemented.
2. Inspect the Site prior to the "final" inspection of the Work by the Construction Manager to determine if it is properly cleaned and ready for the Construction Manager's inspection and use by the Owner.

C. Non-Conforming Work:

1. If Site tests indicate solid waste and debris is hazardous waste, use the special hazardous waste procedures for handling and disposing this material.
2. If Site inspections indicate the Site is not maintained in a safe and healthy condition, the Waste Management Plan is not being properly implemented, or the Site is not properly cleaned and ready for the "final" inspection of the Work by the Construction Manager and use by the Owner, take remedial action to correct this situation.

3.5 CLEANING

A. Construction Materials Cleaning:

1. Prior to incorporating construction materials into the Work, clean them as necessary.
   a. Provide special cleaning as specified in individual Specification Sections, or as required by manufacturer's instructions.
2. At the completion of the Work of each trade, clean surfaces and make the surfaces ready for the Work of successive trades.

B. Progress Cleaning:

1. During the construction of the Work, clean the Site every workday or more often when directed to do so by the Construction Manager.
2. Prior to starting to finish interior surfaces, broom, vacuum, or otherwise clean the affected interior areas.
3. Keep the equipment, structures, grounds, and other areas on and adjacent to the Site free from accumulations of waste materials and trash resulting from the Contractor's construction and demolition operations.
   a. Once materials at the Site become unfit for use in the Contract Work, collect these waste materials, remove them from the Site, and legally dispose of them.
      1) Place collected waste materials in metal containers or dumpsters.
      2) Remove volatile wastes from the Site daily.
   b. Maintain field trailers, buildings, and other facilities used to prosecute the Work neat and clear of refuse, rubbish, and debris accumulations to the satisfaction of the Construction Manager.
   c. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other spaces to be enclosed prior to enclosing the spaces.

d. Remove debris from elevated portions of the building(s) by employing a chute, hoist, or other device that will convey the debris to grade level in a controlled descent.
1) If allowed by the Owner, elevators, stairs, or building entries may be used.

4. Control airborne dust and particles that may become a nuisance to the public or are deleterious to the performance of the Work.
a. Broom and vacuum clean interior areas to eliminate dust.
b. To suppress dust, periodically wet the soil in excavation and backfill work zones, and periodically wet dirt roads.
c. When airborne particles are visible, and the Construction Manager orders application of a topical dust suppressant, apply the material the same day.

5. During construction of the Work, keep streets and pedestrian walkways clean and free of trash and construction debris.
a. Keep paved roadways, streets, and pedestrian walkways, both on and adjacent to the Site, clean.
1) Prevent construction equipment from tracking soil, dirt, and debris onto public roadways and right-of-way.
a) Properly clean construction equipment before allowing it to leave the Site.
b) Construct construction entrances in accordance with the requirements of Section 01 50 00, Temporary Facilities and Controls, and designed to facilitate the removal of soil and dirt from vehicles.
2) Remove spillage resulting from hauling or construction operations along or across streets, roads, paths, and access routes.
a) If dump trucks and other equipment are working on or adjacent to paved streets, keep the streets and adjacent pedestrian walkways clean using street sweepers or other means approved by the Construction Manager.
3) Wash local streets that are soiled from construction activity.

6. Perform the specific cleaning operations as specified in other Sections.

C. Final Cleaning:
1. After the construction work is essentially completed but preceding the “final” inspection of the Work by the Construction Manager to determine if it is ready to be awarded the Certificate of Substantial Completion, clean and prepare the Site, including landscape development areas, to make it ready for the Construction Manager’s inspection and use by the Owner.
a. Inspect interior and exterior surfaces, including concealed spaces, for cleanliness in preparation for requesting Substantial Completion and Final Acceptance.
b. At the completion of alteration work in each area, perform a final cleaning and return the space to a condition suitable for use by the Owner.

2. Perform final cleaning of the Work at times approved by the Construction Manager by cleaning such surfaces or units of the Work to the normal clean condition.
a. Comply with safety standards and governing regulations for cleaning operations.
b. Remove dirt, dust, litter, debris, corrosion, solvents, discursive paint, stains, and extraneous markings from the facilities provided under this Contract.
c. Clean the Site, including landscape development areas, of litter and foreign substances.
1) Sweep paved areas to a broom-clean condition; and remove stains, Petro-chemical spills and other foreign deposits.
2) Rake grounds which are neither planted nor paved to a smooth, even textured surface.
3) Remove surplus materials, except those materials intended for maintenance.

4) Remove tools and equipment used for construction, except those to remain the Owner's property.

d. Comply with manufacturers' instructions for cleaning operations.

e. Clean exposed exterior and interior hard surfaces, including metals, masonry, stone, concrete, painted surfaces, plastics, tile, wood, special coatings, and similar surfaces to a dirt-free condition.

1) Provide final cleaning within buildings in accordance with the requirements of ASTM E 1971.

2) Clean surfaces so that they are free of dust, stains, films, and similar noticeable distracting substances.

a) Vacuum-clean areas where appropriate, such as carpeted and soft surfaces.

b) Remove spots, stains, smears, dirt, dust, litter, debris, hand prints, corrosion, solvents, discursive paint, extraneous markings, Petro-chemical spills, and other defacements of every sort, including those caused by vandals, using commercial cleaning products wherever necessary.

c) Clean mirrors, door and window glass, doors, opening frames, grilles, trim, exposed non-ferrous metal surfaces, floor coverings, light fixtures and plates, plumbing fixtures and trim, and other finish surfaces throughout the facility.

(1) Comply with the manufacturer's instructions for cleaning their products.

(2) Clean fixtures and equipment to achieve a sanitary condition using cleaning materials appropriate to the surfaces and materials being cleaned.

d) Clean and polish transparent and glossy surfaces.

(1) Restore reflective surfaces to their original reflective condition.

e) Sweep paved areas to a broom-clean condition.

f) Rake grounds that are neither planted nor paved to a smooth, even textured surface.

3) Hose and scrub clean concrete flatwork, exposed vertical surfaces of concrete and masonry, and pavement and paved walks.

4) Remove mortar droppings from concrete slabs and pavement wherever they occur.

5) Wipe mechanical and electrical equipment surfaces clean, removing excess lubrication and other grimy substances.

6) Clean or replace dirty filters of operating equipment.

f. Clean debris from roofs, gutters, downspouts, and drainage systems.

1) Insure that drainage systems are free and clear of debris and other obstructions.

3. Remove surplus materials, except those intended for maintenance.

4. Remove tools and equipment used during construction, except for the Owner's property.

a. Remove temporary protective devices and facilities, such as signs or barricades, previously installed to protect completed Work.

5. Remove construction and demolition waste and unused materials, dunnage, loose rock and stone, excess earth, and other debris and foreign substances resulting from the Work.

6. Additional examples of final cleaning include, but are not limited to, the following:

a. Remove temporary labels that are not required as permanent identification.

1) Remove detachable labels and tags, and file them with the manufacturer's specifications of that specific item for the Owner's record.

b. Remove strippable film and other protective coverings at the time of Substantial Completion.

c. Clean materials such as mirrors and window/door glass to remove noticeable dirt, stains, films, and smears.
   1) Replace broken glass.
d. Clean exposed exterior and interior hard-surfaces, including metals, masonry, stone, concrete, painted surfaces, plastics, tile, wood, special coatings, and similar surfaces, to a dirt-free condition, free of dust, stains, films and similar noticeable distracting substances.
   1) Except as otherwise indicated, avoid the disturbance of natural weathering of exterior surfaces.
   2) Restore soiled reflective surfaces to the original reflective condition.
e. Wipe the surfaces of mechanical and electrical equipment clean; and remove excess lubrication and other deleterious substances.
   1) Touch-up damaged surfaces to match with the overall finish of the equipment/system component.

D. Removal of Protection:
   1. Except as otherwise indicated or requested by the Construction Manager, remove temporary protective devices and facilities such as warning, regulatory, or guide signs which were installed during the course of the Work to protect previously completed Work during the remainder of the construction period.

E. Waste Management:
   1. See Specification section 01 74 19 Construction Waste Management and Disposal.

3.6 PROTECTION

A. Limiting Exposures:
   1. Supervise construction operations to assure that no part of the completed or in-progress construction is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.
   2. Apply protective coverings where required to assure protection from damage or deterioration until Substantial Completion is accepted.
      a. Protect completed Work from becoming fouled by overspray, dirt, dust, or debris.
   3. Remove protective coverings when they are no longer needed.
   4. Reuse or recycle plastic coverings if possible.

B. Remove or secure loose material on open decks and other exposed surfaces at the end of each workday, or more often if required, to maintain a hazard- free Site.
   1. Secure loose material in a manner that will prevent its dislodgement by wind or other forces.

3.7 MAINTENANCE

A. Maintenance Service:
   1. Employ an experienced janitorial firm to provide cleaning services for field trailers, buildings, and other facilities, and for restocking consumable janitorial supplies required to maintain the Site in a clean and sanitary condition, during the life of this Contract.
   2. Employ an experienced waste removal firm to remove refuse, rubbish, and debris accumulations to maintain the Site in a neat condition during the life of this Contract.

END OF SECTION

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 – GENERAL

1.01 SECTION INCLUDES:

A. In accordance with NYS Executive Order 4, Metro-North's solid waste management priorities include reducing the generation of solid waste, reusing materials, and recycling materials that cannot be reused. In accordance with the requirements for a large quantity generator (LQG) and a small quantity generator (SQG) of hazardous waste, Metro-North's Hazardous Waste Minimization Plan has been developed to reduce the amount of hazardous waste generated as part of railroad operations.

B. Requirements for managing the material waste generated during construction site activities.

1.02 RELATED SECTIONS:

A. 01_33_60 Safety, Health and Environmental Control

B. 01_35_43 Environmental Protection

C. 02_61_00 Sampling, Testing, Handling, Loading, Removal, &Disposal of Soils

D. 02_82_00 Asbestos Abatement

E. 02_83_00 Lead Abatement

F. 02_84_30 Universal Waste and Miscellaneous Hazardous Materials

1.03 SUBMITTALS:

A. Waste Management Plan: Within thirty (30) calendar days after receipt of Notice of Award, the Contractor shall submit a Waste Management Plan for approval by the Engineer. The Plan shall detail all measures and procedures to be undertaken by the Contractor to manage wastes, including procedures to properly identify, characterize, store, label, containerize, transport, and dispose of wastes (solid, construction and demolition debris (C&D), hazardous, universal) generated during site activities. Where applicable and feasible, the Contractor shall attempt to maximize the quantity of waste material that is diverted from landfills through salvage, reuse or recycling. See Section 3.04 for the Plan's requirements.

B. Waste Management Calculator/Log: Upon commencing significant construction operations and continuing through project completion, the Contractor shall complete and submit a Waste Management Calculator/te Log). The Waste Management Calculator shall be submitted monthly and annually. The monthly log shall report on the preceding month's waste generation. The annual log shall report on the preceding year's waste generation; aggregating and summarizing the waste generated from January through December of the preceding year. See Section 3.05 for the Report's requirements.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

3.01 GENERAL

A. Waste material transporters and disposal sites for off-site disposal of waste material shall be approved by the Engineer prior to use by the Contractor. The Engineer has the right to disapprove any transporter or disposal site that does not meet his approval and to request the Contractor to propose alternate transporters and or disposal sites. Such requests shall not be used by the Contractor as a basis for a delay claim.

B. The Contractor shall utilize transportation and disposal facilities from Metro-North Railroad's list of approved facilities. See *"Metro-North Railroad Environmental Compliance & Services Approved Waste Management Consultants, Disposal Facilities, Transporters and Laboratories".* With the exception of wastes categorized as clean Municipal Refuse (i.e. Household Garbage) and Construction and Demolition Debris, all other wastes shall be transported and disposed of by a Metro-North Railroad approved waste transporter and disposal facility. Should the Contractor choose to utilize companies that have not been pre-approved by Metro-North Railroad, the Contractor shall be responsible for all costs associated with the auditing of the transporter and/or disposal facility and submittal of documentation to Metro-North for review. Any additional facilities are required to meet the same audit requirements as the approved facilities. Submittal of audit documentation does not guarantee Metro-North will approve the transporter or disposal facility for use. Any delays or expenses resulting from the audit and Contractor's submittal of documentation for alternate waste transporters or disposal facilities for Metro-North review, are non-compensable and shall be borne solely by the Contractor.

3.02 SOIL, HAZARDOUS, AND UNIVERSAL WASTE

A. Hazardous waste is defined in 40 CFR Part 261, New York State ECL Section 27-09 or 6 NYCRR Part 371 (Identification and Listing of Hazardous Waste).

B. Hazardous and dangerous waste generated within the job site shall not be moved except in accordance with Federal and State regulations. If the presence of hazardous waste is confirmed, the Metro-North Department of Environmental Compliance and Services shall be advised promptly.

C. In no event shall hazardous waste remain on the site for more than 60 days from generation. All hazardous materials and or waste are to be stored in compatible and regulated storage containers/drums. Provide the SDS to the Engineer. All materials are to placarded and stored in accordance with State and Federal regulations.

D. Copies of Weight Tickets/Bill-of-Lading and/or Waste Profile Sheets; Waste Manifests (for Hazardous Waste) must be submitted to the Engineer for authorization prior to off-site disposal.

E. Signed Originals of Weight Tickets/Bill-of-Lading and/or Waste Profile Sheets; Waste Manifests (for Hazardous Waste) are to be turned over to the Metro-North Engineer after making copies of each following each waste shipment.

Metro-North Engineer will forward each signed original to Metro-North Department of Environmental Compliance and Services.

F. When applicable, the testing, handling and disposal of waste generated from the abatement of asbestos and/or lead containing material shall comply with requirements outlined in Section 02_82_00 Asbestos Abatement and Section 02_83_00 Lead Containing Materials.

G. When applicable, the testing, handling, and disposal of miscellaneous hazardous substances and universal wastes, such as PCB's, mercury, and fluorescent lighting, shall comply with the requirements outlined in Section 02_84_30 Universal Waste and Miscellaneous Hazardous Materials.

H. When applicable, the testing, characterization, handling and disposal of excess excavated soil shall comply with requirements outlined in Section 02_61_00 Sampling, Testing, Handling, Loading, Removal, and Disposal of Soils.

3.03 WASTE MINIMIZATION

A. In accordance with Metro-North Railroad's Waste Minimization Plan, the project's goal is to salvage, re-use, or recycle at least seventy-five percent (75%) by weight of the waste generated on this project.

B. Potential strategies to minimize waste could be:

1. Use alternative techniques of waste disposal such as recycling, salvage and/or reuse that minimizes the amount of waste generated during the demolition/construction process from entering landfill disposal.

2. Prior to demolition, review for recycling, reuse and/or salvage the selective demolition of building components that can be recovered. Recoverable building components include but are not limited to the following: structural and architectural elements, bollards, fences, steel parts, stonework, utility poles, foundations and concrete pavement.

3. Implement efficient management of processes that ensure the generation of as little waste as possible due to error, inaccurate planning, breakage, spills, mishandling, contamination or other factors.

4. To the greatest extent possible, ensure that materials and equipment are delivered in packaging made of recyclable material in a reduced amount of packaging.

5. Establish a field office recycling program for paper, bottles, and cans generated by employees working on the project.

C. Provide containers for waste that is to be recycled clearly labeled as such with a list of acceptable and unacceptable materials. The list of acceptable materials must be the same as the materials to be recycled at the receiving material recovery facility or recycling processor.

D. Provide containers for waste that is to be disposed in a landfill clearly labeled as such.

E. Conduct regular visual inspections of waste handling procedures and the storage container site to ensure that wastes scheduled for recycling, salvage and reuse are not contaminated.

3.04 WASTE MANAGEMENT PLAN

A. The Contractor shall be responsible for the development and implementation of a Waste Management Plan for the project. See Metro-North's Waste Management Plan template for assistance in developing the plan. The Waste Management Plan shall be revised as necessary throughout the duration of the contract to reflect actual waste handling procedures.

B. The Waste Management Plan shall contain the following:

1. Waste handling strategy overview. Provide an overview of the means by which waste material will be gathered, stored and managed on site and transported to its final disposition. This section shall also identify strategies that will be employed to minimize waste that is sent to landfills and identify the person(s) responsible for implementation and compliance with the Plan.

2. Identification and quantifying of waste streams. Identify each type of waste stream including, but not limited to: general Construction and Demolition Debris(C&D), concrete, steel, soil, hazardous materials, salvaged material, etc. Estimate types and quantities by weight, or other pertinent unit of measure, of waste expected to be generated by the project. Calculate expected overall diversion rate from landfills.

3. If the handling of a waste stream is governed and approved through a separate submittal (for example – Lead or Asbestos Site Specific Work Plan), Contractor shall reference the separate plan in the Waste Management Plan but is not required to describe in details the handling and disposal of this waste stream in this plan.

4. Onsite waste collection. Provide description of the onsite waste collection process with drawing depicting waste container laydown and storage areas. Include type and size of containers to be used, and labeling / designation methods for each container. Describe methods used to prevent precipitation from entering and contaminated run-off from draining out of open top roll-off containers (containers shall be properly covered while on site).

5. Transportation. Describe methods used to transport wastes both on site and off site. Describe methods for collecting wastes from work areas, transportation to interim on site storage areas, and containerization methods. Identify vendors providing off site transportation of waste materials. Provide names, addresses, and telephone numbers for transporters/haulers and disposal facilities. Provide permits for transporters/haulers and disposal facilities. Affirm that transporters/haulers are permitted to haul the types of waste they will eb transporting. Provide affirmation that all wastes, with the exception of Construction and Demolition Debris (C&D), will be transported and disposed of by a Metro-North Railroad approved vendor.

6. Disposal. Identify all final disposal sites and include permits for approval. Provide names, addresses, and telephone numbers of persons to contact. Affirm that disposal facilities are permitted to accept the types of wastes they will be receiving. Identify vendors providing transportation of waste materials. Provide names, addresses, and telephone numbers for transporters/haulers and disposal facilities. Provide permits for transporters/haulers and disposal facilities. Affirm that transporters/haulers are permitted to haul the types of waste they will eb transporting. Provide affirmation that all wastes, with the exception of Construction and Demolition Debris (C&D), will be transported and disposed of by a Metro-North Railroad approved vendor.

3.05 WASTE MANAGEMENT REPORTING

A. In accordance with NYS Executive Order 4, and Metro-North's Waste Minimization Plan, solid waste management priorities include reducing the generation of solid waste, reusing materials, and recycling materials that cannot be reused. Metro-North is required to report annually on its waste reduction.

B. The Contractor shall maintain a log of all wastes generated on the project and report such utilizing Metro-North's *Waste Management Calculator*. See Metro-North's *Waste Management Calculator*. The Waste Management Calculator shall be submitted monthly and annually from project initiation through completion, and the Contractor must provide it within 48 hours of a request. In addition to the monthly logs, the Contractor shall submit an annual log. The annual log shall be submitted in January, or upon completion of the project, whichever occurs earlier, summarizing all wastes generated on the project from January through December of the preceding year.

C. The Waste Management Calculator shall contain the following information:

1. At the end of each calendar year in which the project is active, submit a progress report that details:
   - Contract Number and Project Description
   - Contractor
   - Submittal Date
   - Reporting Period,
   - Material Description (i.e. municipal garbage, construction & demolition debris, metals/steel, fluorescent bulbs, ballasts, batteries, etc.),
   - Quantities (in tons),
   - Percent Diverted from Landfill
   - On-Site Handling/Containerization Method (i.e. roll-off, drums, bags)
   - Waste Hauler/Transporters,
   - Recycling/Disposal Facilities,
   - Type of disposal in terms of salvage/re-use, recycled, or disposed to landfill.
   - Overall diversion rate for reporting period (total amount salvaged, re-used, and recycled divided by total waste generated)

2. Provide and submit with the Waste Management Calculator, all manifests, scale tickets, bills of lading, receipts issued by the transporter and disposal facility for the acceptance of waste disposed in a landfill or as issued by an approved recycling facility.

3. For salvaged materials, provide receipts for materials sold or donated to a third party.

4. For material salvaged or reused on site, provide estimated quantity calculations, measured by weight.

END OF SECTION

Metro-North Railroad Environmental Compliance & Services

Approved waste management consultants, disposal facilities, transporters, and laboratories

Waste Management Consultants

WTS, Inc. 435 North 2nd Street Lewiston, NY 14092 716-754-5400 **Capabilities:** Full service waste management firm supplying sampling and analysis, waste characterization, waste profile preparation, logistics, transport and disposal, and preparations of manifests and bills of lading		

Disposal Facilities

110 Sand and Gravel 170 Cabot Street W. Babylon, NY 11980 631-694-2822 **Capabilities:** Railroad ties, non-hazardous soil	**Advanced Greentree Landfill** 635 Toby Road Kearsey, PA 15846 814-231-1744 **Capabilities:** Landfill for non-regulated material	**AERC** 2591 Mitchell Avenue Allentown, PA 18103 610-797-7608 **Capabilities:** Universal waste and mercury recycling
Bayshore Recycling Corp. 75 Crow Mills Road PO Box 290 Keasbey, NJ 08832 732-738-6000 **Capabilities:** Non-hazardous petroleum contaminated soils	**Clean Earth of Carteret, Inc.** 24 Middlesex Road Carteret, NJ 07008 215-428-1700 **Capabilities:** Non-hazardous petroleum contaminated soil	**Clean Earth of New Castle** 94 Pyles Lane New Castle, DE 19720 302-427-6633 **Capabilities:** Non-hazardous petroleum contaminated soil

Clean Earth of North Jersey 115 Jacobus Avenue S. Kearney, NJ 07032 973-344-4004 **Capabilities:** Non-hazardous petroleum contaminated soil	**Clean Earth of Philadelphia** 3201 South 61st Street Philadelphia, PA 19153 215-734-1400 **Capabilities:** Non-hazardous petroleum contaminated soil	**Clean Harbors** 761 Middle Street Bristol, CT 06010 860-583-8917 **Capabilities:** Hazardous and non-hazardous waste disposal.
Clean Harbors of Braintree Inc. 1 Hill Avenue Braintree, MA 02184 781-380-7100 **Capabilities:** Hazardous and non-hazardous waste disposal.	**Clean Harbors of Deer Park TX** 2027 Independence Pkwy South LaPorte, TX 77571 207-450-9695 **Capabilities:** Hazardous and non-hazardous waste disposal.	**Clean Harbors of El Dorado LLC** 309 American Circle Union El Dorado, AR 71730 207-450-9695 **Capabilities:** Hazardous Incineration
Clean Harbors - Spring Grove 4879 Spring Grove Avenue Cincinnati OH 45232 513-681-5738 **Capabilities:** Hazardous and non-hazardous waste disposal.	**Clean Harbors PPM LLC** 1672 E. Highland Road Twinsburg, OH 44087 330-425-3825 **Capabilities:** Hazardous and non-hazardous waste disposal.	**CWM Chemical Services** 1150 Balmer Road Model City NY 14107 716-754-8231 **Capabilities:** Hazardous and non-hazardous waste disposal. PCB landfill (soil)
Clean Water of New York 3249 Richmond Terrace P.O. Box 030312 Staten Island, NY 10303 718-981-4600 **Capabilities:** Non-hazardous waste disposal.	**Deep Green** 1106 River Road New Windsor, NY 12553 845-562-9566 **Capabilities:** Non-hazardous petroleum contaminated soil	**E-Solutions USA** 200 Engineers Road Hauppauge, NY 11788 631-234-7362 **Capabilities:** Electronic Waste
East Coast Railroad Services 42 Argenio Drive New Windsor, NY 12553 845-565-7210 **Capabilities:** Recycling of wood and concrete railroad ties	**East Penn Manufacturing Co., Inc.** Deka Road Lyon Station, PA 19536 610-682-6361 **Capabilities:** Recycling of lead acid batteries	**EQ Detroit** 1923 Fredrick Street Detroit, MI 48211 800-592-5489 **Capabilities:** hazardous and non-hazardous waste treatment/disposal

EQ Michigan 49350 I-94 Service Drive Bellville, MI 48111 800-592-5489 **Capabilities:** Hazardous and non-hazardous waste disposal, PCB landfill	**EQ Pennsylvania** 730 Vogelsong Road York, PA 17404 800-592-5489 **Capabilities:** Hazardous and non-hazardous waste disposal	**EQ Transfer & Processing** 2000 Ferry Street Detroit, MI 48211 800-592-5489 **Capabilities:** Hazardous and non-hazardous waste disposal
High Acres Landfill 425 Perinton Parkway Fairport, NY 14450 800-333-6590 **Capabilities:**	**INMETCO** 245 Portersville Road Ellwood City, PA 16117 412-758-551 **Capabilities:** Recycling of nickel-cadmium and nickel metal hydride batteries	**Minerva Enterprises Landfill** 8955 Minerva Road S.E. Waynesburg, OH 44688 330-866-3435 **Capabilities:** C&D, Asbestos Debris & PCB bulk product material
Modern Disposal Services, Inc. 4746 Model City Road Model City, NY 14107 716-754-8226 **Capabilities:** Non-hazardous landfill	**Salem County Landfill** 52 McKillop Road Alloway NJ 08001 **Capabilities:** non-hazardous landfill	**Stericycle - Providence** 275 Allens Avenue Providence, RI 02905 401-781-6340 **Capabilities:** Hazardous and non-hazardous waste disposal, medical waste management
Stericycle - Hatfield 2869 Sandstone Drive Hatfield, PA 19440 215-822-8995 **Capabilities:** Hazardous and non-hazardous waste disposal, medical waste management	**Tradebe Northeast LLC** 136 Gracey Avenue Meriden, CT 06451 203-238-6754 **Capabilities:** Oil/water and wastewater treatment (hazardous and non-hazardous)	**Tradebe Norlite Corporation** 628 South Saratoga Street Cohoes, NY 12047 518-235-0401 **Capabilities:** Oil/water and wastewater treatment
Tradebe Treatment & Recycling 50 Cross Street Bridgeport, CT 06610 203-334-1666 **Capabilities:** Oil/water and wastewater treatment	**TCI of Alabama** 101 Parkway East Pell City, AL 31525 518-828-9979 **Capabilities:** PCB transformer and oil management	**TCI of NY, LLC** 39 Falls Industrial Park Road Hudson, NY 12534 518-828-9979 **Capabilities:** Transformer disposal

Interstate Batteries **10 John Walsh Boulevard** Peekskill, NY 10566 914-737-6681 **Capabilities:** Recycle Lead Acid Batteries	

Transporters and Service Providers

Miller Environmental Group 169 Stone Castle Road Rock Tavern, NY 12575 1-800-394-8606 *Multiple Locations* **Capabilities:** Hazardous and non-hazardous rolloff, vacuum truck and drum transportation as well as site services and load assistance	**Moran Environmental Group** 20 Commerce Road Newtown, CT 06740 203-270-0095 **Capabilities:** Hazardous and non-hazardous rolloff, vacuum truck and drum transportation as well as site services and load assistance	
Citiwaste LLC 100-02 Farragut Road Brooklyn, NY 11236 718-372-3887 **Medical waste management and transportation**	**Freehold Cartage, Inc.** 825 Highway 33 Freehold, NJ 07728 732-462-1001	**HAZMAT Environmental Group** 60 Commerce Drive Buffalo, NY 14218 716-827-7217
J&D Trucking 3526 NW Blvd. Vineland, NJ 08360 856-362-3959	**Page, E.T.C., Inc.** 2758 Trombley Road Weedsport, NY 13166 800-233-2126	**PARS Environmental, Inc.** 500 Horizon Drive, Suite 540 Robbinsville, NJ 08691 800-959-1119

East Coast Railroad Services 42 Argenio Drive New Windsor, NY 12553 845-565-7210	**Tradebe Transportation** 136 Gracey Avenue Meriden, CT 06451 203-238-6754	
Cuenca Coronel Trucking, Inc. 74 Academy Street Belleville, NJ 07109 973-842-8937 *MBE and DBE paperwork on file*	**Trimvirate Environmental Inc.** 200 Inner Belt Road , Somerville, MA 02143 617-628-8098	**Asbestos Transportation, Inc.** 2 Moriches Middle Island Road Shirley, NY 11967 631-924-5050

Laboratories

York Analytical Labs 120 Research Drive Stratford, CT 06615 203-325-1371	**American Analytical Laboratories** 56 Toldeo Street Farmingdale, NY 11735 631-454-6100	**EET Essential Environmental Technologies** 208 Route 109, Suite 101 Farmingdale, NY 11735 631-249-1456

Metro-North Railroad

Waste Management Calculator

Contract Number/Project Description:	Fill in info here	Contractor:	Fill in name here	Date Submitted:	Fill in date here
				Reporting Period:	Fill in period here

Material Description	Salvaged	Reused	Quantity Recycled	Waste Disposed	Total	Unit	% Salvaged, Reused, Recycled	On-Site Handling / Containerization Method	Check One: Comingled & Sorted Off Site	Check One: Separated On Site	Hauler / Transporter	Recycling / Disposal Facility
Example: Clean C&D	*200*		*1,000*	*2,000*	*3,200*	*Tons*	*38%*	*10 cubic yard dumpster*	☐	☑	*ABC123 Environmental Hauler*	*123ABC Disposal Facility*
RECYCLABLES												
Metals (Structural Steel, other ferrous metals, and non ferrous metals)					-	Tons	0%		☐	☐		
Clean C&D (Asphalt, concrete, brick, untreated woods, etc.)					-	Tons	0%		☐	☐		
Car/truck Batteries					-	Tons	0%		☐	☐		
Other Batteries					-	Tons	0%		☐	☐		
Mixed Paper (Newspaper, Cardboard, Paper)					-	Tons	0%		☐	☐		
Mixed Containers (Glass, Plastic, Metal Cans)					-	Tons	0%		☑	☐		
Electronics					-	Tons	0%		☐	☐		
Paints, Thinners, Solvents, and Adhesives					-	Tons	0%		☐	☐		
Mercury containing devices (other than bulbs)					-	Tons	0%		☐	☐		
Antifreeze					-	Tons	0%		☐	☐		
Various Oils					-	Tons	0%		☐	☐		
Fluorescent lamps/bulbs					-	Tons	0%		☐	☐		
Non-hazardous Industrial Waste (treated wastewater)					-	Tons	0%		☐	☐		
Wood Chips					-	Tons	0%		☐	☐		
Other Recycling*					-	Tons	0%		☐	☐		
WASTE												
Lead Waste (Hazardous)					-	Tons	0%		☐	☐		
PCB's					-	Tons	0%		☐	☐		
Asbestos					-	Tons	0%		☐	☐		
Municipal/Mixed Solid Waste					-	Tons	0%		☐	☐		
Other Waste (non-recyclable)*					-	Tons	0%		☐	☐		
SOILS												
Hazardous Soil (Not Suitable for backfill/reuse on site)	n/a	n/a	n/a		-	Tons	n/a					
Non-Hazardous Petroleum Contaminated Soil (Not Suitable for backfill/reuse on site)	n/a	n/a	n/a		-	Tons	n/a					
Non-Hazardous PCB Contaminated Soil (Not Suitable for backfill/reuse on site)	n/a	n/a	n/a		-	Tons	n/a					
Non-Hazardous Soil/Fill					-	Tons	0%					
Non-Hazardous C&D Soil/Fill					-	Tons	0%					

SUMMARY

TOTALS	**-**	**-**	**-**	**-**	**-**
TOTAL WASTE (Sum of all waste)	**-**				
TOTAL WASTE DIVERTED FROM LANDFILLS (Sum of Salvage, Reused, and Recycled columns)	**-**				
DIVERSION RATE (Diverted Waste divided by Total Waste)	**0%**				

Revision: #6 2017.12.01

Metro-North Railroad

REQUEST FOR TRANSPORT AND DISPOSAL OF WASTE

Generator / Client:	Metro North Railroad	**Date:**	
		Type of Project:	Lead Abatement
Contractor:		**OSS Project No.:**	
Site / Location:			
Waste Storage Area:	Address: Coordinates: Contact:		
Notes:			

WASTE INFORMATION							
Number of Drums	**Contents of Drum**	**Lab Report ID Number**	**Sample ID Number**	**Analytical Results (mg/l)**	**Characterization**	**Estimated Weight**	**Generation Date**

WASTE STORAGE AREA CONTACTS		
Name	**Company**	**Phone / Email**

DISTRIBUTION		
Name	**Company**	**Phone / Email**
Brandee Velez	Metro-North Rail Road – Office of System Safety	velez@mnr.org
Griselda Tolosa	Metro-North Rail Road – Office of System Safety	tolosa@mnr.org
Claire Sammon	Metro-North Rail Road – Environmental Compliance	csammon@mnr.org
Jeff Magyar	Metro-North Rail Road – Environmental Compliance	magyar@mnr.org
Karen Miele	Metro-North Rail Road – Environmental Compliance	kmiele@mnr.org

REMOVAL CONFIRMATION				
Confirmed By	**Date of Removal**	**Number of Drums**		
		Hazardous	**Non-Hazardous**	**Other**
Print:				
Signature:				

Hazardous waste storage area is ……
……..
Coordinates are: ……

Insert Photo of coordinates/map

Insert Photo drums

DIVISION 2
EXISTING CONDITIONS

SECTION 02 41 00 - DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 32 00 - Construction Progress Documentation.

C. Section 01 33 00 - Submittal Procedures.

D. Section 01 43 00 - Quality Assurance.

E. Section 01 50 00 - Temporary Facilities and Controls.

F. Section 01 74 00 - Cleaning and Waste Management.

G. Section 31 10 00 - Site Clearing.

H. Section 32 11 00 - Base Courses.

I. Section 31 20 00 - Earth Moving.

J. Section 32 12 00 - Flexible Paving.

1.3 SUMMARY

A. This Section specifies requirements for:
   1. Selective Site Demolition:
      a. Demolition, removal, and disposal of existing paving, concrete sidewalks and curbs.
      b. Removing existing pavement markings and markers from pavement, including:
         1) Permanent preformed plastic pavement marking tape.
         2) Raised pavement markers.
         3) Thermoplastic markings.
         4) Traffic paint.
      c. Demolition of utilities and other subsurface structures.
      d. Restoration of demolition Sites.
   2. Structure Demolition:
      a. Demolition of buildings and structures.
   3. Selective Demolition:

a. Selective electrical demolition and salvage of existing electrical systems, wiring, raceways, supports, equipment and minor repair of underlying structure.

1.4 REFERENCES

A. Abbreviations and Acronyms:
1. CFR: Code of Federal Regulations.
2. EPA: Environmental Protection Agency.
3. LEL: Lower explosive limit.
4. OSHA: Occupational Safety and Health Administration.
5. RCRA: Resource Conservation and Recovery Act.
6. ROW: Right-of Way.
7. U.S.C.: United States Code.

B. Definitions:
1. Asphalt Concrete Overlay: Plant mix asphalt concrete placed over existing asphalt concrete paving and compacted.
2. Authority Having Jurisdiction (AHJ): Building Code officials, zoning officials, inspectors, and government and regulatory agencies given the authority to protect the public's health, safety, and welfare.
3. Combustible Gas Indicator (CGI): A device having sensors calibrated to measure the amount of a combustible gas or vapor in a given atmosphere and used to test atmospheres for sufficient oxygen content for life support and/or the presence of combustible gases or vapors posing a potential flammability/explosion hazard.
4. Debris: All materials generated as part of demolition activities or designated for removal as part of Site cleanup activities.
5. Lower Explosive Limit (LEL): A lower limiting concentration of a gas or vapor in air at normal ambient temperatures that is needed for the gas or vapor to ignite and explode, expressed as a percentage of the gas or vapor in the air by volume; at gas or vapor concentrations below the LEL in air, there is not enough fuel to continue an explosion.
   a. The concentration of the gas or vapor in air is usually given as a percentage of the LEL.
6. Turbo blasting: A blast cleaning method using high velocity steel shot directed at a surface to be cleaned in order to abrade the surface.

C. Reference Standards:
1. Town of North Salem:
   a. Town of North Salem Construction Management Protocol.
   b. Department of Public Works:
      1) Standard Construction Details.
      2) The Town of North Salem Specifications.
   c. Municipal Code of the Town of North Salem, New York,
   d. The Town of North Salem Supplemental Building Code,:
      1) The Town of North Salem Building Code – Administration and Enforcement.
      2) The Town of North Salem General Construction Code.
      3) The Town of North Salem Mechanical Code.
      4) The Town of North Salem Electrical Code.
      5) The Town of North Salem Fire Code.
      6) The Town of North Salem Smoke Control Code.
      7) The Town of North Salem Property Maintenance Code.
   e. Traffic Ordinance of the Town of North Salem.

2. National Fire Protection Association (NFPA):
   a. NFPA 70 - National Electrical Code (NEC).
3. State of New York:
   a. New York State Department of State:
      1) Division of Code Enforcement and Administration, http://publicecodes.cyberregs.com/st/ny/st/index.htm:
         a) Building Code of New York State.
         b) Existing Building Code of New York State.
         c) Fire Code of New York State.
   b. New York State Department of Transportation (NYSDOT):
      1) NYSDOT Standard Specifications (U.S. Customary Units). https://www.dot.ny.gov/main/business-center/engineering/specifications.
      2) New York State Standard Sheets (U.S. Customary Units). https://www.dot.ny.gov/main/business-center/engineering/cadd-info/drawings/standard-sheets-us.
   c. Official Compilation of the Rules and Regulations of the State of New York (NYCRR).
      1) 12 NYCRR Part 23 - Protection in Construction, Demolition and Excavation Operations.
      2) 16 NYCRR Part 753 - Protection of Underground Facilities.
4. United States Government:
   a. United States Code:
      1) 15 U.S.C. Section 2601 et seq.
         a) Federal Toxic Substances Control Act, Public Law 99-519, as amended.
      2) 33 U.S.C. Section 1251 et seq.
         a) Water Quality Act of 1987, Public Law 100-4.
         b) Clean Water Act of 1977, Public Law 95-217.
         c) Federal Water Pollution Control Act Amendments of 1972, Public Law 95-500.
      3) 42 U.S.C. Section 6901 et seq.
         a) Resource Conservation and Recovery Act (RCRA), Public Law 94- 580.
      4) 42 U.S.C. Section 7401 et seq.
         a) Clean Air Act, as amended by Public Law 101-549, 104 Stat. 2399.95-95.
   b. Occupational Safety and Health Administration (OSHA):
      1) 29 CFR 1910 - Occupational Health and Safety Standards.
      2) 29 CFR 1926 Safety and Health Regulations for Construction.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate and sequence the demolition work with the work of other trades whose activities are mutually affected to avoid conflicts, mistakes, omissions, disputes, and delays.
   2. Utilities:
      a. Obtain the approval of serving utilities and/or the Metro-North as applicable to schedule shut downs of utilities and services.
         1) Coordinate electrical power outages with Metro-North in accordance with the requirements specified in Section 26 05 00, Common Work Results for Electrical.
      b. Obtain the approval of serving utilities and/or Metro-North as applicable to disconnect, relocate, and/or provide temporary utility service connections and lines as needed if these have not been previously completed.

1) Coordinate utility related work during construction activities to avoid tapping into established Metro-North utilities.
2) Forward utility information to Metro-North.

B. Meetings:
1. Pre-Demolition Meeting:
a. Prior to beginning demolition operations, attend a mandatory pre-demolition meeting with the Construction Manager held in accordance with the requirements specified in Section 01 31 00, Project Management and Coordination.
2. Safety Meetings:
a. Conduct daily safety meetings with the demolition staff.

C. Sequencing:
1. Unfinished Work:
a. Sequence and schedule work with consideration for the stability of the areas of the structure not intended for removal or are intended for removal at a later time.
b. Provide and secure bracing, shoring, or lateral supports to shore unstable areas created as a result of any cutting, removal, or demolition work.
2. Traffic Control:
a. Include provisions for traffic control during paving, pavement marking, and marker removal operations in the Traffic Control Plan required by Section 01 50 00, Temporary Facilities and Controls, including provisions for the placement and maintenance of barriers required to protect the pavement from traffic and to protect the workers and the public during removal operations.

D. Scheduling:
1. Coordinate the work schedule with the Construction Manager, Metro-North, and other Contractors.
a. Schedule all work of this Contract with Metro-North through the Construction Manager.
b. Schedule the work so it does not interfere or conflict with the performance of work by Metro-North and Metro-North's tenants.
2. On the Project Schedule required under Section 01 32 00, Construction Progress Documentation, show all phases of the demolition work including dates that each phase of the work will begin and end.
a. Show the shut-off, capping, and continuation of utility services.
b. Do not start work in an area until a schedule has been prepared, submitted, and approved.

1.6 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Removal of Paving and Pavement Markings:
a. Required approvals depend on where the removal of the paving and pavement marking, and marker removal operations are to occur and the owner of the right-of-way, but must be obtained before construction activities begin.
b. Coordinate with and obtain the required approvals from the appropriate State and municipal departments, including but not limited to:
1) Metro-North.
2) Town of North Salem Department of Traffic.

3) Town of North Salem Department of Public Works.
4) New York State Department of Transportation (NYSDOT).

c. Adhere to each owner's specifications and/or permits regarding the Work of this Section and comply with additional requirements of the owners.

d. If the owner of the right-of- way is other than Metro-North, the owner of the right-of-way will be provided the Contract Drawings.

2. Demolition Permit:

a. Do not demolish existing conditions as noted on the Contract plans scheduled to be demolished building unless a demolition permit for that item has been issued by the various governing municipality.

b. Apply for a demolition permit using the required forms furnished by the various municipality for each station.

1) A demolition permit will not be issued unless the applicant shows to the satisfaction of the permit issuer that the following precautions to prevent and control the emission of particulate matter into the open air shall be complied with:

a) Do not demolish walls by topping except within an enclosure approved by the commissioner.

b) Before demolishing a section of concrete ramp, floor, canopy or other structure, employ adequate wetting procedures to lay the dust.

(1) Thoroughly wet debris before loading or dumping it into trucks, other vehicles, or containers.

(2) Ensure wetting procedures are adequate to lay the dust.

(3) Cover trucks adequately to prevent dust dispersion while trucks are in transit to the point of disposal.

c) Do not drop or throw structural members from any floor, but carefully lower them to ground level using hoists.

d) Do not drop or throw debris from any floor to any floor below.

e) Transport debris from the upper floors via enclosed, dust-tight chutes or via buckets

(1) Where chutes are used, employ a water-soaking spray to saturate the debris before it reaches the point of discharge from the chute.

(2) Where buckets are used, adequately wet the debris to preclude dust dispersion when the buckets are dumped.

f) In the event particulate matter becomes airborne, despite the application of the above procedures, or because freezing temperatures preclude the use of water for laying the demolition dust, cease demolition until adequate measures can be taken.

(1) Alternate procedures must be evaluated by Metro-North and the governing municipality before being initiated.

c. Submit a copy of the Demolition Permit to the Engineer for information.

3. Air Pollution Control Ordinance Permits and Certificates:

a. Comply with the various Air Pollution Control Ordinances appearing in the various municipality Codes, which requires maintaining a reasonable degree of purity of the air resources of the area consistent with applicable Federal, State and City law.

B. Qualifications:

1. Licenses:

a. The Contractor and all Subcontractors who perform demolition activities must be properly licensed to perform the demolition work of this Contract.

b. Submit copies of the required licenses to the Construction Manager.

2. Testing Laboratories' Qualifications:

a. Employ a Testing Laboratory for this Contract qualified as specified in Section 01 43 00, Quality Assurance.

3. Off-Site Disposal Facility:
   a. Off-Site disposal facilities must be approved by the Metro-North prior to being used to receive waste materials from this Contract.
   b. Submit the name and location, licenses, certifications, and other qualifications of disposal and recycling facility(s) intended for use for the disposal or recycling of tanks, piping, tank supports, liquid waste, solid waste and appurtenances to the Construction Manager for approval.

C. Site Samples:
1. Waste Characterization Sampling and Analysis:
   a. Perform additional sampling and analysis required by others prior to transporting any potentially contaminated material.
   b. Conduct chemical sampling and analysis of the material being removed throughout the duration of removal activities.
      1) Sample and test the materials to determine if non-hazardous or hazardous contaminated materials disposal is required.
   c. Prepare, maintain, and submit to the Construction Manager documentation of the sampling and analysis, such as sample locations, rationale, chain-of- custody, test results, and similar information prior to removing tank contents.

1.7 SUBMITTALS

A. Action Submittals:
1. Submit the following to the Engineer for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:
   a. Product Data:
      1) Asphalt overlay materials.
      2) Backfill material.
      3) Electrical products.
      4) Patching materials.
   b. Certificates:
      1) Certificates of Destruction.
   c. Delegated Design Submittals:
      1) Lead Exposure Plan, if removal of lead-based paint is required.
      2) Demolition plan.
   d. Qualification Statements:
      1) Demolition licenses.
      2) Resumes, licenses, or other qualifications of the personnel intended for performing tank removal operations.
      3) Licenses, certifications, and other qualifications of the firm intended for performing utility location operations.
      4) Name and location, licenses, certifications, and other qualifications of the firms intended for use as waste disposal or recycling facilities.

B. Informational Submittals:
1. Submit the following to the Engineer for information in accordance with the requirements of Section 01 33 00, Submittal Procedures:
   a. Test and Evaluation Reports:

1) Documentation of the sampling and analysis of materials to be removed and transported.
2) Records of inspections and tests required to comply with the requirements of each disposal facility.
3) Records of the backfill compaction.

C. Closeout Submittals:
1. Submit the following to the Engineer in accordance with the requirements of Metro-North:
a. Record Documentation:
1) Pre-Disposal Records:
a) Names and locations of the disposal areas and facilities to be used for disposing and recycling the materials.
b) Copies of the licenses, certifications, permits, and agreements required or issued for the disposal of materials.
c) Equipment and methods to be used for removal and disposal operations.
2) Records of Waste Disposal Operations:
a) Records of the disposal operation.
b) Manifests of shipments of contaminated materials.
c) Records of corrective actions taken to address any problems encountered during disposal operations.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
1. Deliver asphalt mixtures to the Site in accordance with the requirements of Section 32 12 00, Flexible Paving.
2. Provide the equipment, personnel, and facilities necessary and suitable to remove, load, transport, unload, and dispose of or recycle the excavated soil materials, USTs and hydraulic lifts, associated piping, and other items demolished under this Section.
a. If similar liquid wastes are compatible, they may be bulked for cost effective disposal.
3. Transport and manifest the liquids, residues, and rinsate removed to an approved disposal facility.
a. Have the Construction Manager sign the manifest prior to transporting waste rinsate to an approved disposal facility.

B. Storage and Handling Requirements:
1. Stockpile, store, and handle aggregate in accordance with the requirements of Section 32 11 00, Base Courses.
2. Rinsate:
a. Contain and label rinsate generated by septic tank, UST, pipe, and appurtenance cleaning operations.
1) At a minimum, label the rinsate with the date it was generated, the location of the tank it was removed from, and the type of liquid or residue.
b. Locate rinsate in above ground containers temporarily stored on-site away from traffic patterns as designated by the Construction Manager.
c. Keep rinsate from cleaning operations separate from contaminated and uncontaminated surface runoffs, and from the tank contents.

C. Packaging Waste Management:

1. Comply with the approved Waste Management Plan required in Section 01 74 00, Cleaning and Waste Management.

1.9 SITE CONDITIONS

A. Ambient Conditions:
   1. The use of explosives at the Site is prohibited.

B. Existing Conditions:
   1. Structures to be demolished will be vacated prior to the start of the Work of this Section.
      a. Metro-North assumes no legal responsibility for the actual condition of the structures to be demolished.
      b. The conditions of the structures to be demolished that existed at the time of inspection for bidding purposes will be maintained by the Metro-North.
      c. Keys to the structures to be demolished will be available from the Construction Manager when they exist so the Contractor can review the structures.
   2. Take care not to impede the ongoing work of any tenant of adjacent facilities.
   3. Contract Document Accuracy:
      a. Demolition information shown or otherwise indicated in the Contract Documents is based on visual field examination and existing record documents.
         1) While the information provided is believed to be correct, no assurance is implied relative to its total completeness or accuracy.
         2) Existing underground and aboveground utilities, services, and improvements, if any, are indicated in the Contract Documents to the best of the Metro-North's knowledge and belief; however, the Metro-North has not verified this information by on-site verification of available As-Built documentation.
      b. The Contractor hereby distinctly agrees that neither the Construction Manager nor Metro-North is responsible for the correctness or sufficiency of the existing conditions information given in the Contract Documents after the Contractor's own Site Investigation:
         1) The Contractor must make no claim for delay or extra compensation or damage on account of the information given; and
         2) The Contractor must have no claim for relief from any obligation or responsibility under the Contract with respect to the above stated stipulations.
      c. The Contractor is required to notify the Construction Manager in accordance with the notification and change procedures of the Contract of discrepancies discovered in the information provided.
         1) Report discrepancies to the Construction Manager for disposition before disturbing existing installations.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. Regulatory Requirements:
   1. Comply with the Laws, Codes, and Regulations pertaining to the work being performed.
      a. All work is governed at all times by the applicable provisions of Federal Laws, including but not limited to, the following:

1) Occupational Safety and Health Administration (OSHA):
    a) Occupational Health and Safety Standards.
    b) Safety and Health Regulations for Construction.
2) Environmental Protection Agency (EPA):
    a) National Emission Standards for Hazardous Air Pollutants.
    b) Federal Toxic Substances Control Act.
    c) Water Quality Act of 1987.
    d) Clean Water Act of 1977.
    e) Federal Water Pollution Control Act Amendments of 1972.
    f) Resource Conservation and Recovery Act (RCRA).
    g) Clean Air Act.

b. When performing utility work, observe the governing code authority and utility company rules and regulations as applicable.

c. During demolition activities, constructing soil berms, or other earth moving operations, comply with the various municipality Air Pollution Control Ordinance requirements.

2. Demolition Safety:
    a. Sole responsibility for performing demolition in a safe manner is the Contractor's.
    b. Comply with applicable Rules and Regulations of the State of New York (NYCRR) and OSHA, especially those regarding high voltage power lines, underground facilities, and demolition safety restrictions.
        1) Provide suitable protection against bodily injury.
        2) Protect the demolition excavations, and the safety of workers and the public, in conformance with the requirements of the Occupational Safety and Health Administration (OSHA), particularly "Subpart P – Excavations" of 29 CFR 1926, and the following:
            a) Incomplete Street Crossings:
                (1) At street crossings where backfill and temporary patches have not been completed during regular working hours, provide substantial steel plates complying with the requirements specified in New York State Department of Transportation (NYSDOT) Standard Specifications to bridge across the demolished areas and accommodate traffic.

3. Removal of Pavement and Pavement Markers and Markings:
    a. If removal of lead-based paint striping is required, use methods complying with the requirements specified in 29 CFR 1910 and 29 CFR 1926.
        1) Notify employees of the Contractor, the Construction Manager, Metro-North, and others on the Site, of the lead abatement activities and precautions necessary to avoid contamination by lead compounds.
        2) Submit a Lead Exposure Plan to the Construction Manager for approval at least 48 hours prior to the start of lead-based paint striping obliteration activities.

4. Environmental Protection:
    a. Comply with the regulations governing pollution controls.
    b. If potentially dangerous materials are unexpectedly encountered, discontinue work in that immediate area, and report the conditions to the Construction Manager as soon as practicable.
        1) If on-site materials are found to contain hazardous contaminant concentrations above the Resource Conservation and Recovery Act (RCRA) disposal limit, remove and dispose of them in accordance with the RCRA and its amendments.

2.2 MATERIALS

A. Bituminous Concrete Overlay:
   1. Provide asphalt overlay materials complying with the requirements of Section 32 12 00, Flexible Paving.
   2. Submit Product Data for the asphalt overlay material to the Construction Manager for approval.

B. Backfill:
   1. Provide backfill material conforming to the requirements specified in Section 31 20 00, Earth Moving.
   2. Submit Product Data for the backfill material to the Construction Manager for approval.

C. Basic Electrical Materials:
   1. Electrical products, such as conduit, raceway, wire and cable, support devices, fasteners, and control devices required for work of this Section are specified in other Sections.
   2. Submit Product Data for the electrical products to the Construction Manager for approval.

D. Patching Materials:
   1. Provide patching materials that match, as nearly as practical, the existing material for each surface being patched.
   2. Submit Product Data for the patching materials to the Construction Manager for approval.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Prior to performance of the actual work, carefully inspect the entire Site and locate those objects and structures designated for demolition and removal.
      a. Field verify the dimensions, quantity, type, material, location, means of anchorages and support, interconnection with other facilities, and other pertinent characteristics of facilities which must be removed or demolished to accommodate new facilities.
   2. Locate existing exposed and buried active utilities, and determine the requirements for their protection, or their disposition with respect to the demolition work.
      a. Comply with applicable requirements of OSHA, the State of New York statutes, especially NYCRR 16 Part 753 regarding Underground Utilities, and the local municipal Construction Codes for each station local.
         1) At least 2 to 10 days prior to the start of digging or excavation Work not counting the day of the call prior to the start of digging or excavation Work, contact Dig /Safety. New York at 1-800-962-7962 or 811 to arrange for underground utility owners to locate and mark their underground utilities.
   3. Inspect the properties identified for demolition to identify items of value which the Contractor intends to salvage or retain.
      a. Notify the Construction Manager of the intent to retain or salvage items.
      b. Metro-North reserves the right to renegotiate the Contract Price to reflect proposed salvaged or retained items.
   4. Verify the striping removal limits of this Contract with the Construction Manager before commencing the Work.

a. In order to match and tie into the existing striping, the striping removal limits may exceed the Contract construction limits, or new striping limits.

5. Verify that existing electrical circuiting arrangements and measurements are as shown on the Contract Drawings.
6. Verify that abandoned electrical wiring and equipment serve only the abandoned facility.

B. Pre-Installation Testing:
1. If the type of paint in painted pavement markings to be removed is unknown, verify whether or not the striping paint is lead-based paint by testing samples.

C. Evaluation and Assessment:
1. Verify with the Construction Manager the objects to be removed and preserved.
2. Whether or not the existing pavement marking paint is lead-based paint will determine the appropriate removal methods required.

3.2 PREPARATION

A. General Superintendence:
1. During all times that the Work is performed, the Contractor is responsible to have at least one fully competent and experienced general Superintendent at the Site to represent the Contractor in all matters.
   a. Instructions and information given to the Contractor's general Superintendent by the Construction Manager is considered to have been given to the Contractor.
   b. Whenever emergencies from whatever cause arise during the Contract, be prepared to perform all necessary work promptly to address the emergency conditions, including special efforts or adding extra work shifts to continue work beyond normal working hours.

B. Electrical System De-activation: Prior to electrical demolition and removal work as indicated, de-activate existing electrical systems.

C. Protection of In-Place Conditions:
1. Protection of Existing Structures and Utilities:
   a. Take measures adequate to protect existing utilities and other existing items and structures to remain.
   b. Keep active utilities in service.
      1) Protect active utilities, improvements, and services from damage.
      2) Take precautions to work safely around the utility corridors identified or have the utility services temporarily disconnected.
      3) Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Authorities Having Jurisdiction (AHJ).
      4) During interruptions to existing utilities, provide temporary services acceptable to governing authorities.
   c. Conduct demolition operations in a manner that prevents injury to adjacent buildings, structures, other facilities, and persons.
      1) If public safety could be endangered during the progress of the demolition work, provide adequate protective measures to protect public pedestrian and vehicular traffic on streets and walkways.

a) Provide warning signs, signals, and barricades conforming to requirements of Federal, State and local laws, rules, regulations, precautions, orders, and decrees.

2) Leave the sidewalks, curbs, pavement, and shoring of these and similar items in place and properly braced except as otherwise indicated in the Contract Drawings.

3) If buildings are designated to remain vacant on the Site, secure the doors, windows, and attic access at carports of those buildings in accordance with the requirements specified in Section 01 50 00, Temporary Facilities and Controls.

d. Maintain existing utilities indicated to remain and protect them against damage.

1) Electrical:

a) Disconnect or de-energize onsite electrical wiring close to or entering structures to be demolished.

b) Coordinate with the local electrical utility company for necessary relocation of utilities.

2) Water:

a) Protect existing fire control hydrants and repair damaged hydrants.

b) Coordinate necessary relocations of utilities with the various owners and municipality as required.

3) Natural Gas:

a) Coordinate with the local gas utility company for necessary relocation of utilities if required.

4) Sanitary and Storm Sewers:

a) Disconnect or cap sanitary sewers and storm drains close to exiting structures to be demolished as required.

2. Maintenance of Traffic:

a. Ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities by demolition operations.

1) Do not close or obstruct streets, walks, or other occupied or used facilities without permission from Metro-North and the Authorities Having Jurisdiction (AHJ).

a) Coordinate street and sidewalk closings and traffic control with Metro-North and the various municipalities governing each station, and with other appropriate government agencies.

b) Obtain all permits required by the various municipalities and pay necessary fees.

c) Prepare traffic control and walkway plans to review and approval by Metro-North and the various municipalities having jurisdiction on each station site.

2) Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

a) Ensure safe passage of persons around the area of demolition.

b. Maintain and protect traffic on active streets and roads in accordance with the requirements specified in Traffic Control requirements of each jurisdiction and Section 01 50 00, Temporary Facilities and Controls.

D. Surface Preparation:

1. Control fugitive dust by applying an adequate dust palliative, such as water, to the ground and debris in an amount sufficient to maintain dust as incidental to demolition and lot clearing operations in accordance with the requirements of the various local municipalities Air Pollution Regulations and with the requirements of other Authorities Having Jurisdiction.

a. Sprinkle water, use temporary enclosures, and employ other suitable methods to limit dust and dirt rising and scattering into the air to the lowest practical level.
b. Do not use water to limit dust and dirt when it may create hazardous or objectionable conditions such as flooding and pollution.

2. Before beginning to excavate, place temporary erosion and sediment controls around proposed excavations in accordance with Section 01 50 00, Temporary Facilities and Controls, to eliminate erosion and sedimentation problems caused by the Work of this Section.
   a. Manage surface water runoff, seepage, and infiltrating groundwater.
3. Provide temporary barriers around open excavations in accordance with Section 01 50 00, Temporary Facilities and Controls, to protect workers and the public from injuries sustained from falling into the excavations.
4. If a bituminous concrete overlay is required for obliterating existing pavement markers, 48 hours prior to applying the overlay prepare the surface as follows:
   a. Cut out and patch severely raveled and cracked areas that are depressed more than 3/4 inches from the adjoining pavement.
   b. Fill large shrinkage cracks with asphalt sealing compound acceptable to the Construction Manager.
   c. Clean the surface using a power broom.
   d. Apply a tack coat complying with the requirements of Section 32 12 00, Flexible Paving, to the surfaces to receive the bituminous concrete overlay, and do not permit traffic to travel on the coated surface.

3.3 DEMOLITION/REMOVAL

A. Perform demolition so other Project operations and operations of Metro-North are not delayed or interfered with.

B. Confine demolition operations to the areas as indicated on the Contract Drawings.

C. The choice of equipment, machinery and apparatus, motorized or otherwise, to be used to perform demolition work is at the Contractor's discretion, but it must perform the work within the limits of the Contract requirements.
   1. Except as otherwise specified, the means and methods of performing electrical demolition and removal operations are the sole responsibility of the Contractor; however, equipment used, and methods of demolition and removal are subject to approval of the Construction Manager.
      a. Use equipment and methods that do not damage items to remain or salvaged and areas adjacent to demolition operations.
      b. Use methods that do not interfere with Metro-North's operations and which do not cause excessive dust.
      c. Remove debris as it accumulates.
   2. Cut existing structure materials using methods that will prevent extensive damage beyond the immediate area of cutting.
   3. After demolition and removal work is performed patch the existing structure as required to match the surrounding finish and appearance, including the appropriate surface decoration.

D. Utility, Service, and Improvement Demolition:
   1. Active Utilities:
      a. Remove or relocate active utilities, services, and improvements only as indicated on the Contract Drawings, as specified, or as provide by Change Order.
   2. Inactive or Abandoned Utilities:

a. Coordinate all utility relocations with Metro-North and the utility company.
b. Remove, plug, or cap inactive and abandoned utilities encountered during the work and as indicated in the Contract Documents.
1) Cap all utilities in a location approved by the Metro-North.
2) Use approved cap materials.
3) If no specific setbacks are indicated, plug or cap inactive and abandoned utilities at least 5 feet outside of new building walls or as required by local regulations.

E. Sidewalk Demolition:
1. Demolish and remove sidewalks indicated for removal on the Contract Drawings to the distance required to maintain a 1 inch per foot maximum slope for the replaced portion of sidewalk.

F. Driveway Demolition:
1. Demolish and remove existing driveways indicated for removal on the Contract Drawings.
2. Portland Cement Concrete Driveways, Curbs, Gutters, and Sidewalks:
a. Demolish and remove existing Portland cement concrete driveway, curbs, gutters, and sidewalks indicated for removal on the Contract Drawings after saw cutting the paving at match lines.
1) Saw cut the paving to neat, vertical, true lines without damaging the adjoining surface not to be removed.
2) Minimum Depth of Cut: 1-1/2 inches, or 1/4 of the paving thickness, whichever is greater.
3) Demolish and remove existing concrete driveway curbs and gutters to the right-of way line and the new end of curb faced.
3. Bituminous Concrete Driveways, Curbs, Gutters, and Sidewalks:
a. Demolish and remove existing bituminous concrete driveways, curbs, gutters, and sidewalks indicated for removal on the Contract Drawings after cutting the paving using a device capable of making a neat, straight and smooth cut without damaging the adjoining surface not to be removed.
1) If only saw cutting is to be used, it will be indicated on the Contract Drawings.
4. Remove pavements and aggregate base outside the roadway prism if indicated on the Contract Drawings.

G. Pavement Marking Removal or Obliteration:
1. Perform pavement marking obliterations or removals as shown on the Contract Drawings or as indicated by the Construction Manager.
2. Remove existing pavement markings and markers from pavement to the fullest extent possible by using one of the special techniques specified unless another method is approved by the Construction Manager.
a. Do not use a method for removing existing pavement markings that materially damages the surface or texture of the useable pavement.
b. Do not cover over existing pavement markings with slurry seal, black paint, or stain of any kind.
c. Do not use sandblasting or turbo-blasting within 12 feet of a lane occupied by traffic.
d. Do not use sandblasting, turbo-blasting, or bituminous concrete overlay for airside applications.
3. Techniques for Removing or Obliterating Traffic Paint:
a. High Pressure Water Jet:

1) Use a high-pressure water jet with the proper spray nozzle and pressure to remove the pavement markings.

b. Sandblasting:
1) Sandblast the pavement to remove the pavement markings, taking care not to damage the pavement surface.

c. Turbo-blasting (Steel Shot):
1) Blast the pavement with steel shot to remove the pavement markings, taking care not to damage the pavement surface.

d. Bituminous Concrete Overlay:
1) Cover the pavement markings with a bituminous concrete overlay so the markings are no longer visible.

e. Solvent Cleaning:
1) Employ chemical agents to remove the pavement markings, taking care to comply with environmental regulations and to properly clean up residue.

4. Techniques for Removing Raised Pavement Markers:
a. When removing raised pavement markers, remove both the marker and the adhesive pad, or the adhesive pad alone if the marker is missing.

b. Hammer and chisel:
1) Manually remove the raised pavement markers with a hammer and chisel.

c. Blade:
1) Use the blade on heavy equipment to dislodge and remove raised pavement markers.

H. Demolition in Vegetation Areas:
1. Unless otherwise indicated in the Contract Documents, entirely remove all trees, palms, shrubs, and other vegetation areas in accordance with the requirements of Section 31 10 00, Site Clearing.
a. When clearing lots, remove and properly dispose of sticks, roots, rubbish, and other material.

I. Existing Canopy/Concrete Station Area Demolition:
1. Demolish canopies and concrete structures to the extent indicated on the Contract Drawings.
2. Unless it is indicated to remain, demolish walkway, ramp, foundation concrete and masonry in small sections.
a. Break up concrete slabs on grade.
3. Do not impose excessive loads on supporting walls, floors, or framing.
a. Distribute demolition equipment throughout the structure and remove demolished materials promptly.
4. Use hoists, small cranes, or other suitable equipment to remove and lower canopy structural framing members.

J. Selective Electrical Demolition:
1. Selective electrical demolition work, as specified herein, is not intended to be performed as a wrecking operation but as work relative to the performance of the various construction operations of the Project.
2. Remove, relocate, and extend existing installations to accommodate new construction as indicated in the Contract Documents and/or as required.
a. Remove exposed raceways and related supports.
1) Remove exposed abandoned conduit systems, including abandoned conduit systems above accessible ceiling systems.
2) Cut exposed raceways flush with the floor and plug.

b. Remove the wiring from disconnected circuits, feeders, and equipment unless otherwise specified or indicated.
1) Remove wiring in abandoned conduit systems to the power supply source.
c. Use means and methods for permanent disconnection, which render the remaining electrical systems and apparatus in conformity with NFPA 70 (NEC).
d. Provide temporary wiring and connections to maintain existing systems in service during construction.
1) Conform temporary wiring to the requirements of NEC Article 305, General Requirements.
2) Provide temporary electrical service work as specified in Section 01 50 00, Temporary Facilities and Controls.

3. Maintain access to existing electrical installations which remain active.
a. Modify installations and provide access panels or plates as appropriate.
4. Extend existing installations using materials and methods compatible with existing electrical installations, and as specified in other Specification Sections.
5. Wiring Devices:
a. Disconnect abandoned outlets and remove devices.
1) Remove abandoned outlets if conduit serving them is abandoned and removed.
2) Provide blank covers for abandoned outlets, which are not removed.
b. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
6. Lighting:
a. Disconnect and remove abandoned luminaires and poles, lighting fixtures, and floodlighting units.
b. Remove brackets, stems, hangers, and other accessories.
c. Disconnect and remove abandoned concrete luminaire pole bases.
7. Electrical Equipment:
a. Disconnect and remove electrical equipment where if indicated on the Contract Drawings.
b. Disconnect and remove abandoned distribution equipment, panelboards, disconnect switches, and motor starters as indicated on the Contract Drawings or as otherwise required due to the removal of associated equipment.
8. In exposed through-structure conduit locations, or where concealed conduits become exposed by penetrating a structural floor, wall, or ceiling, cut the abandoned conduits below the finished structural surface in order to perform surface patching.

K. Demolition of Below-Grade Construction:
1. Except as indicated by the Contract Documents, remove all below-grade construction and on-grade concrete slabs to 4 feet below existing grade
a. Contaminated Soil Excavation:
1) If during the underground storage tank (UST) removal activities the Construction Manager determines that contaminated soil has been encountered, excavate the contaminated soil as specified in Section 31 20 00, Earth Moving, and as directed by the Construction Manager.
a) If the Construction Manager determines that excavation work must be phased, complete all phases of the excavation prior to the pre- final inspection.
b. Contaminated Water Removal:
1) If during UST removal activities the Construction Manager determines that contaminated water has been encountered in the excavations, remove the contaminated water from the excavation as directed by the Construction Manager

a) Arrange to dispose of the contaminated water offsite.
(1) Collect water characterization samples in accordance with the disposal or recycling facility's requirements and as directed by the Construction Manager.
b) If approved by the Construction Manager and Metro-North, arrange to treat the water at the Site prior to discharging it to the ground water or surface water as directed by the Construction Manager.
(1) Prior to discharging the treated water, perform the testing required by Local, State, and Federal regulations.

L. Excavation and Grading:
1. Backfill and compact all voids created by demolition operations.
a. Backfill and compact basements, footings, basement walls, and the total volume within substructures in their entirety.
b. Compact backfill in accordance with the requirements specified in Section 31 20 00, Earth Moving.
1) The last 12 inches of backfill may not contain material larger than 3 inches in diameter.
2. Uniformly grade the final compacted surfaces so that they are primarily flat.
a. On Sites that are to be scraped to form soil berms around their perimeter, compact the soil at the Site, including the soil in the berms.

M. Special Techniques:
1. Precast Safety Curbs Inside the Right-of-Way;
a. Unless otherwise indicated on the Contract Drawings, reset safety curbs currently existing inside the right-of-way approximately parallel to the new curb line directly opposite their existing location with their back edge on the right-of-way line.
1) Salvage and stockpile other safety curbs existing inside the right-of-way on the adjacent property at a location agreeable to the property owner.

3.4 REPAIR/RESTORATION

A. Restore adjacent areas to the conditions existing prior to the start of the demolition work.

B. Use the same trade which originally constructed items that have been damaged to patch or repair these items at no increase in the Contract Price.

C. Repair all damage to existing underground and overhead utilities, services, and improvements caused by demolition or other operations; whether or not such utilities, services, and improvements are indicated on the Contract Drawings.
1. Commence and complete the work to repair damaged utilities as soon as practicable.

D. Repair damage to the pavement caused by pavement marking removal by using methods acceptable to the Construction Manager.
1. If asphalt slurry is used to repair damage caused by pavement marking removal methods, place the asphalt slurry parallel to the new direction of travel and not less than 2 feet in width.

3.5 SITE QUALITY CONTROL

A. Site Tests:

1. Compaction Test:
    a. Test Procedure:
        1) Have the Testing Laboratory use a nuclear density gauge or other approved method to measure the compaction of backfill and Site grading as specified in Section 31 20 00, Earth Moving, and submit the testing records to the Construction Manager for approval.
    b. Acceptance Criteria:
        1) Compaction achieving the minimum density specified is acceptable.

B. Site Inspections:
1. The Construction Manager will inspect the Site to verify that required demolition and removals have been adequately performed in a timely manner, and whether incomplete obliteration of markings that could confuse motorists exists.
    a. The Construction Manager will inspect all finished work and notify the Contractor of discrepancies and omitted work.
2. Have the Testing Laboratory perform the inspections required by regulatory agencies, the disposal facilities, and API standards.

C. Non-Conforming Work:
1. If the Construction Manager discovers incomplete obliteration of pavement markings that may result in confusing travelers, remove them immediately.
2. Within 2 days of notification by the Construction Manager of other discrepancies and/or omitted work, correct the discrepancies and perform the omitted work.

3.6 CLEANING

A. Promptly remove the tools, equipment, materials, and debris used during demolition activities from the Site upon completion of the Work of this Section.
1. Leave the area in which the demolition work was performed clean and free of all rubbish and debris.
    a. Do not leave debris inside substructure areas.
2. At the completion of paving removal operations, remove all paving removal equipment and traffic control devices furnished under this Section from the Site.
3. Remove sand or other material that is deposited on the pavement as a result of removing pavement markings and markers as the Work progresses.
    a. If blast cleaning is used as a method to remove pavement markings or objectionable material; immediately remove the residue, including dust, after contact between the sand and the surface being treated.
        1) To remove the residue, use a vacuum attachment operating concurrently with the blast cleaning operation or other methods approved by the Construction Manager.
        2) Do not allow sand or other material that might interfere with drainage or might constitute adverse safety conditions to traffic to accumulate.

B. Clean dust, dirt, and debris resulting from demolition operations from adjacent structures and improvements as directed by the Construction Manager.

C. Waste Management:
1. Burning materials removed from demolished structures on the Site is not permitted.
2. Abandoned Electrical Equipment and Apparatus:

a. Existing electrical equipment and apparatus in or on the structures not claimed as salvage by Metro-North become the property of the Contractor and may not be disposed of onsite but must be removed and disposed of in a lawful manner off-site.

3. Salvage:
   a. Metro-North may claim as salvage any items and materials removed under the work of this Section.
      1) Should such right of salvage be exercised by Metro-North, move and neatly store removed items onsite in a location agreeable to Metro-North in a manner approved by the Construction Manager.
   b. Except for items indicated to remain the property of the Metro-North, other salvaged and demolished materials not indicated for reuse become the property of the Contractor.
      1) The disposition of the other salvaged and demolished materials not indicated for reuse is at the Contractor's option.
   c. Items salvaged by the Contractor may be removed from structures as the demolition work progresses.
      1) Transport salvaged items away from the Site as they are removed.
         a) Storage or sale of the salvaged or removed items onsite is not permitted.
   d. Salvaging items is not cause for claiming delay in the completion time agreed upon for completion of the Contract
4. Debris Removal:
   a. Dispose of demolition debris offsite in a lawful manner.
      1) Containerize or otherwise store debris as work is in progress.
      2) Remove debris, rubbish, and the debris from building demolition, and legally dispose of them off-site.
         a) Transport demolition materials from demolished structures away from the Site.
      3) Remove demolished paving materials from the Site to a legal disposal site unless otherwise specified, indicated on the Contract Drawings, or approved by the Construction Manager.

3.7 PROTECTION

A. Where excavation work is required during demolition operations and is incomplete, provide temporary chain link fencing as specified in Section 01 50 00, Temporary Facilities and Controls, around the excavated areas.

B. If public safety is endangered during the progress of the demolition work, provide adequate protective measures to protect public pedestrian and vehicular traffic on streets and walkways.
   1. Furnish signs, signals, and barricades complying with the requirements of Federal, State and local laws, rules, regulations, precautions, orders and decrees.

END OF SECTION

SECTION 02 61 00
SAMPLING, TESTING, HANDLING, LOADING, REMOVAL AND DISPOSAL OF SOILS

PART 1 GENERAL

1.01 SUMMARY

Section includes requirements for the sampling, testing, loading, handling, on-site reuse, and off-site transport and disposal of soils. Requirements of this section apply to:

1) Soils to be excavated and re-used within the project limits or relocated from one Metro-North Railroad property / location to another; moved from one location to another that is not within the contiguous confines of the work site subject to the approval of Metro-North Railroad Department of Environmental Compliance and Services, and

2) Soils to be removed from Metro-North Railroad property and disposed of off-site at an appropriately permitted disposal facility subject to the approval of Metro-North Railroad Department of Environmental Compliance and Services.

The Contractor shall provide a qualified Environmental Professional (EP) to support the work required by this section. See Section 1.06(B).

The Contractor shall utilize transportation and disposal facilities from Metro-North Railroad's list of approved facilities. Refer to most recent revision of *"Metro-North Railroad Environmental Compliance & Services Approved Waste Management Consultants, Disposal Facilities, Transporters, and Laboratories".*

The Contractor must comply with all applicable Federal, State, County and Local regulations. The more restrictive law, rules and regulations will govern, including revisions to date of Contract.

It shall be known that terms in the singular may represent terms in the plural (i.e. laboratory /

laboratories, facility / facilities, transporter / transporters).

1.02 RELATED SECTIONS

Section 01 33 60 Safety, Health, and Environmental Control
Section 01 35 43 Environmental Protection
Section 01 74 19 Construction Waste Management
Section 31 32 19 Dewatering
Section 31 20 00 Earth Moving

1.03 ABBREVIATIONS AND ACRONYMS

ASP	Analytical Services Protocol
ASTM	American Society for Testing and Materials
BUD	Beneficial Use Determination
C&D	Construction and Demolition
CFR	Code of Federal Regulations
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
EP	Environmental Professional
FSP	Field Sampling Plan
SCR	Soils Characterization Report
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
PCBs	Polychlorinated Biphenyls
PPB	Parts per Billion
PPM	Parts Per Million
QA/QC	Quality Assurance/ Quality Control
SCO	Soil Cleanup Objective
SCL	Soil Cleanup Level
SHP	Soil Handling Plan
SHECP	Safety, Health and Environmental Control Plan
SSCO	Supplemental Soil Cleanup Objectives
TAL	Target Analyte List
TCL	Target Compound List
TPHC	Total Petroleum Hydrocarbon

1.04 STANDARDS AND REGULATIONS

A. Protection of underground facilities shall be conducted in accordance with Metro-North Railroad's *"Protection of Underground Metro-North Railroad Facilities"*, 16 NYCRR Part 753, and Dig Safely New York.

B. The Contractor must comply with all applicable rules and regulations, including but not

limited to, the applicable provisions of the following regulatory agencies:

1. United States Department of Transportation
2. United States Environmental Protection Agency
3. Occupational Safety and Health Administration
4. New York State Department of Environmental Conservation
5. New York State Department of Health
6. New York State Department of Transportation
7. Metropolitan Transportation Authority

1.05 SUBMITTALS

A. **General**

1. The Contractor must prepare and submit for approval three (3) copies of the submittals required by this section. Submittals shall be transmitted to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer. Submittals shall be in accordance with the requirements of the general terms and conditions and the requirements of this Section.
2. Do not submit subsequent submittals until previous submittals are approved by Metro-North Railroad Department of Environmental Compliance and Services (i.e. approval of the Soil Handling Plan is contingent upon approval of the Field Sampling Report and the Field Sampling Summary and Soils Characterization Report).
3. See Section 1.06 Quality Assurance for submittal content / requirements.

B. **Schedule**

1. The Contractor must include the work required by this section in its anticipated schedule.

C. **Environmental Professional (EP)**

1. The Contractor shall identify and provide the credentials of the firm and/or individual serving in this capacity. See Section 1.06(B)

D. **Field Sampling Plan (FSP)**

1. Prepare a Field Sampling Plan (FSP) that prescribes the sampling and laboratory analyses to characterize soils for suitability for reuse on-site and/or off-site disposal. See Section 1.06(C) and (D)

E. **Analytical Laboratories Certifications & Accreditations**

1. Identify the analytical laboratory to be utilized and provide their accreditations and credentials for the analyses to be performed. See Section 1.06(E)

F. **Soils Characterization Report (SCR)**

1. Submit a Soils Characterization Report (SCR) within twenty-one (21) days of completion of the work outlined in the Field Sampling Plan (FSP) and receipt of

laboratory analytical data. See Section 1.06(F)

G. **Soil Handling Plan (SHP)**

1. Submit a Soil Handling Plan (SHP) upon approval of the Soils Characterization Report (SCR). See Section 1.06(G)

H. **Transporter Information**

1. Identify the proposed transporter to be utilized for each of the soil classifications and provide their transporter permits and licenses for the soil classifications they will be hauling. See Sections 1.06(H), and 3.08.
2. The proposed transporter shall be from Metro-North Railroad's list of approved transporters. Refer to most recent revision of *"Metro-North Railroad Environmental Compliance & Services Approved Waste Management Consultants, Disposal Facilities, Transporters, and Laboratories".*

I. **Disposal Facility Information**

1. Identify the proposed disposal facility to be utilized for each of the soil classifications and provide their permits and licenses for the soil classifications they will be accepting. See Sections 1.06(I), and 3.08.
2. The proposed disposal facility shall be from Metro-North Railroad's list of approved disposal facilities. Refer to most recent revision of *"Metro-North Railroad Environmental Compliance & Services Approved Waste Management Consultants, Disposal Facilities, Transporters, and Laboratories".*

J. **Waste Manifest Records, Shipment Records and Certificates of Disposal**

1. Provide applicable waste manifest records, bills of lading, shipment records, scale tickets, and certificates of disposal for each truck and/or container load of soil taken off-site for disposal. See Sections 1.06(J)

1.06 QUALITY ASSURANCE

A. **Schedule**

1. The Contractor must include the work required by this section in its schedule. The schedule shall include the time required for the preparation and review of the submittals by the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer, and actual performance of the work required by this section (i.e. field sampling, laboratory analysis, soils characterization/classification, soil excavation and placement, loading of soils for transport, backfill/re-use/placement, off site removal and disposal).
2. In order to prevent delays in the schedule, the Contractor must anticipate and allot time for the following in their schedule:
   a. Preparation of the FSP (to be determined by the Contractor)
   b. Review/approval of the FSP by the Metro-North Department of Environmental Compliance and Services and the Engineer
   c. Implementation of the FSP, including collection of samples, and analysis of soil

samples by the laboratory (to be determined by the Contractor)

3. Preparation of the SCR within twenty-one (21) days of completion of the work outlined in the Field Sampling Plan (FSP) and receipt of laboratory analytical data. See Section 1.06(F)

   a. Review/approval of the SCR by the Metro-North Department of Environmental Compliance and Services and the Engineer

   b. Preparation of the SHP (to be determined by the Contractor)

   c. Review/approval of the SHP by the Metro-North Department of Environmental Compliance and Services and the Engineer

   d. Implementation of the SHP, including re-use and/or loading, off-site transport and disposal of soils (to be determined by the Contractor)

   e. Receipt of waste manifest records, shipment records and certificates of disposal (to be determined by the Contractor)

B. **Environmental Professional (EP)**

1. The Contractor shall provide an individual to serve as the Environmental Professional (EP) and support the work required by this section. The Contractor shall submit a qualifications package on the firm and/or individual fulfilling this roll. At a minimum, the EP shall meet the following requirements:

   a. The Environmental Professional possess sufficient specific education, training, and experience necessary to exercise professional judgment to develop opinions and conclusions regarding conditions indicative of releases or threatened releases on, at, in, or to a property, sufficient to meet the objectives and performance of the work required by this section.

   b. The Environmental Professional must:

      i. Hold a current Professional Engineer's or Professional Geologist's license and have the equivalent of three (3) years of full-time relevant experience; or

      ii. Be licensed or certified by the federal government or state to perform environmental assessments and have the equivalent of three (3) years of full-time relevant experience; or

      iii. Have a Baccalaureate or higher degree from an accredited institution of higher education in a discipline of engineering or science and the equivalent of five (5) years of full-time relevant experience; or

      iv. Demonstrate a minimum of ten (10) years of experience in performing similar work (i.e. developing field sampling strategies, soil sampling, interpretation of laboratory data/sample results, characterization of soils for disposal)

   c. Relevant experience, as used in the definition of Environmental Professional in this section, means: participation in the performance of all appropriate inquiries, investigations, environmental site assessments, or other site investigations that may include environmental analyses, investigations, and remediation which involve the understanding of surface and subsurface environmental conditions and the processes used to evaluate these conditions and for which professional

judgment was used to develop opinions regarding conditions indicative of releases or threatened releases to the subject property.

C. **Field Sampling Plan (FSP)**

1. The Contractor must conduct soil testing pursuant to a Field Sampling Plan (FSP) approved by Metro-North Railroad Department of Environmental Compliance and Services. The Contractor must submit a Field Sampling Plan (FSP) meeting all requirements of this Section to the Metro-North Department of Environmental Compliance and Services and the Engineer for approval.
2. The resulting data shall be used to prepare a Soils Characterization Report (SCR) See Section 1.06(F) for purposes of classifying the soil types present at the site; determining whether reuse/backfilling of the soil is allowable; determining appropriate Personal Protective Equipment for those who will come in contact with the soil; and identifying what Metro-North-approved transporters and disposal sites will be used in connection with the proper transport and disposal of soils that cannot be backfilled/re-used on site. The Contractor is also required to prepare a Soil Handling Plan (SHP) based upon the information obtained during the preparation and execution of the FSP and SCR. See Section 1.06(G).
3. The FSP must include, but is not limited to, the following:
    a. The testing program to be conducted for all soils in the areas to be excavated during construction (including all associated utility and support work). Identification of the proposed in-situ and/or stockpile samples per unit volume as required by Part 1.06D Soil Sampling and Testing of this Section. Where applicable, the FSP will divide areas into distinct in-situ or stockpiled segments, identifying the volume of soil or fill that each sample will represent. The FSP shall include methodology to complete sampling of in-situ or stockpiled soil to obtain a continuous vertical profile of the soil in order to allow for compositing of samples for proper classification.
    b. Description of sampling procedures and equipment to be used. Description of the method to be utilized to prevent mixing of soil if obvious changes in condition are encountered. Samples shall be placed in laboratory-clean sample containers provided by the analytical laboratory.
    c. The depths to which sampling will be conducted. The sampling depths shall be commensurate with the depth of soils to be encountered during excavation; as either required by the Contract, or by the anticipated depth of the substructure to be installed.
    d. The visual and olfactory inspection of all samples by the Environmental Professional (EP), when they are being collected in the field, to verify the presence or absence of petroleum and/or other such evidence of potential contamination.
    e. Identification of the sample container labeling and sample handling protocol. Immediately after sample collection, each sample container shall be properly sealed to ensure its integrity through receipt at the laboratory. Each sample container shall be labeled with a unique sample identification number just prior to, or immediately after, sample collection and sealing of the container. The sample

identification number shall directly correlate to the attributes of that sample, including but not limited to, contract number, project description, project location, Contractor's name, sample location, sample depth, date and time of sampling, sample inventory number as it correlates to sampling grid, and parameters to be analyzed. Sample attributes shall be recorded on a sampling data sheet and/or chain-of-custody form.

f. A scaled drawing or map of the site showing existing fixed landmarks and the proposed excavation limits. The drawing/map will contain specific sampling locations or proposed stockpiling sampling that will conform to the sampling frequency requirements set forth in Part 1.06D Soil Sampling and Testing.

g. A description of how the contractor will prevent the comingling/mixing of soil stockpiles after sampling. Stockpiles shall not be comingled/mixed unless allowed by the Environmental Professional and the SCR and approved by the Metro-North Railroad Department of Environmental Compliance and Services.

h. A discussion of the field notes that will be maintained by the Contractor during sampling and excavation to allow correlation of sample analysis results with the respective areas, stockpiles, or soil that the data represent, and to verify quantities of soil classification types to be disposed. The field notes made during the sampling shall at a minimum consist of:

   i. Boring or probe logs from each sampling location sampled in that manner that will contain a continuous stratigraphic description of all soil to be encountered during excavation to the depth required by the contract or as required by the anticipated depth of the substructures. Each boring log will include a continuous description of soil including, but not limited to, color, odor, relative grain size distribution, soil composition (including, but not limited to, ash, slag (i.e., material remaining after smelting operations that is typically comprised of metal oxides and silicon dioxide or metal sulfides and elemental metals), organic-free silt, sand, gravel and clay), moisture content, cohesive properties, and relative density (ASTM 1586-D or equivalent), discoloration, sheen, or indication of obvious contamination.

   ii. The location of each sampling point identified via survey or GIS coordinates plotted on a scaled drawing or map. The sampling point shall be located in such a manner that return to that particular location is possible for future sampling if necessary (i.e. survey coordinates, GIS geo located).

   iii. Depth intervals for each sample

   iv. Sample type (grab sample or composite sample)

   v. Any special notes which are included on the laboratory chain-of-custody forms

i. The chain-of-custody form that will accompany each set of one or more samples being submitted for laboratory testing. The chain-of-custody shall identify the samples and any special instructions to the laboratory. The chain-of-custody form shall be signed, with date and time, at all changes in sample custody.

j. Identification of the analytical laboratory proposed to complete the laboratory analysis consistent with the requirements outlined in Part 1.06E Analytical

Laboratories.

k. Listing of all analyses to be performed, by sample, and a description of QA/QC samples that will be submitted (i.e. field blanks, spiked samples).

l. The proposed transporter(s) and disposal facility(ies) to be utilized for soils that cannot be backfilled/reused shall be from Metro-North Railroad's approved list. Refer to most recent revision of *"Metro-North Railroad Environmental Compliance & Services Approved Waste Management Consultants, Disposal Facilities, Transporters, and Laboratories"* and *Sections 1.06(H) and 1.06(I).*

m. As an alternative, the FSP can identify one of Metro-North's on-call waste management firms as the entity to arrange for transport and disposal of the soil classification types involved in the project. If the approved disposal facility is/are not available when the disposal operations begin, the Contractor will be fully responsible for procuring a new Metro-North-approved disposal facility at no additional cost, and with no claims for delay. Any additional sampling, analysis, delay in approval, and labor involved in submitting new disposal facilities after the initial disposal facilities are accepted will be at the Contractor's expense.

4. Sampling shall not be conducted until the Metro-North Department of Environmental Compliance and Services and the Engineer has reviewed and formally approved the FSP in writing. The Metro-North Department of Environmental Compliance and Services will approve the FSP only if it clearly provides for the information to allow for the classification of all soil proposed for excavation in accordance with the definitions of soil classification stated in Section 1.07. Any changes in protocol must be submitted by the Contractor for the review and approval of the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer prior to sampling.

5. The Contractor will be advised by the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer if there is a need for additional samples to be collected after reviewing the initial sampling data. Additional sampling ordered by the Metro-North Department of Environmental Compliance and Services and the Engineer to replace data that was deemed by the Metro-North Department of Environmental Compliance and Services and/or the Engineer to be unusable or unacceptable will be performed at the Contractor's expense, and the time delays and the work associated with submissions, approvals, sample collection, analysis, and data review of the additional samples, shall be the responsibility of the Contractor.

6. Additional samples outside those listed in the FSP, collected and sampled by the Contractor, for the Contractor's convenience and not ordered or approved by the Metro-North Department of Environmental Compliance and Services and/or the Engineer, shall be at no additional cost to Metro-North.

D. **Soil Sampling and Testing**

1. The Contractor will be responsible for determining the actual required frequency of sample collection and analysis and the testing/analytical parameters that are necessary to satisfy the proposed disposal facilities.

2. The number and type (grab, composite) of soil samples to be collected for Total Concentrations testing will be based on the volume (e.g., cubic yards) of soil to be

excavated and potentially re-used/disposed in relation to the requirements set forth in NYSDEC DER-10 Table 5.4(e)10 and NYSDEC CP-51 Table 4, table provided below for convenience. At a minimum, sampling frequency shall follow the table below. However, the actual frequency of samples to be collected and tested will be determined by the approved disposal facility or facilities.

Recommended Number of Soil Samples for Soil Imported to or Exported from a Site

Contaminant	VOC's [(a)]	SVOC's, Inorganics, PCB's, Pesticides	
Soil Quantity (cubic yards)	Discrete Samples	Composite	Discrete Samples/Composite
0-50	1	1	Each composite sample for analysis is created from 3-5 discrete samples from representative locations in the soil/fill
50-100	2	1	
100-200	3	1	
200-300	4	1	
300-400	4	2	
400-500	5	2	
500-800	6	2	
800-1,000	7	2	
>1,000	Add an additional (2) VOC and (1) composite for each additional 1,000 cubic yards, or consult with NYSDEC.[(b)]		

(a) VOC samples cannot be composited. Discrete samples must be taken to maximize the representativeness of the results

(b) For example, a 3,000 cubic yard soil pile to be sampled and analyzed for VOCs would require 11 discrete representative samples. The same soil pile to be sampled for SVOCs, Inorganics, PCBs and Pesticides would require 4 composite samples with each composite sample consisting of 3-5 discrete samples.

3. The Contractor shall have the soil samples analyzed by a qualified, appropriately accredited, and approved laboratory. Samples shall be analyzed for at least the parameters listed below. The Contractor is responsible for including any other specific analyses required by the disposal facility and State(s) of disposal.
   a. Target Compound List (TCL) volatile organic compounds (Method 8260)
   b. TCL semi-volatile organic compounds (Method 8270)
   c. TCL pesticides (Method 8081)
   d. Chlorinated herbicides (Method 8151)
   e. Target Analyte List (TAL) metals (Method 6010/7470)
   f. Cyanide (Method 9010)
   g. Total Petroleum Hydrocarbons (TPH) (Method 8015)
   h. Ignitability (Method 1010 or 40 CFR 173)
   i. Corrosivity (Method 9045)
   j. Reactivity (Chapter 7.3.2). The reactivity results shall be reported as Total

Releasable Cyanide and Total Releasable Sulfide in mg/kg of soil.

k. Polychlorinated Biphenyls (Method 8082)

l. Full Toxicity Characteristic Leaching Procedure (TCLP) list volatile organic compounds, semi-volatile organic compounds, pesticides, herbicides and metals (Methods 1311, 8260, 8270, 8081, 8151, and 6010/7470).

m. Moisture

E. **Analytical Laboratories**

1. Identify the name and location of the analytical laboratory that will perform analyses/testing of samples for the purpose of soil classification meeting the requirements below. The laboratory shall be identified prior to or during preparation of the FSP.

2. York Analytical Laboratories of Stratford, Connecticut is an example of a facility that meets the project requirements.

3. Analytical laboratories shall retain current accreditation under the New York State Department of Health Environmental Laboratory Approval Program (ELAP) for each of the analytical methods and parameters for the soil analyses required. Additionally, the laboratory must retain the accreditations required by and acceptable to any state where material is proposed to be disposed. Submit copies of current accreditations under the New York State Department of Health Environmental Laboratory Approval Program (ELAP) and any others required by the disposal facilities for each of the analytical methods and parameters for the soil analyses required.

4. The laboratory must perform the analyses in accordance with methods presented in NYSDEC ASP, and if required by the Metro-North Railroad Department of Environmental Compliance and Services and/or the disposal site, report results as ASP Category B deliverables. In addition, other analyses not included in NYSDEC ASP, but required by the disposal facility and/or the host State, must conform to the requirements of that facility and/or the host State. The laboratory's current ELAP certifications shall be for the specific analytical methods required.

5. Sample holding times must comply with NYSDEC ASP holding time requirements. Various state agencies may have specific requirements relative to approved methods, sample holding times, and preservation techniques; the most stringent of these shall be used. All excess samples and extract shall be archived by the laboratory for six (6) months after collection. Disposal of excess soils and extracts shall be the responsibility of the laboratory.

6. The laboratory shall simultaneously submit electronic copies of each data package to the Contractor, the Metro-North Railroad Department of Environmental Compliance and Services, and the Engineer. At a minimum, each analytical data package

prepared by the laboratory shall include the following:

a. Laboratory name and address
b. Date of report
c. Analytical results
d. Non-conformance summary
e. Laboratory batch spikes and duplicates, or other QA/QC checks
f. Chain-of-custody forms
g. Laboratory certification statement
h. Laboratory credentials

F. **Soils Characterization Report (SCR)**

1. The Soils Characterization Report (SCR) shall summarize the field sampling conducted pursuant to the Field Sampling Plan (FSP), the laboratory analytical data, and characterize the soils for reuse and/or disposal. The Soils Characterization Report (SCR) shall include:

   a. All field notes, data from field instrumentation, visual observations and other project related information gathered during the sampling
   b. Legible copies of all boring logs
   c. All laboratory analytical data and corresponding chain-of-custody forms
   d. The location of each sampling point identified via survey or GIS coordinates plotted on a scaled drawing or map
   e. Summary tables comparing the analytical laboratory test results to NYSDEC Part 375 soil cleanup objectives (SCOs), NYSDEC CP-51 soil cleanup levels (SCLs), and NYSDEC Part 371 hazardous waste criteria, as applicable.
   f. Guidance on safety procedures (i.e. recommended safe work practices for persons coming into contact with the soils, personal protective equipment)
   g. Classification of soils at each location sampled, based on the definitions identified in Section 1.07 and as provided by the chosen disposal facilities
   h. Recommendations for re-use and/or disposal of soil generated during construction activities
   i. Summary comparison, in both tabular and graphical (site plan) format, of analytical results and classification criteria
   j. The locations, in detail, of classified soil types, their depths, limits, and their in-situ or stockpiled quantities.
   k. Classification from the Environmental Professional (EP) for specific grids, piles, or areas.
   l. The proposed transporter and disposal facility to be utilized for soils that cannot be backfilled/reused. The proposed transporters and disposal facilities shall be from Metro-North Railroad's approved list. See Sections 1.06(H) and 1.06(I) and

Appendix A: *"Metro-North Railroad Environmental Compliance & Services Approved Waste Management Consultants, Disposal Facilities, Transporters, and Laboratories".*

G. **Soil Handling Plan (SHP)**

1. The Soil Handling Plan (SHP) shall describe the procedures to be used to excavate, load, store/stockpile, maintain soils of differing characterizations separately, transport (on site and off site), quantify, and dispose of soils. The SHP shall describe the handling procedures for soils, including:
   a. the locations, depths, and in-situ or stockpiled quantities of each of the soil classification types to be encountered/disturbed,
   b. the areas and depths of excavation, and the soil classifications to be encountered,
   c. a description of the excavation operation itself, the sequence of excavation, the type of equipment to be utilized, the manpower to support the operation,
   d. transportation methods, both on-site and off-site,
   e. the management of each soil classification type, how soils of differing characterizations will be maintained separately, means of preventing comingling/mixing of soils of differing characterizations
   f. the procedure for stockpiling, appropriate stockpiling locations, and all associated details including siltation and erosion control
   g. which soils will be backfilled/re-used on-site and where they are proposed for backfill/re-use
   h. the disposal of soils that cannot be backfilled/re-used on-site, including estimated quantities, how they will be measured for payment (i.e. disposal facility scale tickets), and the proper documentation of soils for disposal at an approved facility.
2. No soils shall be removed from the site unless prior approval is obtained from the Metro-North Railroad Department of Environmental Compliance.
3. Should soil need to be removed from the site (e.g. soil contaminated beyond reuse limits, or excess soil that cannot be reused on site), the Contractor shall make appropriate provisions to account the for the amount of material to be removed (i.e. how many tons/cubic yards), the frequency of removal (i.e. how many transport vehicles per shift), the availability/ability of transporters to haul, the disposal facility's ability to accept, and the anticipated quantities at the anticipated frequencies. The inability of transporters to haul or the disposal facility's ability to accept soil from the site shall not be grounds for delay.
4. The SHP shall describe the procedure to be implemented when, during excavation, it becomes evident that the soil being excavated is contaminated (e.g., olfactory or visual indication) and differs from surrounding soils, and how this material will be stockpiled and maintained separate from other soils not exhibiting similar characteristics.
5. If soil is to be excavated, stockpiled and then sampled for classification, then the SHP shall be submitted by the Contractor concurrently with its FSP. The approach of

submitting the SHP at the same time as the FSP must be approved by the Metro-North Railroad Department of Environmental Compliance and Services prior to implementing the work. Once field sampling has begun, stockpiles shall not be added to or borrowed from, or commingled with other stockpiles, until the soils are classified and a determination is made regarding their suitability for reuse. Upon completion of field sampling and receipt of laboratory analytical data, the Contractor's Environmental Professional shall prepare the SCR for use in determining soil/fill re-use and disposal options and provide it to the Metro-North Railroad Department of Environmental Compliance and Services.

6. The Contractor shall additionally address the following considerations:

7. Personnel Safety. In accordance with Section 01 33 60, the Contractor will be responsible for the development and implementation of a Safety, Health and Environmental Control Plan (SHECP) that includes provisions for the protection of on-site workers and the public. It is anticipated that Level D personal protective equipment will be required, but the Contractor will be responsible for determining the level of personal protection required and complying with the OSHA standards and the approved SHECP. If hazardous soils, or soils exhibiting characteristics and/or constituent concentrations that the contractor believes warrant off-site disposal, are encountered during construction-related work, the Contractor is to consult with the Metro-North Department of Environmental Compliance and Services with respect to approval of additional precautions to be developed and added to the SHECP.

   a. Environmental effects

   b. Prevention of transporter leaks on-site

   c. Vehicle decontamination verification prior to leaving the site

   d. Initial removal and stockpiling sequence

   e. Dust control, and monitoring if deemed necessary. In accordance with Section 01 35 43, the Contractor will be responsible for the development and implementation of a community air monitoring plan (CAMP) for the protection of the public health, and a SHECP for the protection of site workers, during ground intrusive activities. At a minimum this CAMP must comply with the provisions outlined in NYSDEC DER-10, Appendix 1A, 'Generic Community Air Monitoring Plan' and Appendix 1B 'Fugitive Dust and Particulate'.

H. **Transporter Information**

1. The Contractor shall utilize a transporter for soils that cannot be backfilled/reused from Metro-North Railroad's approved list. Refer to most recent revision of *"Metro-North Railroad Environmental Compliance & Services Approved Waste Management Consultants, Disposal Facilities, Transporters, and Laboratories".*

2. The Contractor must provide to Metro-North Railroad Department of Environmental Compliance and Services and the Engineer copies of all waste transporter licenses and permits including, but not limited to, NYSDEC 6 NYCRR Part 364 Waste Transporter Permits, hazardous waste transporter permits issued under 6 NYCRR Part 372.3, and any other state and local vehicle and waste hauling permits in the submittal. The Contractor may submit multiple Metro-North approved transporters for each soil classification type to anticipate changes in transporters, and/or final

quantities for disposal.

3. The Transporter must comply with all pertinent Federal, State and Local regulations regarding the transport of soils.

I. **Disposal Facility Information**

1. The Contractor shall utilize a disposal facility from Metro-North Railroad's list of approved disposal facilities for soils that cannot be backfilled/reused. Refer to most recent revision of *"Metro-North Railroad Environmental Compliance & Services Approved Waste Management Consultants, Disposal Facilities, Transporters, and Laboratories".*

2. The Contractor must provide to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer the following information for each disposal facility:

   a. Copies of the current appropriate operating permits indicating a physical description of both the type of soils allowed and not allowed for final disposal.

   b. The maximum allowable concentrations of contaminants that can be accepted as indicated in NYSDEC 6 NYCRR Sub part 375. The facility will review data reports pertinent to the soil proposed for disposal and confirm that the soil complies with its existing permits.

   c. Analytical protocol requirements for sampling prior to accepting soil for disposal, including specific parameters, protocols, and minimum detection limits.

   d. The site-specific minimum sampling frequency, in samples per cubic yard of in-situ or stockpiled soil, and the facility's standard practices for determining classification of soil.

   e. Daily, annual, and project specific volume of each classification of soil that it is permitted to accept and a written indication as to the total and daily volume of soil that will be accepted from this project.

   f. Any state environmental agency sampling, analytical, or review requirements for soil being transported to a proposed disposal location outside of New York State.

   g. A list of any violations, citations, and administrative complaints from federal, state, and local agencies

J. **Waste Manifest Records, Shipment Records and Certificates of Disposal**

1. Provide waste manifests, bills of lading, shipment records and certificates of disposal for each truckload of soil removed from the site. Manifests and other documentation shall be properly prepared, filed, and distributed by the Contractor in accordance with regulatory requirements. Upon completion of disposal, the completed manifest, bill of lading, scale ticket from the disposal facility, and certificate of disposal shall be mailed or hand delivered directly to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer.

2. At least two (2) weeks prior to proposed off-site disposal, submit the following to the Metro-North Railroad Department of Environmental Compliance and Services and the

Engineer for approval.

a. Statutory Manifest Documents: A copy of the statutory manifest form and other documents that will be used in connection with the disposal of hazardous soils. Manifests and other documentation shall be properly prepared, filed, and distributed by the Contractor in accordance with regulatory requirements. The Contractor shall type in the name of the generator, transporter and disposal facility on each form. All other pertinent information shall be included on the manifest.

b. Bill of Lading/Record of Waste Transport and Disposal: A copy of the bill of lading / record of waste transport and disposal to be used to track the transportation and disposal of non-hazardous soils. See Appendix B Record of Waste Transport and Disposal. The Contractor may utilize the form provided in Appendix B, or submit their own form to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer for approval. The bill of lading shall record the following for each truckload: the date, the transporter, the printed name and signature of the transporter's driver, the weight and volume of material on each truckload, the destination / receiving disposal facility, and an acknowledgement by the disposal facility that they have accepted the soil.

3. Scale tickets generated by the disposal facility scale operator identifying the transporter, the transport vehicle/container unique identification number, and its laden and un-laden weights shall be submitted by the Contractor to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer.

4. Certificates of Disposal: A Certificate or Documentation of Disposal along with each completed manifest shall be prepared by the disposal facility and mailed to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer once the soil has been properly treated and/or disposal is completed.

1.07 SOIL CLASSIFICATION

For the purposes of this Contract, the following soil classification shall apply. See Table 1.0 *Soil Classification Summary*

A. **Hazardous Soil**

1. Is soil as defined in 40 CFR Part 261 and New York State ECL Section 27-09 or 6 NYCRR Part 371, Identification and Listings of Hazardous Waste including soil containing concentrations that are Hazardous. This would also include soils contaminated with PCBs at or above 50 parts per million (ppm).

2. Hazardous soils must be disposed of at a disposal site that is permitted to accept hazardous waste. This soil is NOT suitable for backfill/re-use on site.

B. **Non-Hazardous Petroleum-Contaminated Soil**

1. Is soil that exhibits a distinct petroleum odor or contains visible petroleum product, or can be associated with a reportable spill, or contains petroleum constituents above NYSDEC Part 375 Soil Cleanup Objectives (SCOs) for protection of groundwater, as well as NYSDEC CP-51 Soil Cleanup Levels (SCLs).

2. Soils associated with a spill are to be handled separately in accordance with NYSDEC Technical Guidance Documents and Policies and direction provided by the Metro-

North Railroad Department of Environmental Compliance and Services.

3. This soil is only suitable for recycling at a licensed, properly permitted, petroleum recycling facility and/or for disposal at an approved and properly permitted disposal facility that can accept non-hazardous petroleum-contaminated soil. This soil is NOT suitable for backfill/re-use on site.

C. **Non-Hazardous PCB-Contaminated Soil**

1. Is soil that contains less than the hazardous waste limit of 50 parts per million (ppm) of polychlorinated biphenyls (PCBs, on a dry weight basis) as referenced in 6 NYCRR Part 371.4(e).
2. Soil that contains greater than 1.0 ppm and less than 50.0 ppm PCBs must be disposed at an approved and properly permitted disposal facility that can accept non-hazardous PCB-contaminated soil.
3. Soil that contains less than or equal to 1.0 ppm PCBs is suitable for backfill/re-use on the Site as it meets the NYSDEC Part 375 soil cleanup objective of 1.0 ppm for PCBs, with any excess disposed at an approved and properly permitted disposal facility that can accept non-hazardous PCB-contaminated soil. Soil with a PCB level greater than 1.0 ppm is NOT suitable for backfill/re-use on site.

D. **Non-Hazardous Soil/Fill**

1. Is soil/fill that is non-hazardous, non-petroleum-contaminated, non-PCB-contaminated (i.e., containing PCB concentrations at or below 1 ppm) soil/fill generated by manufacturing or industrial processes as defined in NYSDEC NYCRR Part 360, Solid Waste Regulations Solid Waste Management Facilities, 360-1.2 (b) (88).
2. Is soil/fill that contains >1% fouled and historic railroad ballast (i.e., containing the constituents and concentrations typically encountered on MNR railroad lines), ash, foundry sand or slag (i.e., material remaining after smelting operations that is typically comprised of metal oxides and silicon dioxide or metal sulfides and elemental metals), end or by-products of incineration or other forms of combustion, coal, coal dust, cinders, etc.
3. This soil/fill is suitable for backfill/re-use on-site, if approved by the Metro-North Railroad Department of Environmental Compliance and Services, and appropriate precautions are followed to preclude off-site migration or impact to the public during construction and post-construction activities. Any excess soil/fill must be disposed at an approved and properly permitted disposal facility that can accept non-hazardous soil/fill.

E. **Non-Hazardous C&D Soil/Fill**

1. Is soil/fill that is non-hazardous, non-petroleum-contaminated non-PCB-contaminated (i.e., containing PCB concentrations at or below 1 ppm), soil/fill, as defined in NYSDEC Division of Solid and Hazardous Materials, 6 NYCRR Part 360, Solid Waste Management Facilities, 360-1.2 (b)(38).
2. Is soil/fill that contains <1% fouled and historic railroad ballast, ash, foundry sand or slag, end or by-products of incineration or other forms of combustion, coal, coal dust,

cinders

3. This soil/fill is suitable for backfill/re-use on site, if approved by the Metro-North Railroad Department of Environmental Compliance and Services. Any excess soil/fill must be disposed at an approved and properly permitted disposal facility that can accept non-hazardous C&D soil/fill.

NOTE: THE FOLLOWING TABLE/SOIL CLASSIFICATIONS SHALL BE USED TO DEVELOP THE UNIT PRICE SHEET FOR SOIL DISPOSAL

Table 1.0 - Soil Classification Summary

SOIL CLASSIFICATION	DESCRIPTION	SUITABILITY FOR REUSE
Hazardous	• Soils containing concentrations that are Hazardous as defined in 40 CFR Part 261 and New York State ECL Section 27-09 or 6 NYCRR Part 371, Identification and Listings of Hazardous Waste. • Soils containing PCBs at or above 50 parts per million (ppm).	**No** - must be disposed of at a disposal site that is permitted to accept hazardous waste
Non-Hazardous Petroleum Contaminated	• Soils exhibiting a distinct petroleum odor or containing visible petroleum product. • Soils associated with a reportable spill. • Soils containing petroleum constituents exceeding NYSDEC Part 375 soil cleanup objectives (SCOs) for commercial use or protection of groundwater • Soils containing petroleum constituents exceeding NYSDEC CP-51 Soil Cleanup Levels (SCLs).	**No** - suitable for recycling at a licensed properly permitted petroleum recycling facility and/or for disposal at an approved and properly permitted disposal facility that can accept non-hazardous petroleum-contaminated soil
Non-Hazardous PCB Contaminated	• Soils containing greater than 1.0 ppm and less than 50.0 ppm (>1.0 ppm and <50 ppm) PCBs (on a dry weight basis) as referenced in 6 NYCRR Part 371.4(e).	**> 1.0 ppm PCB's – No** - must be disposed of at an approved and properly permitted disposal facility that can accept hazardous PCB-contaminated soil. **< or = 1.0 ppm PCB's – Yes** – but any excess must be disposed of at an approved and properly permitted disposal facility that can accept non-hazardous PCB-contaminated soil.
Non-Hazardous Soil/Fill	• Soil/fill that is non-hazardous, non-petroleum-contaminated, non-PCB-contaminated and is generated by manufacturing or industrial processes as defined in NYSDEC NYCRR Part 360, Solid Waste Regulations Solid Waste Management Facilities, 360-1.2 (b) (88). • Contains >1% fouled and historic railroad ballast, ash, foundry sand or slag, end or by-products of incineration or other forms of combustion, coal, coal dust, cinders, etc.).	**Yes** – upon approval of the Metro-North Dept. of Environmental Compliance and Services. Any excess soil must be disposed of at an approved and properly permitted disposal facility that can accept non-hazardous soil/fill.
Non-Hazardous C&D Soil/Fill	• Soil/fill that is non-hazardous, non-petroleum-contaminated, and non-PCB-contaminated, , as defined in NYSDEC Division of Solid and Hazardous Materials, 6 NYCRR Part 360, Solid Waste Management Facilities, 360-1.2 (b)(38) • Contains ≤1% fouled and historic railroad ballast, ash, foundry sand or slag, end or by-products of incineration or other forms of combustion, coal, coal dust, cinders, etc.).	**Yes** – upon approval of the Metro-North Dept. of Environmental Compliance and Services. Any excess must be disposed of at an approved and properly permitted disposal facility that can accept non-hazardous C&D soil/fill.

1.08 PERMITS

The Contractor must obtain and pay for all required permits, fees and inspections by authorities having jurisdiction for soil removal and disposal.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall furnish all labor, equipment, materials, permits, and subcontracted services (e.g. Environmental Professional, field sampling, analytical laboratory, transporter, disposal facility), as necessary, to provide for the lawful reuse of excess soils on site, or removal and disposal of excess soils from the site in accordance with local, state and federal laws and regulations. The Contractor is responsible for all costs associated with the lawful transportation and disposal of soils by one or more of Metro-North Railroad's pre-approved waste transporters and disposal facilities.

B. Prior to conducting subsurface disturbance, borings, or excavation, the Contractor shall follow "*Protection of Underground Metro-North Railroad Facilities*" and 16 NYCRR Part 753.

C. Prepare the submittals required by this Section for approval by the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer. See Sections 1.05 and 1.06 for submittal requirements.

3.02 PREPARATION / INSPECTION

A. Pre-Work Inspection: Prior to the start of work, to verify existing conditions, the Contractor shall inspect and examine the areas where contract work is to be performed and soil disturbance will occur. This pre-assessment shall be used to assist in preparation of the required submittals.

B. Inspections During Work: The Contractor shall provide regular inspections of soil excavation and stockpile areas throughout the duration of the work. The Contractor shall correct conditions without impact to the completion of the Work. The Contractor will not be allowed to proceed until the unsatisfactory conditions have been corrected.

3.03 ENVIRONMENTAL PRECAUTIONS

A. To minimize risk to personnel, the Contractor shall limit access to the excavation areas to as few people as possible. During all excavation, the SHECP, SWP, and SHP shall be followed.

B. During excavation, the Contractor shall maintain grading and drainage of the site so that no stormwater runs from outside the excavation into the excavation. Rainwater falling directly into the excavation shall be allowed to percolate into the soil. Should dewatering be required, it shall be conducted in accordance with specification Section 31_23_19 Dewatering.

C. Transport vehicles must be cleaned prior to departure from the site to reduce the risk of losing soil and/or debris on public roads. Cleaning is to include, but not be limited to: wheels, tires, and under carriages. The Contractor shall construct "knock off" pads at the

exits from the construction / excavation areas as necessary to assist with vehicle cleaning.

D. All soils to be excavated must be sampled in-situ and/or moved directly to the stockpiling area for sampling in accordance with the FSP. All excavated soils are to be tested and classified prior to removal and/or loading into transport vehicles.

E. The Contractor shall identify, in detail, in the Soil handling Plan (SHP), the procedures to avoid commingling of soils from different excavations, or soil that is removed after a classification sample is collected.

3.04 STOCKPILES OF EXCAVATED SOIL

A. On-site stockpiled soil shall not impact the work of any other Contractor. Following the Contractor's sampling, stockpile shall not be added to, moved or otherwise impacted by other soil that could affect the resulting classification of the soil.

B. Refer to specification Section for Environmental Protection. Stockpiles shall be constructed to isolate contaminated soil from the environment. Stockpiles shall be constructed to include:

1. A chemically resistant geo-membrane liner shall be placed on ground surfaces below stockpiles of soils determined unsuitable for reuse. Liners shall be scrim reinforced, having a minimum weight of 40 pounds per 1,000 SF, and a permeability coefficient less than 10-8cm/sec. The ground surface on which the membrane is to be placed shall be free of rocks greater than ½ inch in diameter and any other items that could damage the membrane.

2. A geo-membrane cover to control dust and to prevent precipitation from entering the stockpile. Scrim reinforced membranes shall have a minimum weight of 26 pounds per 1,000 SF. The cover shall be anchored to prevent it from being removed by wind. Stockpiles shall be covered during non-working hours and during periods of no construction activity.

C. The temporary storage of excavated soil in stockpiles shall comply with the dust monitoring and control requirements defined in the NYSDEC DER-10 Appendix 1B, "Fugitive Dust and Particulate Monitoring".

D. A berm shall surround each stockpile, a minimum of 12 inches in height. Vehicle access points shall also be bermed.

E. Provide and maintain siltation control measures (i.e. silt fencing, hay bales, mulch filled socks) around stockpiled soil.

F. No liquids shall be allowed to collect on stockpiles of excavated soil.

3.05 REUSE OF SOIL

A. The Contractor shall take all reasonable efforts to backfill/re-use as much soil on-site as possible. All opportunities must be explored to backfill/re-use excavated soils in compliance with NYSDEC requirements. The Contractor is to consult with the Metro-North Department of Environmental Compliance and Services with respect to backfill/re-

use options. Refer to Table 1.0 – Soil Classification Summary.

B. Soils can be backfilled/re-used at the project site if:

1. they meet the geotechnical requirements of the Project, and,
2. they are classified as Non-Hazardous C&D Soil/Fill, Non-Hazardous Soil/Fill, and Non-Hazardous PCB Contaminated (containing less than or equal to 1.0 ppm PCB's), and
3. the backfill/reuse location is approved by the Metro-North Department of Environmental Compliance and Services.

C. Soil that is not backfilled/re-used on the project site shall be disposed of in accordance with this specification by the Contractor.

3.06 EXCESS SOIL

A. Excess soils that cannot be reused on-site shall be disposed of by the Contractor in accordance with this Section. To assure soil is properly disposed of, no soil shall be removed from Metro-North property without prior written approval from the Metro-North Department of Environmental Compliance and Services.

B. The Contractor must NOT make any arrangements for disposal of soil without following the procedures identified in this specification. No soil is to be assumed 'clean' until it has been determined to be so by the Metro-North Railroad Department of Environmental Compliance and Services.

C. Soil is NOT to be offered for backfill/re-use off-site unless specific written permission is obtained from the Metro-North Railroad Department of Environmental Compliance and Services and if applicable, from the NYSDEC in the form of a Beneficial Use Determination (BUD).

3.07 BORROW SOIL / BORROW PIT TESTING FOR SOURCE APPROVAL

A. No fill soil can be accepted from an off-site source unless approved by the Metro-North Department of Environmental Compliance and Services. In such cases, the Contractor will be required to complete and execute a Clean Borrow Certification and the Metro-North Department of Environmental Compliance and Services reserves the right to require sampling and laboratory analysis to confirm that such fill is clean. Any such costs are to be borne by the Contractor at no expense to Metro-North.

B. For fill and backfill to be accepted from an off-site source, the soil is to be tested using approved methods which yield laboratory limits and meet the following criteria:

1. Contains no compounds or inorganic analytes at concentrations above the lower of 6 NYCRR 375-6.8(b) Unrestricted Use SCOs or Protection of Groundwater SCOs [unless a less restrictive option (e.g., Commercial Use) is approved by the Metro-North Railroad Department of Environmental Compliance and Services];
2. Contains no compounds or inorganic analytes above the lower of the NYSDEC CP-51: Soil Cleanup Guidance for Unrestricted Use and Protection of Groundwater Supplemental Soil Cleanup Objectives (SSCOs);
3. Meets NYSDEC pre-determined beneficial use determination (BUD) requirements

referenced in 6 NYCRR 360-1.15(b);

4. Meets the project geotechnical requirements; and
5. Its use must be approved by the Metro-North Railroad Department of Environmental Compliance and Services prior to being brought on-site.

3.08 TRANSPORTERS AND TREATMENT, STORAGE AND DISPOSAL FACILITIES

A. Soils that require off-site disposal, or cannot be re-used on-site, shall be transported and disposed of in accordance with this Section.

B. The Contractor shall provide transport vehicles that comply with requirements for hauling soil and regulated materials as outlined in NYSDEC regulations (e.g., 6 NYCRR Part 360 and 364). The Contractor is responsible for vehicles having all required permits and approvals.

C. The Contractor shall utilize one or more of the Metro-North Railroad audited and approved waste transporters and disposal facilities, or contract with one of Metro-North Railroad's on-call waste management firms, as necessary, to transport and dispose of soils in compliance with all applicable regulatory requirements. Refer to most recent revision of *"Metro-North Railroad Environmental Compliance & Services Approved Waste Management Consultants, Disposal Facilities, Transporters, and Laboratories"* for waste transporters and disposal facilities that have been audited and approved by Metro-North Railroad.

D. The Contractor may choose to utilize more than one of the Metro-North Railroad approved transporter and disposal facilities. In this case, each facility must be in compliance with the above requirements, and each facility must have the ability to stabilize the soil (when deemed necessary) and dispose of the soil.

E. Should the Contractor choose to submit for use an alternate transporter or disposal facility that is not on the referenced approved list, the Contractor may elect to have an audit of the transporter or disposal facility conducted by Metro-North Railroad's on-call environmental consultant (currently Day Engineering, P.C.), at the Contractor's expense. Submittal of alternates must be initiated in the early stages of the project as to allow sufficient time for the audit to be conducted and completed before the Contractor begins using the alternate transporter or disposal facility. The Contractor shall not utilize the proposed alternate transporter or disposal facility until: 1) the audit is complete, 2) it has been submitted to the Metro-North Railroad Department of Environmental Compliance and Services for review, and 3) they have been approved for use by the Metro-North Railroad Department of Environmental Compliance and Services. The proposed transporters or disposal facilities are required to meet the same audit requirements as the entities already approved by Metro-North Railroad. The request and submittal of an alternate transporter or disposal facility for auditing does not guarantee that the entity will be approved for use by Metro-North Railroad. The Contractor is solely responsible for coordinating the audit with Metro-North Railroad's on-call environmental consultant (currently Day Engineering, P.C.), all costs incurred, and any resulting delays associated with the submittal and auditing process.

F. The Contractor is responsible for contacting transporters and disposal facilities to arrange for transport and disposal of the volumes and classifications of soils specific to the Project.

G. Transporters shall have current Part 364 - Waste Transporter Permits (or permits

applicable for soil characterized). Note that each transporter has specific types of waste that they can transport under their transporter permits and may be limited in their permit as to what disposal sites they may transport to. It is the Contractor's responsibility to make sure that the transporter can transport to the selected disposal site(s).

H. If the approved disposal facility is/are not available when the disposal operations begin, the Contractor will be fully responsible for procuring a new approved disposal facility at no additional cost, and with no claims for delay. Any additional sampling, analysis, delay in approval, and labor involved in submitting new disposal facilities after the initial disposal facilities are accepted will be at the Contractor's expense.

I. The disposal facility must be able to treat and/or dispose of all of the soil removed from the site within the allotted Contract time. The ability of the facility to accept the soil should not limit the rate at which the Contractor can excavate and transport the soil. The Contractor is advised that as transporters and disposal facilities vary in the volume and classification of soils they can transport and dispose, that it cannot be assumed that all facilities can transport and dispose of all amounts and classifications of soils that may be encountered. It is the Contractor's responsibility to confirm that the disposal site(s) can take the classification(s) of soil that will be generated at the necessary volumes.

J. The Contractor may choose to streamline the transportation and disposal process by utilizing the services of one of Metro-North Railroad's on-call waste management firms.

Should it choose to do so, the Contractor will be responsible for contracting directly with the waste management firm and paying that firm directly. Services include performance of the following tasks:

1. Waste identification/classification (including any required lab services).
2. Completion of all necessary waste approval shipping documentation (waste profiles, manifests, bills of lading, land disposal restriction forms, and labels).
3. Arranging for compliant transportation and disposal.
4. Scheduling with the transporters and disposal facilities.
5. When necessary, review of a site to assist in stockpiling and loading logistics.

3.09 Waste Manifest Records, Shipment Records and Certificates of Disposal

A. Provide applicable waste manifest records, bills of lading, shipment records, scale tickets, and certificates of disposal for each truckload of soil removed from the site. Submit this documentation for each soil classification removed from the site for off-site disposal.

B. At least two (2) weeks prior to proposed off-site disposal, submit the following to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer for approval

1. A copy of the manifest form and other documents that will be used in connection with the disposal of hazardous soils.
2. A copy of the bill of lading form that will be used to track the movement of all identified soil classification types associated with the project.

C. Statutory Manifest Documents: The Contractor must comply with statutory manifest document requirements that are to be used in connection with the disposal of hazardous

soils.

D. The Contractor is responsible for assuring that all transportation vehicles have the required manifests and/or bill of ladings necessary for transporting each truckload of soil for each soil classification type. Each manifest or bill of lading will be signed by the transporter and carried to the approved disposal facility. Prior to the transport vehicle leaving the site, each manifest or bill of lading shall be signed by the Engineer, and a preliminary copy of each partially completed form shall be provided to the Engineer. The Engineer shall provide originals to the Metro-North Railroad Department of Environmental Compliance and Services and retain copies for their records.

E. All trucks shall be weighed upon their arrival to the disposal facility and weigh scale tickets shall be provided. Scale tickets generated by the disposal facility scale shall identify the transporter, the transport vehicle/container unique identification number, and its laden and un-laden weight. Scale tickets must be received back from all disposal sites and provided to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer.

F. Disposal Facility Records: The Contractor must comply with disposal facility record requirements. The disposal facility shall complete the waste manifest or bill of lading when the disposal facility accepts the waste. The disposal facility is to mail completed waste manifests to the appropriate regulatory agencies. A copy of the completed manifest or bill of lading, along with a copy of the scale ticket from the disposal facility, must be mailed or hand delivered directly to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer. A Certificate or Documentation of Disposal along with each completed manifest shall be prepared by the disposal facility and mailed to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer once the soil has been properly treated and/or disposal is completed.

3.010 METHOD OF MEASUREMENT

A. Refer to Measurement and Payment specification.

3.011 BASIS OF PAYMENT

A. Refer to Measurement and Payment specification.

END OF SECTION

PROVIDE THE FOLLOWING ON STANDARD COMPANY LETTERHEAD

(INSERT DATE)

(INSERT COMPANY NAME HERE)

Re: *(INSERT CONTRACT NUMBER & DESCRIPTION)*

CLEAN FILL CERTIFICATION

The undersigned, *(INSERT NAME OF COMPANY OFFICER)*, hereby certifies that the material being brought by *(INSERT COMPANY NAME)*, onto Metro North Railroad property at *(DESCRIBE LOCATION WHERE FILL IS BEING PLACED)* is appropriate for general construction use under the applicable provisions of the Environmental Protection Agency and the New York State Department of Environmental Conservation.

The source of the material is: *(DESCRIBE SOURCE OF SUPPLY)*

The undersigned further certifies that there are no contaminants in the material that pose a threat to persons or to the environment, and that the undersigned has supplied all available test results for the material to Metro-North.

The undersigned agrees that should the appearance and/or odor of the material at any time present a concern to Metro-North, that the material will be removed promptly from Metro-North property or, in the alternative, if agreed to by Metro-North, sampling of the material, as specified by Metro-North, will be undertaken by the undersigned at the undersigned's expense and such sampling results will be provided to Metro-North. The material will remain stockpiled until sampling results have been received and reviewed by Metro-North, and it shall be Metro-North's unilateral determination as to whether delivery of the material may proceed.

CERTIFIED BY: *(INSERT SIGNATURE OF COMPANY OFFICER)*

OF *(INSERT COMPANY NAME)*

DATE: *(INSERT DATE)*

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 02 83 00

LEAD-CONTAINING MATERIALS SPECIFICATIONS

TABLE OF CONTENTS

Contents

SECTION 02 83 00

LEAD-CONTAINING MATERIALS SPECIFICATIONS

PART 1 – GENERAL

1.01 Project Overview

The following specification is intended for use with a site specific scope of work for any activity which will disturb lead containing coatings or materials on Metro-North Railroad property. Coating or material disturbance activities may result in occupational exposure to airborne lead particulate as described in 29 CFR 1926.62 Lead Exposure In Construction; Interim Final Rule. The requirements of the following specification shall apply to any and all construction activities known or suspected to result in worker exposure to airborne lead particulate, dust, or fume. Although not specifically covered under this specification, potential for personal or environmental exposure to harmful substances, including heavy metals other than lead, shall be considered when determining the best methods and procedures for executing the work.

All work resulting in the disturbance of lead containing coatings or other lead containing materials shall be conducted utilizing currently accepted lead abatement technologies and standards of practice in compliance with applicable regulations and Metro-North Railroad standards. The Contractor shall conduct all work in a manner which protects the health and safety of contract employees, Metro-North Railroad employees, Metro-North Railroad property, the surrounding community, the public, and the environment.

1.02 Definitions

A. Action Level - As set by 29 CFR 1910.1025, the level of exposure that triggers medical surveillance and selected other administrative and/or training controls for workers exposed to lead in general industry is 30 micrograms per cubic meter.

B. Closed Abrasive Blast Cleaning - The propulsion of abrasive particles against the surface to be de-leaded by means of compressed air or centrifugal wheels, the blasting action being contained within an enclosure creating a seal to the surface being de-leaded, and having vacuum capabilities for a simultaneous cleaning and blasting action.

C. Competent Person Responsibilities - In compliance with OSHA requirements, each Metro-North work site will have a competent person overseeing the work. The competent person will identify lead hazards, determine the strategy of exposure control, and ensure employees performing the work use personal protective equipment and hygiene facilities. The competent person will inspect the work regularly, make note of deficiencies and the corrective steps taken, ensure employees are using equipment properly and oversee maintenance of engineering controls and equipment.

D. Compliance Program - As per 29 CFR 1926. 62 (e); the employer's site specific written program which describes engineering controls, work procedures and administrative controls which will serve to limit employees exposure to lead concentrations to, or below the Permissible Exposure Limit. The site specific plan describes hygiene facilities, housekeeping, personal protective equipment, respiratory protection, the scope of work, technology considered to reduce exposures, a description of the activities which will disturb lead and potentially create exposures, identification of the competent person and his/her responsibilities, air monitoring data, etc. all relevant to the site specific scope of work and conditions.

E. Construction Industry Standards - As per 29 CFR 1926, "Safety and Health Regulations for Construction", the identification of OSHA standards developed for worker protection in the construction industry.

F. Containment System - The sealing of walls, floors and any entryways. Within the contained area there shall be a ventilation system of either forced or natural air imports and natural or mechanical exhaust. Air

filtration systems may exist within the containment system. The purpose and design shall prohibit the emission of lead particulate from within the containment system to the ambient air.

G. Contractor - Any entity that has entered into contract with Metro-North Railroad.

H. Critical Barrier - The installation of flexible, sealed partitions, which prohibit the escape of particulate from the work area.

I. Engineer - The Resident Engineer, Project Engineer, Site Engineer, or Construction Manager, representing the best interest of Metro-North Railroad, and assigned to direct, manage, and oversee the execution of the work.

J. Environmental Monitor - The designated entity or third party, representing the best interest of Metro-North Railroad, responsible for overseeing the Contractor's compliance efforts.

K. Hand Tool Cleaning - Manual scraping, brushing or sanding of loose paint, rust and mill scale. Tools include chisels, knives, hammers, sandpaper and wire brushes.

L. Hazardous Waste (LEAD) - Debris containing 5 parts per million lead or greater when tested as per the Toxic Characteristic Leaching Procedure (TCLP). Lead is assigned the EPA Haz Waste #D008.

M. HEPA - High Efficiency Particulate Air (Filter) - Being, using, or containing a filter designed to remove 99.97% of airborne particles measuring 0.3 microns or greater in diameter passing through it.

N. Histoplasma Capsulatum – Fungus living in the environment, usually in association with large amounts of bird or bat droppings.

O. Histoplasmosis – a disease caused by the fungus Histoplasma Capsulatum.

P. Isolation Barriers - The construction of partitions, the placement of solid materials, and the plasticizing of apertures to seal off the work place from surrounding areas to contain and prohibit emissions.

Q. Lead Health and Safety Plan (LHASP) - Site Specific and meeting the requirements 29 CFR 1026.62 (e) for Site Specific Compliance Plan.

R. Log Book - A permanently bound book kept at the entrance to the work area. This book shall serve as a legal record of each work shifts' activity, profile of crewmembers, signatures of all persons visiting the work site, accidents/incidents and a daily sign-in and sign-out record for the crewmembers. Waste quantities generated, stored and released for transport shall be recorded here on a daily basis. Emergency contact phone numbers shall be listed inside the front cover and a street map containing a highlighted route to the nearest hospital shall be kept with the book.

S. Medical Surveillance Program – For the purposes of this specification, detailed medical examinations and physician consultations for employees who have been exposed to lead above the action level of 30 micrograms per cubic meter of air for more than 30 days per year per 29 CFR 1926.62 (j),.

T. Metro-North Railroad - The Owner, Metro-North Railroad, or a designated entity or third party representing Metro-North Railroad.

U. Movable Objects - Any objects within the work area, which may be cleaned and removed prior to start of deleading.

V. OSHA - Acronym for Occupational Safety and Health Administration

W. Open Abrasive Blast Cleaning - Compressed air is used to propel abrasive particles against the surface being deleaded without the benefit of localized containment.

X. Owner - A person, firm, corporation, guardian, conservator, receiver, trustee, executor or other judicial officer, who, alone or jointly or severally with others, owns, holds, or controls the whole or any part of the freehold or leasehold title to any property, with or without accompanying actual possession of it, and shall include in addition to the holder of legal title, any vendee in possession of it, but may not include a mortgagee or an owner of a reversionary interest under a ground rent lease. In this instance, unless otherwise specified, the owner shall mean Metro-North Commuter Railroad.

Y. Permissible Exposure Limit (PEL) - A limit of exposure to a particular toxic material or harmful physical agent which is published and enforced by OSHA as a legal standard. This standard is typically based upon time weighted average (TWA) concentrations for a normal 8-hour workday over a 40-hour workweek. Per 29 CFR 1926.62, the PEL for workers exposed to lead in construction / general industry is 50 micrograms of lead per cubic meter of air, without regard to the use of respiratory protection.

Z. Polyethylene - Known commonly as plastic sheeting or poly, and having a conformance of 6 mil thickness, unless otherwise specified.

AA. Power Tool Cleaning – De-leading via the use of power operated impact tools. Power tools may include roto peens, disc sanders, needle guns, grinding wheels, brush blasters and similar equipment.

BB. Pressure Washing - Pressurized water, typically up to 4,000 psi, to clean surfaces.

CC. Respirator Fit Test - Qualitative and quantitative testing conducted to assure a respirator fits the employee properly and will function as intended.

DD. Respiratory Protection Program – As defined by 29 CFR 1910.134; the contractor's written program delineating employee training, storage, inspection and selection of respirators.

EE. Solid Panels - Building materials, which are impermeable to dust and may be used for construction of containments or for the purpose of encapsulation.

FF. Tarpaulin - A solid, flexible barrier impervious to dust.

GG. Tent - A flexible, sealed enclosure constructed for limited, localized quantities of de-leading.

HH. Time Weighted Average (TWA) - An employees' average airborne exposure to a particular toxin in over a given period of time, typically an eight-hour work shift of a 40-hour work week.

II. Visible Emission - Any emission of lead particulate or fume, which is detected by the human eye, without the aid of instrumentation.

JJ. Water Jetting - Pressurized water directed against the surface to be de-leaded at 20,000 pounds per square inch pressure (psi), or for ultra-high pressure at 20,000 to 40,000 psi.

KK. Wet Abrasive Blast Cleaning - Compressed air used to propel abrasives against a surface to be de-leaded. Water is injected into the abrasive stream and thereby significantly reduces dust generation.

LL. Worker Decontamination Facility - Appendage to the worksite containing a series of rooms, each segregated from the other by a series of air-locks and curtained doorways. A typical configuration of these rooms runs in a sequential series and includes three chambers; clean area, decontamination area (shower) and equipment room.

SECTION 02 83 00

LEAD-CONTAINING MATERIALS SPECIFICATIONS

1.03 Contract Requirements

A. General

1) The Contractor is solely responsible for the occupational health and safety of the Contractor's employees. The Contractor shall conduct work utilizing all available methods and procedures to protect the health and safety of employees involved in the work, the surrounding community, the public, and to prevent environmental degradation.

2) The Contractor is hereby notified that lead exposure activities include the disturbance of lead containing materials, lead-containing coating removal and subsequent work on surfaces which have been abated of visible coatings. Therefore; these specifications apply to all lead exposure activities which may include but not be limited to coating removal, hot work, such as torch cutting, rivet busting, and use of mechanical or hand tool equipment on surfaces from which coatings have been removed.

3) The Contractor shall provide all labor, materials, equipment, services, certificates, variances, permits, and insurances necessary to execute the site-specific scope of work. The Contractor shall complete the work per the requirements set forth herein and at the direction of Metro-North Railroad, the Engineer, and the Environmental Monitor.

4) Work shall be conducted in compliance with 29 CFR 1926.62 Lead Exposure In Construction; Interim Final Rule, the requirements set forth in these specifications, Metro-North Railroad Operating Rules & Procedures, Society for Protective Coatings (SSPC) Guidelines, all applicable standards and local, state and federal regulations. The Contractor shall conduct the work in accordance with direction provided by Metro-North Railroad or their representative, the Project Engineer, Project Management, the Environmental Monitor, and any agency having jurisdiction over the work.

5) The Contractor shall comply with the requirements of this specification and all applicable Federal, State, and Local laws, codes, and regulations, including but not limited to the regulations of the United States Environmental Protection Agency (USEPA), United States Department of Transportation (USDOT) Occupational Safety and Health Administration (OSHA), New York State Department of Environmental Conservation (NYS DEC), New York State Department of Health (NYS DOH), and the New York State Department of Labor (NYS DOL), and the New York City Department of Environmental Protection (NYC DEP), AASHTO, ACI, ANSI, DOT, NEMA, UL. The referenced regulations, standards and codes shall be of the latest revision, in effect at the time of execution of the work. Recommendations or suggestions contained within referenced regulations, codes and standards promoting employee health and safety or the overall quality of the work shall be deemed mandatory.

6) Reference to specific regulations, standards, codes, or other items in this specification which are of specific interest to Metro-North Railroad in no way relieves the Contractor of the requirement to comply with all applicable legal requirements, nor should it be construed that Metro-North Railroad, the USEPA, USDOT, NYSDEC, NYSDOH, NYSDOL, NYCDEP, or other Federal, State and City regulators are only interested in these items. Compliance with this specification does not relieve the Contractor of the obligation to comply with other applicable requirements.

7) The Contractor shall comply with all applicable laws, codes and regulations even if they are not specifically referenced herein. Failure to reference a particular code, standard, or regulation within this specification, does not relieve the Contractor from compliance with or conducting work in accordance with all applicable codes, standards, and/or regulations.

8) If an applicable law, code or regulation is more restrictive than the requirements of this specification; the Contractor shall follow the more restrictive requirements. In event of conflict between codes, regulations, standards, contract documents or specifications, the more restrictive requirements shall

apply as interpreted by Metro-North Railroad. Metro-North Railroad's decision regarding applicability of the provisions applied independently or as supplemented, modified or voided, shall be final.

9) For estimating and bidding purposes, the Contractor shall assume the more restrictive method will prevail and shall prepare the bid price to reflect the more restrictive method.

10) It is the responsibility of the Contractor to ensure that all Subcontractors are familiarized with the requirements of this specification.

B. Owner's Representatives

1) The Contractor shall adhere to the requirements of this specification, any regulatory agency inspecting the work, managing agents, project managers, project engineers, or any other entities or individuals representing Metro-North Railroad.

2) Metro-North Railroad may engage the services of third parties to provide air monitoring and/or oversee work conducted by the Contractor. The Project Engineer and Environmental Monitor shall serve as representatives of Metro-North Railroad, serving the best interest of Metro-North Railroad. The Engineer and the Environmental Monitor shall report to Metro-North Railroad on matters pertaining to the work being performed and the Contractor's conformance with these specifications and regulatory requirements. Metro-North Railroad authorizes the Project Engineer and the Environmental Monitor to have free access to the work site and all work areas for the performance of duties.

3) The Contractor is hereby notified that the Engineer or the Environmental Monitor has the jurisdiction to stop the Contractor's work if he/she witnesses or observes an instance of substantial non-conformance with these specifications, the contract documents, and/or a situation that may adversely affect the health, safety, and/or wellbeing of the contractor's workforce, Metro-North Railroad's employees, Metro-North Railroad's property, the general public, and/or the environment. Work may be stopped for instances including but not limited to, non-conformance with contract documents or specifications, unsafe work practices, employee misuse or non-use of appropriate personal protective equipment, releases or emissions resulting from the work, use of materials or equipment other than those submitted and approved for use, work not meeting the satisfaction or standard of quality of Metro-North Railroad or the Engineer. The Contractor shall not resume work until corrective measures have been implemented meeting the satisfaction of Metro-North Railroad, the Engineer, and the Environmental Monitor.

C. Use of Subcontractors

1) The Contractor shall submit required submittals for each proposed lead abatement or demolition Subcontractor to Metro-North Railroad Office of System Safety Department for review and approval prior to using any subcontractor(s) to perform any of the specified work.

2) Subcontractors shall be required to perform work in compliance with these specifications and applicable regulations and standards.

1.04 Submittals

A. General

Certain lead specific submittals will be required prior to the start of any work. The Contractor shall make these and any other required submittals in conformance with Part 3 of these specifications in advance of the work, allowing sufficient time for review and revision. In addition to the submittals required herein, the Contractor is hereby given notice that the Contractor's Corporate Health and Safety Plan, Respiratory Protection Plan, Personal Protective Equipment (PPE) Plan and Hazardous Communication Program as well as scope specific submittals other are mandatory submittals as required by these Specifications and will be reviewed separately. The Metro North Lead Projects Submittal Outline & Checklist is attached.

B. Project – Site Specific

1) Lead Health and Safety Plan (LHASP)
2) Site Specific Work Plan & OSHA Compliance Program
3) Waste Management Plan (As per Section 01 74 19: Construction Waste Management and Disposal)
4) Worker Submittals

C. Requirements

1) The foregoing is a summary of submittals to be provided by the Contractor and applicable sub-contractors to Metro-North Railroad for review. Metro-North Railroad expects for each submittal to be complete upon submission. Metro North reserves the right to request additional submittals from the Contractor as deemed necessary.

1) Information regarding all equipment and materials to be used for the performance of the work must be submitted for Metro-North Railroad's review and approval prior to use. This shall include, at a minimum, product and technical data sheets, specification sheets, material/equipment cut sheets, samples of materials, and design drawings. Submittals shall be of sufficient detail to satisfy Metro-North Railroad's requirements.

2) The Contractor shall maintain all product and equipment data sheets and instructions at the project site.

3) The Contractor shall submit evidence of one or more individuals that have completed the SSPC C3 Competent Person/Lead Supervisor Training. The person directly responsible for the on-site supervision of the work force shall have C3 certification and shall be present on site during all lead exposure related activities.

4) At the direction of Metro-North Railroad, the Contractor shall provide additional preconstruction or post construction photos and/or photos of damages resulting from the Contractor's operations.

D. Site Specific Lead Health & Safety Plan

1) A Lead Health and Safety Plan (LHASP) shall be prepared for the work covered under this specification. This plan shall discuss the occupational health and safety aspects relevant to the construction activities to be undertaken by the Contractor.

2) The LHASP shall address the specific components of this specification and shall be reviewed by the Contractor's Certified Industrial Hygienist (CIH) prior to submission for review by Metro-North Railroad. The plan shall conform to all applicable laws, codes, rules, and regulations.

3) The LHASP shall incorporate by reference, but not be limited to, the following:

   a. OSHA 29 CFR 1910 and 29 CFR 1926, including, but not limited to 29 CFR 1926.21, 1926.62 and 1926.103.

   b. National Institute of Occupational Safety and Health (NIOSH) Pocket Guide

   c. National Institute of Occupational Safety and Health (NIOSH) Manual of Analytical Methods

   d. American Conference of Governmental Industrial Hygienist (ACGIH) Threshold Limit Values

   e. OSHA Sampling and Analytical Methods

4) The LHASP shall, at a minimum, address the following:

   a. The Contractor's policy concerning employee health and safety, A description of how the policy applies to the project including site specific information so that the plan reflects the actual site conditions and scope of work,

   b. A statement of the Contractor's understanding of the Contractor's responsibility to maintain employee health and safety and enforce implemented health and safety procedures,

   c. Responsibilities for site control, management, supervision, and enforcement of health and safety procedures shall be detailed in the plan. The Contractor shall designate an individual who will be responsible for employee health and safety and has the background and authority to know what constitutes safe practices and direct their implementation at the site,

   d. The Contractor's procedures for the protection of Contractor's employees, and employees of Metro-North Railroad, the Engineer, and Metro-North Railroad's representatives shall be detailed in the plan,

   e. The Contractor's policy and procedures for environmental protection including, prevention of air, water, and soil contamination shall be provided in site-specific detail,

   f. The Contractor shall give a description of any special provisions made for safety and health procedures for specific work requirements such as scaffolding, trenching, blasting, torch cutting, fall protection, welding, hoists, cranes, maintenance and protection of traffic, confined space entry,

   g. The plan shall review the Contractor's program for maintaining and revising the health and safety plan as needed to reflect site conditions and procedures and reassessing, re-evaluating the plan on a set schedule or as needed to maintain accuracy and applicability to the work,

   h. The plan shall include a statement regarding the review, revision, and approval of the plan by the Contractor's American Board of Industrial Hygiene, Certified Industrial Hygienist (CIH),

   i. General requirements for emergency planning and contingency plans with a contact list and emergency phone numbers shall be provided,

   j. Directions, maps and addresses of nearby health care facilities, fire departments and police departments shall be provided,

k. Reference to the Contractor's other written programs including the Respiratory Protection Plan and Personal Protective Equipment (PPE) Programs including selection and usage specifications, Hazardous Communication Program, and Site Specific Lead Health & Safety Compliance Program shall be incorporated in the plan,

l. A statement of conformance and methods of conformance to the plan by the Contractor, subcontractors, and site visitors shall be included in the LHASP,

m. The LHASP shall detail methods of onsite communication, the lines of communication, and establishment of an emergency contact list,

n. General requirements and the definition of the Work Zone and methods of limiting unauthorized access shall be detailed in the plan,

o. A description of the provisions that will be made for first aid and emergency medical assistance, including equipment available at the site, its accessibility for use by all, and a procedure for replacement of expended first aid materials shall be cited,

p. The plan shall provide a statement that treatment of an injured worker shall not be delayed for the reason of decontamination,

q. Procedures for reporting accidents, injuries, and incidents shall be included in the plan,

r. A description of the site specific medical surveillance program shall be included,

s. EPA's recommended "Levels of Protection" including descriptions and usage requirements shall be included,

t. Industrial hygiene practices including employee Right-To-Know and usage and availability of MSDS,

u. Details of personal exposure monitoring procedures, including a description of the tasks to be monitored, the analytes, equipment, calibration and usage requirements and reporting methods,

v. The Contractor's plan for providing sanitary facilities and clean, potable drinking water,

w. Procedures for employee hygiene and decontamination,

x. The use of safety gear including but not limited to personal protective equipment including eye protection, hearing protection, hard hats, safety shoes, respirators, protective clothing, harnesses, fall protection, fall arrest, gloves and safety belts,

y. Safe electrical procedures, including adequate lighting of work areas, maintenance of temporary circuits, use of insulated tools, ground fault circuit interruption (GFCI), lockout/tag out procedures,

z. Documentation of experience, training and certifications of the Contractor's employees, including personnel responsible for overseeing and enforcing on site safety and health procedures, the competent person, the industrial hygienist, and the American Board of Industrial Hygiene (ABIH) certified industrial hygienist,

aa. Description of the Contractor's plan for regularly scheduled safety meetings and other periodic training to ensure safe work practices, including OSHA required annual refresher training,

bb. A description of housekeeping procedures,

cc. A description of emergency egress and fire escape routes, and that each egress shall be clearly identified and not be blocked or locked,

dd. A description of means implemented for fire protection and prevention including providing fire extinguishers at the site, having scheduled fire drills, and training,

ee. Safe working practices for hot and cold environments,

ff. The Contractor's procedures for the use of powder actuated tools including compliance with New York City Fire Department Regulations by individuals retaining a Certificate of Fitness, as applicable.

E. Site Specific Work Plan & OSHA Compliance Program

1) The Contractor shall submit a detailed Site Specific Work Plan and OSHA Compliance Program (Program) per the requirements of these specifications and 29 CFR 1926.62 (e). The Program shall be site specific to the particular project being undertaken and shall describe in detail the means, methods and procedures for execution of the work and protecting employees, the surrounding community, and the environment from lead exposure during performance of the work. The program shall include a detailed discussion of the sequence of work. This shall include a description of all project related activities, from commencement through completion, providing the sequence of work attached to a work schedule or timeline estimating the anticipated duration of each task.

2) Subcontractors may be required to provide submittals separate from those provided by the Contractor.

3) The Site Specific Work Plan & OSHA Compliance Program shall be prepared in accordance with 29 CFR 1926.62 paragraph (e), which shall be carried out by all employees involved in operations which disturb or remove lead containing materials.

a. The program shall describe the methods, procedures, processes, equipment and materials that will be implemented to reduce or eliminate employee exposure to airborne lead particulate concentration.

b. At a minimum, the program shall address respiratory protection that is in full compliance with 29 CFR 1910.134, an emergency plan of action, methods of exposure assessment, signs to be posted in work areas, protective clothing, engineering and administrative controls, hygiene facilities and practices, decontamination, housekeeping, medical surveillance, training and other items to satisfy OSHA standards as required.

c. The program shall be specific to the scope of work and the site conditions.

d. A listing of the contents of the program in accordance with 29 CFR 1926.62 paragraph (e) follows. The following list is provided only as a guide to assist the Contractor in reviewing the program and is not intended to represent the full contents of a complete compliance program.

i. A summary of the project scope of work including methods of abatement and components affected by the work,

ii. A list of all individuals on the work crew. The list should include employee names, employee numbers, certification and/or training identification numbers. In addition, the employee's job description and a brief description of each employee's responsibilities shall be provided,

iii. A description of each work activity which may result in employee exposure to airborne lead particulate,

iv. A description of the specific engineering controls and work practices which will be implemented to reduce employee exposure as required under 29 CFR 1926.62 paragraph (e)(5) and Appendix B to the standard,

v. A listing of the specific equipment and materials to be utilized on the project, including catalogue cut sheets, product data sheets, product information, product specifications, manufacturer instructions and recommendations for use, Material Safety Data Sheets, and any other information pertinent to the functioning and use of the product,

vi. A description of maintenance practices which ensure the proper functioning of equipment used to reduce airborne lead particulate concentrations and employee exposure,

vii. A description of the administrative controls implemented to reduce employee exposure to airborne lead particulate including a discussion of the procedures, schedule, record keeping, of employee and/or task rotation that will be utilized,

viii. A description of the technology considered to reduce employee exposure below the Permissible Exposure Limit (PEL),

ix. A description of the respiratory protection to be utilized on the project, including catalogue cut sheets, product data sheets, specifications, assigned protection factors and recommendations for use. The Contractor shall indicate which respirator will be utilized by employees for each specific task which may result in employee exposure,

x. A description of the personal protective equipment (PPE) to be utilized on the project, including catalogue cut sheets, product data sheets, specifications and recommendations for use. The Contractor is hereby notified that with regard to disposable coveralls; the use of spun bound polypropylene garments is prohibited.

xi. All personal exposure monitoring data compiled during the course of the project shall be maintained at the project site from the onset of the project through project completion. It is the responsibility of the Contractor to ensure that exposure assessment data is collected in accordance with OSHA and NIOSH recommendations for personal exposure assessment and is representative of the actual exposure incurred by the employee(s). The Contractor shall conduct the initial exposure assessments in accordance with 29 CFR 1926.62 paragraph (d). Furthermore, the Contractor shall conduct the initial exposure assessment requirement under 29 CFR 1926.62 paragraph (d) for a minimum of three (3) or more work shifts. The initial exposure assessment data shall be representative of the highest exposure incurred by an employee conducting each potential lead exposure task. During the course of the project, should there be a change of personnel, work practices, types of equipment, processes, or other factor that may affect exposure rates, the initial exposure assessment shall be repeated. Following the initial exposure assessment period, the schedule of personal exposure assessments shall comply with 29 CFR 1926.62 paragraph (d). Personal exposure assessments shall be conducted over the entire work shift. The Contractor is hereby notified that Metro-North Railroad does not accept historical data in lieu of conducting personal exposure assessments.

xii. A description of the schedule for inspections for the work site, equipment, and materials to be made by the competent person shall be provided. In accordance with the requirements of 29 CFR 1926.62, Metro-North Railroad requires that the designated competent person be physically on site during all lead related work activities. The

Contractor shall include a sample of the inspection checklist or compliance report to be completed by the competent person and shall describe the frequency of inspections.

xiii. A description of the housekeeping procedures that will be implemented at the work site to maintain surfaces as free as practicable from accumulations of lead.

xiv. A description of the personal hygiene facilities which will be provided and the hygiene practices to be followed by employees. In addition to the requirements of 29 CFR 1926.62, the Contractor shall provide complete decontamination facilities on projects involving tasks that are known or suspected of resulting in employee exposure to airborne lead particulate in excess of the Permissible Exposure Limit (PEL). The Contractor shall describe in detail the operation, maintenance, and cleaning of facilities and provide manufacturer catalogue cut sheets, product data sheets, instructions and recommendations for use.

xv. A description of the implementation schedule of the program on the project.

xvi. The compliance program shall include a statement in accordance with 29 CFR 1926.62 paragraph (e)(2)(v) that the program will be reviewed and revised as necessary at six (6) month intervals.

xvii. The compliance program shall include a statement the program will be available on the work site and available at all times for review by employees, the competent person, OSHA, Metro-North Railroad, the Environmental Monitor, and any other entity affected by the work.

F. Site Specific Waste Management Plan

a. The Contractor shall provide a written Waste Management Plan as per Section 01 74 19: Construction Waste Management and Disposal, which addresses the proper collection, handling and storage of all waste. Waste includes paint waste, potentially contaminated materials, containment materials, personal protective equipment, construction debris, scrap steel, spent solvents, and any other hazardous or non-hazardous wastes generated during the project.

b. Unless otherwise directed, only hazardous and non-hazardous waste generated directly from lead remediation activities will be transported and disposed of by Metro-North Railroad's contracted waste disposal company. Metro-North Railroad shall contract, separately, the transportation and disposal of all hazardous and non-hazardous waste. The contractor shall provide drums for debris generated.

c. The following information shall be included in the Waste Management Plan:

i. The Contractor shall provide the procedures that will be followed for the collection, site handling, storage, packaging and labeling of the waste.

ii. If solvents are designated for reuse rather than disposal, the Contractor shall provide a solvent handling plan which includes the procedures that will be followed to control and track the solvents while on site, and between the work site and the final destination.

iii. The Contractor shall provide a detailed Emergency Response and Contingency Plan which addresses worker training and the notification, clean up, and reporting in the event of a spill per these specifications. The Contractor shall comply with the requirements for implementation of the Emergency Response and Contingency Plan in the event of releases which may impact the public or the environment.

d. Transporter Information

i. Hazardous Waste Transporters

1. Metro-North Railroad shall be responsible for the transportation of hazardous wastes. Transportation of hazardous wastes is excluded from the Contractor's scope of work.

2. The Contractor shall assist with coordination of the transportation of hazardous wastes with Metro-North Railroad and Metro-North Railroad's representatives designated to arrange for the transportation of hazardous wastes. Coordination efforts shall include assistance with the inventory and scheduling for delivery and pick-up of roll-off containers and/or pick-up of drummed wastes. Contractor in all related cases shall ensure ready access to drums and other containers scheduled for pick-up and disposal.

ii. Non-Hazardous Waste Transporters

i. The Contractor shall submit the name, address, qualifications, and experience of each proposed hauler of construction debris, scrap steel, and filtered, non-hazardous wastewater.

ii. The Contractor shall provide the following information pertaining to the facility:

a. Any violation of any legal requirement in the last five (5) years relating to the protection of the environment, and describe any such notice of violation and status;

b. Any notification of any claim pertaining to investigation or remediation of any hazardous substance at the facility or;

c. Any request for information or other inquiry from a governmental entity or private party relating to the release or potential release of any hazardous substances at the facility.

e. Scrap Steel

a. The Contractor shall identify the entity proposed for handling scrap steel for disposal and the method(s) of disposal that will be used. The Contractor shall provide the entity written notification that the steel is coated with lead containing paint. The Contractor shall provide a letter (attached at the end of section 3) from the entity indicating that it will accept the scrap steel coated with lead paint, is authorized to accept the scrap steel under the laws of the state of residence; has the required capability to assure that scrap steel coated with paint which contains lead and other heavy metals is re-smelted; and will ensure that the steel is destroyed in accordance with the provisions of this specification.

b. The Contractor shall provide Metro-North Railroad with the original letter signed by a legally authorized representative of the entity or facility.

f. Wastewater

a. The environmental monitor will periodically collect samples of waste water. Laboratory analysis of the waste water will determine the classification of the water as hazardous or non-hazardous.

b. The Contractor shall provide drums for waste water collection and storage prior to disposal.

c. Non- hazardous waste water shall be disposed of by the Contractor in accordance with applicable local, state and federal regulations.

d. A firm separately contracted by Metro-North Railroad shall transport and dispose of waste water classified as hazardous. Transportation of hazardous wastes, including waste water, is excluded from the Contractor's scope of work.

G. Worker Submittals

a. Certificate of Lead Awareness Training, (1926.62 (l) (2)) for each worker – Within one year of project date.
b. Lead Physical Examinations (29 CFR 1926.62 (j) (3)) for each worker – Within one year of project date.
c. Analytical results of blood analysis consisting of Blood Lead Levels and Zinc Protoporphyrin testing must be performed within 15 days of project start date,
d. Respirator Fit Tests, for each worker – Within one year of project date.
e. Medical Clearance to wear Respiratory Protection for each worker – Within one year of project date.
f. Current SSPC, C 3 / C 5 Certification for Competent Person.

H. Site Specific Containment Plan

1) The Contractor shall provide a Containment Plan for review and approval by Metro-North Railroad. The Containment Plan shall include containment working drawings, design calculations, and other information requested for review and approval by Metro-North Railroad prior to requisition of the containment system(s). The contents of the Containment Plan shall include, but not be limited to:

2) Detailed drawings stamped by a Professional Engineer licensed in the State of New York. The Professional Engineer must analyze the containment system for the effects of wind forces on the structure as well as the containment system itself and all other imposed loads. The containment system shall not induce a load on the structure which will affect the structural integrity of the structure.

3) Data, calculations, and assumptions used for the design of the containment and ventilation system and the imposed loads on the existing structure, signed by a Professional Engineer licensed in the State of New York.

4) The plan and procedures for staging, installing, moving, and removing the containment.

5) The methods and locations of attachment to the structure.

6) The methods of access that will be provided to work areas inside containment, locations of safety lines, and locations of emergency containment entryways and exits shall also be included.

7) Procedures for cleaning, securing, monitoring and removing the containment and/or protecting materials used to construct the containment at the end of each day and/or in the case of expected inclement weather during work shut downs.

8) Plans for maintaining sufficient lighting inside containment during all work operations, including inspection, and for maintaining the navigational lighting (if applicable) during the work. Procedures for maintaining sufficient exterior lighting to ensure compliance with the restrictions on emissions and releases set forth in this specification, and to the extent that lighting is necessary for nighttime operations, when applicable.

9) Procedures and methods for communicating between equipment operators and workers inside containment, including the responsible foreman and Metro-North Railroad, the Engineer, or the Environmental Monitor, to provide for immediate shut-down of blasting equipment during abrasive blasting operations when necessary, and to communicate any corrective measures which need to be undertaken.

10) Plans and procedures for the collection and removal of waste and debris from within the containment.

11) Technical data sheets, specification sheets, material samples, and any other information needed to thoroughly describe the containment plan and materials proposed for use.

12) Containment drawings including detail sketches of all seams and seals, and ventilation design(s) for proper ventilation and negative pressure, including calculations and assumptions. All drawings and designs shall be in sufficient detail to allow for the proper review by Metro-North Railroad, and shall comply with the requirements of this specification.

13) Samples of containment materials and sealants, and actual methods of sealing, shall be submitted for review.

14) A statement that the Contractor will shut down operations, adjust work practices, modify containment and take other steps as necessary to comply with the results of the monitoring and the assessments of visible emissions as directed by Metro-North Railroad and/or the Environmental Monitor.

15) A written program for the observation of visible emissions during project activities, and inspections for releases or spills of dust and debris that may become deposited on surrounding equipment, property, soil, water, and sediment. Include the frequency and methods of observation and inspection that will be made, areas or work activities that will be observed, and the frequency and nature of clean up that will be undertaken. Include the name(s) and qualifications of the personnel conducting the observations and inspections, and the methods and equipment that will be used for cleanup activities.

16) A written program for visual inspection of the ground, soil, equipment, structure and other surfaces prior to commencement of the project, continuously during the project, and upon completion of the project to ensure that the ground, soil, equipment, structure and other surfaces are not and have not been affected by project activities. Include clean-up procedures that will be followed.

17) A written program identifying the procedures and methods that will be used to conduct daily and final visual cleanliness inspections and evaluations and final clean up upon completion of the project shall be submitted to Metro-North Railroad by the Contractor. These inspections are conducted to assure that the area and surrounding equipment, property, structures, ground, soil, water, sediment, and other surfaces have been properly cleaned and are free of visible paint dust and debris, abrasives, or other contaminated debris in compliance with this specification.

18) The Contractor shall identify the solutions, detergents, solvents, etc. proposed for the cleaning of surfaces and equipment when wet wiping or washing is employed.

I. Site Specific Cleaning, Surface Preparation & Re-Coating Plan

1) The Contractor shall provide detailed, written procedures on intended methods of cleaning, surface preparation, and coating application. The Contractor shall include a description of all equipment and materials, including the equipment manufacturers' catalogue cuts, technical data sheets, specifications and instructions.

2) The Contractor shall identify the level of containment, methods of protection, or work isolation procedures that will be followed to protect surrounding structures, equipment, and property from exposure to all cleaning methods as well as those methods which will provide protection from exposure to paint, overspray, solvent materials, and general paint debris.

3) The Contractor shall describe the proposed method of chloride and ferrous salt removal.

4) The Contractor shall identify the name and chemical composition of detergents or solutions that will be used for cleaning the existing coating or for the removal of mildew. MSDS and product literature shall be submittal to Metro-North Railroad for review and approval prior to use.

5) The Contractor shall identify the type, brand name, and size of the abrasive proposed for use, if applicable. The contractor is hereby notified that only recyclable abrasive blast media and systems are approved for use on Metro-North Railroad property.

6) The contractor shall include procedures to be followed for cleaning of the primer coat prior to field painting as finish coat when specified as part of the scope of work.

7) The Contractor shall identify the coating materials to be applied and include the manufacturer's name, product names, and product numbers. Product data sheets, VOC levels, MSDS, and written application instructions including mixing requirements, specified thinners, and thinner amounts (see Coating Product Submittals) shall be provided to Metro-North Railroad for review. Metro-North Railroad reserves the right to specify the coating products to be used by the Contractor.

8) In the event of conflict between the manufacturer's technical data, specifications, or usage instructions and the requirements of this specification, the Contractor shall comply with the requirements of this specification unless the requirements of the manufacturer are more restrictive. In these cases, the Contractor shall advise Metro-North Railroad of any discrepancies in writing, and comply with Metro-North Railroad's written instruction with respect thereto.

9) The Contractor shall identify the procedures and methods of testing to be utilized to monitor the surface preparation and painting work, utilizing industry standard methods, including but not limited to compressed air cleanliness, ambient conditions, surface temperature, abrasive size and use, surface profile, degree of cleanliness, wet and dry film thickness or adhesion.

J. Project Notifications

1) The Contractor shall provide formal written notification to all local, state and/or federal agencies as required by law or as directed by the Engineer or Metro-North Railroad. The contents of the agency notification(s) shall be submitted to Metro-North Railroad for review fifteen (15) days prior to the deadline for submittal to a specified agency.

2) The Contractor shall provide written notification to adjacent contractors informing them of the potential for exposure to lead. In the event notification is required, the Contractor shall submit the notification to Metro-North Railroad for review prior to submittal to the effected Contractor(s).

3) Should the Contractor launder personal protective clothing, the contractor shall notify the laundry and provide information on bags or containers of contaminated protective clothing and equipment as required by 29 CFR 1926.62 (g)(2)(vii)(B). The Contractor shall provide a sample of the notification to Metro-North Railroad prior to use.

K. Project Close-Out Submittals

1) Upon completion of the work, and prior to release of final payment, the Contractor shall submit the following information to Metro-North Railroad.

2) All filings, permits, variances, approvals, etc. granted to the Contractor by authorities or agencies to complete the work.

3) A complete copy of the Contractor's job log and the competent person's log.

4) All personal exposure monitoring data, including laboratory analytical data, compiled throughout the project.

5) Reports signed by a Certified Industrial Hygienist summarizing all blood testing results.

6) The Contractor shall provide copies of all documentation pertaining to the disposal of all hazardous and non-hazardous waste generated during the work, including but not limited to, a written log of the type and quantity of waste that was generated and removed from the project site, executed waste manifests/waste shipment records (if applicable), bills of lading, waste shipment records.

1.05 Related Sections

A. Section 01 74 19: Construction Waste Management

1.06 References

a. General

1) Reference of a particular code, regulation or standard shall apply to the work with the same authority as if it were included word for word in the specifications. Work shall conform to the applicable provisions of reference documents cited directly in the specifications and shall also conform to all codes, standards and specifications, or part thereof, cited in reference documents stipulated in the specifications. Unless otherwise noted, the latest editions and revisions of the referenced codes standards, specifications and other reference documents in effect during execution of the work shall govern.

2) Failure to reference a particular code, standard, or regulation within this specification, does not relieve the Contractor from compliance with or conducting work in accordance with applicable codes, standards, or regulations.

b. Regulations

Administrative Code of the City of New York

Section 1403, Part III of Chapter 57
Section 16, NYC Department of Sanitation Regulations

Codes, Rules and Regulations of the State of New York (NYCRR)

Title 6, Chapter III, Subchapter B, Air Resources
Part 211.2, Air Pollution
Parts 256 – 257, Ambient Air Quality Standards

Title 6, Chapter IV, Subchapter B, Solid and Hazardous Waste Laws
Part 364, Waste Transporter Permits
Part 370, Hazardous Waste Management
Part 371, Identification and Listing of Hazardous Wastes
Part 372, Hazardous Waste Manifest System and Related Standards for Generators, Transporters, and Facilities
Part 373, Treatment, Storage, and Disposal Facilities
Parts 595-597, New York Rules of Releases, Registration, and Listing of Hazardous Substances

Title 6, Chapter X, New York State Pollutant Discharge of Water Resources Elimination System

New York State Department of Environmental Conservation 6 NYCRR Subparts 371-376.

Code of Federal Regulations (CFR)

29 CFR 1926, Occupational Safety and Health Regulations for the Construction Industry
29 CFR 1926.28 Personal Protective Equipment
29 CFR 1926.33 Access to Employees Exposure and Medical Records
29 CFR 1926.51, Sanitation
29 CFR 1926.55, Gases, Vapors, Fumes, Dusts, and Mists
29 CFR 1926.59 Hazard Communication
29 CFR 1926.62 Lead Exposure in Construction; Interim Final Rule Vol. 58, No. 84
29 CFR 1926.103 Respiratory Protection
29 CFR 1910.134 Respiratory Protection
29 CFR 1910.132 General Requirements for Personal Protective Equipment
29 CFR 1910.133 Eye and Face Protection

40 CFR 50, National Primary and Secondary Ambient Air Quality Standards
40 CFR 58, Ambient Air Quality Surveillance
40 CFR 60, App A, Method 9, Visual Determination of the Opacity of Emissions from Stationary Sources
40 CFR 60, App. A, Method 22, Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Fires
40 CFR 61, Subpart A General Provisions (Hazardous Air Pollutants Listing)
40 CFR 61,152 Standard for Waste Manufacturing, Demolition, Renovation, Spraying and Fabricating Operations.
40 CFR 241 Guidelines for the Land Disposal of Solid Wastes
40 CFR 257 Criteria for Classification of Solid Waste
40 CFR 261 Identification and Listing of Hazardous Wastes
40 CFR 261, Appendix II EPA, Toxicity Characteristic Leaching Procedure
40 CFR 262 Standards Applicable to Generators of Hazardous Waste
40 CFR 263 Standards Applicable to Transporters of Hazardous Waste
40 CFR 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities
40 CFR 265 Interim Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities
40 CFR 265, Subpart C, Preparedness and Prevention
40 CFR 265, Subpart D, Contingency Plan and Emergency Procedures
40 CFR 265.16 Personnel Training
40 CFR 268 Land Disposal Restrictions
40 CFR 302, Designation, Reportable Quantities and Notification
40 CFR 355, Emergency Planning and Notification
40 CFR 71-179, Transportation of Hazardous Materials Regulations

c. Testing Methodologies

1) Below is a partial list of test methods that may be used for verifying compliance to the specifications and/or manufacturer's technical data sheets. Other test methods not listed below may be required at Metro-North Railroad's discretion.

Federal Test Method Standard No. 141 "Paint, Varnish Lacquer and Related Materials: Sampling and Testing"

Federal Test Method 141	4091 Coarse particles and skins in oil base paints & pastes
Federal Test Method 141	6252 Self lifting test
Federal Test Method 141	4053 Non-volatile vehicle

American Society for Testing and Materials (ASTM)

ASTM-D-3925	Sampling for inspection
ASTM-D-1210	Fineness of grind

ASTM-D-2244	Color
ASTM-D-1640	Drying time
ASTM-D-523	Gloss
ASTM-D-563	Phthalic anhydride content in Resins
ASTM-D-2698	Pigment content
ASTM-D-2369	Solids by weight
ASTM-D-2697	Solids by volume
ASTM-D-4400	Sag resistance (mils)
ASTM-D-1849	Skinning
ASTM-D-562	Viscosity
ASTM-D-1475	Weight per gallon
ASTM-D-2369	VOC Content
ASTM-D-1400	Standard Test Method for Non-Destructive Measurement of Dry Film Thickness of Non-Conductive Coatings Applied to a Non-ferrous Metal Base
ASTM-D-3359	Standard Test Methods for Measuring Adhesion by Tape Test
ASTM-D-4138	Standard Test Method for Measurement of Dry Paint Thickness of Protective Coating Systems by Destructive Means
ASTM-D-4285	Standard Test Method for Indicating Oil or Water in Compressed Air
ASTM-D-4414	Standard Practice for Measurement of Wet Film Thickness by Notch Gages
ASTM-D-4417	Standard Test Methods for field Measurement of Surface Profile of Blast Cleaned Steel
ASTM-D-4541	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM-D-4752	Standard Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub

EPA Methods

EP/600/R-94/038b, Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Specific Methods, Section 2.8 (Lead) and 2.11 (PM-10).
SW 846 Test Methods for Evaluating Solid Waste – Physical/Chemical Methods
Method 3050, Acid Digestion of Sediment, Sludge, and Soils
Method 1311 Toxicity Characteristic Leaching Procedure (TCLP)

National Institute for Occupational Health and Safety (NIOSH)

NIOSH Manual of Analytical Methods
NIOSH Method 7082, Lead

Other

American Industrial Hygiene Association (AIHA)

Environmental Lead Proficiency Analytical Testing Program (ELPAT)
Proficiency Analytical Testing Program (PAT)

American National Standards Institute (ANSI) Publications

Z88.2-1980	Practices for Respiratory Protection
Z87.1	Eye Protection

Society for Protective Coatings (SSPC)

SSPC Painting Manual-Good Painting Practice-Volume 1
SSPC Painting Manual-Systems and Specifications-Volume 2 (Eighth Edition)
SSPC-PA 2 Measurement of Dry Film Thickness with Magnetic Gages

SECTION 02 83 00

LEAD-CONTAINING MATERIALS SPECIFICATIONS

SSPC-VIS 1 Visual Standard for Abrasive Blast Cleaned Steel
SSPC-VIS 3 Visual Standard for Hand and Power Tool Cleaned Steel
SSPC Guide 6 Guide for Containing Debris Generated During Paint Removal Operations (revised 12/01/1997)
SSPC Guide 7 Guide for the Disposal of Lead-Contaminated Surface Preparation Debris

Industrial Lead Paint Removal Handbook, 2nd Edition, Volume I (SSPC 93-02)
Project Design, Industrial Lead Paint Removal Handbook, Volume II (SSPC 94-18)
Industrial Lead Paint Abatement: Practical Techniques for Complying With Regulations (SSPC 94-02)

End of Part 1

PART 2 – PRODUCTS

2.01 Equipment Specific to Lead Abatement/Surface Preparation

A. All power tools shall be equipped with commercially available HEPA filtered local exhaust ventilation. Power tools equipped with dust collection shall be attached to HEPA filter equipped vacuums capable of providing the vacuum and airflow recommended by the tool manufacturer.

B. The Contractor shall deliver equipment to the project site in clean, working condition.

C. Equipment having HEPA filters shall be delivered to the work site with new primary and secondary filters installed prior. Removal and replacement of use filter elements after arrival to the project site is prohibited.

D. All ventilation and vacuum equipment having HEPA filtration shall be delivered to the job site with new filter media. Filtration media may be replaced on site during the course of the project, as required to maintain proper functioning of equipment and adequate filtration of exhaust air. On-site filter replacement shall be conducted within containment enclosures having operating engineering controls in place to control airborne particulate.

E. Prior to removal from the work site, the Contractor shall clean all equipment, unused materials, and other non-disposable items to be removed from the work site. Cleaning shall be accomplished via HEPA vacuuming and wet cleaning.

F. Vacuum equipment shall be equipped with HEPA filtration. Vacuum equipment shall be sized and suited to the specific type of planned usage.

G. Collection / filter bags shall be removed from all HEPA vacuums utilized on the project prior to removal from the project site. Gross debris remaining in HEPA vacuum canisters or collection tanks shall be removed via another HEPA vacuum.

H. As applicable, air filtration devices (AFDs) equipped with HEPA filters shall be provided.

I. Unless otherwise directed, used filter elements shall be disposed of as hazardous waste.

J. Prior to removal from the contained work area or project site, the inlets and outlets of dust collectors, ventilation ducts, HEPA vacuums, air filtration devices, and other contaminated equipment shall be sealed to prevent the escape of any debris remaining within the equipment.

End of Part 2

PART 3 – EXECUTION

3.01 Lead Health & Safety

A. Airborne Dust & Particulate Control

1) The Contractor shall implement engineering controls to minimize the generation of airborne particulate.

2) Dust control measures may include wetting of surfaces, the use of HEPA filter equipped mechanical ventilation, or other methods approved by Metro-North Railroad.

3) In accordance with 29 CFR 1926.62 paragraph (e), the Contractor shall implement work practices and engineering controls to reduce employee exposure to lead particulate as the primary means of protecting employees from exposure to lead particulate.

4) The Contractor shall immediately cease work should equipment crucial to maintaining employee health and safety become defective or not be functioning properly.

5) The following work practices/methods are prohibited:

i. Dry sweeping / broom use
ii. Un-contained, open abrasive blasting,
iii. Un-contained use of compressed air to blow down or remove dust from surfaces,
iv. Use of power tools not equipped with HEPA filter equipped local exhaust ventilation.
v. Use of heat guns or open flame to remove coatings.

B. Health & Safety Requirements

1) Competent Person

i. The Contractor shall provide a competent person responsible to perform the duties required by 29 CFR 1926.62. The competent person shall be present on site during all lead related activities. The designated competent person shall be responsible for examination and evaluation of equipment utilized to minimize worker exposure, employee work practices, and personal protective equipment. Other responsibilities shall include, but are not limited to:

1. Maintain a permanently bound daily entry job log, signed by all individuals who enter and leave the site. The log shall record the Contractor, the specific work area, name and signature of the person, Metro-North Railroad's contract number and the type of respiratory protection utilized by the worker. The daily entry logbook shall be available for inspection by Metro-North Railroad throughout the project.

2. Maintaining a project inspection log recording daily events, work progress and unusual events during the course of the work. This log shall remain on-site and be made available to Metro-North Railroad upon request.

ii. The competent person shall have successfully completed the Society for Protective Coatings (SSPC) C-3 Supervisor/Competent Person Training For De-leading of Industrial Structures.

2) Certified Industrial Hygienist

i. The Contractor shall retain the services of a Certified Industrial Hygienist (CIH) holding current certification by the American Board of Industrial Hygiene (ABIH) with at least one (1) year experience on hazardous waste operations. The certified industrial hygienist shall be involved in the preparation of all health and safety related submittals and shall review and approve the Contractor's submittals prior to submission to Metro-North Railroad. The Contractor shall arrange for inspections of the project site by the CIH. At a minimum, site inspections shall be conducted by the CIH during the initial phases of the lead related tasks.

3.02 Work Area Segregation & Preparation

A. Work Area Segregation & Preparation

1) The Contractor shall establish the perimeter boundaries of the work zone. The perimeter of an active work area shall be demarcated by "caution tape" and lead hazard signs consistent with 29 CFR 1926.62 paragraph (m). The work zone shall include the entire area utilized by the Contractor to perform the work. If site conditions allow, an additional exclusion zone extending twenty-five (25) feet from the perimeter of the work zone shall be established. The exclusion zone shall be demarcated by "caution tape" and lead hazard signs consistent with 29 CFR 1926.62 paragraph (m).

2) Lead hazard signs consistent with 29 CFR 1926.62 paragraph (m) shall be posted in accordance with OSHA requirements and at all points of entry to the work zone(s), containment(s), and the decontamination facility. Signs utilized outdoors and exposed to the weather elements shall be weatherproof or otherwise protected from damage and fading. The Contractor shall maintain or replace signs as needed to maintain effectiveness throughout the work.

3) The Contractor shall install temporary fencing enclosing the work zone, or exclusion zone, preventing access of unauthorized personnel. The Contractor shall maintain the fencing as needed to maintain its integrity throughout the work.

4) Access to the work area shall be restricted to Metro-North Railroad, the Contractor, Contract personnel, and other authorized personnel who have donned the appropriate personal protective equipment, have received the appropriate training in respiratory protection and lead exposure hazards, and are familiar with the decontamination procedures specified herein.

5) The Contractor shall request approval from Metro-North Railroad for any person not directly involved in the project, to enter the work area. Only upon Metro-North Railroad's approval shall such persons be allowed to enter the work zone.

B. Requirements For The Establishment of Exclusion Zones

1) The Contractor shall establish regulated areas, or exclusion zones, around areas or activities which may produce airborne emissions of lead in excess of the applicable Action Level.

2) Based upon observations and/or air monitoring conducted by the Environmental Monitor, Metro-North Railroad may require the Contractor to expand the exclusion zones beyond initial boundaries.

3) The Contractor shall provide the Environmental Monitor with a list of workers daily to ensure that all workers who enter the regulated area have had the proper training, blood analysis and medical examinations, and are wearing the required protective clothing and equipment.

4) The Contractor shall prohibit eating, drinking, smoking, and chewing tobacco products in any area where the exposures exceed the Action Level.

C. Signs

1) The Contractor shall post caution signs around the regulated area. Signs must be posted to adequately inform employees of the potential exposure to lead and the need for personal protective equipment. Signs are to be clearly visible during all hours, cleaned as necessary, and positioned as to be easily visible from all routinely used approaches to the lead work area. Signs shall be in compliance with the requirements of 29 CFR 1926.62.

2) The Contractor shall use signs that are a minimum of 8 1/2 inches by 11 inches in size with black block lettering on a white, yellow, or orange background. Signs shall display the following message:

WARNING
LEAD WORK AREA
POISON
NO EATING OR SMOKING

3.03 Specific Lead Abatement Methodologies & Procedures

A. Available Lead Abatement Methodologies

1) The Contractor shall employ one or a combination of lead abatement methods to satisfy Metro-North Railroad‘s requirements depending on the project specific scope of work. Metro-North Railroad reserves the right to accept or reject specific lead abatement methodologies based upon the health and safety, and environmental risks posed to employees performing the work, adjacent occupants, communities, and the public, the Contractor’s experience with performing a specific method, the potential quantities and types of waste resulting from the method, the noise, fumes, and/or odors associated with the specific method, and any other concerns.

2) The following are the currently available and accepted methods of abating lead painted surfaces:

a. Removal of paint from components or building materials:

i. Paint removal shall be known as the complete removal of all visible paint from the substrate. Paint removal may be accomplished utilizing one or a combination of available methods, such as, chemical stripping, power tool cleaning utilizing mechanical surface preparation tools equipped with HEPA filtered local exhaust ventilation, contained abrasive blast cleaning, wet abrasive blast cleaning, or other suitable means submitted by the Contractor and approved for use by Metro-North Railroad.

b. Removal and replacement of components or building materials having lead containing paints, in their entirety:

i. Removal and replacement of lead painted components or building materials shall include the removal of lead based painted components or building materials in their entirety and replacement with similar non-lead based painted components of equal or greater quality. Metro-North Railroad reserves the right to accept or reject replacement materials based upon comparative quality and durability, aesthetic nature and physical attributes, form and function, and the overall suitability of the product for its intended use.

c. Encapsulation of lead based painted surfaces:

i. Encapsulation of lead based painted components or building materials shall include the covering of a lead based painted surface with a coating product, which is applied in a liquid state and then cures to provide a protective film over the underlying lead based painted surface.

d. Enclosure of lead based painted surfaces:

i. Enclosure of lead based painted components or building materials shall include the covering of a lead based painted surface with a rigid building material creating a physical barrier between the underlying lead based painted surface and the area in which the component is located. Enclosure typically involves encasement of a lead based painted surface with gypsum board, paneling, metal sheeting, etc.

B. Surface Preparation & Paint Removal

1) The Contractor may utilize a combination of surface preparation methods described in this specification or otherwise approved by Metro-North Railroad.

2) The Contractor shall not perform any work which requires the disturbance of a lead containing material without the prior authorization of Metro-North Railroad.

3) The Contractor shall perform a demonstration of the cleaning method for Metro-North Railroad to demonstrate the effectiveness of the proposed method of surface preparation.

4) Prior to torch cutting, open flame burning, rivet/bolt busting, or other impact or abrasive related work which may cause lead particulate releases, all visible paint within six (6) inches of the area of disturbance shall be removed, as technologically feasible.

5) All paint chips, paint removal material, and any other debris generated in the cleaning process shall be contained, captured, collected and disposed of in accordance with the provisions set forth in this specification.

C. Abatement of Lead - Containing Paint – Interior Locations

1) Prior to the start of work, all movable objects shall be removed from the work area. All movable objects remaining within the work area at the start of the project shall be considered contaminated unless otherwise determined by Metro-North Railroad. Prior to removal from the work area, and at the direction of Metro-North Railroad, potentially contaminated movable objects shall either be cleaned via approved methods outlined in this specification or methods proposed by the Contractor and approved by Metro-North Railroad or discarded. Upon completion of cleaning, movable objects shall be removed from the work area, and stored in non-contaminated areas outside of the boundaries of the work area. Objects remaining in the work area shall be isolated from the remainder of the work area. At the direction of Metro-North Railroad, the Contractor shall construct a rigid, sealed, enclosure surrounding the items as necessary to protect items from damage during the work.

2) Interior lead-containing paint abatement, including demolition and surface preparation of lead based painted surfaces, shall be contained. Containment for interior lead abatement will require the installation of critical barriers. At a minimum, containment barriers shall be constructed of two (2) layers of six (6) mil poly sheeting. Reinforced poly shall be used to protect floor surfaces.

3) Containment shall prevent the migration of particulate to areas or locations outside the work area. Should an entire area, room, etc. be the work area, containment barriers may be limited to doors, windows, ducts, registers, grilles, or other penetrations to the work area. Critical barriers shall be installed as necessary to isolate components not included in the scope of work.

4) The entry to the work area shall be equipped with an airlock entryway. The airlock entryway shall have a minimum of four (4) feet between airlock flap doors and shall have dimensions large enough to allow for the passage of all movable objects to be removed from the work area, and all materials, tools, equipment necessary to complete the work. The airlock shall be cleaned regularly and walk-off mats shall be installed in the airlock to prevent tracking of dust outside of the work area.

5) In the event the space contains heating, ventilation and air conditioning (HVAC) equipment, the following procedures shall be followed.

   a. If the HVAC system supplies only the active work area and no other areas adjacent to the work area, the HVAC system shall be blanked at the system's entrance to the work area.

   b. If HVAC equipment runs through the work area supplying occupied areas adjacent to, but outside of the boundaries of the work area, the HVAC system shall remain in operation but be completely sealed.

   c. Supply diffusers and return grilles, shall be cleaned and sealed. All seams in the ducting systems shall be cleaned and sealed. The exterior of the ducts running through the work area shall be cleaned as part of the final cleaning, prior to project completion.

6) Electrical, mechanical and other non-moveable equipment within the work area shall be framed out with solid, load bearing barriers of 3/8" thickness or greater. Equipment which must remain operational during the work shall be segregated with a solid rigid barrier and isolated from the work area. Equipment shall be ventilated via a flex duct system brought from outside of the work area.

7) Unless otherwise directed, light fixtures shall remain in place and be securely wrapped with a single layer of 6 mil poly.

8) Mechanical ventilation shall be implemented as an engineering control to reduce employee exposures to airborne particulate during the work. A sufficient quantity of HEPA filter equipped air filtration devices shall be installed to provide a minimum of twelve (12) air changes per hour in the active work area during surface preparation, demolition, or other disturbance of lead containing materials. Air filtration devices shall be located as far as possible from the entry/egress to the work area(s), or other locations of make-up air, to create a cross draft through the work area. Air filtration devices shall be exhausted outside of the work area.

9) The Contractor shall implement additional engineering controls and good work practices such as wetting or misting of surfaces and/or localized exhaust ventilation as necessary to minimize the generation of airborne particulate throughout the work.

D. Cleaning Methods & Procedures

1) General

a. Cleaning of surfaces shall be accomplished via HEPA filter equipped vacuums, and wet wiping,. The Contractor shall identify the specific methods proposed for the cleaning of surfaces and the equipment to be utilized.

2) HEPA Vacuuming

a. HEPA vacuuming shall be utilized to remove, recover, and collect debris. Dry brushing, wiping, sweeping, blowing via compressed air, or other methods resulting in the generation of airborne particulate are prohibited. The vacuum equipment shall be properly sized to the specific task being employed. Recovery of spent abrasive blast media shall be conducted utilizing industrial grade vacuum equipment.

b. HEPA vacuum attachments shall be manufactured by, or approved for use by, the HEPA vacuum manufacturer.

c. The Contractor's site supervisor shall be responsible for the proper operation and maintenance of vacuum equipment and shall review the proper use of equipment and attachments with the work force. .

3) Wet Cleaning Procedures

a. Wet wiping of surfaces shall be conducted using detergent approved by Metro-North Railroad prior to use.

b. The surface shall be deemed "clean" when visible surface contamination can no longer be removed from the surface. No visible detergent residue or streaking from contamination shall remain on the surface.

c. Unless otherwise directed, upon completion of wet wiping, all surfaces shall be rinsed with clean water.

d. All wastewater generated during wet wiping shall be handled in accordance with the waste handling section of these specifications.

e. Care shall be taken to avoid excessive accumulation or pooling of water within work areas. Accumulated water shall be extracted via wet/dry HEPA vacuums or absorbed with sponges or towels.

f. The Contractor shall install dehumidification equipment as necessary to lower the moisture content of building materials to acceptable levels prior to coating application.

g. Surfaces shall be allowed to thoroughly dry prior to application of coatings.

4) Cleaning Carpeted Surfaces

a. Carpet specified for removal shall have visible paint debris removed via HEPA vacuuming. Carpet shall be removed after area work area preparation / isolation has been accomplished.

b. Carpet specified to remain shall be HEPA vacuumed utilizing HEPA vacuums designed for carpeted floor surfaces and having a power head with rotating agitator or beater brush. No exceptions to this requirement will be made.

c. Commercial cleaning of carpet may be implemented upon prior approval from Metro-North Railroad.

5) Cleaning Concrete and Other Rough Surfaces

a. Upon approval of Metro-North Railroad, the Contractor may utilize commercially available equipment specifically designed to pressure wash and recover water simultaneously for cleaning concrete or similar rough surfaces.

E. Demolition of Lead-containing Components

1) Prior to demolition of materials coated with lead containing coating, all loose, peeling, non-adhering paint shall be removed from the components specified for demolition. Paint removal shall meet the requirements of an SSPC SP2 Hand Tool Cleaning.

2) The Contractor shall implement engineering controls and good work practices to reduce the generation of airborne lead particulate. Surfaces shall be wetted prior and during surface preparation and demolition. Mechanical ventilation equipped with HEPA filtration shall be utilized to ventilate the work area.

3) Disposal requirements for lead based painted building components shall be determined via laboratory analysis of representative samples of the waste stream via EPA Methods 1311/6010 (TCLP Lead).

F. Demolition / Dismantling of Steel Components Having Lead Containing Paint

1) Steel repair, replacement, reinforcement, or rehabilitation involving the disturbance of coatings shall be conducted as described in this section and in accordance with 29 CFR 1926.62, 29 CFR Subpart J Welding and Cutting, and specifically 1926.353 Ventilation & Protection: Welding, Cutting, and Heating and 1926.354 Welding, Cutting, and Heating in Way of Preservative Coatings.

2) Prior to demolition of coated steel components, all loose, peeling, non-adhering paint shall be removed from the components specified for demolition. Paint removal shall meet the requirements of an SSPC SP2 Hand Tool Cleaning.

3) At a minimum, existing coatings within six (6) inches of each location at which disturbance will occur shall be removed prior to disturbance. “Disturbance” includes: rivet busting, thermal cutting, welding, grinding, or other methods known to result in worker exposure to lead. Use of sheering methods in substitution of “hot methods” is recommended as an alternative method.

4) If the component is double sided and both faces are painted, paint within six (6) inches of each location at which disturbance will occur, shall be removed from both sides of the component.

5) All visible coatings, shall be removed exposing the underlying steel substrate.

G. Thermal Cutting, Torch Cutting, Burning, Welding & Other “Hot” Work

SECTION 02 83 00

LEAD-CONTAINING MATERIALS SPECIFICATIONS

1) Steel repair, replacement, reinforcement, or rehabilitation involving the disturbance of coatings shall be conducted as described in this section and in accordance with 29 CFR 1926.62, 29 CFR Subpart J Welding and Cutting, and specifically 1926.353 Ventilation & Protection: Welding, Cutting, and Heating and 1926.354 Welding, Cutting, and Heating in Way of Preservative Coatings.

2) At a minimum, existing coatings within six (6) inches of each location at which disturbance will occur shall be removed prior to disturbance. "Disturbance" includes: rivet busting, thermal cutting, welding, grinding without HEPA filtered local exhaust ventilation, or other methods known to result in the generation of airborne particulate or suspected to result in worker exposure.

3) If the component is double sided and both faces are painted, paint within six (6) inches of each location at which disturbance will occur, shall be removed from both sides of the component. "Cut lines" require six inches on either side of cut for a total of 12 inches abated at the cut line point.

4) All visible coatings shall be removed exposing the underlying steel substrate.

5) The Contractor may accomplish removal of coatings utilizing one or a combination of the following methods:

   a. Use of sheering methods as an alternative method to reduce exposure to airborne contaminants is recommended.

   b. The use of chemical stripping agents containing methylene chloride is prohibited.

   c. Power tool cleaning with HEPA filtered attachment, resulting in an SSPC SP3/SP11 degree of cleanliness, may be utilized.

   d. Alternative methods submitted by the Contractor and approved by Metro-North Railroad may be utilized.

6) Employees performing "hot work" shall retain current city and state certifications applicable to performance of the work.

7) Upon completion of coating removal via the requirements in this specification, the Contractor shall implement the additional controls specified below.

8) Demolition of steel components via thermal cutting, torch cutting, burning shall be accomplished utilizing "demolition torches" having a three (3) foot lance length or greater.

9) The Contractor shall implement the following combined engineering controls during thermal cutting, torch cutting, burning, welding, & other "hot work".

   a. Local exhaust ventilation equipped with HEPA filtration to locally "capture" metal fume at the point of generation

   b. Mechanical ventilation to disperse metal fume within the employee's work zone.

10) Employees performing thermal cutting, torch cutting, burning, welding, & other "hot work", after lead containing coating removal, shall use personal protective equipment suitable to the specific task to be completed. Personal protective equipment shall include but not be limited to, respiratory protection having an Assigned Protection Factor (APF) of fifty (50) times the Permissible Exposure Limit until personal exposure monitoring data demonstrates otherwise.

Hygiene facilities compliant with 29 CFR 1926.62 shall be provided. Until exposure assessments are completed, complete decontamination facilities equipped with showers shall be provided. At no time shall the respiratory protection for employees performing thermal cutting, torch cutting, burning, welding, & other "hot work", after lead containing coating removal, be downgraded below an Assigned Protection Factor (APF) of ten (10) times the Permissible Exposure Limit.

3.04 Containment

A. Containment General

1) The degree of containment required shall be consistent with the needs of the site-specific work scope. The Contractor shall utilize SSPC Guide 6 in determining containment design requirements. The Contractor is responsible for consulting Metro-North Railroad in determining specific information on the structural limitations of the structure to be worked and the structural requirements for the containment itself. Unless otherwise directed, containments within or adjacent to the rail traffic envelope shall be capable of withstanding a one hundred (100) mile per hour wind loading and a minimum load carrying capacity of two hundred pounds per square foot (200 lbs/ft^2).

B. Containment Components

1) Materials: All containment materials and materials used for sealing of the containment shall be resistant to water, chemicals, and the anticipated exposure/weathering and shall be able to perform as intended when exposed to such elements. Rigid containment materials consist of solid panels of plywood, aluminum, rigid metal, plastic, fiberglass, composites, or similar materials. Flexible materials consist of screens, tarps, drapes, plastic sheeting, or similar materials. Fire resistant materials shall be used for containments, as applicable.

2) Support structure: Rigid support structures may consist of scaffolding and framing to which the containment materials are affixed or similar types of materials and configurations. Flexible support structures will be constructed of cables, chains, or similar systems to which the containment materials are affixed.

3) Joints: Approved joint sealing methods include tape, caulk, Velcro, zippers, clamps, or other similar material capable of forming a continuous, impenetrable seal. The use of overlapping containment materials (1 foot minimum overlap) to achieve fully sealed joints is acceptable only when emissions of dust and debris are adequately controlled.

4) Airlock Entryway: Re-sealable door entryways shall include the use of flexible or rigid doors capable of being repeatedly opened and resealed. Approved sealing methods include zippers, Velcro, clamps, or similar fasteners.

C. Lighting

1) The Contractor shall maintain all warning beacons and other warning lighting on the structure throughout the work .

2) Flexible containment materials shall consist of a light transmissive material which allow natural light into the containment during daytime hours and artificial light during nighttime hours.

3) Lighting within work areas and containments shall meet the requirements of SSPC-Guide 12 *Guide for Illumination of Industrial Painting Projects.* In strict accordance with SSPC

Guide-12, lighting intensity on the steel surface, by natural or artificial means, shall be maintained at a minimum of 200 foot candles, throughout surface preparation, painting, and inspection. The Contractor shall supply a portable light meter to verify compliance with this specification.

4) The Contractor shall provide adequate artificial lighting for all methods of cleaning, paint application, and inspection work. The use of blast nozzle mounted lighting is recommended to supplement general containment lighting. The Contractor shall not solely rely upon blast nozzle mounted lighting for illumination.

5) Exterior lighting shall be sufficient to allow for visible assessment of emissions from all sides of the containment and environmental control equipment. All exterior sides of the containment and filtration equipment shall be sufficiently illuminated to allow for visual assessment of emissions during nighttime hours.

6) Lighting deemed insufficient by Metro-North Railroad or their representatives shall be grounds for work stoppage until remedial action is taken and the work area is sufficiently illuminated.

D. Ventilation

1) Ventilation: Local exhaust ventilation or mechanical ventilation shall be implemented to the degree compatible with the method of surface preparation employed.

a. Local Exhaust Ventilation

i. The Contractor shall provide suitable local exhaust ventilation for use with shrouded power tools and/or during “hot work”. Local exhaust ventilation equipment shall discharge air through a HEPA filter. Local exhaust ventilation equipment shall be adequately sized to accommodate the operation. The hose connecting the ventilation equipment to the tool shall be properly sized and the length maintained to distances allowing for adequate exhaust ventilation at the point of use.

ii. The Contractor shall provide filtration of the exhaust air with a filtration efficiency of 0.3 microns or better, in order to prevent airborne particulate from being exhausted into the surrounding air.

b. Mechanical Ventilation

i. The Contractor shall provide mechanical ventilation of Class 1A containment(s) as necessary to provide adequate ventilation based upon containment size. A minimum average cross draft velocity of 120 feet per minute and/or average downdraft velocity of 70 feet per minute shall be maintained during blasting and cleaning operations.

ii. When mechanical ventilation systems are used, the Contractor shall provide filtration of the exhaust air with a filtration efficiency of 0.5 microns or better.

iii. The Contractor shall verify negative pressure through instrument monitoring to achieve a minimum of 0.03 in. (7.5 mm) water column (W.C.) relative to ambient conditions, or through visual assessments for the concave appearance of the containment enclosure.

iv. Work areas shall be adequately ventilated during use of solvent borne materials in accordance with the MSDS of products utilized. In the event ventilation cannot be maintained as recommended on the MSDS, the Contractor shall provide employees with suitable respiratory protection equipment.

E. Pre-Work Inspection & Construction Verification

1) Containment Construction Certification

a. Upon completion of installation of the containment system and prior to the start of surface preparation activities, the Contractor shall conduct an inspection of the containment system as built and certify that the containment system has been assembled as shown on the approved, signed and sealed engineered drawings. The certification shall be submitted to Metro-North.

b. If the containment is not constructed in accordance with the design drawings, the Contractor's design engineer shall issue supplemental calculations for the new design for review and approval in accordance with the original submittal requirements. After supplemental calculations have been reviewed and approved by Metro-North Railroad, the Contractor shall conduct a new containment inspection and certify that the containment system has been assembled as shown by the supplemental calculations. This certification shall be submitted to Metro-North Railroad.

2) Pre-Surface Preparation Inspection

a. The Contractor shall notify Metro-North Railroad two (2) days in advance of the intended date of completion of erection/installation of the containment system. Upon completion of containment installation, Metro-North Railroad, the Engineer, and the environmental monitor shall conduct a "Pre-Surface Preparation Inspection" verifying containment construction meets the requirements of the specification and is constructed per the approved containment plan. Sealing, ventilation, and illumination, among other design parameters, will be investigated. Should the containment fail to meet the specified requirements, the Contractor shall take all necessary actions to correct discrepancies or deficiencies. Additional "Pre-Surface Preparation Inspections" shall be conducted as necessary until conformance to the specifications and containment plan submittals is achieved.

F. Routine Cleaning & Maintenance

1) Preventative Measures & Daily Routine Cleaning

a. The Contractor shall prevent dust, solvents, paint, paint chips, and debris from being released or spilled into the soil, water, sediment, or storm sewers.

b. The Contractor shall replace worn or damaged materials and/or equipment as necessary or as directed by Metro-North Railroad to maintain the integrity of environmental controls and protection. This shall include replacement of worn or damaged containment tarpaulins as necessary to maintain their effectiveness.

c. The Contractor shall conduct work site clean-up during and after the project, including the removal of pre-existing litter or debris the distance of two times the height of the containment in all directions surrounding the containment.

2) Cleaning & Securing Containment

a. The Contractor shall clean and secure the containment materials and equipment at the following times: the end of each work shift, prior to relocation or moving to another point along the structure, when the containment will be unmanned, and when inclement weather is forecast.

b. Cleaning shall be accomplished via vacuums equipped with HEPA filtration.

c. The Contractor shall clean all loose debris from within the containment and containment materials and equipment to the extent that dust or debris is not dislodged, by physical contact and to prevent emissions during moving of the containment or non-working hours.

d. The Contractor shall clean all containment materials and equipment prior to moving or removing materials and equipment from the site.

e. The Contractor shall thoroughly HEPA vacuum, wet wipe, or otherwise decontaminate reusable items until all loose surface dust and debris have been removed. Items requiring cleaning include, but are not limited to, paint removal and ventilation equipment, containment materials, ground covers, scaffolding, work platforms, fasteners, etc.

f. If adequate cleaning is not possible, the Contractor shall treat the materials as a separate waste stream and containerize for testing and disposal in conformance with this specification.

g. When the containment is unmanned and/or inclement weather is forecast, the Contractor shall shut down operations, perform cleanup as required herein and secure the containment and equipment as a safeguard against winds or inclement weather.

h. The Contractor shall coordinate all containment cleaning and securing activities described herein with Metro-North Railroad.

3) Containment Maintenance During Inclement Weather or Non-Working Hours

a. The Contractor shall assign personnel to inspect and secure the containment, platform, and its components during inclement weather conditions and non-working hours. Non-working hours include all times when the containment is unmanned, including without limitation weekends, holidays and other extended shut down periods.

b. During extended shut down periods the Contractor shall inspect the containment, scaffold, work platform, and other related components at least one (1) time per week for damage and/or defects.

c. At all times, during working and non-working hours, the Contractor shall correct any potentially unsafe condition, including but not limited to repairing any deficiencies and/or defects, securing any torn or loose containment components and removing any excessive loadings to safeguard the structure, surrounding property, and the general public.

G. Final Cleaning & Clearance

1) The Contractor shall undertake a final, thorough inspection and cleanup of the project site and surrounding area within two (2) days of completion of project activities.

2) After all Contractor equipment and materials have been removed, the Contractor shall conduct a visual inspection of the project site, which includes all areas used as staging and equipment yards, storage and decontamination areas, waste storage, and all surrounding areas and surfaces located within two times the height of the structure in all directions. If project debris is observed beyond two times the height of the structure, the limits of the inspection shall be increased, as directed by Metro-North Railroad.

3) The Contractor shall thoroughly inspect the area and surfaces for the presence of visible debris and waste. This includes, but is not limited to, lead dust, spent abrasives or other paint removal media, paint chips, solvents, materials of construction, fuel, and other litter. In the areas and surfaces subject to inspection, the Contractor shall clean up and remove debris and wastes to the satisfaction of Metro-North Railroad even if the debris and waste are a pre-existing condition.

4) Cleaning will include manually removing paint chips, by HEPA vacuuming, and/or wet wiping or washing, as directed by Metro-North Railroad.

5) Clean the surrounding water with the use of approved materials and equipment including but not limited to water booms and/or boats with skimmers, as directed by Metro-North Railroad.

3.05 Environmental Monitoring

A. Clearance Inspections Final Report

1) The Contractor shall prepare a report presenting the results of the inspections conducted to verify the final cleanliness of the project site, surrounding property, waterways, equipment, buildings, and structures within one (1) week of the inspection performed in accordance with this specification.

2) The Contractor shall include a summary of any problems or releases that occurred during the project, and the cleanup and corrective action measures that were taken to resolve the problem.

B. Visible Emissions & Releases

1) The Contractor is required to perform his own assessments of visible emissions in addition to those performed by the environmental monitor.

2) The Contractor shall conduct assessments of visible emissions as required by this specification to account for all locations where emissions of lead dust might be generated, including but not limited to, the containment, dust collection and abrasive recovery equipment, and waste containerizing areas.

3) The Contractor shall conduct observations and corrections of visible emissions on an ongoing basis.

4) In addition to maintaining the required written documentation, the Contractor shall verbally communicate the results to Metro-North Railroad on a daily basis.

5) The Contractor shall immediately cease operations and undertake corrective action to control emissions if there is a failure of mechanical ventilation or inability to maintain continuous negative pressure and/or any emissions regardless of time, duration or opacity.

6) When visible emissions or other releases are observed, in addition to cleaning the debris, the Contractor shall take the initiative to change work practices, modify the containment, or take other appropriate corrective action to prevent similar releases from occurring in the future.

C. Reporting/Documenting Visible Emissions and Releases

1) The Contractor shall report the results of the daily assessments of visible emissions and releases in a report form approved by Metro-North Railroad. At a minimum, the visible emission observation form shall include information such as the Contract number, Contractor's name, work location, date of observations, location and duration of emission, outline of the visible emission criteria, notification to Metro-North Railroad, corrective actions taken, and signature block for the observer.

2) The Contractor shall document all cases where work has been halted due to visible emissions or releases, the resulting cleanup activities performed, the reason or explanation for the emission or release, and the corrective action taken to avoid a reoccurrence. The written report shall be provided to Metro-North Railroad within forty-eight (48) hours of the occurrence.

3) The Contractor shall summarize the individual reports and the corrective action taken and provide the combined information to the environmental monitor and Metro-North Railroad each month. The Contractor shall cooperate with the environmental monitor in the preparation of any reports for Metro-North Railroad.

D. General

1) Metro-North Railroad has contracted the services of a third party environmental monitor to conduct assessments of emissions and releases into the environment including air, soil and water.

2) The Contractor shall comply with the requirements for assessment of visible emissions, releases, and ambient air monitoring throughout the work.

3) The Contractor shall coordinate all monitoring activities with the environmental monitor, and cooperate with the assessments and results of the testing and inspection performed by the environmental monitor.

4) The Contractor shall comply with any directions given by the Engineer or the environmental monitor, including shut down of operations when emissions or releases violate the requirements of this specification. The Contractor shall undertake all necessary corrective action to control emissions and clean up the area.

3.06 Waste Handling

A. Submittals

1) Waste Management Plan

a. The Contractor shall provide a written Waste Management Plan. The Waste Management Plan shall address the proper collection, handling, storage, and disposal of all waste. The Waste Management Plan required under this specification is for the protection of workers, the public and the environment. The

requirements of the Waste Management Plan are outlined in the Submittals section of this specification.

2) Close-Out Submittals

a. The Contractor shall provide copies of all documentation pertaining to the disposal of all hazardous and non-hazardous waste generated during the work, including but not limited to, a written log of the type and quantity of waste that was generated and removed from the project site, executed waste manifests/waste shipment records (if applicable), bills of lading, waste shipment records.

B. Waste Handling Requirements

1) General

b. The Contractor is responsible for all labor, materials, equipment, services, and costs associated with the proper and compliant collection, handling, separation, containerization, and storage of solid, liquid, hazardous, non-hazardous, industrial, and municipal wastes generated throughout the course of the work in accordance with all applicable Federal, State and Local laws, codes, rules and regulations. Waste handling shall be conducted in accordance with 40 CFR Part 261, Part 262, and Part 268, and applicable state and local regulations.

c. Unless otherwise directed, Metro-North Railroad shall be responsible for the lawful transportation and disposal of all hazardous and non-hazardous industrial wastes. The Contractor is responsible for the disposal of all non-hazardous, non-industrial, and municipal waste streams.

d. The Contractor is solely responsible for obtaining any and all permits, certificates, variances, etc. required for onsite waste storage.

e. The Contractor shall arrange for the transportation and disposal of all waste with Metro-North Railroad and Metro-North Railroad's representatives as specified in this specification.

f. Under no circumstances shall wastes or contaminated debris be allowed to remain in the work area upon conclusion of the work shift. At a minimum, the Contractor shall collect and store the waste at the end of each working day in USDOT-approved storage drums or containers such that no waste is left exposed overnight.

g. When cleaning paint chips and dust, the Contractor shall use vacuuming equipment equipped with HEPA filters, or other means that will effectively remove the dust and debris without re-dispersing lead laden particulate into the air.

h. The Contractor shall recover all waste products generated during the work, including but not limited to containment materials, rags, tapes, sealants, disposable personal protective equipment, filters, paint debris, paint cans, wastewater, etc. The contractor shall provide containers for the collection, storage and disposal of all waste. Containers shall mean drums, bags or other required containers.

i. The Contractor shall train all personnel in the proper handling of hazardous waste in accordance with 40 CFR 265.16 and 6 NYCRR 373. Include procedures in the Waste Management Plan that will be followed in the event of a release or spill,

including required notifications and methods to be used for cleanup. Maintain all training records on-site.

j. The use of additives to render the waste non-hazardous is prohibited.

k. All wastes generated by the Contractor during the work are the property of Metro-North Railroad. Metro-North Railroad shall be known and listed as the primary generator of regulated wastes. The Contractor shall be known as the co-generator of regulated wastes for this project. The Contractor as co-generator is legally and contractually responsible for the proper collection, handling, and storage of waste.

l. The Contractor shall not discharge any waste, potentially contaminated material, or hazardous or regulated material, solid or liquid, into the natural environment. At no time shall the Contractor discharge any liquid effluent, including wastewater, “gray water”, sewage, solvent borne materials, fuels, etc. into the natural environment.

m. Wastewater containing contaminants unable to be properly handled and treated by the wastewater treatment facility shall not be discharged into the sanitary sewer system.

n. Liquid wastes not acceptable to the sanitary sewer system shall be containerized and disposed of in accordance with applicable regulations.

o. If soil remediation is required as a result of the Contractor’s activities, the Contractor shall place the soil into separate containers, and assume all costs for its testing, storage and disposal.

p. Improper handling and storage of waste may result in the immediate shut down of the project until appropriate corrective action is completed.

2) Separation of Waste Streams

a. In an effort to minimize the quantity of hazardous wastes generated in compliance with EPA and RCRA requirements, the Contractor shall separate wastes into differing waste streams based upon their general type and composition. Wastes shall be separated into the following waste streams:

i. General construction debris and other non-contaminated debris (such as cardboard boxes from materials and supplies brought to the site, containers, empty cans, etc.

ii. Paint debris, paint chips, paint dust, respirator cartridges, filters from air filtration devices and HEPA vacuums

iii. Painted demolition debris

iv. Disposable personal protective equipment

v. Containment sheeting and materials

vi. Cleaning devices

vii. Liquid paint residues

viii. Solvents and/or paint thinners

ix. Painted scrap steel components

x. Painted demolition debris

xi. Filtered wastewater

xii. Any other potentially hazardous or regulated wastes generated during the work shall be segregated into separate waste streams, containerized separately in approved storage containers, and properly stored in approved locations.

3) Characterization & Classification of Wastes

a. Historically, based upon the sampling and testing of wastes generated on previous paint removal projects, lead paint wastes are characterized as hazardous based upon lead toxicity. However; the Contractor shall not assume any potentially contaminated waste, with the exception of paint debris, paint chips, paint dust, respirator cartridges, filters from air filtration devices and HEPA vacuums, is hazardous. Testing of each potentially contaminated waste stream shall be conducted by the environmental monitor to satisfy the requirements of the law, as well as that of the transporter and the disposal facility. Testing shall be conducted in accordance with 40 CFR 261, Appendix II, Method 1311 Toxicity Characteristic Leaching Procedure (TCLP).

b. Metro-North Railroad is responsible for all costs associated with laboratory analysis for the characterization of wastes.

c. The Environmental Monitor shall conduct sampling of the various waste streams and report the laboratory results to the Contractor. The Environmental Monitor is responsible for the collection of representative samples of each of the potentially contaminated waste streams and submission of such to an accredited laboratory for analysis via the EPA Toxicity Characteristic Leaching Procedure in order to confirm the classification of the waste as hazardous and non-hazardous. Upon receipt of Toxicity Characteristic Leaching Procedure data, arrangements for the disposal of wastes in accordance with the results of the testing shall be made with Metro-North Railroad or Metro-North Railroad's representative. If the nature of the waste stream initially tested remains constant additional classification is not required for subsequent shipments unless otherwise directed by Metro-North Railroad or Metro-North Railroad's representative, or required by federal, state or local laws, codes or regulations, or the waste recycling or disposal facility. Should the nature of a waste stream change after the initial testing, additional representative samples shall be collected and analyzed to re-characterize the waste stream.

d. The Contractor is hereby notified that hazardous substances other than heavy metals may be present in the waste, characterizing it as Hazardous Waste as defined in 40 CFR 261

e. Solvents designated for disposal shall be characterized as hazardous waste because their ignitable and toxic properties. Solvents that will be used for a purpose other than disposal shall not be classified as waste, and shall be handled in accordance with the Contractor's approved solvent handling plan. The Contractor shall provide written documentation of the tracking of these solvents

while on site and during transportation, including proof of receipt at the final destination.

f. Chemical paint strippers typically contain solvents and/or highly alkaline materials. Waste containing chemical paint strippers shall be characterized appropriately based upon their constituents.

4) Containerization

a. Containerization and packaging of wastes shall be conducted in accordance with 49 CFR Part 172, Part 173, and Part 178 and other applicable sections of the Department of Transportation (DOT) regulations.

b. The Contractor shall maintain an adequate supply of clear plastic bags for the containerization of lead contaminated debris. The waste bags for lead debris shall be clear, polyethylene plastic, having a six (6) mil thickness or greater. Black or opaque bags are prohibited from use, unless specified by Metro-North Railroad. Pre-printed asbestos waste bags are prohibited from use for containerization of lead debris.

c. All potentially hazardous wastes shall be deposited and sealed in appropriate containers or roll off containers concurrent with waste generation.

d. Separate waste streams shall be containerized separately.

e. The Contractor shall cover all containers immediately upon filling and confirm that all lids are attached except when filling and that all required labels are affixed and remain intact and legible. Waste containers shall be properly and securely fastened and sealed upon being filled to capacity.

f. Two (2) methods of waste containerization and transportation are acceptable to Metro-North Railroad; 1) bulk disposal via roll-off style waste containers or 2) drum disposal, utilizing 1A1 or 1A2 approved containers. The Contractor may utilize a combination of such containerization and transportation methods.

g. The Contractor shall supply waste containers meeting the requirements of the Department of Transportation 1A1/1A2 designation, or other containers approved by Metro-North Railroad for the disposal of lead contaminated debris. Waste containers shall comply with the requirements of 40 CFR 262.30-262.32 and 49 CFR Part 172 and Subpart F. 1A1 or 1A2 approved drums shall be new or reconditioned and suitable for the containerization and disposal of hazardous lead waste. Use containers that are resistant to rust and corrosion (painted, if constructed of steel), that have tight fitting lids or covers, and which are water resistant and leak proof.

h. The Contractor shall maintain all containers in good operating condition with all lids and closing mechanisms intact and operational to prevent the escape of debris, spilling of the contents, or access by unauthorized personnel and observe all labeling requirements.

i. The Contractor shall inspect the drums or containers for corrosion, legible labels, proper covers, ground protection, and leaks on a weekly basis and record the results of all the inspections in a log book.

j. Drums for liquid wastes shall have permanently sealed lids with bung openings.

k. Drums for solid wastes shall have removable lids with the appropriate fitting bolted clasps. Spring lever clasps shall not be utilized.

l. Roll off containers shall be lined with bladders provided by the waste transporter or polyethylene sheeting having a nominal thickness of six (6) mils.

m. No container shall be filled to a capacity exceeding the maximum dry volume capacity marked on the container. No container shall be filled to a capacity that will result in a payload weight exceeding the transportation vehicle's safe operating parameters or Department of Transportation (DOT) regulations pertaining to gross vehicle weight. If overfilled containers cause delays during pick-up, remediate the situation at no additional cost to Metro-North Railroad.

n. The Contractor shall provide all containers for non-hazardous waste, including filtered wastewater. Use containers that are free of loose debris when brought on-site. Wastewater shall be containerized in USDOT approved polyethylene drums having sealed lids with bung openings.

o. The Contractor shall provide all containers for liquid paint residues and spent solvents, whether the liquid paint residue or solvent is designated for reuse, or for disposal as a hazardous waste. Liquid paint residues and solvents shall be containerized in USDOT approved steel drums having sealed lids with bung openings. Spent solvents and liquid paint residues shall not be mixed with spent abrasives, paint debris, water, or other waste.

5) Labeling & Identification

a. The Contractor shall immediately label all containers of hazardous waste in accordance with 40 CFR 262, and 49 CFR 171-179 and 6 NYCRR 372. All waste containers shall be properly labeled. Under no circumstances shall containerized debris be stored without proper labeling.

b. All materials shall be labeled and shall conform and comply with the Contractor's Hazardous Communication Program as per 29 CFR 1910.1200 and 1926.059 as well as all applicable state "Right To Know" legislation.

c. The accumulation start date on each container shall be the start date of hazardous waste accumulation. the environmental monitor shall enter it using permanent marking material.

d. A label describing the contents of each container shall be affixed to the outside of the container.

e. Unless otherwise directed, all labeling, marking, and placards shall be the responsibility of the Contractor and shall be done under the supervision of Metro-North Railroad, the Engineer, and the environmental monitor. This work shall be completed to Metro-North Railroad's, The Engineer's, and the environmental monitor's satisfaction prior to the filling or transportation of any particular container.

f. All label markings shall be permanent, printed in English, displayed on a background of contrasting color unobscured by other labels, or attachments. Labeling shall be located away from other markings that could substantially reduce its effectiveness.

g. The contracted waste transporter shall provide all required labels.

h. Upon receipt of results of characterization analyses (TCLP), labels shall be changed to reflect the characterization of the waste. If characterized as hazardous waste, complete the absent information upon receipt of the testing results. Include the following minimum information on the labels:

   i. "Hazardous Waste. Federal law prohibits improper disposal. If found, contact the nearest police, or public safety authority, or the US Environmental Protection Agency."

   ii. Proper DOT Shipping Name (e.g., RQ Hazardous Waste Solid, N.O.S. 9, NA 3077, PG III)

   iii. Manifest Document No (when manifest is prepared; prior to shipping)

   iv. Generator Name, Address, EPA ID Number, and Contract Number.

   v. Date of Accumulation (First day waste placed into container)

   vi. EPA Waste Number

i. The Contractor shall enter the above information using permanent marking material, printed in English, and displayed on a background of contrasting color unobscured by other labels or attachments. Locate labeling away from other markings that could substantially reduce its effectiveness.

j. The Contractor shall complete the labeling, marking, and placarding activities under the observation of Metro-North Railroad or their designee, prior to storing or transporting any container or roll-off.

6) Storage

a. The Contractor shall maintain a secure temporary waste storage/holding area on site as required by the work. The waste storage area shall be a securable, lockable enclosure segregated from access by unauthorized personnel. The Contractor shall determine a suitable location for temporary on site storage of wastes generated throughout the project. The Contractor shall submit the proposed waste storage location to Metro-North Railroad for approval. Waste shall be stored only in areas approved by Metro-North Railroad. The design and location of the waste storage area shall be submitted by the Contractor in the waste management plan.

b. The Contractor shall store non-hazardous waste separately from hazardous waste. Hazardous and non-hazardous waste shall not be mixed and stored together unless approved in advance in writing by Metro-North Railroad.

c. The Contractor shall locate all hazardous waste containers on protected ground (e.g., covered with impermeable tarps) and in a secure area with signs around the perimeter. The Contractor shall adequately shield and/or protect the surrounding area when transferring and/or conveying hazardous waste from one container to another to prevent any dispersion. The storage location(s) must be approved by Metro-North Railroad in advance.

d. Containers shall be elevated from ground surfaces via pallets or other approved means.

e. Arrange containers in the storage area for easy accessibility. Stage the containers together in lots no greater than two rows of five containers each. Maintain a minimum lane clearance of thirty-six (36) inches between each lot of ten containers.

7) Transportation & Disposal

a. Unless otherwise specified in the Contract Documents, transportation and disposal of wastes shall be conducted under separate contract by Metro-North Railroad.

b. Unless otherwise specified in the Contract Documents, Metro-North Railroad shall be responsible for the transportation and disposal of hazardous wastes. Transportation and disposal of hazardous wastes is excluded from the Contractor's scope of work.

c. Unless otherwise specified in the Contract Documents, under no circumstances shall the Contractor remove or transport potentially hazardous wastes from the project site without the prior approval and permission of Metro-North Railroad.

d. The Contractor shall be responsible for coordinating the transportation of hazardous wastes with Metro-North Railroad and Metro-North Railroad's representatives responsible for arranging for the transportation of hazardous wastes.

e. When the transporter arrives to load the waste, the on-site representative may be required to sign the manifest "As Agent For Metro-North Railroad" with their signature. The "Generator" copies of waste manifests, bills of lading, etc. shall be retained and submitted to the Metro-North Railroad Department of Environmental Compliance & Services within three (3) business days.

8) Non-Hazardous Wastes & General Refuse

a. The Contractor shall properly transport, and dispose of all non-hazardous, non-industrial waste and general refuse. The Contractor shall make provisions for the removal of all non-regulated, general garbage generated as a result of his work. The Contractor shall provide their own trash dumpster(s) for the removal of all non-regulated debris and shall not use Metro-North Railroad's containers without the prior approval of Metro-North Railroad. The Contractor shall not site any roll-off containers / dumpsters on Metro-North Railroad's property without the prior approval of Metro-North Railroad.

b. The Contractor shall comply with NYC Department of Sanitation regulations as applicable.

c. The Contractor shall provide a suitable rubbish container device, properly maintained and serviced, replaced as required and protected from access by the public by fencing as approved by Metro-North Railroad.

d. The Contractor shall provide daily trash collection and cleanup of the project area and shall dispose of all discarded debris, and the like in a manner approved by Metro-North Railroad.

e. Contractor shall sweep up and gather together daily all his own rubbish and place same in containers. Wood crates and similar matter shall be broken up, securely

tied into bundles and stacked alongside rubbish containers or in locations as approved by Metro-North Railroad.

f. The Contractor shall provide Metro-North Railroad with bills of lading for all non-hazardous wastes removed from the project site.

9) Special Requirements for Recycled Steel Abrasives

a. When recycled steel abrasives are used, the Contractor shall collect, handle, store, transport, and dispose of the steel abrasive/paint waste as hazardous waste, regardless of the results of the characterization analyses.

10) Special Requirements for Recycling Scrap Steel Coated With Lead Containing Paint

a. Scrap steel coated with lead containing paint shall not be classified as hazardous waste if the steel is sent to a recycling facility approved by Metro-North Railroad. If the lead based painted steel is not recycled, the material shall classified as hazardous or non-hazardous based upon TCLP analysis of the paint itself.

b. The Contractor shall make arrangements with a scrap metal dealer for the removal and recycling of scrap steel coated with lead containing paint. The Contractor may utilize a scrap dealer under contract with Metro-North Railroad, or may utilize other dealers approved by Metro-North Railroad. If the scrap steel is not recycled, the Contractor shall dispose of such in the same manner as other solid wastes containing lead.

c. The Contractor shall utilize lined roll-off containers for the on-site accumulation and storage of all demolished scrap steel coated with lead containing paint.

d. The Contractor shall provide the scrap metal dealer with a written notification that the steel to be received is coated with lead containing paint. A copy of the written notification shall be provided to Metro-North Railroad or his designee prior to shipping the steel. (See example at end of this section)

e. The Contractor shall provide Metro-North Railroad with written confirmation from the scrap dealer, at the time it is received, stating that the coated steel will be recycled and will be properly destroyed within sixty (60) days of removal from the site.

11) Wastewater Handling & Disposal

a. The Contractor shall provide containers for the collection and retention of all wastewater, including but not limited to, water used for hygiene purposes, laundering of clothing if done on site, surface preparation by means of power washing or water jetting, and cleanup activities. Filtered wastewater shall be containerized in polyethylene drums or an approved equal. Steel drums are not permitted for containerization of wastewater.

b. All wastewater generated through pressure washing, the decontamination facility or manual washing shall be filtered through a filtration system capable of removing visible paint chips, particulate, heavy metals and suspended solids prior to placing it into storage containers. Filter the water until the water is not classified as hazardous and will be permissible to dispose of as described below.

c. Prior to disposal, the environmental monitor shall collect samples of filtered, containerized wastewater for analysis to determine lead concentrations. Upon receipt of analytical data demonstrating lead concentrations less than the local discharge limit for the municipality in which the work is being conducted, wastewater may be discharged into the sanitary sewer system, if approved by the local publicly owned treatment works (POTW).

d. The Contractor shall make disposal arrangements with the local publicly owned treatment works (POTW), sanitation company, or other appropriate permitted facility and provide Metro-North Railroad with documentation signed by an official of the facility stating that the facility will accept the waste, and that the levels of any lead or other metals remaining in the water are acceptable. If the facility allows the filtered water to be placed into the sanitary sewer system, include such authorization in the letter.

12) Recordkeeping & Logging of Generated Wastes

a. The Contractor shall maintain inventory by location of waste type collected, quantity, dates stored and dates released to waste hauler. This inventory shall be maintained on site and made readily available to Metro-North Railroad. This inventory shall be kept as part of the Contractor's log book.

b. The Contractor shall cooperate with Metro-North Railroad, the Engineer, and the environmental monitor in record keeping of waste stored and released for disposal.

c. The Contractor shall retain copies of all waste logs, manifests, bills of lading, written notifications and approvals, and all other documentation pertaining to the transportation and disposal of hazardous and non-hazardous waste generated during the work. Copies of the documentation shall be provided to Metro-North Railroad as part of the project closeout submittals.

3.07 Environmental Protection

A. The Contractor shall adhere to the applicable federal, state and local laws and regulations pertaining to the protection of the environment. For the duration of the project, the Contractor shall comply with all applicable federal, state, city, and local laws, regulations, and ordinances pertaining to environmental protection, including all applicable New York State Department of Environmental Conservation (NYSDEC) and New York City Department of Environmental Protection (NYCDEP) requirements.

B. The Contractor shall be familiar with the specific requirements of environmental protection laws, regulations, and ordinances. It is the responsibility of the Contractor to ensure that its subcontractors, vendors, and suppliers comply with applicable requirements.

C. Environmental protection considerations shall include, but are not limited to, the following:

1) Protection of Existing Natural Features and Vegetation
2) Air & Water Pollution
3) Hazardous materials &toxic substances
4) Lead containing particulates such as dust and fumes
5) Dust Control
6) Noise Abatement
7) Erosion and sedimentation control
8) Light Pollution

The Contractor shall execute the work in a manner which prevents releases of environmentally degrading substances such as petroleum-based products, volatile organic compounds, and hazardous materials into the environment.

D. Environmental Remediation Resulting From Contractor's Operations

1) Should the Contractor's work result in the release of a lead containing material, hazardous material, or other regulated material during performance of the work, the Contractor shall take all actions necessary to remediate the condition. All remedial actions shall be conducted per the direction of Metro-North Railroad or those serving as representatives of Metro-North Railroad, the Coast Guard, and federal and state agencies. Remedial actions shall be completed meeting the satisfaction of Metro-North Railroad, the Coast Guard, and federal and state agencies.

2) Remedial actions may include and are not limited to, complete removal and replacement of soil/ballast, facilities, equipment, furnishings, or other materials as deemed necessary by Metro-North Railroad to return the site to pre-existing or better conditions.

3) The Contractor is hereby notified that in the event the Contractor fails to remediate the condition within a schedule acceptable to Metro-North Railroad or to the degree acceptable to Metro-North Railroad, Metro-North Railroad may remediate the condition with its own or other contracted forces. Metro-North Railroad shall deduct the cost of the remediation work from any moneys due the Contractor from Metro-North Railroad per the conditions of the MTA Metro-North Railroad General conditions and Contract governing this scope of work.

SECTION 02 83 00

LEAD-CONTAINING MATERIALS SPECIFICATIONS

(NOTE: THE CONTRACTOR GENERATING THE SCRAP SHALL COMPLETE THE FOLLOWING AND SUBMIT IT TO THE SCRAP YARD/RECYCLER. METRO-NORTH RAILROAD SHALL BE PROVIDED A COPY OF THE SIGNED ACKNOWLEDGEMENT.)

Click here to enter DATE.

Click here to enter NAME & ADDRESS OF SCRAP DEALER.

Re: Notification of Lead Containing Material

Dear Sir/Madam:

Metro-North Railroad's policy requires us to provide you written notification that the material you will receive contains Lead. The scrap material(s) you are receiving from the Metro-North Commuter Railroad Company Click here to enter CONTRACT NUMBER, PROJECT DESCRIPTION, & ADDRESS contains Lead. These materials consist of Click here to enter DESCRIPTION OF MATERIAL. Testing has determined that the materials you will be accepting have Lead containing paint on them.

Kindly acknowledge receipt of this written notification by completing the section below and returning the original to my attention.

Regards,

Insert Name

ACKNOWLEDGEMENT OF RECEIPT OF LEAD CONTAINING MATERIAL

The entity identified below acknowledges receipt of the lead containing material identified above. We will insure that appropriate precautions/procedures are followed in accordance with the requirements of all regulatory agencies having jurisdiction related to lead containing materials.

Company Name:	Click here to enter text.	Phone:	Click here to enter text.
Address:	Click here to enter text.		
Officer's Name (Print):	Click here to enter text.	Signature:	
Officer's Title:	Click here to enter text.	Date:	April 1, 2018

END OF SECTION

(NOTE: THE CONTRACTOR GENERATING THE SCRAP SHALL COMPLETE THE FOLLOWING AND SUBMIT IT TO THE SCRAP YARD/RECYCLER. METRO-NORTH RAILROAD SHALL BE PROVIDED A COPY OF THE SIGNED ACKNOWLEDGEMENT.)

Click here to enter DATE.

Click here to enter NAME & ADDRESS OF SCRAP DEALER.

Re: Notification of Lead Containing Material

Dear Sir/Madam:

Metro-North Railroad's policy requires us to provide you written notification that the material you will receive contains Lead. The scrap material(s) you are receiving from the Metro-North Commuter Railroad Company Click here to enter CONTRACT NUMBER, PROJECT DESCRIPTION, & ADDRESS contains Lead. These materials consist of Click here to enter DESCRIPTION OF MATERIAL. Testing has determined that the materials you will be accepting have Lead containing paint on them.

Kindly acknowledge receipt of this written notification by completing the section below and returning the original to my attention.

Regards,

Insert Name

ACKNOWLEDGEMENT OF RECEIPT OF LEAD CONTAINING MATERIAL

The entity identified below acknowledges receipt of the lead containing material identified above. We will insure that appropriate precautions/procedures are followed in accordance with the requirements of all regulatory agencies having jurisdiction related to lead containing materials.

Company Name:	Click here to enter text.	Phone:	Click here to enter text.
Address:	Click here to enter text.		
Officer's Name (Print):	Click here to enter text.	Signature:	
Officer's Title:	Click here to enter text.	Date:	February 4, 2014

Metro-North Railroad

LEAD PROJECTS
SUBMITTAL OUTLINE & CHECKLIST

*The following outline and checklist is a list of mandatory submittals required for any activity which will disturb lead containing coatings or materials on Metro North Railroad property. Please refer to the MNR LEAD HEALTH PROGRAM for details on submittals requirements for **Lead** projects. This checklist shall be completed by the Contractor and submitted with all required submittals. Failure of the Contractor to complete this checklist shall be grounds for rejection of the submittal.*

Contract Number / Project Description	
Contractor	

(Check One)	☐ Initial Submittal ☐ Revised Submittal	Revision Number Revision Date	

Description		Included	Not Applicable	Comments/Notes Identify Revised Section – Revision Number & Date
GENERAL				
☐	Cover page including name of contractor, contract number, contract title, revision number, revision date, name and signature of Safety Engineer who wrote the LHASP (Lead Health and Safety Plan)			
☐	Table of Contents providing section numbers, title or description of the section contents, the page number of each section, list of attachments, and the revision number and revision date of each section.			
CORPORATE				
☐	Corporate Health and Safety Plan			
☐	Respiratory Protection Plan			
☐	Personal Protective Equipment (PPE) Program			
☐	Hazard Communication Program			
CORPORATE – PROJECT SPECIFIC				
☐	Lead Health and Safety Plan (LHASP) Site Specific			
☐	Site Specific Compliance Plan (29 CFR 1026.62 (e))			
☐	Waste Management Plan			
☐	List and Qualifications of Subcontractors to be utilized by discipline			
☐	Containment Plan			
☐	Cleaning, Surface Preparation/Re-Coating Plan			

Metro-North Railroad

LEAD PROJECTS
SUBMITTAL OUTLINE & CHECKLIST

	Description	Included	Not Applicable	Comments/Notes Identify Revised Section – Revision Number & Date
☐	Applications, Notifications, Permits			
☐	Material Safety Data Sheets			
☐	Catalogue Cut Sheets, Product & Technical Data Sheets			
☐	Samples of Materials & Products			
EACH INDIVIDUAL (As part of LHASP)				
☐	Certificate of Lead Awareness Training (29 CFR 1926.62 (l) (2)			
☐	Lead Physical Examinations (29 CFR 1926.62 (j) (3))			
☐	Analytical results of blood analysis consisting of Blood Lead Level and Zinc Protoporphynrin testing performs within 15 days of start date			
☐	Respirator Fit Test			
☐	Medical Clearance to wear Respiratory Protection			
☐	SSPC, C3 Certification for Competent Person			
☐	Requirement for all on site employees to complete Metro-North Roadway Worker/Contractor Safety Orientation Training			

Prepared By:

Printed Name: _____ **Signature:** _____ **Date:** _____

Title: _____ **Telephone Number:** _____ **Email:** _____

Note: *Metro North Railroad Office of System Safety (OSS) has a minimum of (10) ten working days from receipt of the submittal, to review and response to all submittals, drawings and calculations.*

SECTION 02 84 30 - UNIVERSAL WASTE AND MISCELLANEOUS HAZARDOUS MATERIALS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. This section describes the handling, segregation, packaging, labeling, transport, and disposal of Hazardous Substances and Universal Wastes generated by demolition and or renovation activities. These wastes, classified by the EPA under the Hazardous Waste Management System (40 CFR Parts 260 through 279), require specialized handling, packaging, labeling, shipment, and ultimately recycling or disposal at an approved facility.

1. Universal Wastes: as defined by the Environmental Protection Agency (EPA) and various state departments. Materials that are classified as hazardous wastes but are exempt from hazardous waste regulations provided they are collected for recycling. This includes but not limited to:
   a. High Intensity Discharge (HID) Bulbs
   b. Fluorescent light bulbs
   c. PCB containing ballasts
   d. Used batteries
   e. Mercury-containing equipment
   f. used thermostats
2. Hazardous Waste: as defined by the EPA and various state departments. This generally includes wastes that are ignitable, corrosive, reactive, toxic, or listed by state/federal agencies. This includes but not limited to:
   a. Lead Paint (see alternate Specifications)
   b. Asbestos
3. Protection of the environmental as per Section 01 35 43, to include but not limited to, Dust and Air Monitoring Controls, Noise Control, Management and disposal of debris and other environmentally regulated materials, Spill Prevention and Response, Sediment and Erosion Control.

B. The Contractor must protect and preserve public and private property within and adjacent to the work site and use every precaution to prevent damage, injury, pollution or destruction. Precautions should be made to protect trees and other plants that are to remain.

C. The Contractor is responsible to conduct a survey and provide a report of all the universal and hazardous waste. The report is to be submitted to the Engineer for review prior to the start of the project.

D. High intensity discharge bulbs, fluorescent light bulbs and PCB containing light ballasts. These bulbs may contain mercury, PCB, lead and metals. All spent or discarded light bulbs (a.k.a. waste lamps) and light ballasts from this project shall be collected by the Contractor, handled, transported, and recycled or disposed of in accordance with 40 CFR 273.13 & 273 requirements for universal waste concerning waste lamps.

1.2 RELATED SECTIONS

A. Section 01 33 60 Safety, Health and Environment Control

B. Section 01 35 29 Health, Safety and Environmental Response Procedures

C. Section 01 35 43 Environmental Protection

D. Section 01 74 19 Construction Waste Management and Disposal

E. Section 02 61 00 Testing, Removal and Disposal of Soils

F. Section 02 82 13 Asbestos Abatement

G. Section 02 83 19 Lead Abatement

H. Section 31 20 00 Earth Moving

1.3 CODES AND REGULATIONS

A. The Contractor is to comply with all applicable Federal, State, laws, ordinances and regulations pertaining to environmental protection to include but not limited to the programs in the New York State Department of Environmental Conservation (DEC) Division of Environmental Remediation (DER) and Commissioner Policies (CP). This is to include the management, hauling and disposal of hazardous and universal waste.

B. The Contractor is to take full responsibility and liability for the compliance with all applicable Federal, State, and local regulations pertaining to hazardous waste management and disposal.

C. Federal Requirements which govern the management, hauling and disposal of hazardous waste include but are not limited to the following:
   1. DOT: U.S. Department of Transportation, including, but not limited to:
      a. Hazardous Substances Title 49, Part 171 and 172 of the Code of Federal Regulations
      b. Hazardous Materials Regulations
      c. General Awareness and Training Requirements for Handlers, Loaders and Drivers Titles 49, Parts 171-180 of the Code of Federal Regulations
      d. Hazardous Materials Regulations Editorial and Technical Revisions Title 49, Parts 171-180 of the Code of Federal Regulations.
   2. Handling and transport of universal waste is to be in accordance with 40 CFR 273. The Contractor is to minimize the amount of hazardous waste and look for areas to reduced and prevent items that are hazardous waste from being disposed in a landfill. A plan to reduce the amount of universal waste and reduce material is to be submitted to the Engineer for approval.
   3. 40 CFR 260 Hazardous Waste Management System

D. EPA: U.S. Environmental Protection Agency, including but not limited to Management of Hazardous Wastes, Resource Conservation and Recovery Act (RCRA), Title 40, Parts 260-268 of the Code of Federal Regulations

E. OSHA: Occupational Safety and Health Administration including, but not limited to OSHA General Industry Safety and Health Standards (29 CFR 1910) and OSHA Construction Industry Standards (29 CFR 1926).

F. State Requirements: State requirements which govern the management, hauling and disposal of hazardous waste include but are not limited to the following, New York State Department of Environmental Conservation (NYSDEC), Hazardous Waste; Title 6, NYCRR, Sections 364, 371, 372, and 373.

1.4 SUBMITTALS

A. All plans and programs and surveys are to be submitted within thirty (30) calendar days after receipt of Notice of Award, the Contractor shall submit a Plan(s) to the Engineer for approval. The plan should detail all measures and procedures to be under taken by the Contractor 30 days prior to starting construction activities.

B. Provide the following submittals to the Engineer approval prior to the start of Work:
   1. Submit a Health and Safety Plan (as per Section 01 33 60), Spill Prevention Plan, Dust Control Plan and Noise Surveys (as per Section 01 35 43).
   2. Submit the name of the waste hauler (s) as listed in Section 02 61 00 along with a copy of state and local license and permits for waste hauling.
   3. U.S. EPA Identification Number of waste hauler.
   4. Name and address of waste disposal facility where waste materials are to be disposed including:
      a. Contact person and telephone number.
      b. Copy of state license and permit.
      c. Disposal facility permits.
   5. Copy of Uniform Hazardous Waste Manifest form or Bill of Lading as appropriate.
   6. Copy of EPA "Notice of Hazardous Waste activity" form.
   7. Copy of forms required by state and local agencies.
   8. Provide copies of sample data taken in accordance with Section 02 61 00
   9. Provide sample of disposal label to be used.
   10. Type of personal protective equipment and work procedures to be used.

C. During Work, submit to the Engineer copies of all executed manifests, disposal site receipts or certificates of destruction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Disposal Bags: Provide 0.15mm (6-mil) thick leak-tight polyethylene bags.

B. DOT Hazardous Waste Disposal Drums: Provide DOT 17-H Open –Top Drums (55 gallon) in accordance with DOT regulations title 49 CFR Parts 173, 178, and 179.

C. DOT Hazardous Waste Labels: in accordance with DOT regulations Title 49 CFR Parts 173, 178, and 179.

2.2 LIGHT FIXTURES

A. Lighting is to include but not be limited to mercury bulbs, switch components, PCB-containing light fixtures & ballast, fluorescent, incandescent, high pressure light bulbs, high intensity discharge bulb.

B. Removal Procedures: Remove bulb, switch or component by manufacturer's standard installation, removal procedure, or in such a manner as to not damage the bulb, switch or component. Follow waste containerizing and labeling procedures.

2.3 BATTERIES

A. Batteries that are not hazardous at the time of disposal need not be managed as Universal Waste. Non-hazardous batteries include alkaline, carbon zinc, chloride zinc (commonly labeled *heavy duty*), nickel metal hydride (NiMH), zinc air, and lithium batteries that are nine volts or less and higher voltage lithium batteries that have been discharged to less than one volt. These batteries are to be recycled.

B. The term "battery" also includes intact, unbroken batteries from which the electrolyte has been removed (40 CFR 260.10 and 273.9). In relation to the concept of universal wastes, this term includes all batteries except (40 CFR 273.2(b)):
   1. Spent lead acid batteries that are managed under 40 CFR 266, Subpart G (reclamation of spent lead acid batteries that are recyclable), batteries as defined above that are not yet wastes under 40 CFR 261, including those that do not meet the criteria for waste generation (see definition of Waste Battery), and batteries as defined above that are not hazardous waste. A battery is a hazardous waste if it exhibits one or more of the characteristics identified in 40 CFR 261, Subpart C.

2.4 MERCURY CONTAINING EQUIPMENT

A. A device or part of a device or part of a device (including thermostats but excluding batteries and lamps) that contains elemental mercury integral to its function (40 CFR 260.10 and 273.9).

B. The requirements of 40 CFR 273 do not apply to persons managing the following mercury-containing equipment (40 CFR 273.4(b)):
   1. Mercury-containing equipment that is not yet a waste under 40 CFR 261.
   2. Mercury-containing equipment that is not a hazardous waste. Mercury- containing equipment is a hazardous waste if it exhibits one or more of the characteristics identified in 40 CFR 261, subpart C, or is listed in 40 CFR 261, subpart D.
   3. Equipment and devices from which the mercury-containing components have been removed.

2.5 HAZARDOUS WASTE PACKAGING AND LABELING

A. Segregate And Package Each Waste Type as follows:
   1. Package switches, components in DOT 17-H Open-Top Drums with Polyethylene disposal Bag liners.
   2. Fill liner bags with only one type of waste (e.g.: mercury or PCB waste, etc.), then neck liner bags down into DOT 17-H Open-Top Drum and seal with duct tape.
   3. Install gasket on lid, apply lock ring, and seal.

B. Universal Waste
   1. Apply Waste Label to drum side.
   2. Enter appropriate DOT Shipping Data, for example:
   3. PCB Waste – "Waste PCB Light Ballasts" – RQ, Polychlorinated Biphenyls Mixture, 9, UN2315, PG III
   4. Adjacent to each label, enter the date indicating when waste was first placed in each drum.

C. Sealed and Labeled Containers: maintain all containers in a continuously sealed condition after they have been sealed.
   1. Do not reopen sealed containers.
   2. Do not place additional waste in sealed containers.

2.6 TEMPORARY STORAGE

A. See Section 3.02 for Handling of Waste.

B. Partially filled containers of waste may be stored at the work site for intermittent packaging provided that:
   1. Each container is properly labeled when it is first placed in service;
   2. Each container remains closed at all times except when compatible waste types are added.

C. When moved within the site, each container remains within the geographic boundaries of the facility without moving or crossing public access highways.

D. Immediately seal containers of waste as each container is filled. Remove containers of waste from the work site within 45 days from start of accumulation. All containers are to be marked with the start date of accumulation.

E. Continuously maintain custody of all hazardous material generated at the work site including security, short-term storage, transportation and disposition until custody is transferred to an approved disposal site or recycling center. Document continuous chain-of custody and waste manifest.

PART 3 - EXECUTION

3.1 GENERAL

A. Do not mix potentially hazardous waste streams. Where feasible, separate each type of waste from other types of hazardous wastes, from asbestos waste and from construction waste. Hazardous waste is defined in 40 CFR Part 261, New York State ECL Section 27-09 or 6 NYCRR Part 371 (Identification and Listing of Hazardous Waste). See Section 01 74 19.

B. Segregate, package, label, transport and dispose of Waste in accordance with DOT, EPA, State and Local regulations.

C. The following hazardous wastes that are managed under the universal waste requirements of 40 CFR 273 (40 CFR 260.10 and 273.9):
   1. Batteries as described in 40 CFR 273.2 (see definition of Battery)
   2. Pesticides as described in 40 CFR 273.3 (see definition of Pesticides)

3. Mercury-containing equipment as described in 40 CFR 273.4 (see definition of Mercury-Containing Equipment)
4. Lamps as described in 40 CFR 273.5 (see definition of Lamp).

3.2 HANDLING OF WASTE

A. Hazardous and dangerous waste generated within the job site shall not be moved except in accordance with Federal and State regulations. If the presence of hazardous waste is confirmed, the Metro-North Department of Environmental Compliance and Services shall be advised promptly.

B. In no event shall hazardous waste remain on the site for more than 60 days from generation. All hazardous materials and or waste are to be stored in compatible and regulated storage containers/drums, provide the MSDS to the Engineer. All materials are to placard and stored in accordance with State and Federal regulations.

C. Off-site disposal facilities must be approved by the Engineer as listed in Section 02 61 00 prior to disposal. Testing and sampling of materials and waste are to be done in accordance with Section 02 61 00.

D. Signed Originals of Weight Tickets/Bill-of-Lading and/or Waste Profile Sheets; Waste Manifests (for Hazardous Waste) are to be turned over to the Engineer after making copies of each following each waste shipment. Copies of the Chain of Custody are to be given to the Engineer in accordance with Section 02 61 00.

E. Employee training shall ensure that all employees are thoroughly familiar with proper waste handling and emergency procedures, relative to their responsibilities during normal operations and emergencies and to the type of waste they are handling.
   1. Documentation when a universal waste in storage was first accumulated shall be provided. This is to be done by dating and labeling the waste with the date of the earliest accumulation that can document the length of time the universal waste has been accumulated.
   2. Maintenance of an inventory system on-site that identifies the earliest date that any universal waste in a group of universal waste items or a group of containers of universal waste became a waste was received.
   3. Any waste developed from the work that exhibits one or more characteristics of hazardous waste, that are not specifically identified by EPA and DEC as Universal Waste, must be handled accordingly and not as a universal waste. See the Hazardous Waste Disposal Specification for those wastes.

F. Off-Site Shipment of Universal Waste
   1. Off-Site shipments shall meet the requirements for offsite shipments and is prohibited from sending or taking universal waste to a place other than a designated universal waste handler or a universal waste destination facility.

END OF SECTION

DIVISION 3
CONCRETE

SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements for providing the concrete formwork for construction of all concrete structures set forth on the Contract Drawings and in the Specifications.

1.2 REFERENCED SECTIONS

A. Division 1 – General Requirements; Submittal Procedures

1.3 CITED STANDARDS

A. American Concrete Institute (ACI):
   1. ACI 347, Guide to Formwork for Concrete.
   2. ACI 318/318R, Building Code Requirements for Structural Concrete and Commentary.

B. APA-The Engineered Wood Association (APA):
   1. APA Panel Handbook & Grade Glossary.

C. Southern Pine Inspection Bureau (SPIB):
   1. SPIB Standard Grading Rules for Southern Pine Lumber.

D. U. S. Government:
   1. U.S. Department of Commerce (DOC):
      a. Technology Administration, National Institute of Standards and Technology (NIST):
         1) DOC Voluntary Product Standards:
            a) PS-1, Construction and Industrial Plywood.
            b) PS-20, American Softwood Lumber Standard.

E. Western Wood Products Association (WWPA):
   1. WWPA Western Lumber Grading Rules ‘98.

1.4 QUALITY CONTROL

A. Certifications:
   1. Submit certification that material is acceptable for structures processing or storing potable water.

1.5 SUBMITTALS

A. Prior to the start of the work of this Section, submit the following information for approval in accordance with the requirements of Division 1 – General Requirements, Submittal Procedures:

1. Product Data and current specifications for the following:
    a. Form coating materials.
    b. Form ties.
2. Quality Assurance/Control Submittals:
    a. Certificates:
        1) Certification that material is acceptable for structures processing or storing potable water.

1.6 GENERAL DESIGN AND FABRICATION REQUIREMENTS

A. Design the formwork and falsework in accordance with ACI 347 andthe following:
    1. Include assumed values of live load, dead load, weight of moving equipment operated on the formwork, temporary construction material, foundation pressures, stresses, lateral stability, and such other factors pertinent to safety of the structure during construction in the design.
    2. Design the formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacentconstruction.
    3. Earth forms are not permitted.

B. Design the formwork to ensure that the tolerances indicated are held, and factors pertinent to the safety of personnel during construction are included.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Framing, Sheathing, Struts, Braces, and Shoring for Forms: Provide framing, sheathing, struts, braces, and shoring for the forms made from lumber conforming to WWPA Grading Rules or SPIB Grading Rules.

B. Rough Structural and Dimension Lumber: Provide lumber of allowable species, surfaced on four sides as applicable, and grade stamped with the appropriate WWPA or SPIB stamp indicating product compliance with PS-20-94.

C. Form Sheathing and Panels: Provide Exterior Type B-B Plywood Class I and II for form sheathing and panels that conforms to U.S. Product Standard PS-1-95, and that is not less than 5/8 inch thick.
    1. On surfaces not exposed to view, only use Class II plywood.

D. Metal Forms:
    1. Steel forms of a pre-engineered standard design, conforming to the concrete sections indicated on the Contract Drawings, may be used in lieu of wood forms.
    2. Do not use stay-in-place metal forms.

E. Form Ties:
    1. Provide factory-fabricated, adjustable-length, removable or snap-off metal form ties conforming to ACI 347.
        a. Do not fabricate wire ties, flat bands, or form ties on the Site.
    2. Removable Ties:
        a. For ties that are designed to be completely removed, taper the ties over their full length that passes through the concrete.

1) For liquid containment structures, install tapered ties so the large end of the taper is on the liquid side of the concrete wall.
2) In building foundation walls, install tapered ties so the large end of the taper is on the ground side of the concrete wall.

b. Do not use removable type ties that leave holes larger than one inch.
c. Do not use removable type ties to construct liquid-retaining concrete structures.

3. Snap-off Metal Ties:
   a. Provide snap-off metal ties with ends that break at least 1 1/2 inches from the face of the wall.
4. Do not use wood spacers.
5. To construct liquid-retaining structures and structures designed to exclude groundwater, use ties designed to prevent seepage or flow of water along the embedded tie.
6. Submit Product Data and current specifications for the form tie materials.

F. Form Coatings:
   1. Provide commercial formulation form-coating compounds that do not bond with, stain, or affect concrete surfaces.
      a. Provide form-coating compounds that do not impair subsequent treatment of concrete surfaces requiring bond or adhesion, or impede the wetting of surfaces to be cured with water or curing compounds.
   2. For surfaces designed to be in contact with potable water, do not use coating material that will add taste, odor, or toxic effects to the water.
   3. Submit Product Data and current specifications for the form coating materials.
   4. Fuel shall not be used as a form release agent.

2.2 SOURCE QUALITY CONTROL

A. Provide lumber free of material defects that would deform the finished concrete product.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to placement of concrete, inspect the forms to verify the accuracy of their alignment and for cleanliness.

3.2 PREPARATION

A. Apply form coatings in accordance with the coating manufacturer's specifications.

B. Do not allow excess form coating material to accumulate in the forms.

C. Do not allow form coatings to come in contact with construction joints and reinforcing steel.

3.3 ERECTION

A. Construct the forms in accordance with ACI 347 and to the required dimensions; and erect them plumb, straight, mortar tight, and paste tight where appearance is important.
   1. Fabricate forms for easy removal without hammering or pryingagainst concrete surfaces.
   2. Form intersecting planes to provide true, clean-cut corners withthe concrete not exposed to the edge grain of plywood.
   3. Securely brace and shore the forms to prevent displacement,bowing, pillowing, and to safely support the imposed concrete load.
   4. Provide offsets, keyways, recesses, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and such other features asrequired.

B. Build into the forms items such as inserts, anchors, miscellaneousmetal items, and other embedded items indicated on the Contract Drawings; or otherwise secure these items in the forms.
   1. Accurately place and securely support items to be built into forms.

C. Openings:
   1. Provide temporary openings where the interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, orfor placement of concrete.
      a. Locate temporary openings on forms in locations as inconspicuous as possible consistent with the requirements of the work.
      b. Provide openings in concrete formwork of the correct size and inthe proper location to accommodate other items and operations of construction work passing through the forms.
   2. Securely brace and set temporary openings tightly to forms to prevent the loss of concrete mortar.

D. Wet wooden forms sufficiently to prevent the joints from opening prior to the concrete pour.

3.4 SITE TOLERANCES

A. Set and maintain concrete forms within allowable tolerance limits stated in ACI 347.

3.5 FORM REMOVAL

A. If the atmospheric temperature at the site has been continuously above 50 degrees Fahrenheit from the time of the pour, remove the forms at the earliest practical time within the limits set forth in this Paragraph, and maintainwet curing without delay.
   1. Forms for walls and other vertical faces may be carefully removed 24 hours after the last portion of concrete in the section involved has been placed, provided the concrete has sufficiently hardened to preclude damage resulting from form removal, and provided these members are not subjected to loads for a period of 14 days.
   2. Maintain horizontal forms in place for a minimum of 14 days or until the concrete, as determined by job-cured cylinders, has attained a compressive strength of 3000 psi.
   3. If a water-reducing retarder is used in the concrete mix, the normaltime period for removing forms may need to be increased.

B. If the atmospheric temperature at the site drops below 50 degrees Fahrenheit, leave all forms in place for at least five (5) days regardless of the temperature within protective coverings or enclosures.

C. Remove forms in accordance with ACI 347 without damaging the concrete and in a manner that ensures complete safety and serviceability of the structure.
   1. Do not cut form ties back from the face of the concrete.
   2. Concrete containing slag ground granulated blast furnace slag tends to develop strength slower than a concrete containing 100 percent Portland cement, so forms for such concrete may need to be left in place longer.

D. Do not remove supporting forms or shoring until the members have acquired sufficient strength to safely support their weight and the anticipated construction loads without distortion or excessive deflection.

3.6 RE-INSTALLATION

A. Forms may be re-used, only if they meet the same requirements as new forms with respect to their effect on poured concrete appearance and structural stability.

B. Reusing concrete forms may not cause delays or changes in the concrete pour schedule when compared to the concrete pour schedule that is made possible by using all new forms in the case of wood forms, or by having available the total number of forms required in the case of metal forms.

3.7 FIELD QUALITY CONTROL

A. Notify the Engineer upon removal of a concrete pour's forms so that a review of the newly stripped surfaces may be made before patching takes place.

B. Examine concrete surfaces following removal of forms to verify that they do not contain residual form coating that will interfere with other materials or coatings to be applied.
   1. If detrimental form coating is found, use approved methods to remove it prior to applying other materials or coatings.

3.8 PROTECTION

A. Protect formwork materials before, during, and after erection to ensure acceptable finished concrete work.

B. The Engineer's consent to remove forms does not relieve the Contractor of the responsibility for the safety of the work.

C. Protect in-place materials and the work of other trades during concrete work.

END OF SECTION

(This Page Left Intentionally Blank)

SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements for furnishing and installing reinforcement for concrete structures.

1.2 REFERENCED SECTIONS

A. Division 1 – General Requirements – Submittal Procedures.

B. Section 03 10 00 – Concrete Forming and Accessories

C. Section 03 30 00 – Cast-In-Place Concrete.

1.3 CITED STANDARDS

A. American Concrete Institute (ACI):
   1. ACI 315, Details and Detailing of Concrete Reinforcement.
   2. ACI 318, Building Code Requirements for Structural Concrete.

B. American Society for Testing and Materials (ASTM):
   1. ASTM A 82, Specification for Steel Wire, Plain, for Concrete Reinforcement.
   2. ASTM A 185, Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
   3. ASTM A 496, Specification for Steel Wire, Deformed, for Concrete Reinforcement.
   4. ASTM A 615/A615M, Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   5. ASTM A 663/A663M, Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties.
   6. ASTM A767 / A767M, Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

C. Concrete Reinforcing Steel Institute (CRSI):
   1. CRSI Manual of Standard Practice.

1.4 QUALITY CONTROL

A. Certifications:
   1. Submit certification that material meets specified requirements.

1.5 SUBMITTALS

A. Prior to the start of the work of this Section, submit the following information to the Engineer for approval in accordance with the requirements of Division 1 – General Requirements, Submittal Procedures:
   1. Product Data
      a. Submit the manufacturer's descriptive product data and current specification for each product specified herein, include installation instructions.
         1) Reinforcing steel.
         2) Rebar splicing coupler.
         3) Slab joint dowel bars.
         4) Deformed bar anchors.
   2. Shop Drawings
      a. Prepare Shop Drawings of concrete reinforcement in accordance with ACI 315.
      b. Provide drawings showing all fabrication dimensions and locations for placing reinforcement and bar supports; indicate bending diagrams, splicing and lap of rods, shapes, dimensions and details of bar reinforcing and accessories.
   3. Test Reports
      a. Submit copies of test reports showing the results of tests conducted in accordance with the American Society for Testing and Materials Specifications listed in Paragraph 7.02B.
      b. Test Requirements may be waived, if certified copies of mill test reports that show compliance with specified requirements are provided.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Storage of Materials:
   1. Store concrete reinforcing materials in a manner that prevents excessive rusting and fouling with dirt, grease, and other bond-breaking coatings.

B. Identify bundles of reinforcing steel with tags wired to the reinforcing steel.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcing Steel:
   1. Reinforcement Bars: Provide deformed steel reinforcement bars in accordance with the requirements of ASTM A 615/A615M, Grade 60.
   2. Wire: Provide wire in accordance with the requirements of ASTM A 82.
   3. Welded Wire Fabric: Provide welded wire fabric in accordance with the requirements of ASTM A 185.
      a. Galvanized: Provide galvanized reinforcing steel conforming to the requirements of A 767/A 767M, Class I zinc coated, hot-dip galvanized and chromate wash treated after fabrication and bending in cast-in- place concrete only.
      b. Metal Accessories: Provide metal accessories in accordance with the requirements of the CRSI Manual of Standard Practice.

B. Rebar Splicing Coupler:

1. Use a rebar splicing coupler only where one is shown on the Contract Drawings or where approved by the Engineer.
2. Provide a two-piece dowel bar splicer system manufactured from ASTM A 615/A615M Grade 60 deformed rebar, and consisting of a rebar externally-threaded on the splice end, or "dowel-in", which can be threaded into an internally-threaded hole in a "dowel bar splicer" factory-forged onto the end of the mating rebar and equipped with an integral nailing flange plate.
3. The strength of the completed splice must exceed the tensile strength requirements of ACI 318.
4. Where "dowel bar splicers" are provided for mating with "dowel-ins" to be installed later, install the coupler manufacturer's plastic internal coupler protectors in the "dowel bar splicers".
5. Provide solid plastic sleeves placed over the "dowel-in" ends to protect the threading from damage, contamination, and rust.
6. Acceptable Manufacturers:
   a. Dayton/Richmond Concrete Accessories, www.daytonrichmond.com.
   b. Approved equal.

C. Slab Joint Dowel Bars:
1. To transfer shear forces at slab joints, provide plain round dowel bars conforming to requirements of ASTM A 663/A663M, Grade 70, 75, or 80; and which are not burred, roughened, or deformed out-of-round so that slippage is not hindered.
2. Coat the slab joint dowel bars with curing compound conforming to the requirements specified in Section 03 30 00, Cast-In-Place Concrete, to render the surface of the bars bondless.

D. Deformed Bar Anchors:
1. Provide deformed anchors conforming to the requirements of ASTM A 496 with a minimum yield strength of 50 ksi and a minimum ultimate tensile strength of 61 ksi.
   a. Provide low carbon steel anchors with the following composition:
      1) Carbon: 0.23 percent, maximum.
      2) Manganese: 0.90 percent, maximum.
      3) Phosphorus: 0.040 percent, maximum.
      4) Sulfur: 0.050 percent, maximum.
   b. Provide flux-filled deformed bar anchor similar to Nelson Stud Welding, Inc. Type D2L.
2. Acceptable Manufacturers:
   a. Nelson Stud Welding, Inc., www.nelsonstud.com.
   b. Approved equal.

2.2 FABRICATION

A. Fabricate reinforcement to the dimensions indicated on the Contract Drawings and within the tolerances given in ACI 315.

B. Bend steel reinforcement using the cold bending method.
1. Do not use bars with kinks or bends not indicated on the Contract Drawings.
2. Fabricate bar shapes in a manner that will not injure the material or lessen the member strength.
3. Use either a hand- or power-operated bending machine designed for bending reinforcing steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Placing Concrete Reinforcement:
   1. Place metal concrete reinforcement accurately and in accordance with ACI 318.
      a. Do not lay metal reinforcement on formwork.
      b. Terminate reinforcement two inches from the face of expansion joints.
      c. Continue reinforcement across or through construction joints.
      d. Place additional concrete reinforcement around openings in slabs and walls as detailed on the Contract Drawings.
      e. Use reinforcing accessories to securely brace the reinforcement against displacement outside of permitted tolerances.
   2. Slab Reinforcement:
      a. Install welded wire fabric as indicated, lapping joints eight inches and securely wiring the joints together.
      b. Extend welded wire fabric to within two inches of sides and ends of slabs.
      c. To support slab reinforcement from the ground, place the reinforcement on concrete blocks of the correct height and having a compressive strength equal to or greater than the specified compressive strength of concrete being placed.
         1) Use concrete blocks not larger than 3 inches by 3 inches and of a height equal to required bottom steel cover.
      d. To support slab reinforcement from formwork, place the reinforcement on bar chairs made of plastic or metal.
      e. Field weld deformed bar anchors to slab edge steel bent plate as shown on the Contract Drawings.
   3. Provide fiber reinforcement in concrete sidewalks and in other applications as indicated on the Contract Drawings.

B. Concrete Reinforcement Field Bends:
   1. Do not field bend bars partially embedded in concrete unless approved by the Engineer.
   2. When obstructions interfere with the placement of reinforcement, pass such obstructions by placing reinforcement around it.
      a. Do not bend the reinforcement to clear the obstructions.

C. Splicing Concrete Reinforcement:
   1. Splice metal reinforcement in accordance with ACI 318 and as indicated on the Contract Drawings.
      a. Make mechanical butt splices in accordance with the rebar splicing coupler manufacturer's installation instructions.
   2. Secure metal reinforcement at intersections with not less than 16-gauge annealed wire or appropriately sized clips.
      a. When bar spacing is less than 12 inches, tie alternate intersections.
      b. Do not tack-weld crossing bars.

D. Slab Joint Dowel Bar Installation:
   1. Install one-half the length of the coated bar dowel into the slab to be poured.

3.2 FIELD QUALITY CONTROL

A. Notify the Engineer 48 hours before placing concrete so the placement of metal reinforcement can be inspected.

3.3 CLEANING

A. Clean or otherwise protect metal reinforcement so that at the time the concrete is placed, the reinforcement is free from rust, scale, or other coatings that could destroy or reduce the concrete to steel bond.

3.4 PROTECTION

A. Provide protection for concrete reinforcement during concrete pours in accordance with ACI 318, unless indicated otherwise on the Contract Drawings.

B. Protect in-place reinforcement from excessive construction traffic and other work.

END OF SECTION

(This Page Left Intentionally Blank)

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements for designing the cast-in-place concrete mixes.

B. Requirements for furnishing, placing, and curing Portland cement concrete for concrete structures, both reinforced and un-reinforced, as indicated in the Contract Documents.

C. Requirements for testing and accepting of cast-in-place concrete structures.

1.2 REFERENCED SECTIONS

A. Division 1 – General Requirements - Submittal Procedures.

B. Section 03 10 00 - Concrete Forms and Accessories.

C. Section 03 20 00 - Concrete Reinforcement.

1.3 CITED STANDARDS

A. American Concrete Institute (ACI):
1. ACI 117/117R; Standard Specifications for Tolerances for Concrete Construction and Materials and Commentary.
2. ACI 211.1; Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
3. ACI 301; Specifications for Structural Concrete.
4. ACI 302.1R; Guide for Concrete Floor and Slab Construction.
5. ACI 304R; Guide for Measuring; Mixing, Transporting and Placing Concrete.
6. ACI 304.2R; Placing Concrete by Pumping Methods.
7. ACI 305R; Hot Weather Concreting.
8. ACI 306R; Cold Weather Concreting.
9. ACI 308R; Guide to Curing Concrete.
10. ACI 318/318R; Building Code Requirements for Structural Concrete and Commentary.

B. American Institute of Steel Construction, Inc. (AISC):
1. AISC 303, Code of Standard Practice for Steel Buildings and Bridges.

C. American Society for Testing and Materials (ASTM):
1. ASTM C 31/C 31M; Standard Practice for Making and Curing Concrete Test Specimens in the Field.
2. ASTM C 33; Standard Specification for Concrete Aggregates.
3. ASTM C 39/C 39M; Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

4. ASTM C 42/C 42M; Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
5. ASTM C 94/C 94M; Standard Specification for Ready-Mixed Concrete.
6. ASTM C 138/C 138M; Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
7. ASTM C 143/C 143M; Standard Test Method for Slump of Hydraulic-Cement Concrete.
8. ASTM C 150; Standard Specification for Portland Cement.
9. ASTM C 156; Standard Test Method for Water Retention by Concrete Curing Materials.
10. ASTM C 171; Standard Specification for Sheet Materials for Curing Concrete.
11. ASTM C 172; Standard Practice for Sampling Freshly Mixed Concrete.
12. ASTM C 173/C 173M; Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
13. ASTM C 192/C 192M; Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
14. ASTM C 231; Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
15. ASTM C 260; Standard Specification for Air-Entraining Admixtures for Concrete.
16. ASTM C 309; Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
17. ASTM C 494/C 494M; Standard Specification for Chemical Admixtures for Concrete.
18. ASTM C 779/C 779M; Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
19. ASTM C 881; Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
20. ASTM C 882; Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
21. ASTM C 989; Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
22. ASTM C 1077; Standard Practice for Laboratories Testing Concrete and Concretes for Use in Construction and Criteria for Laboratory Evaluation.
23. ASTM C 1315; Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
24. ASTM D 638; Standard Test Method for Tensile Properties of Plastics.
25. ASTM D 695; Standard Test Method for Compressive Properties of Rigid Plastics.
26. ASTM D 1751; Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
27. ASTM E 329; Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

1.4 QUALITY CONTROL:

A. Qualifications:
   1. Testing and Inspection Agency Qualifications:
      a. Employ an independent Testing and Inspection Agency having the proper qualifications and having the following additional qualifications:
         1) Conforming to the quality standard requirements of ASTM C 1077.
         2) Capable of performing the reviews, inspections, and testing required by this Section; including but not limited to the following:
            a) Inspecting, sampling, and testing proposed materials and concrete production as required by the Building Code for compliance with the Contract Documents.

(1) Capable of conducting concrete slump, strength, and air entrainment testing.
(2) Capable of securing production samples of materials at plants or stockpiles during the course of the work, and testing the samples for compliance with the Contract Documents.

b) Capable of reviewing and testing the Contractor's proposed mix designs.

B. Regulatory Requirements:
1. Only provide curing compounds which comply with the low volatile organic compound (VOC) requirements of the U.S. Environmental Agency as defined in 40 CFR Part 51.100.

C. Certifications:
1. Batch Mixing Plant Certification:
a. Submit to the Engineer and local authorities requiring them, certificates originated by the batch mixing plant certifying that the ready mixed concrete, as manufactured and delivered, is in conformance with ASTM C 94/C 94M.
2. Curing Compound/Architectural Finish Bond Certification:
a. Submit written certification by the product manufacturer that liquid membrane-forming curing compounds to be applied over concrete with an architectural finish is non-detrimental to the bond of the finish material.
3. Clear Curing and Sealing Compound Certification:
a. Submit written certification by the product manufacturer that liquid-type membrane-forming clear curing and sealing compound is compatible with other treatments and finishes to be applied to the concrete.
4. Mix/Admixture Certification:
a. Prior to submitting the concrete mix design to the Engineer for approval, submit written certification that the mix conforms to the requirements of proposed admixtures.

D. Field Samples:
1. Submit Samples of materials being used when requested by the Engineer, including the Samples' names, sources, and descriptions.

E. Pre-Installation Meetings:
1. Prior to placement of concrete, convene an onsite meeting to establish and coordinate procedures that will enable the Contractor to provide the best possible product under anticipated field conditions.
2. Required attendees to this meeting include representatives of organizations and material suppliers involved with the design and construction of floor slab.

1.5 SUBMITTALS

A. Submit the following information to the Engineer for approval in accordance with the requirements of Division 1 – General Requirements, Submittal Procedures:
1. Product Data:
a. Concrete materials and accessories per Subparagraph 1.04.D.1.
2. Shop Drawings:
a. Schedule showing construction methods, construction joint locations, and the sequence of pouring per Paragraph 1.10.A.
3. Samples:
a. Samples of materials being used per Paragraph 1.07.D.1.

4. Quality Assurance/Control Submittals:
    a. Design Data.
        1) Design mixes per Subparagraph 2.03.A.1.
    b. Test Reports.
        1) Source concrete test reports per Subparagraph 2.05.A.1.a.
        2) Test reports for concrete slump per Subparagraph 3.05.A.1.f and Subparagraph 3.05.A.2.
        3) Test reports for concrete air content tests for new concrete per Subparagraph 3.05.A.1.f and Subparagraph 3.05.A.3.
        4) Test reports for new concrete strength tests per Subparagraph
        5) 3.05.A.1.f and Subparagraph 3.05.A.4.
        6) Test reports for concrete core tests for in-place concrete per Subparagraph 3.05.A.1. and Subparagraph 3.05.A.5.b.
        7) Test reports for concrete load tests for in-place concrete if required per Subparagraph 3.05.A.1.f and Subparagraph 3.05.A.5.b.2.b.
    c. Certificates.
        1) Batch Mixing Plant Certification per Subparagraph 1.07.C.1.a.
        2) Curing Compound/Architectural Finish Bond Certification per Subparagraph 1.07.C.2.a.
        3) Clear Curing and Sealing Compound Certification per Subparagraph 1.07.C.3.a.
        4) Mix/Admixture Certification per Subparagraph 1.07.C.4.a.
    d. Manufacturers' Instructions.
        1) Concrete material and accessories installation instructions per Subparagraph 1.04.D.2.
        2) Submit a letter from the curing compound manufacturer that specifies the coverage rate necessary to meet the restriction for loss of water per Subparagraph 2.01.J.1.c.1.a.1.
    e. Manufacturers Field Reports.
        1) Concrete delivery tickets per Subparagraph 1.08.A.1.c.

1.6 DEFINITIONS

A. Cementitious Material: A mixture of cement and ground granulated blast-furnace slag.

B. VOC: An acronym for volatile organic compounds, generally meant to refer to organic chemical compounds that have high enough vapor pressures under normal conditions to significantly vaporize and enter the atmosphere.

1.7 GENERAL DESIGN AND FABRICATION REQUIREMENTS

A. American Concrete Institute (ACI) Compliance:
1. Provide cast-in-place concrete work conforming to the requirements of ACI 301 except as modified by the Specifications and Contract Drawings.

B. Concrete Mix Design Properties:
1. Design concrete mixes to provide the following properties for the classes listed:
    a. Minimum compressive strength of 4,000 psi at 28 days, and a minimum cementitious material content of 564 pounds per cubic yard.

C. Concrete Admixtures:
   1. Only provide non-corrosive, non-chloride concrete admixtures.

D. Product Data and Installation Instructions:
   1. Submit the manufacturer's descriptive product data and current specifications for the concrete materials and accessories specified in this Section.
   2. Submit manufacturer's installation instructions for the concrete materials and accessories specified in this Section.

1.8 PERFORMANCE REQUIREMENTS

A. Requirements for Acceptance:
   1. Concrete Compressive Strength:
      a. If concrete fails to meet the minimum specified compressive strength test requirements, the concrete represented by such tests will be considered questionable and subject to further testing and other requirements as follows:
         1) Additional curing may be required as directed by the Engineer.
         2) Modifications may be required for remaining concrete work, including changes in the concrete mix designs.
         3) When the strength of the structure is considered potentially deficient by the Owner and/or the Engineer, structural analysis and/or additional testing may be required.
            a) If in the opinion of the Owner and/or the Engineer there is cause for concern over the adequacy of the structure regardless of the results of any previous tests, additional tests of the hardened concrete may be required.
               (1) Conduct the additional testing of questionable concrete in accordance with the requirements of ASTM C 42/C 42M at no increase in Contract Price, except as noted in Subparagraph 1.05.A.1.a.3.a.2.
               (2) If the initial test acceptance requirements had been met, the Contractor is not required to bear the costs of such additional tests unless their results confirm that the concrete in place is deficient.
            b) If concrete work is judged inadequate by the Engineer based on structural analysis or by results of a load test, reinforce it with additional construction if so directed by the Engineer or Owner, or replace it at no increase in Contract Price.
   2. Concrete Appearance:
      a. Repair defects which adversely affect the appearance of the specified finish in concrete exposed to view if possible.
         1) If in the opinion of the Engineer the defect cannot be repaired, the concrete may be accepted or rejected as provided in this Section.
         2) Concrete not exposed to view is not subject to rejection for defective appearance.
   3. Location of Members:
      a. Concrete members cast in the wrong location may be rejected if the strength, appearance, or function of the structure is adversely affected; or if the misplaced items interfere with other construction.
   4. Dimensional Tolerances:
      a. Inaccurately formed concrete surfaces which are exposed to view and exceed the requirements of ACI 117/117R may be rejected.
         1) Repair, or remove and replace, the section if required.

2) If the outlines of formed concrete surfaces are smaller than required by an amount exceeding the requirements of ACI 117/117R, they will be considered deficient in strength and subject to the provisions of Subparagraph 1.05.A.1.
3) If the outlines of formed concrete surfaces are larger than required by an amount exceeding the requirements of ACI 117/117R, they may be rejected.
a) The Engineer may require that the excess material be removed.
b) If the excess material is to be removed, do so in a manner that maintains the strength of the section and meets the other applicable requirements of function and appearance.

b. Finished flatwork exceeding the allowable tolerances may be repaired provided that the strength or appearance of the flatwork is not adversely affected.
1) Remove high spots with a terrazzo grinder.
2) Fill in low spots with an approved patching compound.
3) Perform other remedial measures as permitted by the Engineer.

B. Concrete Acceptance:
1. Completed concrete work which meets the specified requirements will be accepted without qualification.
2. The Engineer will determine the extent and manner of actions to be taken to correct defective concrete revealed by surface defects or otherwise.
a. Prior to repairing defects, submit proposed materials and repair methods to the Engineer for approval.
b. Obtain approval from the Engineer before performing repair work other than removing imperfect texture and filling pin holes and insert holes.
3. Completed concrete work which fails to meet one or more requirements but which has been repaired to be in compliance will be accepted without qualification.
a. Repairs must be made at no increase in the Contract Price.
4. Completed concrete work which fails to meet one or more requirements and which cannot be brought into compliance may be accepted or rejected as provided in this Section.
a. The Owner and the Engineer reserve the right to reject any or all items which do not meet the requirements of the Contract Drawings and Specifications.
b. Repairs and additional testing and/or analysis must be performed at no increase in the Contract Price unless otherwise noted.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Acceptance at Site:
1. Delivery Tickets:
a. Each load of concrete from the batch plant must be accompanied by a delivery ticket.
b. Each delivery ticket must be signed by the Contractor's representative, and be annotated with the time and place of concrete pours using the concrete from the load represented by the delivery ticket.
c. Keep the original delivery tickets as a record at the Work Site, and submit copies to the Engineer for information.
1) Make delivery tickets available for inspection upon request by the Engineer.
d. Include the tabulation described by ASTM C 94/C 94M as well as any additional information the local codes may require on the delivery ticket.

B. Storage and Protection:

1. Store the concrete admixtures in a manner that prevents contamination, evaporation, moisture penetration, and damage.
2. Do not use concrete admixtures that have been stored longer than 6 months.

1.10 PROJECT CONDITIONS

A. Project Environmental Requirements:
   1. Cold Weather Concreting:
      a. Perform cold weather concrete work in accordance with the requirements of ACI 306R and the following additional requirements:
         1) The temperatures of the subbase and other surfaces that come in contact with concrete must be above freezing.
            a) The subbase and surfaces of concrete forms must be free of snow and ice.
            b) Do not place concrete around any embedment which has a temperature below freezing.
         2) Provide equipment for heating and protecting concrete and concrete materials during freezing or near-freezing weather.
            a) Do not use foreign materials or materials containing snow or ice.
            b) When using artificial heat indoors, vent exhaust gases to the outside.
   2. Hot Weather Concreting:
      a. Perform hot weather concrete work in accordance with the requirements of ACI 305R and the following additional requirements:
         1) Do not deliver concrete having a temperature exceeding 90 degrees Fahrenheit to the Work Site.
         2) Cool the mix's ingredients before mixing to prevent the temperature of the mix from exceeding 90 degrees Fahrenheit.
            a) Furnish windbreaks, shading, fog spraying, sprinkling, or wet covering when necessary.

1.11 SCHEDULING

A. A minimum of 10 days prior to placing concrete, submit a schedule to the Engineer showing proposed construction methods, construction joint locations, and the sequence of pouring.

B. Before concrete is to be placed, give five days notice to those performing other construction work related to the concrete pours, such as to those performing work that must be supported by or embedded in concrete, to allow embedded items to be introduced or furnished before the concrete is placed.

C. When placing concrete in walls and slabs, allow at least two days elapsed time for slabs and five days elapsed time for walls before concrete is placed against an adjacent vertical joints.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement:

1. Provide Portland Cement conforming to the requirements for Type I, Normal, cement specified in ASTM C 150, except for concrete exposed to water, wastewater, or hydrogen sulfide gas.
2. For concrete exposed to water, wastewater, or hydrogen sulfide gas, provide Portland Cement conforming to the requirements for Type II, Moderate Sulfate Resistance, cement specified in ASTM C 150.
3. Use cementitious material to determine the water/cementitious (W/C) ratio for cement.
4. For exposed concrete, provide only one approved brand and manufacturer of cement.

B. Normal Weight Concrete Aggregate:
1. Provide processed aggregate meeting the requirements of ASTM C 33.
2. Coarse Aggregate Size:
   a. Within the following maximum size limitations, but in no case larger than 1 1/2 inches:
      1) One-fifth or less of the narrowest dimension between the sides of the forms within which the concrete is to be cast.
      2) Three-fourths or less of the minimum clear spacing between reinforcing bars.
      3) One-third or less of the slab thickness for unreinforced slabs.
   b. For use in metal pan stairs only, provide reduced aggregate concrete containing aggregate with a particle size not less than 1/8 inch or more than 1/2 inch in any dimension, and containing a maximum of 5 percent of particles passing a No. 8 sieve.

C. Water:
1. Provide water clean and free of injurious amounts of oils, acids, alkalis, salts, organic materials, and other substances that may be deleterious to concrete or concrete reinforcement.

D. Concrete Admixtures:
1. Admixture Manufacturers:
   a. Provide admixtures produced and serviced by established, reputable manufacturers.
2. Air-Entraining Admixture:
   a. Provide a product conforming to requirements of ASTM C 260.
3. Water-Reducing Admixture:
   a. For all concrete except where an admixture listed below is used, provide a product conforming to the requirements specified for Type A in ASTM C 494/C 494M.
   b. Manufacturers:
      1) The Euclid Chemical Company, Eucon WR-75, www.euclidchemical.com.
      2) BASF Admixtures, Inc., Pozzolith 220N, www.basf-admixtures.com.
      3) Sika Corporation, Plastocrete 161, www.sikaconstruction.com.
      4) Approved equal.
4. Water-Reducing and Retarding Admixture:
   a. Provide a product conforming to the requirements specified for Type D in ASTM C 494/C 494M.
   b. Manufacturers:
      1) The Euclid Chemical Company, Eucon Retarder-75, www.euclidchemical.com.
      2) BASF Admixtures, Inc., Pozzolith 100XR, www.basf-admixtures.com.
      3) Sika Corporation, Plastiment, www.sikaconstruction.com.
      4) Approved equal.
5. Water-Reducing and Acceleration Admixture:
   a. Provide a product conforming to the requirements specified for Types C or E in ASTM C 494/C 494M.
   b. Manufacturers:
      1) The Euclid Chemical Company, Accelguard 80, www.euclidchemical.com.

2) BASF Admixtures, Inc., Pozzutec 20, www.basf-admixtures.com.
3) Sika Corporation, Plastocrete 161 FL, www.sikaconstruction.com.
4) Approved equal.

6. High-Range, Water-Reducing Admixture:
   a. Provide a product conforming to the requirements specified for Type F in ASTM C 494/C 494M.
   b. Manufacturers:
      1) The Euclid Chemical Company, Eucon 1037, www.euclidchemical.com.
      2) BASF Admixtures, Inc., Pozzolith 400N, www.basf-admixtures.com.
      3) Sika Corporation, Sikament 2000, www.sikaconstruction.com.
      4) Approved equal.

E. Preformed Expansion Joint Fillers:
   1. Nonextruding and Resilient Bituminous Types:
      a. Provide nonextruding and resilient bituminous types of joint fillers for exterior use in pavements and sidewalks only.
      b. Provide nonextruding and resilient bituminous joint fillers conforming to the requirements of ASTM D 1751.
   2. Manufacturers:
      a. The Euclid Chemical Company/Tamms Industries, Inc., www.euclidchemical.com.
      b. W. R. Meadows, Inc., www.wrmeadows.com.
      c. APS Supply Company, http://apscork.com.
      d. Approved equal.

F. Vinyl Waterstops:
   1. Provide ribbed type waterstops conforming to the requirements of COE CRD C 572, and manufactured from virgin polyvinyl chloride plastic compound.
   2. Construction Joints:
      a. Provide flat ribbed 6-inch by 3/8-inch construction joints, such as Catalog Number R6-38 manufactured by Vinylex Corporation, www.vinylex.com; or approved equal.
   3. Expansion Joints:
      a. Provide 9-inch by 3/8-inch; ribbed expansion joints with a 1½-inch outside diameter center bulb, such as Catalog Number RLB9-38 manufactured by Vinylex Corporation, www.vinylex.com; or approved equal.
   4. Retro-fit Waterstops:
      a. Provide 6-inch by 3/8-inch retro-fit vinyl waterstops with a 3 3/16-inch T-leg, such as Product Number 609 manufactured by Greenstreak, Inc., www.greenstreak.com; or approved equal.
   5. Manufacturers:
      a. Vinylex Corporation, catalog numbers as specified above, www.vinylex.com.
      b. The Euclid Chemical Company/Tamms Industries, Inc., www.euclidchemical.com.
      c. W. R. Meadows, Inc., www.wrmeadows.com.
      d. Approved equal.

G. Curing Materials:
   1. Provide curing materials that will not stain or affect the concrete finish, or lessen the concrete strength.
      a. Burlap:
         1) Provide burlap materials conforming to the requirements of AASHTO M 182.
      b. Sheet Materials:
         1) Provide sheet materials conforming to the requirements of ASTM C 171.

c. Liquid Membrane-Forming Curing Compound:
    1) Provide liquid membrane-forming curing compound material conforming to the requirements for Type 1 specified in ASTM C 309.
        a) Provide a compound that restricts the loss of water to not more than 0.039 gallons per cubic centimeter of surface in 72 hours when tested in accordance with ASTM C 156 at the coverage rate recommended by the manufacturer.
            (1) Submit a letter from the manufacturer that specifies the coverage rate necessary to meet this restriction for loss of water.
        b) Provide liquid membrane-forming curing compounds which are nontoxic, free of taste and odor, and comply with the low volatile organic compound (VOC) requirements of the U.S. Environmental Agency.
    2) Manufacturers:
        a) L&M Construction Chemicals, Inc., L&M Cure, www.lmcc.com.
        b) BASF Admixtures, Inc.., Masterkure 200W, www.basf- admixtures.com.
        c) Euclid Chemical Company, Kurez DR, www.euclidchemical.com.
        d) Approved equal.

H. Clear Curing and Sealing Compound:
1. Provide a liquid-type membrane-forming clear curing and sealing compound conforming to the requirements for Type I, Class A, specified in ASTM C 1315.
2. Provide material that has a maximum volatile organic compound (VOC) rating of 350 grams per liter.
3. Provide material that has a moisture loss not more than 0.40 kilograms per square meter when applied at an application rate of 300 square feet per gallon.
4. Manufacturers:
    a. Euclid Chemical Co., Super Diamond clear VOX, www.euclidchemical.com.
    b. BASF Admixtures, Inc., Sonneborn®, Kure-N-Seal 25LV, www.chemrex.com.
    c. L&M Construction Chemical, Inc., Lumiseal WB Plus, www.lmcc.com.
    d. Approved equal.

I. Non-Slip (Dry-Shake) Aggregate Surfacer:
1. Provide aluminum-oxide, non-slip aggregate surfacer to be applied to fresh concrete by the dry-shake method.
2. Manufacturers:
    a. Sonneborn; Frictex, www.chemrex.com.
    b. Approved equal.

J. Epoxy Bonding Compound:
1. Provide a high-modulus, low-viscosity, moisture-insensitive epoxy adhesive conforming to the requirements for Type II, Grade 2, Classes B and C, specified in ASTM C 881 when mixed, and having the following properties:
    a. Compressive Strength (Minimum): 8,000 psi at 28 days when measured in accordance with the requirements of ASTM D 695.
    b. Tensile Properties:
        1) Tensile Strength (Minimum): 4,000 psi at 14 days when measured in accordance with the requirements of ASTM D 638.
        2) Elongation at Break: One to three percent when measured in accordance with the requirements of ASTM D 638.
        3) Modulus of Elasticity: 3 x 105 psi when measured in accordance with the requirements of ASTM D 638.

c. Minimum Bond Strength (Plastic Concrete to Hardened Concrete): 1,700 psi at 14 days (moist cure) when measured in accordance with the requirements of ASTM C 882.

2. Manufacturers:
   a. Sika Corporation; Sikadur 32 Hi-Mod, www.sikaconstruction.com.
   b. Euclid Chemical Company; Euco Epoxy #452 MV or #620, www.euclidchemical.com.
   c. Fosroc, Inc.; Notobond 881, www.studiolina.com/studio/websites/fosroc.
   d. Approved equal.

K. Epoxy Adhesive (For Grouting Dowels):
1. Provide a high-modulus, moisture insensitive epoxy adhesive of thick (gel) consistency conforming to the requirements for Type I, Grade 3, Classes B and C, specified in ASTM C 881, and having the following properties:
   a. Compressive Strength (Minimum): 10,000 psi at 28 days when measured in accordance with the requirements of ASTM D 695.
   b. Tensile Properties:
      1) Tensile Strength (Minimum): 3,000 psi at 14 days when measured in accordance with the requirements of ASTM D 638.
   c. Minimum Bond Strength (Hardened Concrete to Hardened Concrete): 2,000 psi at 14 days (moist cure) when measured in accordance with the requirements of ASTM C 882.
2. Manufacturers:
   a. Sika Corporation; Sikadur 31 Hi-Mod Gel, www.sikaconstruction.com.
   b. Euclid Chemical Company, Euco Epoxy #452 Gel or #620 Gel, www.euclidchemical.com.
   c. Fosroc, Inc.; Anchorbond, www.studiolina.com/studio/websites/fosroc.
   d. Approved equal.

L. Dovetail Anchor Slots:
1. Provide 24 gauge-galvanized steel, foam filled dovetail anchor slots.

M. Construction Joint Devices:
1. Provide integral, galvanized steel construction joint devices formed to make a tongue and groove profile.
   a. For exposed concrete areas, provide plastic joint cap strips that can be removed to allow placement of sealant.
2. Manufacturers:
   a. Meadowburke, www.meadowburke.com.
   b. Heckmann Building Products, Inc., www.heckmannbuildingprods.com.
   c. Approved equal.

N. Contraction Joint Inserts:
1. Provide two-piece, plastic, preassembled, preformed contraction joints with a depth of embedment equal to 1/4 of the slab thickness.
2. Manufacturers:
   a. Meadowburke, Burke Zip Strip, www.meadowburke.com.
   b. W.R. Meadows, Speed - E - Joint., www.wrmeadows.com.
   c. Approved equal.

O. Construction and Control Joint Filler (For Slabs-on-Grade):
1. Provide two-component epoxy construction and control joint fillers.
2. Manufacturers:
   a. Sika Corporation, Sikadur 51 SL, www.sikaconstruction.com.

b. Euclid Chemical Company, Euro 700, www.euclidchemical.com.
c. BASF Admixtures, Inc., Masterfill 300, www.basf-admixtures.com..
d. Approved equal.

2.2 EQUIPMENT

A. Furnish plant equipment and facilities conforming to the requirements specified in the NRMCA Plant Certification Checklist - Section 3 for producing the ready-mixed concrete.

2.3 MIXES

A. Design Mix:
1. Prior to producing concrete, submit all mix designs proposed for Contract to the Engineer for approval on form attached at the end of this Section.
   a. Include a standard deviation analysis or laboratory trial mixture test data with the submittal in accordance with Section 4 of ACI 301.
   b. Use materials in proposed design mixes as specified in this Section.
   c. Make adjustments in the proposed design mix as directed by the Engineer at no increase in the Contract Price.
2. Do not add water to concrete mixes at the Work Site unless it is withheld from the mix at the batch mixing plant.
   a. Indicate the amounts of mix water to be withheld for later addition at the Work Site in the approval form.

B. Proportions of Ingredients:
1. Select the proportion of normal weight concrete in the mix in accordance with the requirements of ACI 211.1.
2. Establish proportions of ingredients of the mix, including the water-cement ratio, on the basis of either laboratory trial mixture tests or standard deviation analysis, using the materials specified within this Section.
   a. Perform the Laboratory Trial Mixture Test in accordance with Section 4 in ACI 301.
   b. Perform the Standard Deviation Analysis in accordance with Section 4 in ACI 301.

C. Water-Cement Ratio:
1. Provide a maximum water-cement ratio of 0.45.

D. Slump:
1. Proportion and produce concrete to produce a slump as indicated in Table 03300-1.

Table 03300-1 Concrete Slump Requirements

Type of Construction	Slump (Inches)	
	Maximum[1]	Minimum
Slabs	4	1
Building columns, piers	4	1
Pavements and slabs-on-grade	3	1

2. For pumped concrete, use concrete having a maximum slump measured prior to pumping of 5 inches.
3. For concrete containing high-range water-reducing admixtures, the maximum allowable slump after the admixture is added to concrete with an initial slump of 2 to 4 inches is 8 inches.

E. Admixtures:
1. Comply with the manufacturer's recommendations when using concrete admixtures.
2. Air Entraining Admixture:
a. Provide air-entrained concrete for each concrete pour unless indicated otherwise in the Specifications or on the Contract Drawings.
1) Do not air-entrain concrete for interior floor slabs.
b. The total air content required is as indicated in Table 03300-2:

Table 03300-2 Air Content

Maximum Coarse Aggregate Size (Inches)	Air Content (Percent by Volume)
1 1/2	5 ± 1
3/4 or 1	6 ± 1

3. Water-Reducing Admixture:
a. Unless high temperatures occur or placing conditions dictate a change, provide concrete containing a water-reducing admixture.
4. Water-Reducing and Retarding Admixture:
a. When high temperatures occur or placing conditions dictate, the water- reducing admixture (Type A) may be replaced with a water-reducing and retarding admixture (Type D).
1) Notify the Engineer of this change, and submit product data for the water-reducing and retarding admixture prior to placing the modified concrete.
5. Water-Reducing and Accelerating Admixture:
a. When low temperatures occur or placing conditions dictate, the water- reducing admixture (Type A) can be replaced with a water-reducing and accelerating admixture
1) Notify the Engineer of this change, and submit product data for the water-reducing and accelerating admixture prior to placing the modified concrete.

2.4 FINISHES

A. Concrete Surface Irregularities:
1. Allowable surface irregularities in concrete finishes are designated as either "abrupt" or "gradual" in this Section.
a. Furnish 10-foot straightedges to check gradual irregularities in concrete finishes.

B. Formed Surface Finishes:
1. Apply one or more of the following finishes to the surfaces of formed concrete after removing the forms:
a. Rough Form Finish:
1) The surface of the formed concrete may not include roughness and irregularities exceeding 1/2 inch.
2) Patch tie holes and defects.
b. Ordinary Wall Finish:
1) The surface of the formed concrete must be true and uniform without any conspicuous offsets or bulges.
2) Gradual irregularities may not exceed 1/2 inch, and abrupt irregularities may not exceed 1/4 inch.
c. Plywood Finish:
1) The surface must comply with the requirements for the Ordinary Wall Finish, except gradual irregularities exceeding 1/2 inch and abrupt irregularities exceeding 1/8 inch must be removed.

a) Completely remove all fins on the surface.
b) Rub the surfaces which cannot meet these requirements as specified in Subparagraph 2.04.B.1.d.

2) Construct the surface of the forms using 5/8-inch plywood or boards lined with tempered hardboard not less than 3/16 inch thick.
3) Place the plywood or liner sheets in an orderly and symmetrical arrangement using sheets as large as practicable.
4) Do not use sheets showing torn grain, worn edges, patched holes from previous use, or other defects which will impair the texture of the concrete surfaces.

C. Unformed Surface Finishes:
1. Apply one or more of the following finishes to the surfaces of unformed concrete:
a. Floated Finish:
1) After the concrete has been placed, consolidated, struck off, and leveled, do no further work until the concrete is ready for the floating operation.
2) Begin a floating operation when the water sheen has disappeared and the surface of the concrete has stiffened sufficiently to permit the operation.
a) During or after the first floating, check the planeness of surface by laying a straightedge on top of the concrete surface at not less than two different angles.
b) During this procedure, cut down high spots and fill low spots to produce a surface with true planes within 1/4 inch in ten feet as determined by placing a ten foot straightedge anywhere on the slab in any direction.
c) Immediately following checking the surface with the straightedge, re-float the slab to a uniform texture.
b. Steel Trowel Finish:
1) This finish is applied immediately to a fresh Floated Finish by working the floated finish with a steel trowel.
a) Perform the first troweling to produce a smooth surface which is relatively free of defects, but which may still show some trowel marks.
b) Perform additional trowelings by hand after the surface has hardened sufficiently.
c) Perform the final troweling when a ringing sound is produced as the trowel is moved over the surface.
2) Thoroughly consolidate the surface by hand trowel operations to produce a finished surface essentially free of trowel marks, uniform in texture and appearance, and with true planes within 1/4 inch in ten feet as determined by a ten foot straightedge placed anywhere on the slab in any direction.
c. Broom or Belt Finish:
1) This finish is applied immediately to a fresh Floated Finish by drawing a broom or burlap across the surface to give the surface a coarse transverse scored texture.
d. Nonslip Finish:
1) Apply non-slip aggregate surfacer to the surfaces using the "dry shake" method of application.
2) Apply the non-slip aggregate surfacer in accordance with manufacturer's recommendations and at a rate not less than 25 pounds per 100 square feet.

2.5 SOURCE QUALITY CONTROL

A. Tests:

1. Materials specified in this Section require advance examination or laboratory testing according to the methods referenced herein, or as required by the Engineer.
    a. Submit concrete test reports for the testing specified in this Section.
2. Compression Test:
    a. For laboratory trial batches of concrete, make compression test cylinders in accordance with ACI 301.
    b. Test four compression test cylinders for each class of concrete, breaking two at seven days and breaking two more at 28 days per the requirements of ASTM C 192/C 192M and ASTM C 39/C 39M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect the locations that will receive cast-in-place concrete for deficiencies which would prevent proper execution of the concrete work.
    1. Do not proceed with concrete placement until deficiencies discovered by the inspection are corrected to the satisfaction of the Engineer.

3.2 PREPARATION

A. Prepare formwork in advance in accordance with the requirements of Section 03 10 00, Concrete Forms and Accessories; and remove snow, ice, water, and debris from within forms.

B. Pre-position reinforcement in accordance with the requirements of Section 03 20 00, Concrete Reinforcement; in advance of concrete pours.

C. Sprinkle the subgrade sufficiently to eliminate water loss from concrete in accordance with ACI 302.1R.
    1. Verify that the subgrade is moist, with no free water and no muddy or soft spots, before placing concrete.

D. Vapor Barrier:
    1. Immediately before pouring concrete floor slabs, place vapor barrier on their crushed stone bases under the imminent slab pours.
        a. Lap all vapor barrier sides 6 inches and vapor barrier ends 12 inches.
        b. Parch any holes and rips in the vapor barrier film to the satisfaction of the Engineer.
        c. At exterior walls, turn the vapor barrier up to the top of the slab.
    2. Coordinate vapor barrier placement with installation of the perimeter foundation insulation.

E. Embedded Pipes and Conduits:
    1. The Engineer may permit material that is not harmful to concrete to be embedded in the concrete if the following conditions are satisfied:
        a. The maximum outside dimension of an item to be embedded is not greater than one-third the overall thickness of the member in which it is to be embedded.
        b. The minimum spacing between items to be embedded is not less than 3 widths on center, or 3 inches clear between items, whichever is less.
        c. The item(s) to be embedded will not impair the strength of the concrete member.

d. A 2-inch minimum clearance from the embedded item(s) to the face of the concrete slab is maintained.
e. Items to be embedded are not made of aluminum.
f. Concrete reinforcement within the concrete member will not be cut, bent, or displaced in order to embed the item(s).

2. Anchor Rods:
a. Install anchor rods accurately, both vertically and horizontally, in the formwork as shown on the Contract Drawings.
b. Insure anchor rods are held firmly in the correct position and at the proper elevation by suitable templates during the placement of concrete.
c. Limit the variation in the locations of anchor rods and other embedded items from the dimensions shown on the Contract Drawings to within the tolerances listed in AISC 303.

3. Dovetail Anchor Slots:
a. Recess dovetail anchor slots for brick veneer masonry anchors in concrete every 24 inches horizontally and 16 inches vertically.

F. Anchor Reinforcement Dowels into Existing Concrete.
1. Using a carbide tip bit or star bit, drill holes for each dowel to the size and depth indicated on the Contract Drawings.
a. Core drilling is not permitted.
b. Do not drill into, cut, or otherwise damage existing reinforcement bars.
1) If existing reinforcement bars are encountered during the drilling operation, relocate the hole to clear the existing reinforcement as directed by the Engineer.
2. Blow clean each finished hole with an oil free air jet, and then flush the hole with a jet of clean water.
3. Immediately prior to placing and grouting the dowel bar into the hole, remove all water from the hole and from the walls of the hole.
4. Mix and place epoxy adhesive completely around the dowel bar in the hole in strict accordance with the manufacturer's recommendations.
a. Pay particular attention to the manufacturer's specified time limit within which the material must be placed after mixing.
b. Do not re-temper grout that has begun to stiffen; discard such grout.

3.3 CONSTRUCTION

A. Construction of Concrete Elements:
1. Construct the concrete elements indicated on the Contract Drawings or in the Specifications; including but not limited to, beams, columns, slabs, foundations, in-ground encasement of piping and conduit, reaction backings for piping, concrete backfill, and the reinforced concrete bases for equipment and piping provided under this Contract.
2. Provide only Class A concrete to construct concrete elements for this Contract except where indicated otherwise on the Contract Drawings or in the Specifications.
a. For in-ground encasement of piping, provide Class B concrete.
1) Encase pipes in concrete that are under structures and buildings or that are indicated to be encased in concrete on the Contract Drawings for the full length of the pipe run under the structure and as indicated.
b. For in-ground encasement of conduit runs, provide Class B concrete.
1) Encase conduit runs indicated to be encased in concrete on the Contract Drawings as indicated and detailed on the Contract Drawings.

c. For reaction backings, provide Class B concrete.
d. For backfilling of over-excavated foundation area, foundation voids, and cavities, provide Class B concrete.

B. Concrete Production:
1. Batch, mix, and transport ready-mixed concrete in accordance with ASTM C 94/C 94M.
2. Add admixtures to the mix in accordance with ACI 301.

C. Conveying and Placing Concrete:
1. Maintain the required concrete quality by rapidly conveying the concrete from the mixer to the location of the placement, and by using methods which will prevent segregation and loss of ingredients.
a. After introducing either the mixing water to the cement and aggregates, or the cement to the aggregates, complete discharging the concrete within 1 1/2 hours or before the mixing drum has revolved 300 revolutions; whichever comes first.
b. Do not convey concrete through aluminum or aluminum alloy equipment.
2. If the concrete is to be conveyed and placed by pumping, conform to the applicable requirements of ACI 304R, Chapter 9, and ACI 304.2R.
a. Do not place concrete by pumps or other similar devices without prior written approval of the Engineer.
3. Place concrete in accordance with the requirements of ACI 304R and the additional requirements specified in this Section.
a. Do not drop concrete freely more than 4 feet or in areas where reinforcing will cause segregation.
b. Deposit concrete in approximately horizontal layers 12 to 18 inches deep.
c. Do not allow concrete to flow laterally more than three feet.
d. Do not use concrete which has partially hardened, or has been contaminated by foreign materials.
1) Place concrete at a rate so that the concrete which is being integrated with the fresh concrete is still plastic.
2) Do not deposit concrete on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within sections.
e. Do not place concrete in forms containing standing water.
f. Do not bend reinforcement out of position when placing concrete.
g. Within pour sections, continuously place concrete to produce a monolithic unit.
h. Do not cast or erect beams, girders, or slabs supported by columns or walls until the concrete in the vertical support members is no longer plastic.
4. Consolidating Concrete:
a. Consolidate concrete by vibration, spading, rodding or other manual methods.
1) Work the concrete around the concrete reinforcement and embedded items, and into corners.
2) Eliminate all air or stone pockets; and eliminate other causes of honeycombing, pitting, and planes of weakness.
3) Use vibrators capable of transmitting vibrations to the concrete in frequencies sufficient to provide satisfactory consolidation.
a) Use the internal type of vibration equipment, and not the type attached to forms or concrete reinforcement.
b) Do not use vibrators to spread the concrete.
4) Do not leave vibrators in one spot long enough to cause segregation.
b. Keep sufficient vibration equipment in reserve on the Work Site to prevent a shutdown of the Work occasioned by a failure of the primary vibration equipment.

D. Joints:
1. Joint Locations:
a. Only the locations of critical joints are indicated on the Contract Drawings.
1) Subject to the Engineer's approval, locate additional joints that are required in walls, slabs, and foundations throughout the structures.
a) Submit requests for approval of additional joint locations to the Engineer ten days prior to scheduled concrete pours adjacent to the proposed joints.
b) Do not make concrete pours unless the joint locations have been approved by the Engineer.
b. If concreting is to be interrupted for more than 45 minutes, or long enough for the concrete to harden, form and construct a construction joint.
c. Locate the additional construction joints required in walls and foundations where they will least impair the strength of the structure.
1) Do not locate construction joints in continuous grade beams and footings more than 60 feet apart horizontally.
2) Do not locate construction joints in foundation slabs more than 30 feet apart horizontally.
3) Do not locate construction joints in continuous walls more than 30 feet apart horizontally.
a) At corners or other intersections of two or more walls, provide a construction joint in each wall in all directions that is less than 20 feet from the intersection point.
b) Align construction joints in walls with the construction joints placed in the supporting foundation element (base slab, continuous footing, grade beam), or offset the construction joints a minimum of 5 feet.
d. Locate the additional construction joints required in elevated (suspended) formed slabs where they will least impair the strength of the structure.
1) Locate joints within the center third of an elevated formed slab's span.
2) Do not locate construction joints more than 30 feet apart in each direction in an elevated formed slab.
a) Some minor deviation from this spacing may be approved by the Engineer to allow correction for column spacing and construction details.
3) Continue the concrete reinforcement through the construction joints.
4) Locate joints in girders with intersecting beams a minimum offset distance from the beam of two times the width of the beam.
5) Do not cast or erect beams, girders, or slabs supported by columns or walls until the concrete in the vertical support member is no longer plastic.
e. Locate additional control joints and construction joints in slabs-on-grade at the following maximum spacing unless noted otherwise:
1) In 5-inch slabs, space the joints 15 feet apart each way.
2) In 6-inch slabs, space the joints 18 feet apart each way.
3) In 8-inch slabs, space the joints 24 feet apart each way.
f. Install expansion joints and contraction joints where indicated on the Contract Drawings.
2. Construction Joints:
a. Typically, construct construction joints before the initial hardening of the concrete can take place by forming keyways, installing PVC waterstops in the concrete if required, and embedding reinforcement dowels in the concrete extending a minimum of one splice length beyond the joint.
1) Provide PVC waterstops in construction joints that will be exposed to liquids, are in contact with earth, or are exposed to the weather;.

2) If concrete placement is interrupted long enough for a "cold joint" (hardened surface) to form, install dowel so that one splice length will extend into the present concrete section pour, and one splice length will extend into the adjacent future pour.
a) Size the embedded dowels to match the size of the concrete reinforcement in the slab, wall, or foundation being poured.
b) In elevated slabs, splice the dowels to the top and bottom concrete reinforcement.

b. Only use the "construction joint devices" in concrete that is not intended to retain water.
c. Horizontal construction joints are not permitted in slabs or footings.

3. Control Joints and Construction Joints in Slabs-On-Grade:
a. Control joints can be constructed in a slab-on-grade by installing a "contraction joint insert" in the slab by pressing a straight edge cutting tool into the slab's wet concrete to part the aggregate.
1) Place the insert into the separation until the top of the insert lays on the surface of the wet concrete.
2) Remove the top section of the insert, and float the concrete to fill voids adjacent to the insert and finish the concrete surface.
b. Control joints can also be constructed in a slab-on-grade by saw-cutting a continuous straight slot to a depth of one-fourth the thickness of the slab.
1) Submit detailed procedures and plans to the Engineer for review and acceptance before constructing control joints.
2) Saw the slot as soon as the concrete has hardened sufficiently; but complete the sawing within 12 hours after the concrete has been placed.
c. Fill all construction and control joints in slabs-on-grade with construction and control joint filler.

4. Expansion Joints and Contraction Joints in Walls:
a. Do not extend reinforcing or other embedded metal items through expansion and contraction joints except where indicated otherwise on the Contract Drawings.
b. For expansion joints and contraction joints that will be exposed to liquids, are in contact with earth, or are exposed to the weather; provide PVC waterstops in the joints.

5. Bonding Hardened Concrete to New Concrete:
a. Bond fresh new concrete to hardened previously poured concrete in accordance with the following:
1) Roughen and clean the hardened concrete to remove foreign matter and laitance, and then dampen the hardened concrete with water.
2) Cover the hardened concrete with a heavy, 1/2-inch thick, coating of grout.
a) Provide grout having the same material composition and proportions as the concrete being poured, except omit the coarse aggregate.
b) Provide grout with a slump of 6 inches, minimum.
3) Place the new concrete on the grout before the grout has attained its initial set.
4) Any other bonding methods must be approved by Engineer prior to use.

6. No exceptions to the specified requirements for joints are permitted unless written approval is given by the Engineer.

E. Finishing Concrete:
1. Whether the concrete is to remain natural concrete or will receive an additional applied finish or material, finish the concrete surfaces as indicated or scheduled on the Contract Drawings and as specified in this Section
a. For concrete having unformed surfaces, use just enough mortar to avoid the need for excessive floating.

b. Slope exposed unformed surfaces to provide quick, positive drainage; and to avoid puddles in low spots.
    1) Unless noted otherwise on the Contract Drawings, slope all unformed surfaces exposed to the weather 1/4 inch per foot for drainage.

2. Unless the type of finish is indicated on the Contract Drawings or is a Special Finish, finish concrete surfaces as follows.
    a. Rough Form Finishes:
        1) Provide a Rough Form Finish on concrete surfaces to be covered by earth.
    b. Ordinary Wall Finishes:
        1) Provide an Ordinary Wall Finish for the following:
            a) Interior and exterior concrete wall surfaces not exposed to view.
            b) The inside vertical concrete surfaces of tank type structures 18 inches or more below the normal water level.
            c) The interior concrete walls of water filter structures 6 inches or more below the filter media.
            d) The concrete walls and overhead surfaces of clearwells.
            e) The undersides of concrete slabs to be covered by architectural ceilings.
    c. Plywood Finishes:
        1) Provide a Plywood Finish for all surfaces to be painted.
    d. Rubbed Finishes:
        1) Provide a Rubbed Finish for the following:
            a) Interior and exterior concrete surfaces exposed to view which will not be painted.
            b) Exterior concrete surfaces above the level beginning 6 inches below finished ground.
            c) Concrete equipment pads.
            d) The inside vertical concrete surfaces of tank type structures above the elevation located 18 inches below the normal water level.
            e) The interior concrete walls of water filter structures above the level 6 inches below the filter media.
            f) Concrete pipe support bases.
    e. Floated Finishes:
        1) Provide a Floated Finish for all unformed concrete surfaces unless otherwise specified.
    f. Steel Trowel Finishes:
        1) Provide a Steel Trowel Finish for the following:
            a) The tops of exposed concrete walls.
    g. Broom or Belt Finishes:
        1) Provide a Broom or Belt Finish for the following:
            a) Concrete traffic surfaces.
            b) Concrete sidewalks.
    h. Non-slip Finishes:
        1) Provide a Non-slip Finish for exterior concrete stair treads and landings.

F. Curing Concrete:
1. Immediately after placing and finishing concrete, protect the concrete from premature drying, excessive hot or cold temperatures, and mechanical injury.
2. Cure the concrete by water curing, sheet form curing, or liquid membrane forming methods in accordance with ACI 308R.
    a. Cure concrete continuously for a minimum of 7 days at ambient temperatures above 40 degrees Fahrenheit.

1) Cure the concrete during cold weather according to the requirements of Subparagraph 1.09.A.1.
2) Cure the concrete during hot weather according to the requirements of Subparagraph 1.09.A.2.

b. Control the curing of concrete surfaces that will get a membrane coating, by using water fog spraying, water damped coverings, and/or an impermeable sheet film cover for the full 7-day period specified in Subparagraph 3.03.F.2.a.
1) Do not apply the membrane until the concrete surfaces have cured a minimum of 28 days.
2) Do not use liquid membrane- forming curing compounds on these surfaces.

c. If liquid curing compounds will be used to cure the concrete, complete finishing operations prior to applying the compound; and apply the compound as soon as the free water on the concrete surface disappears and no water sheen is visible.
1) Do not use liquid curing compounds on concrete surfaces which will receive later treatments, such as hardeners, special finishes, protective coatings, damp proofing, waterproofing, future grout, grout fill, or other coatings.
2) Do not use liquid curing compound when the ambient air temperature during placement and for 24 hours after placement is or will fall below 35 degrees Fahrenheit.
3) The surface must be capable of having workers walk on it without marring the surface.
4) Apply the liquid curing compound twice.
a) Do not apply liquid curing compound to the surfaces of construction joints.
b) Protect exposed reinforcement during application of curing compound.
c) Water cure those areas not coated with liquid curing compound.

3. Note that concrete containing ground granulated blast furnace slag may require a longer time to set compared to 100 percent Portland cement concrete.
4. Protect the finished surfaces and slabs from the direct rays of the sun to prevent checking and crazing.

3.4 REPAIR/RESTORATION

A. Remove concrete segregated into ingredients during consolidation by vibrator operations, and replace the segregated concrete with new concrete.

B. As soon as the forms have been stripped from the concrete and the concrete surfaces have been exposed, do the following:
1. Remove fins and other projections, fill recesses left by the removal of form ties, and repair surface defects which do not impair the structural strength of the concrete.
2. Clean all exposed concrete surfaces and adjoining areas stained by the leakage of concrete to the satisfaction of the Engineer.

C. Repair tie holes and other small cavities by cleaning out the resulting cavities, wetting the cavity area, and then filling the cavity with a stiff mortar of the same material used in the concrete, but somewhat leaner.

D. Repair and patch other defective areas with cement mortar of mix proportions and materials identical to those used in the surrounding concrete.
1. Produce a finish on the patch that is indistinguishable from the surrounding concrete.

E. Where honeycomb or voids are not excessive, and repairs are authorized by the Engineer; saw cut a 1/2 to 3/4 inch deep square outline around the area of defective concrete to be removed and patched, and chip out the defective concrete inside the outline to a depth not less than 2-inches until sound solid concrete is encountered.
   1. If chipping is necessary, make the edges of the depression perpendicular to the concrete surface or slightly undercut to provide a key at the edge of the patch.
   2. Thoroughly clean, dampen, and brush coat the area to be patched with neat cement grout; and follow this preparation by placing a cement mortar to patch the concrete.
      a. Other patching materials may be used if accepted by Engineer in writing prior to start of repair work.
   3. Keep the patch damp for 7 days at a temperature above 50 degrees Fahrenheit.

3.5 FIELD QUALITY CONTROL

A. Site Tests:
   1. During the period when concrete is being placed, must perform routine and other testing of materials at no additional cost to the Agency.
      a. Advise the Testing and Inspection Agency sufficiently in advance of operations to allow testing personnel to be assigned and to provide sufficient time for quality tests to be performed and completed.
      b. Provide and maintain adequate and separate facilities for safe storage and proper curing of concrete test cylinders on the Work Site for the sole use of the Testing and Inspection Agency.
      c. Provide containers for transporting concrete test cylinders to the testing laboratory.
      d. The Testing and Inspection Agency must perform additional materials testing due to changes in materials or proportions requested by the Contractor or testing required by failure of material to meet specified requirements.
      e. Failure of Testing and Inspection Agency to detect defective work will not prevent its rejection later when the defect is discovered, neither does it obligate the Engineer or Owner to grant final acceptance of the Work.
      f. Submit the test results of the following field quality control testing to the Engineer for information.
   2. Concrete Slump Test:
      a. Test Procedure:
         1) Determine the slump of a concrete Sample from each truckload of concrete upon its arrival at the Work Site, and from other concrete whenever the consistency of the concrete appears to vary.
         2) Determine the temperature of the concrete Sample.
         3) Determine the slump according to the requirements of ASTM C 143/C 143M.
      b. Acceptance Criteria:
         1) Refer to Paragraph 2.03.D.
   3. Air Content Test:
      a. Test Procedure:
         1) Determine the air content of the concrete on a regular and frequent basis in accordance with ASTM C 231, ASTM C 173/C 173M, or ASTM C 138/C 138M.
      b. Acceptance Criteria:
         1) Refer to Subparagraph 2.03.E.2.b.
   4. Concrete Strength Test for New Concrete:
      a. To evaluate the potential strength and uniformity of new concrete, perform at least five strength tests for each specified mix design to represent the mix's strength.

b. Test Procedure:
    1) Secure composite samples in accordance with ASTM C 172.
        a) Obtain representative test samples from different batches of concrete on a truly random basis by selecting a test batch number at random before commencing the placement of concrete.
        b) When pumping or pneumatic equipment is used, obtain samples at the truck and discharge ends.
        c) Take sufficient test samples to perform not less than 5 strength tests of two 28 day cylinders per test for each concrete mix design.
            (1) Take samples for each concrete mix design not less than once a day, or not less than once for each 100 cubic yards of concrete, or not less than once for each 3000 square feet of surface area placed.
    2) Mold at least 4 concrete test cylinders in strict compliance with the requirements of ASTM C 31/C 31M for each strength test, and cure the cylinders for a 24-hour initial curing period.
        a) Have a responsible representative from the Quality Assurance Testing and Inspection Agency observe the making of the concrete test cylinders by the Contractor, and immediately thereafter pack them in a sturdy container that was furnished by the Contractor and approved by the Quality Assurance Testing and Inspection Agency.
        b) Surround the concrete test cylinders with wet sand or sawdust and protect them from freezing.
        c) Sequentially number the concrete test cylinders and record the number, the date each cylinder was made, and the results of the slump test and the temperature for each sample on the proper form; forward the form to the Engineer, and then transport the cylinders to the testing laboratory where they will be cured in strict compliance with ASTM C 31/C 31M until the time of the test.
    3) Conduct each strength test in accordance with ASTM C 39/C 39M as follows:
        a) Test 2 concrete test cylinders from the same sample 7 days after the cylinders were made for information.
        b) Test 2 additional concrete test cylinders from the same sample 28 days after the cylinders were made for acceptance.
        c) Average the compressive strengths of the two specimen cylinders tested at 28 days.
        d) If one concrete test cylinder in a strength test manifests evidence of improper sampling, molding, or testing, discard it and consider the strength of the remaining cylinder to be the test result; if both specimen cylinders in a test for a single sample show any of the above defects, discard the entire test for that sample.
c. Acceptance Criteria:
    1) Evaluate the test results for standard molded and cured test cylinders separately for each specified concrete mix design by comparing the test results to the minimum requirements for the Class of concrete as specified in Subparagraph 1.04.B.1.
    2) The strength level of the concrete will be considered satisfactory so long as the average of all sets of three consecutive compressive strength test results equal or exceed the specified strength f'c, and no individual strength test result falls below the specified strength f'c by more than 500 psi.

5. Concrete Strength Test for Concrete in Place:

a. The Engineer will determine locations where the concrete in place is potentially deficient, and where to obtain test cores to least impair the structure's strength.
   1) As an aid to evaluate in place concrete strength or for selecting areas to be cored, the Engineer may permit concrete-in-place to be tested by impact hammer, sonoscope, or other nondestructive device to determine the relative strengths at various locations in the structure.
   2) Preliminary tests of concrete-in-place will not be used as a basis for accepting or rejecting the concrete, but the core testing will be the basis for accepting or rejecting the in-place concrete.

b. Concrete Core Test:
   1) Test Procedure:
      a) The Engineer will determine the locations in each member or area of concrete in place where the required cores may be obtained.
      b) Where required, take at least three representative core samples, each at least 2-inches in diameter, from each member or area of concrete in place that is considered potentially deficient.
         (1) If the concrete in the structure will be dry under service conditions, air dry the cores for 7 days before the test at a temperature of 60 to 80 degrees Fahrenheit and a relative humidity of less than 60 percent; and test the cores dry.
         (2) If the concrete in the structure will be more than superficially wet under service conditions, the cores test the cores after moisture conditioning them in accordance with ASTM C 42/C 42M.
      c) Test the core samples in accordance with ASTM C 42/C 42M.
         (1) If one or more of the cores shows evidence of having been damaged before the testing, replace it either subsequent to or during its removal from the structure.
      d) Solidly fill core holes with low slump concrete.
   2) Acceptance Criteria:
      a) Concrete in the area represented by a core test will be considered adequate if the average compressive strength of the cores is equal to at least 85 percent of the specified strength f'c, and if no single core is less than 75 percent of the specified strength f'c.
      b) If the core tests fail to demonstrate concrete strengths adequate for the intended purpose of the member or members in question, or are inconclusive or impractical to obtain, or if structural analysis does not confirm the safety of the structure, load tests may be required.
         (1) Evaluate the results in accordance with ACI 318/318R.

END OF SECTION

FINAL CONCRETE MIX DESIGN SUBMITTAL FORM
(One for each required mix design)

PROJECT:_____ Location: _____
General Contractor:
Mix design no.:_____ Design strength: _____

USE:(Describe): _____
Mix Design Preparation: Based on Standard Deviation Analysis: _____
(check one) or Based on Trial Mixture Test Data: _____

MATERIALS:

Aggregates: (Provide size, type, source, specification)
Coarse: _____
Fine: _____

Cement Type/Source: _____
__

Admixtures: (Provide product, manufacturer)
Water Reducer (WR): _____
Air Entraining (AE): _____
Accelerator: _____
Other: _____

CONCRETE PROPERTIES

Water/Cement Ratio: _____
Slump:_____inches
Entrained Air:_____%
Density_____pcf

SPECIFIC GRAVITIES

Fine Aggregate: _____
Coarse Aggregate: _____

ADMIXTURES

Accelerator_____oz. per 100# cement
W. R._____oz. per 100# cement
A. E._____oz. per 100# cement
Other_____oz. per 100# cement

MIX PROPORTIONS

	Weight (lbs)	Absolute Volume (cubic feet)
Cement:		
Fine Aggregate:		
Coarse Aggregate:		
Water:		
Entrained Air:		
Other:		
TOTAL		

TEST RESULTS SUBMITTAL FORM

METHOD 1 - STANDARD DEVIATION ANALYSIS (ACI 318/318R, ACI 301):

Number of Test Cylinders Evaluated:_____ Standard Deviation: _____
(Attach Copy of All Test Results)
Mix Designs Proportioned to Achieve Both of the Following:

$f'_{cr} = f'_c + 1.34s =$ _____ psi
$f'_{cr} = f'_c + 2.33s - 500 =$ _____ psi
Actual $f'_c =$ _____ psi (f'_{cr})
Slump =_____ in. Air Content =_____ %

METHOD 2 - TRIAL MIXTURE TEST DATA (ACI 318/318R-05, 5.3.2.2):

Age (days)	Mix 1 (comp. str.)	Mix 2 (comp. str.)	Mix 3 (comp. str.)
7	_____		_____
28	_____		_____
28	_____		_____
28-day avg.	_____	_____	_____

Mix Design Proportioned to Achieve the Following:

$f'_{cr} = f'_c + 1200$ psi (for f'c 5000 psi or less)
or $f'_{cr} = f'_c + 1400$ psi (for f'c > 5000 psi)

Slump =_____ in. Air Content =_____ %

REMARKS: _____

_____

_____

Note: Fill in all blank spaces. Use -0- (zero) or N.A. (not applicable).

SUBMITTED BY:
Ready-Mix Supplier: Name _____

Address: _____

Phone Number: _____

END OF SECTION

(This Page Left Intentionally Blank)

SECTION 03 30 30 - CONCRETE TESTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide concrete materials sampling and testing.

B. Provide concrete sampling and testing.

1.2 RELATED SECTIONS

A. Section 014300 – Quality Assurance Program

B. Section 014529 –Testing Laboratory Services

1.3 REFERENCES

A. ASTM C31 -Method of Making and Curing Concrete Test Specimens in the Field.

B. ASTM C39 -Method of Test for Compressive Strength of Cylindrical Concrete Specimens.

C. ASTM C42 -Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

D. ASTM C138 -Method of Test for Unit Weight, Yield and Air Content (Gravimetric) of Concrete.

E. ASTM C143 -Method of Tests for Slump of Portland Cement Concrete.

F. ASTM C172 -Method of Sampling Fresh Concrete.

G. ASTM C173 -Method of Test for Air Content of Freshly Mixed Concrete by the Volumetric Method.

H. ASTM C231 -Method of Test for Air content of Freshly Mixed Concrete by the Pressure Method.

I. ASTM C567 -Method of Test for Unit Weight of Structural Lightweight Concrete.

J. ASTM C900 -Pullout Strength of Hardened Concrete

K. Determine temperature of concrete sample for each strength test.
   1. ASTM E329-09 – Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.

1.4 QUALITY

A. The testing agency retained and paid by the Contractor shall meet requirements of the American Society for Testing and Materials "Specification for Minimum Requirements for Agencies Engaged

in Testing and/or Inspection of Materials used in Construction", ASTM E329. The testing agency shall be responsible for all the concrete mix design and trial batch mixing.

1.5 TESTING

A. All concrete testing shall be performed by an independent testing laboratory hired by the Contractor and approved by the Engineer. All test results shall be submitted to the Engineer for review. All costs associated with testing shall be paid for by the Contractor.

B. Concrete mix designs shall meet New York State Department of Transportation (NYSDOT) Standards and be submitted and approved by the Engineer prior to placement of the concrete. A pour sequence shall be submitted to the Engineer for approval prior to placement of the concrete.

C. Testing shall include the following work as related to concrete testing.
   1. Submission of the proposed materials with supporting information and the establishment of mix designs.
   2. Additional testing of materials or concrete occasioned by their failure by test or inspection to meet specification requirements.
   3. Additional testing and inspection required because of changes in materials or proportions.
   4. Additional testing of materials or practices which do not complying with the Specifications, which could possible result in defective work, thereby rendering it necessary or advisable to perform tests to determine whether or not work is acceptable.
   5. Inactive time spent by inspectors because of cancellations or delays in concrete placement or other work.
   6. Site cured cylinders requested by the Contractor to verify strengths for removal of forms.

1.6 DUTIES AND AUTHORITIES OF DESIGNATED TESTING COMPANY

A. Representatives of the Contractor shall inspect, sample and test the materials and the production of concrete as required by the Engineer.
   1. When it appears that any material furnished or work performed by the Contractor fails to fulfill specification requirements, the testing company shall report such deficiency to the Engineer and the Contractor.

B. The Contractor shall report all test and inspection results to the Engineer and Contractor immediately after they are performed. All test reports shall include the exact location of the work at which the batch represented by a test deposited. Reports of strength tests shall include detailed information on storage and curing of specimens prior to testing.

C. The testing company and its representatives are not authorized to revoke, alter, relax, enlarge or release any requirement of the Contract Documents, nor to approve or accept any portion of the work.

1.7 RESPONSIBILITIES AND DUTIES OF CONTRACTOR

A. The use of testing services shall in no way relieve the Contractor of the responsibility to furnish materials and construction in full compliance with the Contract Documents.

B. The Contractor shall submit to the Engineer the concrete materials and the concrete mix designs proposed for use with a written request for approval. This submittal shall include the results of all testing performed to qualify the materials and to establish the mix designs. No concrete shall be placed in the work until the Contractor has received such approval in writing.

C. To facilitate testing and inspection, Contractor shall:
   1. Furnish any necessary labor to assist the designated testing company in obtaining and handling samples at the project or other sources of materials.
   2. Advise the designated testing company not less than 24 hours (excluding weekends and holidays) in advance of operations to allow for completion of quality tests and for the assignment of personnel.
   3. Provide and maintain for the sole use of the testing company adequate facilities for the safe storage and proper curing of concrete test specimens on the project site for the first 24 hours as required by ASTM C31.
   4. Submit copies of mill test reports for shipments of cement, reinforcing steel and prestressing tendons to the Engineer when required.

1.8 ACCEPTANCE OF CONCRETE

A. For evaluation of potential strength and uniformity, each specified mix design shall be represented by at least five tests.

B. The strength level of the concrete will be considered satisfactory so long as the averages of all sets of three consecutive strength tests results equal or exceed the specified strength f'c, and no individual strength test result falls below the specified strength by more than 500 psi.

C. Concrete failing to meet specification shall be replaced at Contractor's expense.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 03 35 00 - CONCRETE COATINGS

PART 4 - GENERAL

4.1 SUMMARY - This section provides for two (2) types of coatings. All concrete surfaces shall be treated with one of these types of coatings as specified below:

A. SEALER - Provide concrete penetrating sealer system on all supported horizontal concrete deck surfaces, concrete gutters and concrete slabs on grade.

B. ANTI-GRAFFITI COATING - Provide an anti-graffiti coating system on all new vertical surfaces, concrete bollards and all surfaces exposed to vandalism as directed by the Engineer.

4.2 RELATED SECTIONS:

A. Section 03 30 00 Cast-in-Place Concrete

4.3 QUALITY CONTROL

A. Codes and Standards:
   1. Comply with the provision of the following specification and standards, except as otherwise specified.
      a. NCHRP 244 procedure - Series I, II, III & IV.
      b. Repellency Rating - 80% or better, based on comparison of untreated versus treated samples, where repellency rating of untreated samples =0%. Calculations will be in accordance with NCHRP 244 procedures.
      c. Penetration (1 application) 1/8" - 1/4".
      d. Scaling Resistance of Concrete (ASTM C-672) - Excellent.
      e. Alberta Transportation and Utilities Penetrating Sealer type 1B - Initial Water Repellency (minimum 82.5%; Water Repellency after Abrasion (minimum) 82.5%.
      f. Reduction in chloride infusion by a minimum of 83%
   2. Comply with Local and State VOC (Volatile Organic Compound) regulations where applicable.

B. Sealer Coordination:
   1. Review other sections of these specifications in which curing compounds or paints, are to be provided on concrete surfaces to be sealed to ensure compatibility with the concrete sealer and Anti-graffiti coating.

C. Warranty:
   1. The system manufacturer shall furnish the Owner a written single-source performance warranty that the Concrete Penetrating Sealer System will be free of defects related to workmanship or material deficiency for a five (5) year period from the date of substantial completion of the project. The following problems shall be specifically covered under the warranty:

a. The concrete surfaces, which receive the concrete sealer, shall not scale, dust or spall.
b. The concrete sealer shall not permit water, salts, deicers, acids and oils to penetrate the treated surfaces.

2. Any repair required under the warranty will be made by the system manufacturer as follows:
   a. Scaling or dusting will be repaired by removing loose surface materials to sound substrate and reapplying the sealer system.
   b. Spalled surfaces (surface deterioration related to the expansive forces of corrosion of reinforcement steel) shall be repaired by epoxy concrete patching done in accordance with current applicable ACI standards.
3. Any required repairs under the warranty shall be made by the system manufacturer. The system manufacturer shall provide the required written warranty.

4.4 SUBMITTALS

A. Submit manufacturer's product, application specifications, testing data and warrantee for approval prior to sealing concrete decks and applying anti-graffiti coating for specified manufacturers

B. In order for the Engineer to determine if a product is equal, submit the following:
1. List of previous work minimum of fifteen (15) projects with eight (8) of them being over ten (10) years
2. Submit photographs for work as it was installed and photographs of the same project after ten (10) years have elapsed.
3. Submit or develop 10-year weather testing results, including but not limited to; coloring weathering, surface wear spalling and salt intrusion results as required by the engineer.
4. Reimburse the owner and owner’s consultant for expenses incurred on 5 inspection field trips to sites containing similar submitted products and work.
5. Perform at the Contractor’s expense all required testing and engineering work as required by the Engineer.

4.5 JOB CONDITIONS

A. Environmental Requirements:
1. Do not proceed with application of materials if ambient temperature is below 40 degrees F. or if ice or frost are covering the substrate.
2. Do not proceed with application if ambient temperature of surface temperature exceeds 100 degrees F.
3. Do not proceed with application of materials in rainy conditions or if heavy rain is anticipated within 8 hours after application. Materials shall not be applied to damp substrates. The surface should be sufficiently dry to observe the spray pattern during application.

PART 5 - PRODUCTS

5.1 SEALER MATERIAL AND ANTI-GRAFFITI COATING

A. Provide a clear liquid "silane" type sealing compound, minimum 100 percent solid content, which will penetrate the concrete to provide a surface which is resistant to salts, de-ice chemicals, moisture, gasoline, oil and acids. Sealer material shall not alter the appearance of surface texture of concrete surfaces.

B. Sealant material shall be one of the products offered by the manufacturer's listed below.
   1. Dynamit Nobel of America, Inc. - Chem-Trete-BSM
   2. Hydrozo, Inc. Enviroseal
   3. LymTal International, Inc. - LymTal 800 Sealer, 100% Concentration
   4. Penetrating Silane Sealer complying with NYSDOT Section 717-03 and from the NYSDOT Approved List
   5. Engineer’s Approved Equal

C. Anti-graffiti shall be one of the products offered by the manufacturer's listed below. Substitute materials or manufacturers will be allowed, upon meeting the requirements of Section 1.03 A and 1.03 B.
   1. Nu-Wall Two by Enviro Solutions, Inc., P. O. Box 3483 Milford CT 203-226-7327 or 800-452-0080 2. Prosco Inc, SC-1 Sacrificial Anti-Graffiti Coating
   2. Engineer’s Approved Equal

PART 6 - EXECUTION

6.1 PREPARATION

A. Examine surfaces to receive sealer to assure that conditions are acceptable for application of materials. Concrete shall be cured a minimum of 28 days.

B. Remove dirt, dust and materials that will interfere with the proper and effective application of the water-repellent coating.

C. All caulking, patching and joint sealants should be installed prior to application of this product.

6.2 TRIAL APPLICATION AND TESTING

A. Test Procedure:
   1. Prior to full-scale surface preparation and application of selected material, a trial application shall be conducted. The area shall be 11 feet by 11 feet (121 square feet) in size, at a location determined by the Engineer. The preferred location will be on a sloping ramp.
   2. The trial area shall be cleaned according to manufacturer’s recommendations in the same manner as planned for the entire project. This may include sweeping and cleaning with compressed air, water cleaning under pressure or shot blasting. For the purposes of this test only, sandblasting is an acceptable substitute for shot-blasting.

3. Upon completion of surface preparation, a core will be removed and tested for water absorption. This is the Untreated Water Absorption value. The test area will then be treated with one gallon of the selected material. From the treated area, two core samples shall be removed. One is to be split with a chisel and dye tested for depth of sealer penetration. The second core is to be tested for Treated Water Absorption. The repellency rating is calculated on the basis of untreated and treated water absorption values.
4. Once field test results are obtained, which meets requirements of Section 1.02.A.1.b. and 1.02.A.1.c, the Contractor will be authorized to perform full-scale surface preparation and application of the selected material. Do not proceed with application unless directed in writing by the Engineer.

6.3 APPLICATION

A. Product shall be applied as packaged at a rate of 125 sq. ft. per gallon. Do not dilute or alter the material.

B. Preferred method of application for anti-graffiti is with low-pressure (15 PSI) airless spray equipment or with a heavily saturated brush or roller. Spray equipment should be equipped with solvent resistant gaskets and hoses.

C. Preferred method of application for concrete sealers is by either brush or roller. Care will be taken to ensure that sufficient material is being applied to thoroughly saturate the treatment surfaces maintaining the appropriate square foot coverage rate required.
1. Product shall be applied to horizontal surfaces in a single saturating application.
2. Sufficient material shall be applied so that treated surfaces remain wet for a few minutes before penetration into the concrete.
3. Surface residues, pools and puddles shall be broomed out thoroughly until they completely penetrate into the surface.
4. Treated surfaces shall be protected from rain and other surface water for a period of not less than eight (8) hours after application.
5. Treated surfaces shall be protected from excessive foot and vehicular traffic for a period of not less than eight (8) hours after application.

6.4 WATER TEST

A. After the water repellent has dried, provide water and flood the treated surfaces with water as directed by the Engineer. Apply additional coating to areas, which show evidence of water absorption.

6.5 CLEAN-UP

A. When the work of this Section is complete, and at such other times as directed, remove surplus and waste materials, debris, rubbish, equipment, and implements from the site, and leave the work in a clean, neat and acceptable condition, as approved by the Engineer.

END OF SECTION

SECTION 03 41 00 - PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Requirements for designing, furnishing, and installing precast prestressed components as indicated on the Contract Drawings and in the Specifications.
2. Precast, prestressed structural concrete components as shown on the Drawings, specified herein, and needed for complete and proper installation including:
3. Design not shown on the Contract Drawings,
4. Erection drawings and Production drawings,
5. Factory inspection and testing per PCI certification requirements,
6. Fabrication of specified precast concrete components,
7. Handling, storage and protection of precast concrete components,
8. Transportation of precast concrete components to erection site,
9. Erection of precast concrete components including all bearing pads, base plates, inserts, clamps, nuts, bolts, and other necessary appurtenances, and other hardware items for connections between cast-in-place concrete and precast components and tolerances for the placement of these components.
10. Work includes but is not limited to:
11. Independent inspection and testing work.
12. Cast-in-place concrete
13. Reinforcement and embedded items in cast-in-place concrete.

1.2 RELATED SECTIONS

A. Section 03 20 00 Concrete Reinforcing

B. Section 03 30 00 Cast-In-Place Concrete

1.3 REFERENCES

A. American Concrete Institute (ACI):
1. ACI 318/318R; Building Code Requirements for Structural Concrete and Commentary.
2. ACI 347 – Recommended Practice for Concrete Formwork.

B. Precast/Prestressed Concrete Institute (PCI)
1. PCI MNL-116, Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.
2. PCI MNL-120, Design Handbook - Precast and Prestressed Concrete.

C. American Society For Testing and Materials (ASTM):
1. ASTM A 36/A 36M; Standard Specification for Carbon Structural Steel.
2. ASTM A 82; Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

3. ASTM A 153/A 153M; Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. ASTM A 416/A 416M; Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.
5. ASTM A 615/A 615M; Standard Specification for Deformed and Plain Billet- Steel Bars for Concrete Reinforcement.
6. ASTM C 31/C 31M; Standard Practice for Making and Curing Concrete Test Specimens in the Field.
7. ASTM C 33; Standard Specification for Concrete Aggregates.
8. ASTM C 39/C 39M; Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
9. ASTM C 42/C 42M; Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
10. ASTM C 150; Standard Specification for Portland Cement.
11. ASTM C 260; Standard Specification for Air-Entraining Admixtures for Concrete.
12. ASTM C 330; Standard Specification for Lightweight Aggregates for Structural Concrete.
13. ASTM C 494/C 494M; Standard Specification for Chemical Admixtures for Concrete.
14. ASTM A767 / A767M, Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
15. ASTM A706 / A706M, Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

D. American Welding Society (AWS):
1. AWS D1.1/D1.1M; Structural Welding Code - Steel.
2. AWS D1.4/D1.4M; Structural Welding Code - Reinforcing Steel.

1.4 DESIGN REQUIREMENTS

A. Design the precast concrete sections in accordance with the design criteria and requirements of ACI 318/318R.

B. Design the precast concrete sections for total superimposed loads as noted on the Contract Drawings.

C. Submit Shop Drawings and Product Data for the precast structural concrete plank sections that include at a minimum the following information:
1. Dimensions of the precast prestressed sections.
2. The design camber.
3. Details of inserts, anchors, connections, accessories, joints, and openings.
4. The chamfer and radius of corners.
5. The location and type of reinforcing steel and prestressing stands.
6. Welds.
7. The size and type of bearings.
8. Headers.
9. Lifting positions and devices.

D. Submit installation drawings showing the installation layout of the precast prestressed sections using the same identification marks used to fabricate the sections, and showing field welds and lifting positions and devices.

1.5 SUBMITTALS

A. Submit the following information to the Engineer for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:

1. Product Data: For each type of product indicated, include technical data and tested physical and performance properties.
   a. Portland cement.
   b. Aggregates.
   c. Air-Entraining Admixture.
   d. Water-Reducing, Retarding, Accelerating, and High-Range Water-Reducing Admixtures.
   e. Corrosion Inhibitor Admixture.
   f. Steel Prestressing Tendons.
   g. Mild Steel Reinforcing.
   h. Wire.
   i. Grout.
   j. Sealant.
   k. Bearing Material.
   l. Structural Steel Plates and
   m. Hot-Dip Galvanizing.
   n. Design Mixes: For each concrete mix.
2. Shop Drawings:
   a. Erection Drawings:
      1) Member piece marks and completely dimensioned size and shape of each member.
      2) Plans and/or elevations locating and defining all products furnished.
      3) Sections and details showing connections, cast-in items and their relation to the supporting structures.
         a) Details, dimensional tolerances and related information of other trades affecting precast concrete work should be furnished to precast concrete manufacturer.
            (1) Openings and Joints, between members and between members and structure.
            (2) Description of all loose, cast-in and field hardware.
            (3) Field installed anchor location drawings.
            (4) Erection sequences, when required to satisfy stability, and handling requirements.
         b) If the sequence of erection is critical to the structural stability of the structure, or for access to connections at certainlocations, it should be noted on the Contract plans and specifications.
   b. Production drawings:
      1) Loadings for design:
         a) Initial handling and erection stress limits.
         b) All dead and live loads as specified on the Contract Drawings.
         c) All other loads specified for all members, where applicable.
      2) As directed on the Contract Drawings, design calculations of products shall be performed, sealed and submitted for approval by an engineer registered in the state where the project is located, who is experienced in precast, prestressed concrete design.
      3) Design steel plank support heads when such headers are determined necessary by the manufacturer's engineer.

4) Refer to architectural drawings for fire ratings where applicable.
5) Design calculations shall be performed by an engineer, registered in the state that the project is located in, and experienced in precast prestressed concrete design. Design calculations to be submitted for approval upon request.
6) Design shall be in accordance with applicable codes or ACI 318 or the latest edition of the PCI Design Handbook.

c. Engineering Data:
1) Submit complete design calculations for all precast members and connections. Indicate all design loads, including live loads, wind loads, seismic loads, and dead loads. Design calculations shall be preformed, sealed and submitted by Precast Concrete Contractor's Professional Engineer, licensed to practice in the State where Project is located, who is experienced in precast, prestressed concrete design. Design calculations shall be based on requirements of Performance Requirements and product design criteria specified herein.

d. Samples:
1) Submit three samples, 12"x12", as required.
2) Prior to product fabrication of precast concrete panel units, for projects where more than one finish is required, or where more than one type of reveal is required, prepare a (4'X 4') , partial panel mock up for final approval1 of the color and finish; arrange for architect's timely review of mock up at precaster's plant.
a) Notify architect when sample is ready for review at precaster's plant, and advise of schedule impact if review is not made in a timely way.
b) Do not start production fabrication of precast concrete architectural panel units until sample units have received architect's written approval.
c) The approved mock-up panels shall be a standard of quality for the color and range of required finish.

e. Test Reports:
1) Submit test report on concrete and other material.

f. Certifications:
1) Design compliance certification.
2) Material compliance certification.
3) Manufacturer's Instructions:
4) Precast structural concrete unit manufacturer's instructions for handling, transporting, and erecting their units.
5) Current welder certificates for welding of reinforcement, shop and field connections.

g. Qualifications Statements:
1) Manufacturer experience.
2) Manufacturer plant PCI certification.
3) Field erection supervisor's resume.

1.6 QUALITY ASSURANCE

A. Qualifications:
1. Fabricator Qualifications:
a. Experience: Submit documentation that the precast structural concrete manufacturer has been regularly engaged in manufacturing structural precast prestressed concrete for at least five years.

b. Plant Certification Requirements: Submit documentation that the manufacturer's plant is certified under the Precast/Prestressed Concrete Institute's Plant Certificate Program. Manufacturer shall be certified in category C3A at a minimum.

2. Erector Qualifications:
   a. Erector Crew Qualifications:
      1) Either provide an erection crew completely familiar with the erection practices of the manufacturer of the precast structural concrete units, or use the manufacturer's erection crew.
      2) Regularly engaged for at least 5 years in the erection of precast concrete architectural and structural panels similar to the requirements of this project. (PCI certified erector, certified S2).
   b. Field Erector Supervisor's Qualifications:
      1) Regardless of the choice of erector crew, employ a representative of the manufacturer of the precast structural concrete units as afield erection supervisor to provide full-time supervision of the erection of the precast structural concrete units.
      2) Only employ a field erection supervisor who can demonstrate a minimum of five years continuous experience erecting precast structural concrete units.
      3) Submit the field erection supervisor's resume.
3. Design Standards: Comply with ACI 318 and the design recommendations in PCI MNL 120, "PCI Design Handbook—Precast and Prestressed Concrete."
4. Welder Qualifications:
   a. Only employ welders for erecting the precast structural concrete units who can demonstrate they are qualified to perform the types of work required by having passed the qualification tests prescribed in AWS D1.1/D1.1M for the procedures.
      1) Submit certified copies of qualification test records that indicate each welder employed to perform the Work has satisfactorilypassed the AWS qualification tests for the required weldingprocedures.

B. Certifications:
1. Design Compliance Certification:
   a. Submit evidence from the manufacturer certifying that the precast structural concrete units have been designed to meet the load requirements specified.
      1) Submit design calculations stamped by a registered Professional Engineer with structural experience in the type of work being sealed and licensed in the State of New Jersey for all members and connections.
      2) Include evidence that the critical panels unique to the project have been investigated.
2. Material Compliance Certification:
   a. Submit evidence from the manufacturer certifying that the material complies with the requirements of the Specifications, and submit evidence to support the certification.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
1. Follow the manufacturer's instructions for handling and transporting the products specified in this Section.
2. Transportation, site handling and erection shall be performed by the precaster, or its agents, with equipment methods, and qualified personnel acceptable to the precaster.
3. Comply with the requirements of PCI MNL-116 and PCI MNL-120.

4. Submit the precast structural concrete unit manufacturer's instructions for handling, transporting, and erecting their units.

B. Storage and Protection:
   1. Do not place precast structural concrete units in positions which will cause overstress, warp, or twist in the members.
   2. Place stored precast structural concrete units so that identification marks are discernible.
   3. Stack precast structural concrete units so that lifting devices are accessible and undamaged.
   4. Separate stacked precast structural concrete units by battens across the full width of each bearing point.
   5. Protect all holes and reglets against water and ice in freezing weather.
   6. Do not use upper member of stacked tier as storage area for shorter member or heavy equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the requirements specified in this Section, manufacturers offering products that may be incorporated in the Work include the following:
   1. Precast Prestressed Straight-Strand Structural Members.
   2. Precast concrete structural insulating wall panels.
   3. Precast concrete structural solid wall panels.
   4. Precast concrete steel reinforced structural columns, beams and girders.
   5. Precast Prestressed Hollow-Core Planks.
   6. Precast Prestressed solid flat slabs.
   7. Architectural Precast Products.
   8. Or as noted on Contract Drawings.

2.2 MATERIALS

A. Portland Cement:
   1. Provide Portland Cement that complies with the requirements of ASTM C 150, for Type I, Type II or Type III.

B. Aggregates:
   1. Provide aggregates that comply with the requirements of ASTM C 33 or ASTM C 330.

C. Water:
   1. Provide potable water or water free from foreign materials in amounts harmful to concrete and embedded steel.

D. Admixtures:
   1. Air-Entraining Admixture: Provide a product conforming to the requirements of ASTM C 260.
   2. Water reducing, retarding, accelerating, high range water reducing admixtures: ASTM C494 or C1017.
   3. Viscosity-Modifying Admixtures/

4. Metakaolin Admixture: ASTM C618, Class N
5. Calcium chloride or admixtures containing chlorides shall not be used.

E. Water-Reducing, Retarding, Accelerating, and High-Range Water-Reducing Admixtures:
1. Provide water-reducing, retarding, accelerating, and high-range water-reducing admixture products conforming to the requirements of ASTM C 494/C 494M.
2. Do not provide admixtures containing chlorides.

F. Corrosion Inhibitor Admixture:
1. Provide corrosion inhibitor admixture products conforming to the requirements of ASTM C 494/C 494M, Type C; calcium nitrite.

G. Steel Prestressing Tendons:
1. Provide uncoated, 7-wire, low-relaxation strand conforming to the requirements of ASTM A 416/A 416M, Grade 250 or 270 (Grade 1720 or 1860), or indented, 7-wire, low-relaxation strand (including supplement) conforming to the requirements of ASTM A 886/A 886M, Grade 270 (Grade 1860).

H. Mild Steel Reinforcing:
1. Provide reinforcing steel conforming to the requirements of ASTM A 615/A 615M, Grade 60.

I. Low-Alloy-Steel Reinforcing Bars:
1. Provide reinforcement that is welded conforming to the requirements of ASTM A 706/A 706M.

J. Plain-Steel Welded Wire Fabric:
1. Provide welded wire fabric for concrete reinforcement conforming to the requirements of ASTM A 185, fabricated from steel wire into flat sheets.

K. Steel Reinforcing Supports:
1. Manufacturer's bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place according to PCI MNL 116.

L. Epoxy Coated Interlaid Carbon Fiber Mesh:
1. As per panel manufacturer.

M. Anchors and Inserts:
1. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
2. Carbon-Steel Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished; AWS D1.1, Type A or B, with arc shields.
3. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.
4. Carbon-Steel Structural Tubing: ASTM A 500, Grade B.
5. Stainless steel: ASTM A666, Type 304.
6. Bolts: ASTM A307, A325 or F1554.
7. Threaded Rods: ASTM A36, A193, A307 or F1554.
8. Deformed bar anchors: ASTM A496 or A706.
9. Finish: For exterior steel items, and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M, after fabrication, and ASTM A 153/A 153M, as applicable.
    a. Galvanizing Repair Paint: DOD-P-21035A or SSPC-Paint 20.

10. Shop-Primed Finish: Prepare surfaces of non-galvanized steel items, except those surfaces to be embedded in concrete, according to requirements inSSPCSP 3 and shop-apply lead- and chromate-free, rust-inhibiting primer, complying with performance requirements in FS TT-P-664 according to SSPC- PA 1.

N. Grout:
1. Provide a grout mixture of not less than one part Portland cement to three parts fine sand with a consistency such that joints can be substantially filled without seepage over adjacent surfaces.
2. Provide grout having a 28-day compressive strength of 3500 psi, minimum.
4. Non-shrink grout: Premixed, packaged ferrous or non-ferrous aggregate shrink resistant grout.

O. Bearing Pads:
1. As per panel fabricator's requirements.

P. Insulation:
1. Comply with thermal and physical requirements specified and or shown on Contract Drawings.

Q. Sealant:
1. Provide gun-grade caulking as specified in Section 07 92 00, Sealers and Caulking.

R. Bearing Material:
1. For Structural Concrete Planks:
   a. Provide asphalt-saturated roofing felt or non-leaching multimonomer plastic strip.
   b. Thickness: 1/8-inch, maximum
2. For Structural Concrete Beams and Girders:
   a. Provide random-oriented fiber-reinforced pads with dimensions as determined by the precast manufacturer.
   b. Provide pads capable of supporting a compressive stress of 4000 psi with no cracking, splitting, or delaminating in the internal portions of the pad.
   c. Acceptable Manufacturer:
      1) JVI, Masticord pad, www.jvi-inc.com.

S. Structural Steel Plates and Shapes:
1. Provide structural steel plates and shapes conforming to the requirements of ASTM A 36/A 36M.

T. Hot-Dip Galvanizing:
1. Provide hot-dip galvanizing conforming to the requirements of ASTM A 153/A 153M.

2.3 FABRICATION

A. Comply with the manufacturing procedures and tolerances in PCI MNL-116.

B. Formwork: Comply with ACI 347. Prefabricated mold shall be one-piece seamless rigid molds for exposed faces. Prevent deformation of molds and maintain mold surfaces free of irregularities, dents, sags, or damage of any kind.

C. Anchorage Hardware: Fabricate with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations.

D. Furnish loose steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast architectural concrete units to supporting and adjacent construction.

E. Cast-in reglets, slots, holes, and other accessories in precast architectural concrete units to receive windows, cramps, dowels, reglets, waterstops, flashings, and other similar work as indicated.

F. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" and PCI MNL 116 for fabricating, placing, and supporting reinforcement.

G. Reinforce precast concrete wall units to resist handling, transportation, and erection stresses.

H. Pre-stress tendons for precast concrete wall units by either post-tensioning or pretensioning method. Comply with PCI MNL 116.

I. Mix concrete according to PCI MNL 116 and requirements in this Section.

J. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 116 for measuring, mixing, transporting, and placing concrete.
   1. The production of SCC shall be carried out in plants in which the equipment, operation and materials are suitably controlled.
   2. All production staff involved in the production of SCC shall have been trained and possess experience in SCC.

K. Identify pickup points of precast concrete wall units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast concrete wall unit on a surface that will not show in finished structure.

L. Openings:
   1. Manufacturer shall provide for openings 12 inch square or larger as shown on the Contract Drawings.
   2. Other openings shall be located and field drilled or cut by the trade after erection. Openings shall be approved by both architect and precaster before drilling or cutting.

M. Cure concrete, according to requirements in PCI MNL 116, by accelerated heat curing using low-pressure live steam or radiant heat and moisture.
   1. SCC can set faster than conventional concrete. Initial curing shall commence as soon as practicable after placement to minimize the risk of shrinkage cracking.

N. Fabricate precast concrete wall panels straight and true to size and shape, with exposed edges and corners precise and true so each finished panel complies with PCI MNL 116 product tolerances as well as position tolerances for cast-in items.

O. Patching: Shall be acceptable providing the structural adequacy of the product and the appearance are not impaired.

P. Damaged, chipped or discolored units shall be replaced, patched or refinished as directed by the Architect and/or Engineer, and to their approval.

Q. Compressive Strength:
   1. Cure the units at the manufacturer's plant by steam curing or other suitable method to secure a 3000 psi, minimum, compressive strength at the time of the initial prestress, and a 5000 psi, minimum, compressive strength after 28 days.

R. Corrosion Inhibitor Admixture:
   1. Add corrosion inhibitor admixture at the rate of 3 gallons per cubic yard to the concrete mix.
   2. Decrease water in mix to account for addition of admixture.

S. Provide a concrete cover over reinforcing in accordance with ACI 318/318R unless noted otherwise on the Contract Drawings.

2.4 FINISHES

A. Finish the precast structural concrete in conformance to the requirements of PCI MNL-116.

B. For surfaces to be painted, provide the finish required by paint manufacturer.

C. Finish exposed –face surfaces of precast concrete wall panels to match approved design reference sample. Refer to architectural drawings for finishes.

2.5 SOURCE QUALITY CONTROL

A. Quality Control Testing: Test and inspect precast concrete according to PCI MNL 116 requirements.

B. Concrete Compression Tests:
   1. Test Method:
      a. Direct the precast prestressed plank manufacturer to test the concrete compressive strength of the concrete used to fabricate the planks in accordance with the requirements of ASTM C 39/C 39M.
      b. Mold and cure four test specimens for each concrete compression test in accordance with ASTM C 31/C 31M.
      c. Perform at least one concrete compression test for each 75 cubic yards of concrete, but not less than one concrete compression test for each day's production of concrete planks.
   2. Acceptance Criteria:
      a. Test two specimens to verify stress transfer strength, and test two additional specimens after 28 days for acceptance.
      b. The strength level of the concrete is satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual test result is below the specified strength by more than 500 psi.
   3. Test Reports:
      a. Submit reports that document the results of all concrete tests and inspections performed immediately after the work is performed.
      b. In the reports, state whether the tested and inspected items comply with specified requirements or deviate from them.

C. Non-Conforming Test Results:
   1. If the strength of the tested cylinders falls below the specified compressive strengths, the Engineer has the authority to order a change in the mixproportions for the remaining concrete being poured.
   2. If required by the Engineer, obtain and test core specimens from the hardened concrete planks in accordance with ASTM C 42/C 42M.

D. In accordance with the requirements of Section 01 40 00, Quality Requirements, will be verified by a code-required Approved Agency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Site access: General Contractor shall be responsible for providing suitable access to the building, proper drainage and firm, level bearing for the hauling and erection equipment to operate under their own power.

B. Preparation of structures to receive precast panels: General Contractor shall be responsible for:
   1. Providing true, level bearing surfaces on all field placed bearing surfaces.
   2. Placement and accurate alignment of anchor bolts, plates or dowels in column footings, grade beams and other field placed supporting members.
   3. All pipes, stacks, conduits and other such items shall be stubbed off at a level lower than the bearing plane until after the plank are set. Masonry, concrete or steel shall not be installed above plank-bearing surface until after the plank is in place.

C. Install precast concrete members.
   1. Erection shall be carried out by competent erectors that are PCI qualified.
   2. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.
   3. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
   4. Openings in planks shall be field cut only after grout has cured, unless authorized by the manufacturer's engineer.
   5. Members shall be properly aligned. Variations between adjacent members shall be reasonably leveled out by jacking, bolting or any other feasible method as recommended by the manufacturer.

D. Anchor precast concrete units in position by bolting, welding, grouting, or as otherwise indicated.

E. Welding: Perform welding in compliance with AWS D1.1 and AWS D1.4, with qualified welders.
   1. Repair damaged steel surfaces by cleaning and applying a coat of galvanized repair paint to galvanized surfaces or by re-priming damaged painted surfaces.

F. Install precast concrete wall units level, plumb, square, true, and in alignment without exceeding the non-cumulative erection tolerances of PCI MNL 125 or 127.

G. Repair exposed exterior surfaces of precast concrete wall units to reasonably match color, texture, and uniformity of approved mock up panel(s) and surrounding precast concrete when repair is permitted by Architect and/or Engineer.

H. Subject to approval of the Architect and precast Engineer, precast concrete wall panels may be drilled or "shot" by other trades for attachment of other building components provided no contact is made with prestressing steel. Should spalling occur, repair of the spall shall be the responsibility of the trade doing the drilling or the shooting.

I. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt, and stains caused by the erector. If other trades cause damage, marks, dirt, or stains they shall be liable for the costs of cleaning or repair.

J. Inspection and Acceptance: Final inspection and acceptance of erected precast concrete units shall be made by the Architect and/or Engineer within a reasonable time after the precast units are installed and final alignment of the units iscompleted.

END OF SECTION

SECTION 03 60 00 - GROUTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements for the grouts, except for masonry grouts, indicated on the Contract Drawings and required in other Specification Sections.

1.2 REFERENCED SECTIONS

A. Division 1 – General Requirements - Submittal Procedures.

B. Section 03 30 00 - Cast-In-Place Concrete.

C. Section 07 92 00 – Sealants and Caulking.

1.3 CITED STANDARDS

A. American Concrete Institute (ACI):
1. ACI 305R, Hot Weather Concreting.
2. ACI 306R, Cold Weather Concreting.
3. ACI 306.1, Standard Specification for Cold Weather Concreting.
4. ACI 308, Standard Specification for Curing Concrete.
5. ACI 351.1R, Grouting between Foundations and Bases for Support of Equipment and Machinery.

B. American Society for Testing and Materials (ASTM):
1. ASTM C 33, Standard Specification for Concrete Aggregate.
2. ASTM C 109/C 109M, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using two-inch or 50-mm Cube Specimens).
3. ASTM C 150, Standard Specification for Portland Cement.
4. ASTM C 191, Standard Test Method for Time of Setting of Hydraulic Cement by Vicat Needle.
5. ASTM C 827, Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
6. ASTM C 1090, Standard Test Method for Measuring Changes in Height of Cylindrical Specimens from Hydraulic-Cement Grout.
7. ASTM C 1107, Standard Specification for Packaged Dry, Hydraulic Cement Grout (Non-shrink).

1.4 QUALITY CONTROL

A. Certifications:
1. Submit independent laboratory test reports from the grout manufacturer certifying that the non-shrink grout meets the performance requirements specified in Paragraph1.03.A.

1.5 SUBMITTALS

A. Submit the following information to the Engineer for approval in accordance with the requirements of Division 1 – General Requirements, Submittal Procedures:
   1. Product Data:
      a. Non-shrink non-metallic grout per.
   2. Quality Assurance/Control Submittals:
      a. Design Data:
         1) Sand/cement grout design mixes.
      b. Test Reports:
         1) Sand/cement grout design test reports per.
      c. Certificates:
         1) Grout manufacturer non-shrink certification per.
      d. Manufacturers' Instructions:
         1) Manufacturer's placing instructions per.

1.6 GENERAL DESIGN AND FABRICATION REQUIREMENTS:

A. Non-Shrink Grout:
   1. Provide non-shrink grout that meets the following requirements from the time of placement:
      a. Early Height Change: 0.0 to 4.0 percent when tested in accordance with the requirements of ASTM C 827.
      b. Hardened Height Change: 0.0 to 0.3 percent when tested in accordance with the requirements of ASTM C 1090.
      c. Compressive Strength: 4,000 psi developed with a trowelable mix within 24 hours when tested in accordance with the requirements of
      d. ASTM C 109/C 109M.
      e. Indicating placement time: Not less than 60 minutes based on initial set, when tested in accordance with the requirements of ASTM C 191.
   2. Provide grout that meets the performance requirements of ASTM C 1107 for Grades A, B, and C.

1.7 DELIVERY, STORAGE AND HANDLING:

A. During delivery and handling, provide a protective covering over grout materials to prevent moisture damage and contamination.

B. Store grout materials in undamaged condition with seals and labels intact as packaged by the manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aggregate:
   1. Fine Aggregate: Provide fine aggregate conforming to the material quality requirements of ASTM C 33.
   2. Reduced Size Coarse Aggregate: Provide aggregate conforming to the size requirements for AASHTO Number 8 aggregate as specified in AASHTO M 6.

B. Non-Shrink Metallic Grout:
1. Provide a factory-premixed material containing no corrosive irons, aluminums, chemicals, or gypsums.
a. Provide a ready-mix type of grout requiring only the addition of water.
1) Provide water proportions conforming to the manufacturer's specifications for the desired mix consistency.
b. Do not add other materials to the grout.
c. For grout applications not in contact with sewage, provide grout manufactured using Type I (Normal) cement as specified in Section 03 30 00, Cast-In-Place Concrete.
d. For grout applications in contact with sewage, provide grout manufactured using Type II (Sulfate Resistant) cement as specified in Section 03 30 00, Cast-In-Place Concrete.
e. To enhance impact resistance, provide grout containing metallic aggregate.
2. Acceptable Manufacturers:
a. Five Star Products, Inc., http://fivestarproducts.com.
b. US Grout, LLC, www.usgrout.com.
c. Approved equal.

C. Non-Shrink Non-Metallic Grout:
1. Provide a factory-premixed material containing no corrosive irons, aluminums, chemicals, or gypsums.
a. Provide a ready-mix type of grout requiring only the addition of water.
1) Provide water proportions conforming to the manufacturer's specifications for the desired mix consistency.
b. Do not add other materials to the grout.
c. For grout applications not in contact with sewage, provide grout manufactured using Type I (Normal) cement as specified in Section 03 30 00, Cast-In-Place Concrete.
d. For grout applications in contact with sewage, provide grout manufactured using Type II (sulfate resistant) cement as specified in Section 03 30 00, Cast-In-Place Concrete.
2. Acceptable Manufacturers:
a. Five Star Products, Inc., http://fivestarproducts.com.
b. US Grout, LLC, www.usgrout.com.
c. Approved equal.

D. Portland Cement:
1. Provide Portland cement conforming to the requirements of ASTM C 150, Type I or Type II.
a. For applications where the grout will be in contact with sewage, use only Type II (sulfate resistant) cement.

E. Water:
1. Provide potable quality water that is free from deleterious amounts of acids, alkalis, and organic substances.

2.2 MIXES

A. Neat Cement:
1. Use Type I Portland cement (Normal) and water in the same proportions specified inSection 03 30 00, Cast-In-Place Concrete, for Class A cast-in-place concrete, but omit the fine and coarse aggregates from the mix.

B. Sand/Cement Grout:

1. Proportion the proposed design mix using a mixture of Portland cement, fineaggregate, and water in the proportion specified for Class A cast-in-place concrete as specified in Section 03 30 00, Cast-In-Place Concrete.
    a. For grout swept in by mechanism, add reduced size aggregate.

2.3 SOURCE QUALITY CONTROL

A. Submit the grout manufacturer's descriptive product data and current specifications covering the non-shrink metallic grout and non-shrink non-metallic grout products to the Engineer for approval.

B. Submit sand/cement grout design mixes and test reports for the grout to the Engineer for approval.
1. Follow the criteria listed for cast-in-place concrete in Section 03 30 00, Cast-In-Place Concrete.
    a. Prior to production of grout that will be swept in by mechanism, submit a design mix indicating both material proportions and the water-cement ratio.
2. Make adjustments in the proposed design mix as directed by the Engineer at no increase in Contract Price.

PART 3 - EXECUTION

3.1 PREPARATION

A. Submit the grout manufacturer’s placing instructions to the Engineer for approval.

B. Surface Preparation:
1. Clean the surfaces to be grouted to a condition free of oil, grease, laitance, dirt, and other contaminants.
2. Remove loose material.
3. Remove rust, paint, and oil from metal components that will be in contact with grout.
4. Perform additional surface preparation in accordance with the grout manufacturer's instructions.

C. Formwork:
1. Use forming procedures that allow proper and complete placement of the grout.
2. Pre-treat wood forms with forming oils so that the forms do not absorb moisture.
3. Anchor formwork support elements so no movement is possible.

D. Mixing the Grout:
1. Use a power operated mechanical mixer of sufficient capacity to mix complete batches of grout without interruption.
2. Mix non-shrink grout in accordance with manufacturer’s published instructions.
3. Mix sand/cement grout in accordance with the requirements specified for mixing Class A cast-in-place concrete in Section 03 30 00, Cast-In-Place Concrete.

3.2 INSTALLATION

A. Non-Shrink Metallic Grout:
1. Place non-shrink metallic grout in exposed or unexposed areas where grouting or equipment is subject to heavy vibratory forces.
2. Place non-shrink metallic grout in accordance with the manufacturer’s published instructions.

B. Non-Shrink Non-Metallic Grout:
   1. Place non-shrink non-metallic grout only at locations indicated on the Contract Drawings.
   2. Place non-shrink non-metallic grout in accordance with the manufacturer's published instructions.

C. Equipment and Machinery Support:
   1. To support installed equipment and machinery, place non-shrink grout between thefoundations of the supporting structures and the equipment and machinery bases in accordance with the requirements of ACI 351.1R.

D. Grouting Process Areas:
   1. Provide sand/cement grout when grouting processareas.
   2. For applications, other than those wherein grout is placed by a mechanism to sweep the grout into place, place and cure grout as follows:
      a. After the surface has been prepared as specified in Paragraph 3.01B, first saturate the surface to be grouted with water, remove any excess water, and then brush on a coat of Neat Cement.
         1) Place the grout while the Neat Cement is wet.
      b. Place the grout in a single pour, consolidate, and finish the grout with a steel trowel.
         1) In vertical applications, place grout in monolithic pours.
      c. Cure and seal the grout in accordance with ACI 308.
   3. For applications wherein grout is placed by a mechanism to sweep the grout into place, place and cure the grout as follows:
      a. After the surface has been prepared as specified in Paragraph 3.01B, first saturate the surface to be grouted with water, remove any excess water, and then brush on a coat of Neat Cement.
         1) Place the grout while the Neat Cement is wet.
      b. Place the grout in a single pour, starting at the center of the area to be grouted and working the grout out towards the perimeter and walls.
         1) As grout placement proceeds, slowly strike off the grout using screeds attached to the bottom of the equipment's grouting mechanism that are adjusted to produce the proper depth.
         2) Take care not to damage the surface of the grout when filling depressions and removing excess grout in front of screed blades.
      c. Consolidate and finish the grout using a wood float.
      d. Score joints at the perimeter of the grouted area and walls to the full depth of the grout.
         1) Do not saw joints after the grout is cured.
      e. Cure the grout using wet burlap or inundation in accordance with the requirements of ACI 308.
         1) Do not cure the grout using liquid curing compounds.
      f. After curing the grout, fill scored joints with joint sealer.

3.3 FIELD QUALITY CONTROL

A. Process Areas Grouting:
   1. After placing sand/cement grout and completing any screeding operations, use a straight edge to check exposed surfaces for trueness.

3.4 PROTECTION

A. Remove formwork supports only after the grout has hardened.

B. Protect grout against high and low temperatures and unfavorable environmental conditions in accordance with the requirements of ACI 305R, ACI 306R, and ACI 306.1 for placement of concrete until it has cured.

END OF SECTION

DIVISION 4
MASONRY

SECTION 04 20 00 – UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete Block.

B. Mortar and Grout.

C. Reinforcement and Anchorage.

D. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 03 20 00 - "Concrete Reinforcement"

B. Section 05 12 00 -"Structural Steel Framing"

C. Section 07 84 00 - "Firestopping"

D. Section 09 90 00 – “Painting”

1.3 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; American Concrete Institute International; 2013

B. ASTM A153/A153M Rev A - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016.

C. ASTM A580/A580M - Standard Specification for Stainless Steel Wire; 2016.

D. ASTM C55 - Standard Specification for Concrete Building Brick; 2017.

E. ASTM C90 Rev A - Standard Specification for Loadbearing Concrete Masonry Units; 2016.

F. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.

G. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2017.

H. ASTM C140/C140M - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2017.

I. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

J. ASTM C150/C150M - Standard Specification for Portland Cement; 2017.

K. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

L. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

M. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2017.

N. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

O. ASTM C476 - Standard Specification for Grout for Masonry; 2016.

P. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2017.

Q. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar; 1992a (Reapproved 2014).

R. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2016.

S. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength; 2013.

T. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2014.

U. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting mix designs and shop drawings, review and examine procedures for ensuring quality of concrete unit masonry fabrication and installation requirements. Require representatives of each entity directly concerned with concrete unit masonry to attend, including the following:

a. Contractor's superintendent.

b. Concrete unit masonry manufacturer.

c. Testing agency.

2. Minutes of the meeting shall be recorded, typed, and distributed by the Contractor to all concerned parties, including but not limited to the owner's representative and all attendees within 5 days of the meeting.

1.5 SUBMITTALS

A. All submittals are to be in accordance with Section 01 33 00 – Submittals.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

D. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

E. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.

F. Shop Drawings: For the following:

1. Concrete Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.

3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

G. Samples for Verification: For each type and color.

H. Material Certificates

1. Masonry Units - Include data on material properties, material test reports substantiating compliance with requirements.

2. Cementitious materials. Include name of manufacturer, brand name, and type.

3. Mortar admixtures.

4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.

5. Reinforcing bars.

6. Joint reinforcement.

7. Anchors, ties, and metal accessories.

8. Integral water repellent used in CMU.

I. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength,

ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.

2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

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

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

L. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

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

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

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

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

E. Fire Rated Assemblies: Conform to applicable code for UL Assembly No. as indicated on drawings.

1.7 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar, accessories, and wall openings in mock-up.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

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

C. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos

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

1.9 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

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

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

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

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:

1. Size: Standard units with nominal face dimensions of 12 by 8 inches and nominal depths as indicated on the drawings for specific locations. Manufactured to dimensions 3/8 inch less-than-nominal dimensions.

2. Special Shapes: Provide non-standard blocks configured for corners.

3. Load-Bearing Units: ASTM C90, normal weight.

a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.

b. Hollow block, as indicated.

4. Non-Loadbearing Units: ASTM C129.

a. Hollow block, as indicated.

b. Normal weight.

5 Units with Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid or powder admixture added to concrete masonry units at the time of manufacture.

c. Performance of Units with Integral Water Repellent:

(1) Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours.

(a) No water visible on back of wall above flashing at the end of 24 hours.

(b) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.

(c) No more than 25% of wall area above flashing visibly damp at end of test.

(2) Flexural Bond Strength: ASTM C1072; minimum 10% increase.

(3) Compressive Strength: ASTM C1314; maximum 5% decrease.

(4) Drying Shrinkage: ASTM C1148; maximum 5% increase in shrinkage.

d. Use only in combination with mortar and grout that also has integral water repellent admixture.

e. Use water repellent admixtures for masonry units, mortar and grout by a single manufacturer.

f. Manufacturers:

(1) Amerimix, an Oldcastle brand; CMU with Rainbloc GP: www.amerimix.com.

(2) Or approved equal.

2.2 CONCRETE AND MASONRY LINTELS

A. General: Provide one of the following:

1. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section 03 30 00 "Cast-in-Place Concrete," and with reinforcing bars indicated. Do not use concrete lintels for exposed masonry walls, unless

indicated on drawings.

2. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

3. Steel Lintels: Subject to requirements of Specification Section 05 50 00 "Metal Fabrications.

2.3 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91/C91M, Type S.

B. Mortar Cement: ASTM C 1329/C 1329M.

C. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction.

D. Hydrated Lime: ASTM C207, Type S.

E. Mortar Aggregate: ASTM C144.

F. Grout Aggregate: ASTM C404.

G. Grout Aggregates for sound absorption for acoustical assembly.

H. Water: Clean and potable.

I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

J. Integral Water Repellent Admixture for Mortar and Grout: Polymeric liquid or powder admixture added to mortar and grout at the time of manufacture.

1. Use only in combination with masonry units manufactured with integral water repellent admixture.

2. Use only water repellent admixture for mortar and grout from the same manufacturer as water repellent admixture in masonry units.

3. Meet or exceed performance specified for water repellent admixture used in masonry units.

K. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.

1. Type: Type S.

2. Color: Standard gray.

3. Manufacturers:

a. Amerimix, an Oldcastle brand; AMX 400: www.amerimix.com.

b. Amerimix, an Oldcastle brand; AMX 410: www.amerimix.com.

c. Or approved equal.

2.4 REINFORCEMENT AND ANCHORAGE

A. Manufacturers of Joint Reinforcement and Anchors:

1. Blok-Lok Limited: www.blok-lok.com.

2. Hohmann & Barnard, Inc: www.h-b.com.

3. WIRE-BOND: www.wirebond.com.

4. Or approved equal.

B. Reinforcing Steel: Type specified in Section 03 20 00; size as indicated on drawings; epoxy finish.

C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

D. Single Wythe Joint Reinforcement: Truss or ladder type; stainless steel conforming to ASTM A580/A580M Type 304; 0.1875 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

E. Strap Anchors: Bent steel shapes configured as required for specific situations, 1-1/4 in width, 0.105 in thick, lengths as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face, corrugated for embedment in masonry joint, stainless steel.

F. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face.

G. Wall Ties: Corrugated formed sheet metal, 7/8 inch wide by 0.05 inch thick, stainless steel, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face.

H. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws; corrosion resistant finish or hot dip galvanized to ASTM A153/A153M.

1. Manufacturers:

a. ITW Commercial Construction North America; Teks Select Series: www.ITWBuildex.com.

b. Or approved Equal.

I. ASTM Hollow C90 Units.

J. Manufacturer's standard units with nominal face dimensions of 16 inches long x 8 inches high x thickness indicated on drawings.

Exposed face: Manufacturer's accepted color and texture.

2.5 ACCESSORIES

A. Preformed Control Joints: Polyvinyl chloride material. Provide with corner and tee accessories, fused joints.

1. Manufacturers:

a. Blok-Lok Limited: www.blok-lok.com.

b. Hohmann & Barnard, Inc: www.h-b.com.

c. WIRE-BOND: www.wirebond.com.

d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Joint Filler: Closed cell polyethylene; oversized 50 percent to joint width; self-expanding; Width as required for partition thickness, minus 1 inch wide by maximum lengths available.

1. Manufacturers:

a. Hohmann & Barnard, Inc: www.h-b.com.

b. WIRE-BOND: www.wirebond.com.

c. Or approved equal.

C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

D. Metal Flashing: Provide metal flashing complying with Section 07 62 00 "Sheet Metal Flashing and Trim."

2.6 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification. Provide the

following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.

2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 3000 psi.

3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M

C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

2. Verify that foundations are within tolerances specified.

3. Verify that reinforcing dowels are properly placed.

4. Verify that substrates are free of substances that would impair mortar bond.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

D. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

3.4 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:

1. Bond: Running.

2. Coursing: One unit and one mortar joint to equal 8 inches.

3. Mortar Joints: Flush.

3.5 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

F. Interlock intersections and external corners.

G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

I. Isolate masonry partitions from vertical structural framing members with a control joint.

J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

K. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

L. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

M. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry

3.6 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.

2. Bed webs in mortar in grouted masonry, including starting course on footings.

3. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted

3.7 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 12 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.

3.8 LINTELS

A. Install precast concrete lintels over openings.

B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.

1. Openings to 42 inches: Place two, No. 3 reinforcing bars 1 inch from bottom web.

2. Openings from 42 inches to 78 inches: Place two, No. 5 reinforcing bars 1 inch from bottom web.

3. Do not splice reinforcing bars.

4. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

5. Place and consolidate grout fill without displacing reinforcing.

6. Allow masonry lintels to attain specified strength before removing temporary supports.

C. Maintain minimum 8 inch bearing on each side of opening.

3.9 GROUTED COMPONENTS

A. Lap splices minimum 24 bar diameters.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

C. Place and consolidate grout fill without displacing reinforcing.

D. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.10 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.

2. Anchor masonry with anchors embedded in masonry joints and attached to structure.

3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.11 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Do not continue horizontal joint reinforcement through control or expansion joints.

C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in

accordance with manufacturer's instructions.

D. Form expansion joint as detailed on drawings.

E. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.

2. Install preformed control-joint gaskets designed to fit standard sash block.

3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.

4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

3.12 BUILT-IN WORK

A. As work progresses, install built-in metal door frames, , anchor bolts and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.

1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.13 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4 inch.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft. and 1/2 inch in 20 ft. or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft. and 1/4 inch in 10 ft.; 1/2 inch in 30 ft.

3.14 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, and sleeves. Coordinate with other sections of work

to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.15 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Testing Prior to Construction: One set of tests.

C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

D. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for conformance to requirements of this specification.

E. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

F. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.16 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.17 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

B. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

C. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

DIVISION 5
METALS

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Section Includes:
   1. Requirements for the design, fabrication, and installation of structural steel framing and Architecturally Exposed Structural Steel (AESS).

1.2 REFERENCED SECTIONS

A. Division 1 – General Requirements - Submittal Procedures.

1.3 CITED STANDARDS

A. American Institute of Steel Construction (AISC):
   1. AISC Specifications for Structural Steel Buildings - Allowable Stress Design and Plastic Design.
   2. AISC Code of Standard Practice for Steel Buildings and Bridges.

B. American Society for Testing and Materials (ASTM):
   1. ASTM A 36/A 36M, Standard Specification for Carbon Structural Steel.
   2. ASTM A 53/A 53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
   3. ASTM A 123/A 123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   4. ASTM A 325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   5. ASTM A 490, Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
   6. ASTM A 500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   7. ASTM A 563, Standard Specification for Carbon and Alloy Steel Nuts.
   8. ASTM A 572/A 572M, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
   9. ASTM A 780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   10. ASTM A 992/A 992M, Standard Specification for Structural Steel Shapes.
   11. ASTM E 164, Standard Practice for Ultrasonic Contact Examination of Weldments.
   12. ASTM E 709, Standard Guide for Magnetic Particle Examination.
   13. ASTM F 436, Standard Specification for Hardened Steel Washers.
   14. ASTM F 959, Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
   15. ASTM F 1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105- ksi Yield Strength.

16. ASTM F 1852, Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

C. American Welding Society (AWS):
1. AWS D1.1/D1.1M Structural Welding Code - Steel.

D. Research Council on Structural Connections of the Engineering Foundation (RCSC):
1. RCSC Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts.

E. The Society for Protective Coatings (SSPC):
1. SSPC Painting Manual.
a. SSPC-SP 3, Power Tool Cleaning.

F. U.S. Government:
1. U. S. General Services Administration (GSA):
a. Federal Specifications:
1) A-A-1923A, Shield, Expansion (Lag, Machine and Externally Threaded Wedge).

1.4 QUALITY CONTROL

A. Qualifications:
1. Professional Engineer Qualifications:
a. Employ a licensed Professional Engineer licensed in the state of New York and experienced in engineering services related to structural steel systems to prepare design calculations, Shop Drawings, and other structural data necessary to comply with the requirements of this Section.
2. Welding Qualifications:
a. Prior to beginning work that requires welding, submit the procedures to be used for pre-qualifying welders and welding procedures.
1) For all procedures, other than those set forth in AWS D1.1/D1.1M, submit a copy of the procedure qualification test records.
2) Only use welders, tackers, and welding operators demonstrating they are qualified to perform the types of work required by having passed the qualification tests prescribed in AWS D1.1/D1.1M for the procedures.
a) Submit certified copies of qualification test records that indicate each welder, welding operator, and tacker employed to perform the Work has satisfactorily passed the AWS qualification tests for the required welding procedures.
3. Fabricator Qualifications:
a. Employ a qualified structural steel fabricator experienced in fabricating structural steel similar to that indicated for this Contract.
1) The qualified fabricator chosen must be currently certified by the AISC Quality Certification Program for Structural Steel Fabricators, and be designated as an AISC Certified Fabricator, Standard for Steel Building Structures.
2) Use a structural steel fabricator exhibiting a minimum of 5 continuous years of successful in-service performance.
b. Employ a structural steel fabricator having sufficient production capacity to produce and deliver the materials in time to meet the approved construction schedule for this Contract.

c. Submit the qualifications of the fabricator and evidence that it has sufficient capacity to accommodate the Work of this Contract.

4. Erector Qualifications:
   a. Employ an erector experienced in erecting structural steel work similar to that required for this Contract who has a minimum of 5 continuous years of providing successful in-service performance.
   b. Submit the erector's qualifications to the Engineer for approval.

B. Regulatory Requirements
1. Comply with the applicable provisions of the references listed in Article 1.02 of this Section unless otherwise indicated.
2. All steel used for this Contract must be American-made.
   a. Submit a guarantee certifying that all steel used for this Contract is American-made.
3. Provide steel with the following percentages of recycled steel, and submit written affidavits from the steel manufacturer indicating that the recycled steel content provided complies with this requirement:
   a. Post-industrial recycled content: 90 percent, minimum.
   b. Post-consumer recycled content: 75 percent, minimum.

C. Certifications:
1. Submit certified copies of test reports from the independent Testing and Inspection Agency for all analyses and tests required by the referenced ASTM Specifications, including test reports for filler metals for welding, and mechanical tests for high-strength threaded fasteners.
2. Submit mill test reports, signed by the manufacturer of the structural steel products, to certify that the products provided comply with the specified requirements.

1.5 SUBMITTALS

A. Submit the following information to the Engineer for approval in accordance with the requirements of Division 1 – General Requirements, Submittal Procedures:
1. Product Data
2. Shop Drawings:
   a. Standard details.
   b. Shop Drawings that identify details.
   c. Working drawings per.
3. Quality Assurance/Control Submittals
   a. Design Data:
      1) Connection calculations.
   b. Certificates:
      1) Guarantee certifying that all steel used for this Contract is American- made.
   c. Test Reports:
      1) Procedure qualification test records.
      2) ASTM analyses and tests.
      3) Mill test reports.
   d. Qualification Statements:
      1) Additional qualifications of the Testing and Inspection Agency qualification test records.
      2) Fabricator qualifications.
      3) Erector's qualifications.

1.6 GENERAL DESIGN AND FABRICATION REQUIREMENTS

A. The connection details shown on the Contract Drawings are illustrative only, the Design-Builder is responsible for completing the structural steel design in conformance with the requirements of this Section.

B. Connection Design and Calculations:
   1. Design all connections in accordance with AISC Specifications for Structural Steel Buildings - Allowable Stress Design and Plastic Design using the Allowable Stress Design method.
      a. Design the connections to safely withstand the combined effects of shears, direct forces, moments, and torques at the applicable design stresses.
      b. Design and detail the connections so interference with architectural clearance lines and finishes does not occur.
   2. Use the type of shop and field connections shown on the Contract Drawings.
      a. If no type is shown, use the most appropriate type.
      b. One-sided or other eccentric connections are not permitted unless detailed on the Contract Drawings.
   3. Submit complete design calculations for the connections prepared and sealed by a Professional Engineer experienced in structural engineering and licensed in the State of New York.

C. Standard Details:
   1. Prior to submitting detailed Shop Drawings, submit the standard details for typical beam, girder, and column splices, and for moment connection details to the Engineer for approval.
   2. Provide standard details prepared under the supervision of and sealed by a Professional Engineer experienced in structural engineering and licensed in the State of New York.

D. Product Data and Shop Drawings:
   1. Submit Product Data for the materials and products used to perform the Work of this Section.
   2. Submit Shop Drawings that identify the details as shown on the Contract Drawings, and completely indicate the location of the details within the Work of the Contract.
      a. Indicate the size, weight, and quantities of members; the methods of joining various components; finishes; the location and type of anchors; and necessary dimensions.
      b. Use standard welding symbols of the American Welding Society on Shop Drawings; showing the size, length, and type of each weld.
      c. Note variations in tolerances or clearances between various products on the Shop Drawings.
      d. For shop assemblies that require markings to facilitate identification during erection, provide easy-to-read markings on the Shop Drawings and erection drawings.
         1) Clearly identify all AESS members and note special quality, tolerance, and surface preparation requirements.
      e. Provide Shop Drawings prepared under the supervision of and sealed by a Professional Engineer experienced in structural engineering and licensed in the State of New York.

E. Working Drawings:
   1. Submit erection drawings and the setting diagrams, templates, and directions for installing structural framing anchor bolts, bearing plates, and other embedded items.

1.7 DELIVERY, STORAGE AND HANDLING

A. Ensure that materials are delivered to the worksite at times and intervals that facilitate uninterrupted progress of the Work and continuity of installation.
   1. Deliver anchor rods and other anchorage items to be embedded in or attached to concrete, masonry, or other materials in ample time so that the Work is not delayed.

B. Use special care in handling and shipping members.

C. Ship small parts, such as bolts, nuts, washers, pins, fillers, and small connecting plates and anchors, in boxes, crates, or barrels.
   1. Pack each length and diameter of bolt and each size of nut and washer separately.
   2. Plainly mark an itemized list and description of the contents on the outside of each container.

D. Handle structural steel so no parts are bent, broken, or otherwise damaged; and avoid damage to other material and work.
   1. Exercise care to avoid scraping and over stressing the steelwork.
   2. Replace pieces that are bent or damaged, unless the Engineer authorizes repairs.

E. Store structural steel on platforms, skids, blocking, or other supports to prevent contact with dirt, debris, and moisture.
   1. Store beams with webs vertically.
   2. Protect structural steel from exposure to conditions that produce rust.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel:
   1. Type: Provide structural steel meeting the requirements of ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50; and ASTM A 992/A 992M as noted on the Contract Drawings.
   2. For the structural steel types listed below, provide steel meeting the requirements of the standards following that type.
      a. Rectangular and Square High Strength Steel (HSS) Tubing: Provide steel meeting the requirements of ASTM A 500, Grade B.

B. Fasteners
   1. High-Strength Bolted Connections:
      a. High Strength Bolts: Provide bolts meeting the requirements of ASTM A 325.
      b. Carbon and Alloy Steel Nuts: Provide heavy hex nuts meeting the requirements of ASTM A 563.
      c. Hardened Steel Washers: Provide washers meeting the requirements of ASTM F 436, Type 1.
      d. Direct Tension Indicators: Provide direct tension indicators meeting the requirements of ASTM F 959, Type 325, for use in slip-critical connections.
      e. Twist-Off-Type Tension Control Bolt Assemblies: Provide twist-off-type tension control bolt assemblies meeting the requirements of ASTM F 1852.
   2. Anchor Rods:
      a. Rods: Provide end-threaded rods meeting the requirements of
      b. ASTM F 1554; Grade 36, 55, or 105 as noted on the Contract Drawings.

c. Nuts: Provide heavy hex nuts meeting the requirements of ASTM A 563.
d. Washers: Provide washers meeting the requirements of ASTM F 436.

3. Bolt Lubricant: Provide bolt lubricant having a molybdenum disulfide base.
4. Expansion Anchors:
   a. Provide steel expansion anchors and stainless steel expansion anchors conforming to the requirements of Federal Specification A-A-1923A, Type 4.
   b. Acceptable manufacturers and models:
      1) Hilti Corporation; Kwik-Bolt TZ, www.us.hilti.com.
      2) Phillips, Red Head Wedge-Anchor, www.phillipsfastener.com.
      3) Molly, Parabolt.
      4) Approved equal.
5. Adhesive Anchors:
   a. Provide adhesive anchors composed of an anchor rod assembly and injection cartridge.
      1) Anchor Rod Assembly:
         a) Provide a chamfered and threaded stud made of ASTM A 36/A 36M steel and a nut and washer.
         b) Size the stud as indicated on the Contract Drawings.
      2) Injection Adhesive:
         a) Provide a mixture of resin, hardener, cement, and water that provides optimal curing speed and high strength.
         b) Furnish the components in side-by-side refill packs that keep two components separate until use; or alternately furnish the product in large rigid cartridges.
   b. Acceptable manufacturers and models:
      1) Hilti Corporation; HIT HY150, www.us.hilti.com.
      2) Approved equal.

C. Welding Electrodes:
1. Provide welding electrodes meeting the requirements specified in AWS D1.1/D1.1M, Table 3.1, for E70XX.
2. Provide low-hydrogen electrodes for field welding.

D. Grout:
1. Provide non-shrink, non-metallic grout as specified in Section 03 60 00, Grouting.

2.2 FABRICATION

A. Fabricate structural steel in accordance with the Contract Drawings and the AISC standards referenced in Paragraph 1.02A.

B. Perform shearing, flame cutting, and chipping carefully and accurately so as not to induce residual stress in the metal being cut.
1. Flame-cut the edges of members subjected to dynamic loading either by using a mechanically guided torch or by hand, and remove all nicks.
   a. Fabricate the radii of re-entrant gas-cut fillets as large as practicable, but in no case less than 3/4 inch.
   b. Perform flame cuttings so that the metal being cut is not carrying stress.
   c. Finish the exposed edges of members that were flame-cut by hand by grinding.

2. Add additional reinforcing as required where members are cut or coped to meet framing conditions.

C. Bolt Holes:
1. Punch, drill, subpunch, subdrill, and ream holes for bolts as required in accordance with the requirements specified in the AISC Specifications for Structural Steel Buildings - Allowable Stress Design and Plastic Design.

D. Holes for Other Work:
1. Provide holes required for securing other work to structural steel framing and for passage of other work through members as shown on the final approved Shop Drawings.
   a. Ream, drill, or punch holes perpendicular to the metal surface.
   b. Do not flame cut holes or enlarge them by burning.
2. Do not make additional openings in members not shown on the final approved Shop Drawings unless approval to do so is received from the Engineer.

E. Mill the ends of columns and other members that will transmit loads in bearing.

F. Except where welded connections are shown, use ASTM A 325 bolts for shop connections.
1. Install and tighten high strength bolts in accordance with the requirements of the RCSC Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts.
2. Arrange the bolts as indicated on the Contract Drawings; or if not indicated, arrange the bolts so that heads show in areas exposed to view.
3. Clearly indicate the bolt arrangements on Shop Drawing submittals.

G. Welding:
1. Perform all welding in accordance with AWS D1.1/D1.1M except as modified herein.
2. Use a welding procedure and sequence of welding that prevents needless distortion and minimizes stresses.
   a. If it is necessary to straighten transverse warpage of flanges, use controlled heating along the outside face.
   b. Allow for expected weld shrinkage when laying out and assembling members in the shop.
   c. Trim members to size only when most or all of welding has been completed.
3. On Architectural Exposed Structural Steel (AESS), prevent surface bleeding of back-side welding.
   a. Provide continuous welds of uniform size and profile.
   b. Grind exposed fillet welds 1/2 inch and larger smooth.
   c. Grind butt welds flush.
   d. Dress exposed welds.
4. Weld tabs for temporary bracing and safety cabling at points concealed from view in the completed structure.

H. Fabricate the exposed surfaces of Architecturally Exposed Structural Steel (AESS) smooth, square, and free of surface blemishes including pitting, rust and scale marks, roller marks, rolled trade names, and roughness.
1. Comply with the fabrication requirements, including tolerance limits, for Architecturally Exposed Structural Steel in the AISC Code of Standard Practice for Steel Buildings and Bridges.
2. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating, and shop priming.

I. Properly mark and match-mark materials to facilitate handling and field assembly.
   1. Mark each member with its weight.
   2. Match-mark all shop pre-fitted members.

2.3 FINISHES

A. Shop Priming:
   1. Surface Preparation:
      a. Clean the surfaces in accordance with the requirements of SSPC-SP 3 Power Tool Cleaning found in the SSPC Painting Manual.
   2. Primer:
      a. Immediately after surface preparation, apply the fabricator's standard rust- inhibiting primer according to the manufacturer's instructions at a rate as recommended in the SSPC Painting Manual to provide a dry film thickness of not less than 1.5 mils.
      b. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

B. Finish Coat:
   1. Apply finish coats of paint to structural steel in accordance with the requirements of Section 09 90 00, Painting.

C. Below Grade Coating:
   1. Where structural steel is placed below grade, apply a coal tar epoxy coating to a total thickness of 20 mils.

D. Galvanizing:
   1. For structural steel specified to be galvanized, hot-dip galvanize the steel members and fabrications in accordance with ASTM A 123/A 123M and to the thicknesses specified therein.
   2. Repair galvanizing damaged by welding and flame cutting, and galvanizing damaged during handling, transport, and erection by using an approved repair method in accordance with ASTM A 780.

E. Do not paint the following surfaces of structural steel members:
   1. Connection plates and members where slip-critical connections are required.
   2. Surfaces in contact with fireproofing.
   3. Surfaces to be encased in concrete, except for the initial 2 inches of the length embedded.
   4. Top flanges of beams to which metal decking or shear connectors are to be attached.
   5. Surfaces that are within 0.5 inch of the toe of a weld prior to welding.

F. After structural steel fabrication, clean heavy deposits of oil and grease from unpainted structural steel surfaces in accordance with applicable AISC standards.

2.4 SOURCE QUALITY CONTROL

A. Materials and fabrication procedures are subject to inspection and tests by the Testing and Inspection Agency in the mill and shop.
   1. Provide the independent Testing and Inspection Agency with access to the places where structural steel work is being fabricated or produced so the required inspections and testing can be performed before the work is shipped.

B. Shop-Bolted Connections:
   1. Direct the independent Testing and Inspection Agency to inspect and test the shop-bolted structural steel connections in accordance with the AISC specifications listed in Paragraph 1.02A, and the RCSC Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts.
   2. Verify that proper fastening components were used and the connected elements were fabricated properly.
   3. For slip-critical and pretension connections, test 2 bolts per connection.

C. Shop Welding:
   1. Direct the independent Testing and Inspection Agency to verify that all welders and welding materials being supplied under this Contract are properly certified, and to conduct the inspections and tests specified.
      a. Inspect and test shop welds made during fabrication of structural steel assemblies by performing a visual inspection of the full length of all welds, and inspecting and testing shop-welded connections in accordance with the requirements of AWS D1.1/D1.1M and the following:
         1) Ultrasonically inspect and test the entire length of full penetration welds in accordance with the requirements of ASTM E 164 and the following.
            a) For rigid (moment) frame flange connection plates on columns, test 50 percent of tension plate welds and 20 percent of compression plate welds.
            b) For tube member connections to end connection plates, test 20 percent of the welds.
            c) For all other groove and full-penetration welds, test a minimum of 10 percent of the welds.
         2) Inspect the entire length of fillet welds in accordance with the requirements for the Magnetic Particle Method specified in ASTM E 709 and the following.
            a) For gusset plates welded to steel members, test 20 percent of fillet weld locations.
            b) For all other fillet weld locations, test a minimum of 5 percent of the welds.
      b. Record both the type and location of all defects found in the work, and record the work required and the work performed to correct deficiencies.

D. Inspect AESS fabrications in the shop prior to the shipment of those materials to the field.

E. Submit mill test reports certifying that the material provided conforms to the appropriate ASTM specification.

F. Promptly remove and replace materials or fabricated components that do not comply with specified requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before proceeding to erect the structural steel, verify that the elevations of concrete and masonry bearing surfaces and the locations of anchorages are in compliance with the Contract Documents and ready to receive the work of this Section.

B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. If anchor rods were cast in the substructure when it was constructed, ensure that they are held firmly in the correct position and at the proper elevation by suitable templates.

B. Expansion and Adhesive Anchor Installation:
   1. Install expansion and adhesive anchors in strict accordance with the manufacturer's instructions.
      a. Drill holes of the required diameter and depth consistent with the anchor manufacturer's installation instructions using a rotary hammer type drill.
   2. Expansion Anchor Installation:
      a. Embed expansion anchors to a minimum embedment of four and one-half bolt diameters, unless otherwise indicated on the Contract Drawings.
   3. Adhesive Anchor Installation:
      a. Prior to setting the anchor studs, clean loose material from the drilled holes first by vacuuming and then finishing with a blast of compressed air.
      b. Cover each cleaned hole until an adhesive anchor is actually installed in it.
      c. Embed anchor rods to a minimum embedment of four and one-half rod diameters, unless otherwise indicated on the Contract Drawings.

C. Ensure that anchor rods and other embedded items that vary in location from the dimensions shown on the Contract Drawings are positioned within the tolerances listed in the AISC Code of Standard Practice for Steel Buildings and Bridges.

D. Report errors in the structural steel which will prevent the proper erection and fitting of parts immediately, whether the errors resulted from shop fabrication or deformation caused by handling or transportation.

3.3 ERECTION

A. Thoroughly clean surfaces to be joined.

B. Erect steel structures true and plumb in accordance with the Contract Drawings, match marks, pertinent regulations, and the AISC standards referenced in Paragraph 1.02A.
   1. Align column bases and bearing plates for beams and similar structural members using steel wedges or shims.
   2. Do not field cut or alter structural members without the approval of the Engineer.
   3. Allow concrete foundations to cure for a minimum of 14-days before tightening anchor rod hardware.
      a. Do not tighten anchor rod hardware using impact torque wrenches.
   4. Apply a coal tar epoxy coating to steel below grade.

C. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads.
   1. Use temporary bracing to resist loads to which the structures may be subjected, including loads from erection equipment or its operation.
   2. Leave temporary bracing in place as long as may be required for safety.

D. Bolted Connections:
   1. For connections using high-strength steel bolts, conform to requirements of the AISC Specifications referenced in Paragraph 1.02A.
      a. Assemble high-strength bolted parts so that they fit solidly together when assembled.
         1) Remove scale, dirt, butts, and other defects liable to prevent proper seating when joint surfaces are assembled, including joint surfaces adjacent to washers.
         2) Do not use gaskets or any other interposed compressible materials.
         3) Only use drift pins for bringing members into position, not to enlarge or distort holes.
   2. Ensure that holes are not enlarged and that drifting occurring during assembly does not disturb metal in the vicinity of holes.
      a. Enlarge holes to admit bolts for connections only if approved by the Engineer.
         1) Make the enlargement by reaming and not by burning.
         2) Avoid hand reaming.
   3. As erection progresses, install sufficient bolts in the work to resist dead loads, wind loads, and erection loads.
      a. Arrange and insert the bolts so that the bolt heads show in areas exposed to view.
      b. Do not permanently fasten the bolted connections until the structural steel has been sufficiently aligned and bolted to support as much of the structure as possible by such fastening work.
   4. For bearing-type connections, tighten the ASTM A 325 bolts to a snug tight condition by either applying a few impacts from an impact wrench or the full effort of an ironworker using an ordinary spud wrench so that all plies of the connected material have been brought into firm contact.
   5. For slip-critical and pretension connections, tighten the ASTM A 325 bolts, nuts, and direct tension indicators or twist-off-type tension control bolt in accordance with the AISC specifications listed in Paragraph 1.02A.
      a. Clean oil, paint, and lacquer from the contact surfaces of slip-critical joints.
      b. Place direct tension indicators under either the bolt head or the hardened flat washer.
         1) If direct tension indicators are placed under the turned element, place a hardened round steel washer between the direct tension indicator and the turned element.
      c. To ensure proper tensioning of these connections is achieved, have a representative from the direct tension indicator supplier on site during their initial tightening to witness and approve of the degree of tightening.

E. Field welding is only permitted where approved by the Engineer or as indicated in the approved Shop Drawings.
   1. Securely tighten erection bolts used in welded construction and leave them in place.
   2. Field welding rigid frame flange connection plates on columns may only be done if required for ease of erection, and if required, must be clearly indicated on the approved Shop Drawings and approved by the Engineer.

F. After the supported members have been aligned and properly positioned and the anchor nuts have been tightened, dry-pack the entire area under bearing plates with non-shrink non-metallic grout.

G. Prior to installing metal decking, clean all heavy rust, mill scale, dirt or other material from the unpainted top flanges of supporting beams.

3.4 FIELD QUALITY CONTROL

A. Direct the independent Testing and Inspection Agency to inspect the high-strength bolted connections and welded connections; to perform the specified tests and interpret the test results; to confirm that the structure is square, plumb, and level in accordance with AISC tolerances, including special tolerances for AESS; and to prepare and submit the test reports for this work.
   1. Field-Bolted Connections:
      a. Direct the independent Testing and Inspection Agency to inspect and test the field-bolted structural steel connections in accordance with the AISC specifications listed in Paragraph 1.02A, and the RCSC Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts.
      b. Verify that proper fastening components were used and the connected elements were fabricated properly.
      c. For slip-critical and pretension connections, test 2 bolts per connection.
   2. Field Welding:
      a. Direct the independent Testing and Inspection Agency to verify that all welders and welding materials in the field are properly certified, and to conduct the inspections and tests specified.
         1) Inspect and test field welds made during erection of structural steel assemblies by performing a visual inspection of the full length of all welds, and inspecting and testing field-welded connections in accordance with the requirements of AWS D1.1/D1.1M and the following:
            a) Inspect the entire length of fillet welds in accordance with the requirements for the Magnetic Particle Method specified in ASTM E 709 and the following.
               (1) For all fillet weld locations, test a minimum of 10 percent of the welds.
         2) Record both the type and location of all defects found in the work, and record the work required and the work performed to correct deficiencies.

B. Manufacturer's Field Services:
   1. To ensure proper tensioning of slip-critical and pretension connections is achieved, provide the services of a representative from the direct tension indicator supplier on Site during their initial tightening to witness and approve of the degree of tightening.

3.5 REPAIR/RESTORATION

A. Remove and replace work that does not comply with specified requirements.
   1. Correct deficiencies in structural steel work that inspections and test reports have indicated to be not in compliance with requirements.
   2. Additional tests performed by the independent Testing and Inspection Agency to reconfirm any noncompliant original work and verify compliance of corrected work will be performed at no additional cost to the Owner.

B. Immediately after erection, clean field welds, bolted connections, and areas where shop paint is abraded; and prime them with paint of the same quality as that used for the shop coat in accordance with the requirements specified.

C. Apply touch-up paint to exposed areas using material as specified.
   1. Completely blend touch-up paint with adjacent surfaces on AESS.

END OF SECTION

(This Page Left Intentionally Blank)

SECTION 05 40 00 - COLD FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Division 1 General Requirements

1.2 SUMMARY

A. Section includes:
   1. Canopy framing.
   2. Partition wall framing.
   3. Interior and exterior soffit framing.
   4. Accessories such as clips, stiffeners, bridging, bracing, and fasteners.

1.3 REFERENCES

A. Building Code of New York State, 2010 Edition

1.4 ADMINISTRATIVE REQUIREMENTS

A. Size and arrange components and accessories to support dead loads and to withstand live loads indicated on the drawings.

B. Maximum Allowable Deflection: Design system to withstand 100 percent loading without deflecting beyond the limits specified below.
   1. Floor: 1/360 of the span.
   2. Roof: 1/180 of the span.
   3. Walls: 1/240 of the span.

C. Design framing systems to withstand movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperatures.

D. Design system to accommodate deflection of building structural members and construction tolerances.

1.5 QUALITY ASSURANCE

A. Design of Framing Members: Calculate structural characteristics of framing members in compliance with American Iron and Steel Institute (AISI) “Specifications for the Design of Cold-Formed Steel Structural Members.”

B. Welding: Qualify welding procedures and each welder in accordance with American Welding Society (AWS) D1.3, "Structural Welding Code -Sheet Steel."

C. Store materials above the ground in a dry area, in manufacturer's original packaging. Keep labels showing product type, name, and grade intact.

1.6 SUBMITTALS

A. Product data.

B. Engineering Calculations: Submit calculations for loadings and stresses of system members and connections. Have calculations signed and sealed by an engineer registered in the state in which the project is located.

C. Shop Drawings: Submit layout and arrangement drawings showing all framing components, member layout and configuration, connection details and fastener sizes, quantity and arrangement.

D. All submittals are to be in accordance with Division 01 – Submittal Procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
1. Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials in manufacture's unopened packages and bearing manufacturer's label.

B. Storage and Handling:
1. Store materials in a dry and well ventilated place, adequately protected from damage and exposure to the elements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products of the following manufacturers, provided they comply with requirements of the Contract documents, will be among those considered acceptable:
1. Super Stud Inc.
2. Alabama Metal Industries Corporation (AMICO).
3. Gold Bond Building Products, a National Gypsum Division.
4. Dale/Incor.
5. Approved equal

2.2 COLD FORMED METAL FRAMING

A. Fabricate metal framing units from ASTM A 446, A 570, or A 611 steel sheet.
1. Finish: Galvanized (zinc-coated), Class G60, minimum.

B. Joists: Provide manufacturer's standard shaped sections fabricated from steel and sized as indicated.

C. Framing Accessories: Fabricate from minimum 16 gage steel sheet of the type and finish used for framing members. Provide manufacturer's standard configuration for the following accessory items:
   1. Track channel.
   2. V-bridging.
   3. Flat strapping.
   4. Web stiffeners.
   5. Joist hangers.

2.3 ACCESSORY MATERIALS

A. Welding Materials: Conform to requirements of AWS Code.

B. Fasteners:
   1. Threaded fasteners: ASTM A 90, hot-dip galvanized.
   2. Anchorage devices: Hot-dip galvanized steel or stainless steel. Acceptable types include:
      a. Powder actuated fasteners.
      b. Power-driven anchor screws.
      c. Drilled expansion bolts.
      d. Screws with sleeves.

C. Touch-up Paint: FS TT-P-645, zinc-molybdate alkyd.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspection: Verify that project conditions and substrates are appropriate to begin installation of cold formed metal framing systems.
   1. Verify that inserts, clips, and similar attachment devices installed as work of other sections are located and installed properly.

3.2 INSTALLATION - GENERAL

A. Comply with requirements of ASTM C 1007 except where exceeded by other requirements.

B. Install framing accessories such as web stiffeners, diagonal bracing, and bridging as indicated and in accordance with metal framing manufacturer's written instructions.

C. Fastening: Join components by welding or by using screws or bolts, as recommended by framing component manufacturer for members to be joined.
   1. Wire tying of framing elements is prohibited.
   2. Clean welds, removing spatter and slag, and apply one coat of touch-up paint.
   3. Provide minimum fastening in conformance with the following tables and with New York State Building Code, 2010 Edition, Table 2304.9.1. More stringent specification will prevail.

a. Fasteners in floor framing

LOCATION	FASTENER	FREQUENCY OR QUANTITY
Joist to girder	1/2" #10 panhead	1 @ joist to girder
Joist to connection clip	1/2" #10 panhead	3 to 4 @ each clip
Bridging to joist	1/2" #10 panhead, hexhead	1 @ each joist
Joist to 2X wooden end stiffener	1-1/4" #10 teks pancake head	2 @ each joist
End stiffener to joist	3/4" #10 panhead	3 to 4 @ each stiffener to joist
End stiffener to wooden rim joist	8d common wire nail	2 @ each end stiffener to rim joist
Steel rim joist to end stiffener	3/4" #10 panhead	3 @ each joist
Steel rim track to end stiffened	3/4" #10 panhead	3 @ each joist
Joist hanger to joist	7/8" #10 panhead, hexhead	3 @ each joist
Joist to overlapping joist	3/4" #10 panhead	3 @ support
Wooden sole plate (wall) to rim joist & track	2-1/2" #12 flathead	1 @ 24" O.C. & max. 12" from each end of track
Plate track (bottom) to joist & track	1-15/16" #12 panhead with pilot point	1 @ 24" O.C. & max. 12" from each end of track
Subfloor to joist	buglehead	1 @ 16" or 24" O.C.
Sheathing to joist	buglehead	1 @ 16" or 24" O.C.
Floor joist to steel beam	hexhead	1 @ 24" O.C.
Rim track to steel beam	hexhead	1 @ 24" O.C.
Solid blocking	panhead	1 @ 16 or 24" O.C.

b. Fasteners in non-load-bearing wall framing

LOCATION	FASTENER	FREQUENCY OR QUANTITY
Stud to plate track (bottom)	1/2" #8 screws low-profile panhead	1 @ each flange
Stud to plate track (top)	1/2" #8 screws low-profile panhead	1 @ each flange
Lateral bracing to stud	1/2" #8 screws panhead	2 @ flange
Stud to stud (nested)	1/2" #10 screws panhead	1 @ 24" O.C.
Stud to stud (back to back)	1/2" #10 screws panhead	1 @ 24" O.C.
Stud to stud (@ wall intersection)	1/2" #10 screws panhead	1 @ 24" O.C. or 1 @ each blocking
Drywall to stud	1" #10 type-S buglehead	1 @ 16" or 24" O.C.
Sheathing to stud	1" #10 type-S buglehead	1 @ 24" O.C.
Furring to lath	1/2" #8 type-W buglehead	1 @ 24" O.C.

LOCATION	FASTENER	FREQUENCY OR QUANTITY
Rigid insulation to stud	1-1/2" #10 type-S buglehead	1 @ 16" O.C.

c. Fasteners in Roof Framing

LOCATION	FASTENER	FREQUENCY OR QUANTITY
Ceiling joist to wooden top plate	1" #12 panhead	1 @ each joist
Ceiling to joist to top plate track	3/4" #10 panhead	1 @ each joist
Connection clip to wooden top plate	1" #12 panhead	4 @ each slip to top plate
Connection clip to top plate track	3/4" #10 panhead	4 @ each clip to plate track
Connection clip to ceiling joist	3/4" #10 panhead	Min. 3 @ each clip to ceiling joist and as per loading
Connection clip to rafter	3/4" #10 panhead	Min. 3 @ each clip to rafter and as per loading
Ceiling joist to parallel rafter	3/4" #10 panhead	No. varies as per loading
Ceiling joist to truss web	3/4" #10 panhead	Min. 2 @ flange and as per loading
Ceiling joist, overlapped at support	3/4" #10 panhead	Min. 2 @ web
Connection clip to ridge board	3/4" #10 panhead	4-6 @ each clip to ridge
Rafters overlapped at ridge	3/4" #10 panhead	Min. 6 @ overlapped web section and as per loading
Built-up beam (ridge board)	3/4" #10 panhead	1 @ each flange @ 12" O.C.
Stiffback bracing to joist	3/4" #10 panhead	Min. 2 @ each joist
Subfascia track to rafter	3/4" #10 low-profile panhead	1 @ each connection clip and max. top plate
Wooden fascia to subfascia track	1-5/8" #12 trimhead	2 @ 24" O.C. and @ max. of 12" from each end of board or corner
Rafter to rafter	3/4" #10 panhead. hexhead. buglehead	Min. 2 @ 24" O.C.
Collar tie to rafter	3/4" #10 panhead. hexhead	2 @ per each collar tie
Bridging to rafter	3/4" #10 panhead. hexhead	2 @ min.
Rafter to ceiling joist	3/4" #10 panhead. hexhead	1 @ each joist
Gusset to rafter	3/4" #10 panhead	Min. 3 @ gusset
Kingpost to rafter	1" #10 panhead	1 min. each rafter

LOCATION	FASTENER	FREQUENCY OR QUANTITY
Truss web to rafter	1-1/4" #10 panhead	No. varies per loading
Bracing to rafter	3/4" #10 panhead, hexhead	2 @ each rafter
Rafter to web stiffener	3/4" #10 panhead	1 @ each rafter
Trim molding to rafter	1/4" #8 ovalhead	1 @ 24" O.C.
Drywall to rafter	1" #10 type-S buglehead	1 @ 16" O.C.
Rigid insulation to ceiling joist	1" #10 type-S buglehead	1 @ 24" O.C.
Drywall to ceiling joist	1" #10 type-S buglehead	1 @ 16" O.C.

3.3 JOIST FRAMING

A. Verify level and secure bearing surfaces for joists.

B. Make provisions for erection stresses. Provide temporary bracing and alignment.

C. Set joists parallel and level, with lateral bracing and bridging.

D. Provide web stiffeners at reaction points.

END OF SECTION

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Division 1 General Requirements

B. Section 03 30 00 Cast-in-Place Concrete

C. Section 05 12 00 Structural Steel Framing

D. Section 05 52 00 Metal Railings

E. Section 05 53 00 Metal Gratings and Treads

F. Section 10 14 00 Signage

1.2 SUMMARY

A. Section Includes but is not limited to:
   1. Steel framing and supports for mechanical and electrical equipment.
   2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   3. Miscellaneous steel trims
   4. Loose bearing and leveling plates for applications where they are not specified in other Sections.
   5. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
   6. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
   7. Shelf Angles
   8. Metal ladders
   9. Metal downspout boots

B. Products furnished, but not installed, under this Section:
   1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
   2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections

1.3 REFERENCES

A. American Institute of Steel Construction (AISC):
   1. Specifications for the Design of Cold-Formed Steel Structural Members.

B. American Welding Society (AWS):

1. ANSI/AWS D1.1-Structural Welding Code.

C. American Society for Testing and Materials (ASTM):
   1. A36/A36M, Specification for Carbon Structural Steel
   2. A47, Specification for Ferritic Malleable Iron Castings
   3. A48, Specification for Gray Iron Castings
   4. A53, Specification for Pipe, Steel, Black and Hot-Dipped,Zinc-Coated Welded and Seamless
   5. A123, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   6. A153, Specification for Zinc Coating (Hot-Dip) on Iron and Steelhardware
   7. A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
   8. A320/A320M, Specification for Alloy Steel Bolting Materials for Low-Temperature Service
   9. A325, Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi minimum Tensile Strength
   10. A336/A336M, Specification for Steel Forgings, Alloy, for Pressure and High-Temperature Parts
   11. A489, Specification for Carbon Steel Lifting Eyes
   12. A500, Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
   13. A563, Specification for Carbon and Alloy Steel Nuts
   14. A570/A570M, Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
   15. A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   16. A786/A786M, Specification for Rolled Steel Floor Plates
   17. F436, Specification for Hardened Steel Washers

D. Federal Specifications (FS)
   1. FF-B-561, Bolts, (Screw), Lag
   2. FF-B-588D, Bolt, Toggle: And Expansion Sleeve, Screw
   3. FF-S-92B(1), Screw, Machine, Slotted, Cross Recessed orHexagon Head.
   4. FF-S-111D, Screw, Wood
   5. FF-S-325, Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
   6. FF-T-276B, Thimbles, Rope
   7. FF-T-791B, Turnbuckle
   8. FF-W-84A, Washers, Lock (Spring)
   9. FF-W-92B, Washer, Flat (Plain)
   10. TT-P-641G, Primer Coating; Zinc Dust-Zinc Oxide (For Galvanized Surfaces)

E. American National Standards Institute (ANSI):
   1. ANSI B.18.22.1, Plain Washers.
   2. ANSI/ASME B.18.5, Round Head Bolts (Inch Series).
   3. ANSI/ASME B.18.5.2.2M, Bolts, Metric Round Head Square Neck.

F. National Association of Architectural Metal Manufacturers (NAAMM)

1.4 ADMINISTRATIVE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Qualifications for Welding Work: Welds shall be made only by welders, tackers and welding operators who have been previously qualified by tests as prescribed in the Structural Welding Code, ANSI/AWS D1.1 of the American Welding Society to perform the type of work required.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer of metal fabrication is a certified installer with a documented history of installing manufacturer's products according to manufacturer's specifications.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
   3. AWS D1.6, "Structural Welding Code - Stainless Steel."

D. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

E. Verify dimensions at worksite before preparation of shop drawings and before product fabrication begins. Surfaces to receive metal fabrication shall be sound, square, and true; examine surfaces for defects that would impair installation of metal fabrications before metal fabrications are installed.

1.6 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details formetal fabrications.
   1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

B. Copies of manufacturer's catalog cuts, specifications, load tables, dimension diagrams, anchor details, setting diagrams and templates, and manufacturer's printed installation instructions, including paint products.

C. Certificates of welders' qualifications showing date of qualification, qualification grade and rating, and notarized signature of inspector.

D. Samples of materials and finishes of products as specified and if requested by the Engineer.

E. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Qualification Data: For qualified professional engineer.

G. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.

H. Welding certificates.

I. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
1. Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials inmanufacture's unopened packages and bearing manufacturer's label.

B. Storage And Handling:
1. Store materials in a dry and well ventilated place, adequately protected from damage and exposure to the elements.

PART 2 - PRODUCTS

2.1 GENERAL METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304

D. Steel Tubing: ASTM A 500, cold-formed steel tubing.

E. Steel Pipe: ASTM A 53/A 53M, standard weight unless otherwise indicated.

2.3 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

E. Bronze Plate, Sheet, Strip, and Bars: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper).

F. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).

G. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).

H. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.

I. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20percent leaded nickel bronze).

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
   1. Provide stainless-steel fasteners for fastening aluminum.
   2. Provide stainless-steel fasteners for fastening stainless steel.
   3. Provide stainless-steel fasteners for fastening nickel silver.
   4. Provide bronze fasteners for fastening bronze.

B. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless- steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy Group 1.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

D. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A 489.

F. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

G. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).

H. Wood Screws: Flat head, ASME B18.6.1.

I. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

J. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

K. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete,

as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

L. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either

M. ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

N. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee- head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 09 Section 09 90 00 Painting.

C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC- Paint 20 and compatible with paints specified to be used over it.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Non-shrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Concrete: Comply with requirements in Division 03 Section 03 30 00 Cast-in- Place Concrete for normal-weight, air-entrained, concrete.

2.6 GENERAL FABRICATION

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
   1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50- mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
   1. Fabricate units from slotted channel framing where indicated.
   2. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports where indicated.

E. Prime miscellaneous framing and supports with primer specified in Division 09 Section 09 90 00 Painting where indicated.

2.8 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize miscellaneous steel trim.

D. Prime miscellaneous steel trim with primer specified in Division 09 Section 09 90 00 Painting.

2.9 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19- mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
   1. Provide mitered and welded units at corners.
   2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.

2.10 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

C. Prime plates with zinc-rich primer.

2.11 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.12 METAL DOWNSPOUT BOOTS

A. Provide downspout boots made from cast iron in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.
   1. Outlet: Vertical, to discharge into pipe.

B. Prime cast iron downspout boots with zinc-rich primer

2.13 STEEL BOLLARDS

A. Provide NPS 8 Schedule 40 galvanized steel pipe with outside diameter of 8.625 inches.
   1. Bollards to be filled with concrete per Section 03 30 00 –Cast-In-Place Concrete.
   2. Provide fully welded galvanized steel flange for surface mounting of all bollards.
   3. Anchor per Section 05 12 00 – Structural Steel Framing.

B. Prime steel bollards with zinc-rich primer and paint with color “Safety Yellow.”

2.14 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Grind exposed surfaces smooth to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.15 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
   1. Shop prime with primers specified in Division 09 Section 09 91 00 Painting unless otherwise indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
   1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   3. Items Indicated to Receive Primers Specified in Division 09 Section "High- Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   4. Other Items: SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.16 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which miscellaneous metal items are to be installed. Surfaces that are to receive metal fabrications shall be free from defects. Embedded products shall have been installed where indicated.

B. Furnish setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

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

3.3 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
   1. Cast Aluminum: Heavy coat of bituminous paint.
   2. Extruded Aluminum: Two coats of clear lacquer.

3.4 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
   1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
   1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.5 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
   1. Use non-shrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 Section 09 91 00 Painting.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 05 50 10 - MISCELLANEOUS METALS

PART 1 - GENERAL REQUIREMENTS

1.1 Scope of Work

A. Furnish and install all materials, tools and equipment necessary for miscellaneous metals work as indicated on the Construction Drawings and as specified herein.

1.2 Codes and Standards

A. At a minimum, all materials and work furnished pursuant to this Specification shall comply with the latest edition of the following applicable code provisions and all applicable standards listed below. The publications listed below are incorporated herein by reference to the extent applicable.

B. ANSI - American National Standards Institute / NFSI - National Floor Safety Institute

1.	ANSI/NFSI B101.3-2012	Test Method of Measuring Wet DCOF of Common Hard - Surface Floor Materials

C. ADAAG - ADA Accessibility Guidelines for Buildings and Facilities

D. ASTM - American International

1.	ASTM A27/A27M-13	Standard Specification for Steel Castings, Carbon, for General Applications
2.	ASTM A36/A36M-14	Standard Specification for Carbon Structural Steel
3.	ASTM A48/A48M-03(2012)	Standard Specification for Gray Iron Castings
4.	ASTM A53/A53M-12	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless
5.	ASTM A240/A240M-15a	Standard Specification for Chromium and Chromium-Nickel Stainless Steel, Plate, Sheet, and Strip for Pressure Vessels and General Applications
6.	ASTM A480/480M-14b	Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
7.	ASTM A536-84(2014)	Standard Specification for Ductile Iron Castings
8.	ASTM A1008/A1008M-15	Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened & Bake Hardenable
9.	ASTM A1011/A1011M-14	Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Ultra High Strength

E. NFSI - National Floor Safety Institute

1.3 Quality Assurance

A. All work as much as practicable, shall be built up and assembled in the shop and shall conform to the actual measurements taken by the Contractor at the site where the work is to be installed. All work shall be plumb and true and in conformity with the Construction Drawings.

B. For all fabricated items: The Fabricator shall have a minimum of three (3) years of experience in the fabrication of items of the types specified.

C. All walkway surfaces including stairs shall meet the requirements of the referenced standards for wet dynamic coefficient of friction (DCOF) cited herein and shall be specified as high traction products.

D. Walkway surface products shall have the manufacturer's certificate of compliance issued by the National Floor Safety Institute (NFSI).

E. Contractor shall be responsible for all errors that can be discovered by checking or examining the shop drawings. The approval of such shop drawings by the Design Professional and the Engineer shall not relieve the Contractor of this responsibility.

1.4 Submittals

A. Submit product specifications, installation instructions, certificates of compliance and other data necessary to prove compliance with the requirements specified herein and with the referenced standards.

B. Drawings: Submit shop drawings, including plans, elevations, sections and details of castings, gratings and other metal fabrications and their connections that are required in this Section.

C. Design Calculations: For all metal fabrications that are required to comply with design loadings, submit calculations signed and sealed by a Professional Engineer licensed to practice in New York State.

D. Submit manufacturer's product Certificate of Compliance issued by the NFSI for each walkway surface product specified including but not limited to stairs, access hatches and covers of equipment.

1.5 Manufacturer's Warranty

A. Provide manufacturer's written warranty for repair or replacement of materials that are defective or shows substandard workmanship or fails within a one (1) year warranty period.

1.6 Delivery, Storage, and Handling

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

B. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

C. Stack materials out of mud and dirt and provide for proper drainage. Protect from damage or soiling by adjacent construction operations.

D. The Engineer reserves the right to reject any material which has been stored improperly.

PART 2 - MATERIALS

2.1 Steel

A. Steel for miscellaneous metals shall conform to ASTMA529. Steel for steel gratings shall conform to ASTM A1011, Grade D.

2.2 Steel Pipe

A. Galvanized steel pipe shall conform to ASTM A53 for seamless pipe.

2.3 Cast Iron Process

A. Cast iron shall be of gray iron casting, and shall conform to Class 30 ASTM A48.

B. Annealed ductile iron shall conform to ASTM A536, cast grade 65-45-12, with a minimum tensile strength of 65,000 psi.

2.4 Cast Steel

A. Cast steel shall conform to the requirements of ASTM A27, with the following requirements:
   1. Ultimate tensile strength, pounds per square inch, minimum.....65,000
   2. Yield point, pounds per square inch, minimum.....35,000

2.5 Fasteners

A. Use Type 316L stainless steel anchor bolts or expansion bolts securing miscellaneous metals to masonry, as directed by the Design Professional. Use anchor bolts to secure railings to copings, floors, and stairs. Use expansion bolts where it is necessary. Drills holes to the exact size in the masonry for the bolts or sleeves. Do not use packing. Install expansion bolts of the approved type, diameter, and length. Set anchor bolts into epoxy. Fill holes thoroughly and caulk. Provide tamper resistant type fasteners.

2.6 Aluminum

A. Aluminum shall be made from the best grades of virgin metal and scrap of known and approved composition. The aluminum shall be of the proper alloy. It shall receive an anodizing surface treatment suitable for the intended purpose for which the material shall be used. The treatment shall be accordance with the specifications and recommendations of the Aluminum Company of America. Aluminum shall also receive a protective coating of an approved lacquer.

B. Aluminum sheet shall be true to gauge, uniform in quality and temper, shall be sound, smooth, and clean, free from seams, laminations, buckles or other defects, and shall be commercially flat to a degree suitable for the intended purpose.

C. All bolts, nuts, washers, screws and rivets shall be of stainless steel unless otherwise specified herein.

D. Special precaution shall be taken to prevent galvanic action between the metals when aluminum comes in physical contact with other metals.

E. Provide a bituminous coating or other type of galvanic separator when aluminum comes into contact with wet cementitious products.

F. Reinforce aluminum for the attachment of hardware. Use stainless steel screws for securing steel or bronze hardware. Steel hinges and bronze hardware in direct contact with aluminum work shall be heavily chromium plated and given a satin finish.

G. The exposed surfaces of aluminum unless otherwise specified herein, shall have a directional "satin finish". "Satin finish" shall mean the surfaces of aluminum are finished with very fine scratched lines obtained by the use of various grades of abrasive, the abrasive being used in steps from coarse to fine sizes. The satin finish will be determined through sample approval process.

2.7 Stainless Steel

A. Provide Type 316L for stainless steel exposed to the exterior environment, with a satin No. 4 finish as specified by ANSI standards for architectural stainless steel and as per U.S. standards, or as otherwise indicated on the Construction Drawings.

B. Protect all stainless steel products from contamination during forming or other manufacturing steps such as forging, machining, heading, conning, drawing, welding, or spinning.

C. Work done in shops shall not be performed on machines or with tools that have been used on carbon steel.

D. Thoroughly clean grinding tools before use on stainless steels.

E. After fabrication chemically clean the stainless steel in solutions (recommended by the American Steel Institute) that will dissolve carbon steel particles.

2.8 Stainless Steel Handrail Pipe and Bracket

A. Use Type Schedule 40 ASTM 240 stainless steel tubing with a satin No. 4 finish. Provide a minimum 1.66” outside diameter for pipe and fittings.

B. Use Type 316L Stainless steel for handrails and guardrails exposed to the exterior environment.

C. Space stainless steel handrail brackets no more than four feet on center. Provide brackets as manufactured by Julius Blum & Co., Inc., or R & B Wagner Inc., or approved equal as indicated on Construction Drawings.

D. Provide continuous diameter handrails throughout the length of pipe. Welding and grinding smooth procedures of connections at curves or straight runs shall not diminish the diameter of the handrail pipe. Handrails and appurtenances shall be smooth throughout.

2.9 Cast Aluminum Abrasive Treads/Nosings

A. Stair nosings and treads: Abrasive cast aluminum, cross hatched pattern with integral safety edge strip and 1" x 1-1/2" nose, Alloy 443, or equivalent in quality and performance to one of the following manufacturers, or approved equal:
   1. Safe-T-Metal Co. Inc.: Abrasive material is No. 24 electric-furnace corundum grit
      a. Model KK-ADA can be specified with or without toeplate. With toeplate for steel stairs and without when embedded in concrete.
   2. Wooster Products, Inc.: Wooster's Alumogriit (abrasive cast aluminum) - No. 43 prime ingot, low copper content corrosion resistant.
      a. Model 105: Treads with toeplate attach to steel stairs.
      b. Model 105A: Treads without toeplate, embed into concrete.
   3. American Safety Tread Co. Inc.: American Safety Tread's Alumnacast (abrasive cast aluminum)
      a. Model 805 - ADA can be specified with or without toeplate. With toeplate for steel stairs and without when embedded in concrete.
      b. Where existing concrete stairs have recessed risers and concrete nosings, the stair treads shall be abrasive cast aluminum, cross-hatched pattern with 5/16” x 1-1/2" nosing, Alloy 443, or equivalent in quality and performance. Stair treads shall be model type 116A, manufactured by Wooster Products, Inc., or approved equal.
      c. Where stair tread and nosings are exposed to inclement weather, water, salt and highly corrosive elements use Aluminum Alloy 535.2.

B. Any holes or countersinks shall be machine-made. Cored holes or countersinks are not acceptable. Screw heads shall not protrude above tread surface. Furnish treads with two rows of pre-drilled countersunk holes. Hole spacing shall be 12” on center, staggered, and 3” maximum from each end. Nuts, and bolts for attaching the treads shall include a lock washer.

C. All metal types shall have a shot-blasted finish with treads and nosings.

D. Tread Thickness: 5/8" thick minimum abrasive cast aluminum treads.

E. Tread Tolerances: Treads up to 3 feet in length shall be level with a tolerance of 1/16th of an inch. Treads between 3 feet to 6 feet in length shall be level with a tolerance between the range of 1/16th to 1/8 of an inch. Treads longer than 6 feet shall be level with a tolerance of 1/8 of an inch maximum. There shall be no warpage from the back of the tread to the nosing.

F. Provide a galvanic separator (self-adhering EPDM) between aluminum tread and steel support.

G. Provide factory applied zinc chromate coating to all surfaces where contact shall occur with treads installed in concrete, or on a mortar bed, or other cementitious material. Do not use spacers to level the bed.

H. Embed fasteners a minimum of 2-1/2” into the concrete for tread installation on concrete stairs.

2.10 Sheet Metal

A. Sheet Steel: Cold-rolled, rust-resisting commercial sheet steel, conforming to ASTM A1008. Minimum 16 gauge unless otherwise indicated.

B. Sheet Stainless Steel: ASTM A480, rollable temper stainless steel, brush finish unless otherwise noted.

PART 3 - EXECUTION

3.1 Steel Gratings

A. Steel gratings shall be of the type indicated on Construction Drawings.

B. Gratings shall be set in frames as indicated on the Construction Drawings. Place all bearing bars in the short dimension of the span.

C. Gratings and frames shall be galvanized after fabrication by the "hot dip" process, as specified in Section 9M - Galvanizing. Coat all surfaces with at least two ounces of zinc per square foot of galvanized surface. Preliminary hot dip gratings before fabrication, in addition to the final dip stated above, if the Design Professional deems it necessary.

3.2 Pipe Railings

A. Weld pipe railings and guard rails to base plates or angles and secure to concrete with expansion bolts. Accurately cut pipe for a close-fit at all intersections. Weld all joints. Ground welds smooth without impairing their strength. Paint railing as specified in Section 9A/9AS - Painting.

3.3 Pipe Handrails

A. Provide ends of platforms and areas as shown on the Construction Drawings with steel pipe handrails for their entire length. Provide stainless steel pipe handrails at other locations as shown on the Construction Drawings. Form steel pipe handrails using welded bends and returns as shown on the Contract Drawings, or as directed by the Design Professional. Provide brackets and sockets of galvanized malleable iron.

B. Secure sockets and brackets to the masonry with approved expansion bolts. Handrails shall be neatly and accurately fitted into the socket and secured in place in the approved manner. It is the intention of the Engineer to have handrails installed that do not rattle. Neatly curved and finish all bends and returns. Paint handrails as specified Section 9A/9AS – Station Painting.

C. Install stainless steel handrails with a No. 4 finish on stairways, and stairway landings at locations shown on the Construction Drawings. Provide welded type handrails for the entire length of the stairways and landings. Fabricate handrails from welded Type 316L stainless steel, nominal pipe size 1-1/4”, Schedule 40 thickness, and an outside diameter of 1.66”. Provide connector sleeves at welding locations, and Type 316L stainless steel, No.4 finish wall brackets and posts as shown on the Contract Drawings. For handrails and guardrails exposed to the exterior environment use type 316L stainless steel.

1. Install continuous, diameter handrail pipe. Maintain diameter of handrail pipe. Welding and grinding smooth of connections shall not diminish pipe diameter. Provide smooth handrails and appurtenances throughout pipe length.
2. Paint hardware black that connects pipe handrails to the floor. Rotation of handrails within the fittings is not permitted. Fill and polish handrail seams

3.4 Miscellaneous Architectural Steel and Iron

A. Provide miscellaneous architectural steel and iron work where indicated on the Construction Drawings, or as required by the Design Professional for:
1. Steel ladders, stairways (including pipe railings), and landings.
2. Steel supports.
3. Checkered steel plate covers with continuous steel angle frames for pipe trenches and pits.
4. Cable pulling eyes, pipe barriers with chains, swing bars, lintels, and handgrips.
5. Cable racks for manholes.
6. Services boxes.
7. Steel manhole steps.

B. Provide ladders with rungs that consist of flat steel stringers with round or flat steel rungs as shown on the Construction Drawings. Rungs shall be peened, and welded on the outside of the stringers. Secured ladders with expansion bolts set in masonry. Install toe holds in the masonry as indicated on the Construction Drawings.
1. Paint steel ladders at the ends of platforms leading to the track area safety yellow as specified in Section 9A/9AS - Station Painting.

C. Install steel ladders and stairways (including the ladders for sidewalk hatches) consisting of flat steel stringers or channels, with angles welded or riveted thereon for the support of the treads. Provide treads made of checkered steel plates with checkered plate nosings that are bolted to the supporting angles, as shown on the Contract Drawings. Secure stringers for ladders and stairways with clip angles, and expansion bolts set into the masonry. Provide checkered, steel plate, landings for ladders and stairways supported on steel shapes, as shown on the Contract Drawings.

D. Install roof ladder with cage and platform to comply with OSHA requirements and as manufactured by Precision Stair Corp., 5727 Superior Drive, Morristown, TN 37814, (800) 225-7814, or an approved equal.

E. Provide grip bars or railings of steel in conjunction with all stairways, ladders and landings.

F. Furnish and install miscellaneous steel shapes necessary to complete the work under this Contract.

G. Work shall be as far as practicable built-up and assembled in the shop. Conform to actual measurements taken at the work site.

H. Protect primed or galvanized surfaces against damage during construction and remove protection at time of substantial completion.

I. Install work plumb, level and in line with adjacent structure.

3.5 Metal Door Saddles

A. Metal door saddles shall be of approved cross-section, scribed and fitted to the door jambs and shall be of the type indicated on Construction Drawings, or approved equal. Wood blocks and metal anchors or expansion bolts shall be set in place in the concrete floors for securing saddles in place.

3.6 Stanchions (Guard Posts or Bollards)

A. Install seamless, extra strong, concrete filled, ASTM A500 galvanized steel pipe, Grade 'B" (extra heavy) stanchions where shown on the Construction Drawings. Fill space between pipe, and sleeve with grout, or an appropriate material approved by the Design Professional. Contractor shall perform all masonry work.

3.7 Abrasive Stair Treads and Nosings

A. Do not install stair treads that show any signs of warp or bowing. Check treads for compliance with tolerances.

B. Coordinate installation where tile pavers are disturbed. Chop existing treads, install anchors as required, in mortar bed.

C. Construct new concrete steps to the proper level and pitch. Cure concrete steps prior to tread installation.

D. Install treads using manufacturer's recommended counter sunk bolt.

E. Install treads in accordance with the recommended procedure listed below:
   1. Spread thin set mortar evenly spread on top of the concrete step.
   2. Back-buttered treads with a thin layer of thin set mortar to ensure full bond between tread and substrate.
   3. Set treads shall be into freshly laid mortar. Remove and re-install mortar that has already set.
   4. Adjust treads for proper pitch (front to back), and leveled from left to right.
   5. Drill holes for anchors through freshly laid mortar, and into the concrete step to accept an expansion bolts.
   6. Install and only partially tighten expansion bolts to set the tread down into the mortar, and adjust to keep the tread properly pitched and level.
   7. Tighten expansion bolts all the way after mortar is cured.

F. Rest stair treads and nosings continuously, and solidly on cement substrate. There shall be no voids. Center stair treads, and nosings within stair sidewalls. Pitch treads forward for positive drainage in accordance with the Building Code of New York State. Back pitching is not acceptable.

3.8 Sheet Metal Fabrication

A. Fabricate sheet metal items using concealed lock joints and continuous welds. Close tops and bottoms with inverted steel channels. Ensure that all items exposed to the weather are watertight.

B. Provide steel plate, angle, or channel reinforcing as indicated or as required to ensure rigid, even assembly.

Submittal Approvals

Item No.	Paragraph No.	Submittals	Approval By (Engineer or Designer)
1.	1.5 a	Product specifications, installation instructions, certificates of compliance and other data.	Design Professional and the Engineer
2.	1.5 b	Shop Drawings	Design Professional
3.	1.5 c	Design calculations	Design Professional
4.	1.5 d	Submit manufacturers product certificate of compliance	Contractor's Quality Manager
5.	1.6 a	Manufacturer's warranty	Engineer

Notes:

1. This table does not include approvals for "or-equal" proposals.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 05 51 33 - METAL LADDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements for complete fixed metal ladder assemblies

1.2 REFERENCES

A. Reference Standards:

1. American Society for Testing and Materials (ASTM):
   a. ASTM A 36, Structural Steel
   b. ASTM A 47, Malleable Iron Castings
   c. ASTM A 53, Welded and Seamless Pipe
   d. ASTM A 108, Steel Bars, Carbon, Cold Finished, Standard Quality
   e. ASTM A 123, Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
   f. ASTM A 193 / A 193M-03, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
   g. ASTM B 209 - Standard Specification for Aluminum and Aluminum- Alloy Sheet and Plate; 2001.
   h. ASTM B 209M - Standard Specification for Aluminum and Aluminum- Alloy Sheet and Plate (Metric); 2001.
   i. ASTM B 210 - Standard Specification for Aluminum and Aluminum- Alloy Drawn Seamless Tubes; 2002.
   j. ASTM B 221 - Standard Specification for Aluminum and Aluminum- Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2000.
   k. ASTM B 221M - Standard Specification for Aluminum and Aluminum- Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2000.
   l. ASTM A 240 / A 240M-03b, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
   m. ASTM A 283, Low and Intermediate Tensile Strength Carbon Steel Plates of Structural Quality
   n. ASTM A 307, Standard Specification for Carbon Steel Bolts and Studs, 60000 PSI Tensile Strength
   o. ASTM A 366, Steel Carbon, Cold-rolled Sheet, Commercial Quality
   p. ASTM A 500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
   q. ASTM A 513, Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
   r. ASTM A 570, Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality
   s. ASTM A 563-00, Standard Specification for Carbon and Alloy Steel Nuts
   t. ASTM A 780-01, Standard Practice for Repair of Damaged and Un- coated Areas of Hot-Dip Galvanized Coatings

u. ASTM A 786 / A 786M-00b, Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates
v. ASTM A 1011 / A 1011M-03, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
w. ASTM B 308 - Standard Specification for Aluminum - Alloy T6061-T6 Standard Structural; 2002
x. ASTM B 308M - Standard Specification for Aluminum - Alloy T6061-T6 Standard Structural; 2002
y. ASTM D 6386 – Standard Practice for Preparation of Zinc Coated Iron and Steel Product and Hardware Surfaces for Painting
z. ASTM F 844-00, Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use

B. Codes and Standards: In addition to complying with applicable Building Codes and regulations, comply with ANSI A 14.3, ANSI A 12.1, ANSI A58.1, and OSHA as applicable to ladders and protection of floor openings.
1. "Specification for Design, Fabrication, and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction. General requirements for rolled steel plates, shapes, sheet piling and bars for structural use ASTM A61 and structural steel, ASTM A36.
2. "Code for Welding in Building Construction", AWS D1.0, 01.1 and AWSB3 latest edition of the American Welding Society.
3. Specification for Design, Fabrication, and Erection of Structural Steel for Buildings, American Institute of Steel Construction AISC S326.
4. Society of Automotive Engineers, SAE J429 Mechanical and Material Requirements for Externally Threaded Fasteners.

C. Conflicting Requirements: In the event of conflict between pertinent codes and regulations and the requirements of the referenced standards of these Specifications, the provisions of the more stringent shall govern.

1.3 QUALITY ASSURANCE

A. Qualifications of Welders: Use only certified welders and the shielded arc process.

1.4 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Fully dimensioned shop drawings of all items as necessary to completely fabricate and install the ladders, including documentation of all field conditions and dimensions as verified by the Manufacturer’s representative.

1.5 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY:
   1. Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials in manufacturer's unopened packages and bearing manufacturer's label

B. STORAGE AND HANDLING:
   1. Store materials in a dry and well ventilated place, adequately protected from damage and exposure to the elements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of the following:
   1. ALACO Ladder Company
   2. Or approved equal.

2.2 MATERIALS

A. Steel, Shapes and Bars: ASTM A 36.

B. Steel Plates to be Bent or Cold-Formed: ASTM A 283, Grade C.

C. Cold-Finished Steel Bars: ASTM A 108, grade as selected by fabricator.

D. Hot-Rolled Carbon Steel Sheets and Strips: ASTM A 570.

E. Cold-Rolled Carbon Steel Sheets: ASTM A 366.

F. Fasteners: Nuts to be ASTM A563 Grade 0; Bolts at handrail to stringer to be hex head SAE J429 Grade 5, ½" diameter x 13 TPI; Bolts at anchoring to structure to be carriage head A307 or hex head SAE J429 Grade 5, ½" diameter x 13 TPI.

G. Malleable Iron Castings: ASTM A 47, grade as selected.

H. Steel Pipe: ASTM A 53; welded and seamless steel pipe Grade B; black finished; standard weight (Schedule 40).

I. Brackets, Flanges and Anchors: Cast or formed metal of the same type materials and finish as supported rails.

J. Welding Electrodes: Shall conform to requirements of AWS A 5.1, "Specifications for Mild Steel Covered Arc-Welding Electrodes", Grade 60 or 70.

K. Bolts and Nuts: ASTM A 307.

L. Shop Paint: Tnemec 88-556 Gray, or approved equal. Apply to cleaned steel surfaces at rate to provide a 2.0-mil dry film thickness.

M. Finish Paint: Refer to Section 09 90 00 – Painting.

N. Non-shrink Grout: CE CRD C 588.

O. Extruded Aluminum Profiles: ASTM B 221/B 221M, ASTM B 210, ASTM B 308/B 308M, Alloy 6061-T6; standard mill finish.

P. Aluminum Sheet and Plate: ASTM B 209/B 209M, Alloy 6061-T6; standard mill finish.

Q. Aluminum Fasteners: Aluminum solid aircraft rivets rated at 300 lbs (1335N) shear strength.

R. Cast fittings, connectors and rung ends: Cast Aluminum alloy 356

S. All other materials, not specifically described but required for a complete and proper installation shall be new, best quality and of their respective kinds.

2.3 FABRICATION, FIXED WALL LADDERS

A. Ladders - General: Comply with ANSI A14.3 and OSHA regulations

B. Fixed Steel Wall Ladders:
   1. Space siderails 16 inches apart unless otherwise indicated.
   2. Space siderails of elevator pit ladders 12 inches (300 mm) apart.
   3. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
   4. Rungs: 3/4-inch- diameter steel bars.
   5. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.

C. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

D. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.

E. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.

F. Galvanize ladders, including brackets and fasteners

G. Prime ladders, including brackets and fasteners, with zinc-rich primer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Transmit submittals required by this Section.

B. Furnish products as indicated.

C. Ensure that substrates are in suitable condition to receive the work. Notify the Engineer of unsatisfactory conditions before proceeding.

D. Filed verify all dimensions, elevations, etc. as needed in preparation of shop drawing submittals. Coordinate start and installation of ladders with all other related and adjacent work. Installation shall not start until the construction has progressed to the point that weather conditions and remaining construction operations will not damage required installation.

E. Deliver materials to the job-site in good condition and properly protected against damage to finished surfaces.

F. Store material in a location and manner to avoid damage. Do not stack components. Lay out components on firm foundation material suchthat bending cannot occur.

G. Store metal components in a clean dry location, away from uncured concrete, cement, or masonry products, acids, oxidizers, rain water, or any other chemical or substance that might damage the material or finish.

H. Plan work and storage locations to keep on-site handling to a minimum.

I. Exercise particular care to avoid damage to material finishes or unprotected surfaces when handling.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, and in compliance with ANSI A14.3 and OSHA 1910.27.

3.3 ADJUSTMENT AND CLEANING

A. Touch-up marred and abraded shop paint and galvanizing after erection in the field per standards ASTM A780, D6386, and A123.

END OF SECTION

SECTION 05 52 00 - METAL RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Division 1 General Requirements

B. Section 05 50 00 Metal Fabrications

C. Section 05 53 00 Metal Gratings and Treads

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

1.2 SUMMARY

A. Requirements for stainless steel handrails and guardrails with metal mesh infill panels and metal cane detection rails.

B. All stainless steel trim and finishing as shown on architectural drawings.

C. High tension cable barrier guardrail system located at Level P1.5 and at wall openings along Column Gridline B as a cable "car stop," as indicated on Architectural drawings.

D. The work specified in this Section consists of furnishing and installing metal handrails, guardrails and railings as shown and as indicated on the Contract Drawings.

1.3 REFERENCES

A. Reference Standards:
   1. American Society for Testing and Materials (ASTM): Stainless Steel
      a. ASTM A312/312M - Seamless and Welded Austenitic Stainless Steel Pipes
      b. ASTM A480/480M - General Requirements for Flat-Rolled Stainless and Heat Resisting Steel Plate, Sheet, and Strip
      c. ASTM A484/484M - General Requirements of Stainless Steel Bars
      d. ASTM A555/555M - General Requirements for Stainless Steel and Heat Resistant Steel Wire and Wire Rods
      e. ASTM A666 - Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar for Structural and Architectural Applications
      f. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs
   2. American Society for Testing and Materials (ASTM): Steel
      a. ASTM A 36, Structural Steel
      b. ASTM A 108, Steel Bars, Carbon, Cold Finished, Standard Quality
      c. ASTM A 47, Malleable Iron Castings
      d. ASTM A 53, Welded and Seamless Pipe

e. ASTM A 307, Carbon Steel Externally and Internally Threaded Standard Fasteners
f. ASTM A 366, Steel Carbon, Cold-rolled Sheet, Commercial Quality
g. ASTM A 570, Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality
h. ASTM B 209 - Standard Specification for Aluminum and Aluminum- Alloy Sheet and Plate; 2001.
i. ASTM B 209M - Standard Specification for Aluminum and Aluminum- Alloy Sheet and Plate (Metric); 2001.
j. ASTM B 210 - Standard Specification for Aluminum and Aluminum- Alloy Drawn Seamless Tubes; 2002.
k. ASTM B 221 - Standard Specification for Aluminum and Aluminum- Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2000.
l. ASTM B 221M - Standard Specification for Aluminum and Aluminum- Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2000.
m. ASTM B 308 - Standard Specification for Aluminum - Alloy T6061-T6 Standard Structural; 2002
n. ASTM B 308M - Standard Specification for Aluminum - Alloy T6061-
o. T6 Standard Structural; 2002
p. ASTM A 1023/M – Standard Specification for Stranded Carbon Steel Wire Ropes for General Purposes
q. ASTM A 931 – Standard Test Method for Tension Testing of Wire Ropes and Strand
r. ASTM E 8 – Standard Test Methods for Tension Testing of Metallic Materials
s. ASTM A 90 – Standard Test Method for Weight of Coating on Iron and Steel Articles with Zinc or Zinc Alloy Coatings
t. ASTM A 741 – Standard Specification for Metallic-Coated Steel Wire Rope and Fittings for Highway Guardrail
u. ASTM A 499 – Standard Specification for Steel Bars and Shapes,
v. Carbon Rolled from T Rails
w. ASTM A 1 – Standard Specification for Carbon Steel Tee Rails
x. ASTM A 123 – Standard Specification for Zinc (Hot Dip Galvanized)
y. Coatings on Iron and Steel Products
z. ASTM A 563 – Standard Specification for Carbon and Alloy Steel Nuts
aa. ASTM A 153 – Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware

3. AWS: American Welding Society
   a. AWS D1.6 Structural Welding code – Stainless Steel
4. NAAMM – National Association of Architectural Metal Manufacturers
   a. Metal Finishes Manual; Code of Standard Practice for the Architectural Metal Industry
5. SMACNA, Architectural Sheet Metal Manual
6. Federal Specification RR-W-410E for Galvanized Aircraft Cable
7. ANSI A 14.3, ANSI A 12.1, ANSI A58.1 and OSHA as applicable to stairs, ladders, railings and protection of floor openings
8. National Cooperative Highway Research Program Guidelines, Report 350 – Recommended Procedures for the Safety Performance Evaluation of Highway Features
9. American Association of State Highway and Transportation Officials (AASHTO)
   a. AASHTO M30 – Standard Specification for Zinc-Coated Steel Wire Rope and Fittings for Highway Guardrail
   b. AASHTO M103 – Standard Specification for Steel Castings, Carbon, for General Application

B. Codes and Standards: In addition to complying with applicable Building Codes and regulations, comply with ANSI A 14.3 and OSHA.

1. "Specification for Design, Fabrication, and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction. General requirements for rolled steel plates, shapes, sheet piling and bars for structural use ASTM A61 and structural steel, ASTM A36.
2. "Code for Welding in Building Construction", AWS D1.0, 01.1 and AWSB3 latest edition of the American Welding Society.
3. "Metal Stairs Manual" of the National Association of Architectural Metal Manufacturers, latest edition.
4. Specification for Design, Fabrication, and Erection of Structural Steel for Buildings, AISC S326.

C. Conflicting Requirements: In the event of conflict between pertinent codes and regulations and the requirements of the referenced standards of these Specifications, the provisions of the more stringent shall govern.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer of metal handrail and guardrail systems is a certified installer with a documented history of installing manufacturer's products according to manufacturer's specifications.

B. Stainless steel fabrications shall be from a manufacturer who has a dedicated facility for the assembly, welding, and polishing of stainless steel. The manufacturer should have dedicated tooling, fixtures, and machine tools, for the manufacturer of stainless steel products. Dedicated is defined as exclusively used for the use on stainless steel materials. This is to avoid contamination with other metals, especially carbon steel.

C. General: In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of handrail and railing materials based on the following:
1. Stainless Steel: ASCE 8, "Specification for the Design of Cold-Formed Stainless Steel Structural Members."
2. Structural Steel: AISC S335, "Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design with Commentary."

D. Structural Performance of Handrails and Railings: Provide handrails and railings complying with requirements of ASTM E 985 for structural performance, based on testing performed according to ASTM E 894 and ASTM E 935 and capable of withstanding structural loads required by ASCE 7 without exceeding allowable design working stresses of materials for handrails, railings, anchors, and connections. Handrails and railings shall be capable of withstanding the following structural loads without exceeding allowable design working stresses of materials for handrails, railings, anchors, and connections:
1. Top Rail of Guards: Capable of withstanding the following loads applied as indicated:
    a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
    b. Uniform load of 50 lbf/ft. (730 N/m) applied horizontally and concurrently with uniform load of 100 lbf/ft. (1460 N/m) applied vertically downward.
    c. Concentrated and uniform loads above need not be assumed to act concurrently.
2. Handrails Not Serving As Top Rails: Capable of withstanding the following loads applied as indicated:
    a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
    b. Uniform load of 50 lbf/ft. (730 N/m) applied in any direction.
    c. Concentrated and uniform loads above need not be assumed to act concurrently.

3. Metal Mesh Infill Area: Capable of withstanding a horizontal concentrated load of 200 lbf (890 N) applied to 1 sq. ft. (0.09 sq. m) at any point in system, including panels.
    a. Load above need not be assumed to act concurrently with loads on top rails in determining stress on guard.

E. Structural Performance of High Tension Cable Barrier / Car Stop: Provide industrial grade galvanized aircraft cable guardrail capable of withstanding structural loads required by ASCE 7 and NCHRP 350 without exceeding allowable design working stresses of materials for aircraft cable and connections.

F. Thermal Movements: Provide handrails and railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
2. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.5 SUBMITTALS

A. Submit the following:
1. Shop Drawings: Show plans and sections; materials of construction; finishes; methods of fastening; locations of cuts, copes, connections, holes, and threaded fasteners; methods of joining components; type, size, and spacing of welds; and proposed marking of fabrications which will require field assembly.
    a. For high-tension cable barrier / car stop system, shop drawings per Section 1.6.A.1 must be signed and sealed by a Professional Engineer, licensed in the State of New York. Include structural calculations ensuring cable guardrail system will withstand impact from a vehicle.
2. Copies of manufacturer's catalog cuts and specifications.
3. Certificates of welders' qualifications showing date of qualification, qualification grade and rating, and notarized signature of inspector.
4. The Design Builder shall provide one (1) each of the following for each fabrication shown: 12” square and / or lineal sample which will show adequately the quality of fabrication, welding and finish. These can also represent the required finish samples as noted elsewhere in the specification.
5. Provide certification by the passivator stating that the fabrication was passivated after the stainless steel was bent, cut and/or welded.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store & handle rails, posts, panels, hardware, and appurtenant items in strict compliance with manufacturers’ instructions.

B. Protect units adequately against damage from the elements, construction activities, and other hazards before, during, and after construction

PART 2 - PRODUCTS

2.1 MATERIALS

A. Material:
   1. Stainless Steel shall be Austenitic Grade type 316/316L
   2. Stainless Steel Sheet, Plate, Flat Bar: ASTM A666, Type 316/316L
   3. Welding materials: AWS Structural Welding Code: type required for materials being welded. Use E70xx low hydrogen electrodes for stainless steel welds.

B. Galvanized Steel Tube for Guardrails, Railings and Tube Supports: Seamless steel tube, conforming to ASTM A53, Type S, Grade A; 1-1/2 inch diameter; standard weight.

C. Plate: Steel plate for anchor plates shall be standard steel plate, conforming to ASTM A36, weldable quality.

D. Welding Electrodes and Filler Metal: The Design Builder shall use the type and alloy of filler metal and electrodes recommended by the producer of the metal to be welded, and as required to match colors, and strength and for compatibility with the individual components of fabricated items.

E. Anchors, Fasteners, and Accessories: Provide all required anchors, fasteners, miscellaneous components, and accessories as required for complete and finished railing installations. Bolts and studs, nuts, and washers shall conform to ASTM A307, A449, and A563.
   1. Expansion Bolts: Where anchors are not included in the concrete construction, provide galvanized expansion type anchors with matching galvanized steel bolts or studs with nuts, of sizes as indicated or required. Provide washers under all bolt heads and nuts.
   2. Miscellaneous fasteners: Refer to Section 05 50 00 “Metal Fabrication”.

F. Fasteners for Anchoring Railings to Other Construction: Select fasteners of the type, grade, and class required to produce connections that are suitable for anchoring railing to other types of construction indicated and capable of withstanding design loadings.
   1. Provide fasteners fabricated from type 316

G. Fasteners for Interconnecting Railing Components: Use fasteners of same basic metal as the fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
   1. Provide concealed fasteners for interconnecting handrail and railing components and for attaching them to other work, except where otherwise indicated.
   2. Provide concealed fasteners for interconnecting handrail and railing components and for attaching them to other work, except where exposed fasteners are unavoidable or are the standard fastening method for handrail and railing system indicated. Provide Phillips flathead machine screws for exposed fasteners, unless otherwise indicated.
   3. Provide non-metallic isolators between aluminum and all ferrous metals.

H. High Tension Cable Barrier Guardrail System: Provide a fully engineered high tension cable barrier system capable of meeting the structural requirements of its intended use. System must be customized and modified to serve dual function as a pedestrian handrail in the specified locations, with spacing of horizontal cables at a maximum of 3 7/8” o.c. and top rail to be installed at 3’- 6” above finished parking surface level.
   1. Manufacturers:
      a. Gregory Industries

b. Trinity Sling
c. GSI High Tension Cable
d. Approved Equal

2. Provide all required accessories for a complete and securepermanent assembly.

2.2 GUARD AND HANDRAILINGS

A. Fabricate pipe railings to dimensions and details indicated with smooth bends and to other requirements specified herein. Form fabrications from material of size, thickness and shapes indicated, but not less than that needed to comply with the performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of material indicated or specified for various components of each metal fabrication.

B. Shear, punch, and laser cut metals cleanly and accurately. Remove burrs, sharp and rough areas on exposed surfaces.

C. Welded Connections: Fully weld connections, heat and bend bends without distorting metal. Cope intersections of rails and posts, weld joints and grind smooth. Butt-weld end-to-end joints of railings. In all cases, fabricate top rail continuous over posts, and posts continuous from base to top rail. Welding procedures and welding operations shall conform to, and welders and tackers shall be qualified, in accordance with ANSI/AWS D1.1.

D. Weld corners and seams continuously to comply with the following:
1. Use materials and methods that minimize distortion and resist corrosion of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

E. Form exposed work to line and level with angles and surface and with straight sharp edges. Ease exposed edges to radius of approximately 1/32 inch unless otherwise shown. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

F. Form exposed connections with hairline joints to exclude water and which are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type shown, or if not shown, Phillips flathead (countersunk) screws or bolts.

G. Assemble railing systems in shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joinedpieces.

H. Form changes in direction of railing members as follows:
1. By radius bends of radius indicated.
2. By flush radius bends.
3. By bending.
4. By mitering at elbow bends.
5. By insertion of prefabricated flush elbow fittings.
6. By any method indicated above, applicable to change ofdirection involved.

I. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

J. Fabrication Tolerances:
   1. Maximum bow - 1/4 inch per 4 feet
   2. Maximum out of plane - 1/16 inch
   3. Maximum misalignment - 1/8 inch

K. Fabricator shall take all preventative measures to eliminate cross- contamination of stainless steel with ferrous metals during fabrication, machining, storage and delivery. All grinding, polishing, and buffing shall be performed so that no contamination occurs to affect the material's corrosion resistance or finish. Particular care shall be exercised to protect the material from coming in contact with iron particles. All tools used in the fabrication and finishing process shall be tools dedicated only to use on those materials.

L. Hermetically seal all joints so as to exclude water, or provide weep holes where water may accumulate.

M. All stainless steel shall be passivated prior to packaging and shipping. Any area that has been cut, welded or bent shall be passivated to assure that the area does not show signs of rust discoloration created by the fabrication processes.

N. Finish:
   1. Stainless Steel grain shall run in same direction for each fabrication.
   2. Finish shall be #4 brushed for all components unless otherwise specified on the drawings.
   3. When polishing is completed, passivate and rinse surfaces. Remove any embedded foreign matter and leave surfaces chemically clean.

O. When polishing is completed, passivate and rinse surfaces. Remove any embedded foreign matter and leave surfaces chemically clean.

P. Corrosion Control: Apply corrosion inhibitor to railing surface that will abut surfaces constituted of material other than that of the fabricated metal product.

2.3 HIGH TENSION CABLE BARRIER

A. Materials:
   1. Cable: Cable shall be ¾ inch 3x7 steel cable manufactured in accordance with ASTM A 741, AASHTO M30, Type 1, Class A coating.
   2. Post: Intermediate U-channel cable line posts conforming to the physical properties of ASTM A499, and the chemical properties of ASTM A1. In addition, they shall have a minimum yield of strength of 80,000 psi and tensile strength of 100,000 psi. All posts shall be galvanized per ASTM A123.
   3. Cable Hardware: All fittings shall be designed to develop 25,000 lbs. tensile strength. Wedge type cable socket fittings shall be of the open end type and shall permit visual inspection of the cable end and wedge after installation. Malleable iron fittings shall conform to the requirements of ASTM A47. Cast steel fittings shall conform to the requirements of AASHTO M 103, grade 70-36.

4. Locking Hook Bolts: Special locking hook bolts shall be manufactured from ASTM A307 Grade C carbon steel. Nuts shall be ASTM A563 Grade A Heavy Hex. Special locking hook bolts and nuts shall be galvanized per ASTM A153.
5. Delineators: Delineators shall be 3M High Intensity Prismatic adhesive reflective sheeting.
6. Concrete: Barrier system shall be installed in concrete with a minimum strength of 3000 psi minimum. Concrete is to be reinforced according to plan details.

PART 3 - EXECUTION

3.1 PREPARATION

A. Comply with AWS code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

B. All welds shall be subjected to a visual inspection by an independent inspection agency, provided by and paid by the Design Builder, for conformance with ANSI/AWS D1.1.

C. Field Measurements: Where handrails and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating handrails and railing systems without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions

3.2 INSTALLATION, HANDRAILS

A. Install metal handrails and railings in accordance with the Contract Drawings and the approved shop drawings.

B. Install metal handrails and railings with accessories furnished by the railing fabricator as required for complete and finished railing installations.

C. Install handrails and railings in accordance with approved shop drawings, true and horizontal, perpendicular, or at the required angle, as the case may be, level and square, with angles and edges parallel with related lines of the building or structure.

D. Adjust railing prior to securing in place to ensure proper matching of butting joints and correct alignment throughout their length. Secure posts not more than 8 feet on center, unless otherwise indicated. Plumb posts in each direction.

E. Secure posts and rail ends as follows:
   1. Installation in new concrete:
      a. Set posts in sleeves which have been set in concrete, and grout posts therein with non-shrink grout.
   2. Anchor rail ends into concrete and masonry with steel round flanges welded to rail ends and anchored into the wall construction with expansion bolts.

3. Anchor rail ends to steel with steel oval or round flanges welded torail ends and bolted to the structural steel members, unless otherwise indicated.
4. Provide removable railing sections as indicated. Furnish slip-fit metal socket or sleeve for casting into concrete. Accurately locate sleeve to match post spacings.

F. Other than field welded connections:
1. Assemble connections end-to-end and splice joints with internal sleeves.
2. Fitting assembly:
a. Assemble pipe at joints and drive together within 0.02 inch.
b. Assemble fittings into posts before pressing rails into fittings.

G. Isolate components from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.

3.3 INSTALLATION, HIGH TENSION CABLE BARRIER SYSTEM

A. Install barrier system in accordance with manufacturer's specifications, the Contract Drawings, and the approved engineered shop drawings.

B. Install barrier system with accessories furnished by the railing fabricator as required for complete and finished installation.

3.4 CLEANING AND ADJUSTING

A. Clean after installation exposed pre-finished and plated items and items fabricated from stainless steel, as recommended by the metal manufacturer and protect from damage until completion of the project.

END OF SECTION

(This Page Left Intentionally Blank)

SECTION 05 53 00 - METAL GRATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Division 1 General Requirements

B. Section 05 50 00 Metal Fabrications

1.2 SUMMARY

A. Furnish all labor, materials, tools and equipment, and perform all operations related to abrasive stair treads, set in locations as indicated on the Contract Drawings and herein specified. Work includes:
   1. Abrasive cast metal treads at Utility Building stairs.

1.3 SUBMITTALS

A. Product data and structural load tables for each product specified.

B. Shop drawings showing attachment details, dimensions and adjacent construction interfaces.

C. Samples of products and manufacturers catalog information.

D. All submittals are to be in accordance with Section 01 33 00 – Submittal Procedures.

E. Manufacturer's Standard Warranty

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials in manufacture's unopened packages and bearing manufacturer's label.

B. Storage and Handling:
   1. Store materials in a dry and well ventilated place, adequately protected from damage and exposure to the elements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis of Design: American Safety Tread, Model: 807

B. Safe-T-Metal Company

C. Wooster Products Inc.

D. Approved Equal

2.2 MATERIALS

A. Provide Cast Aluminum abrasive stair treads, 3/8”:
   1. Abrasive shall be #20 virgin grain Aluminum Oxide (AL2O3) abrasive, integrally cast into the walking surface to a minimum depth of 1/32inch (0.79 mm).
   2. Safety nosing with cross-hatched surface.
   3. Concealed type anchors shall be slotted rivet type, integrally cast into the body of the nosing a minimum of 3/8". (Not mushroom type.)
   4. Cast metals used shall conform to the following specification:
      a. Abrasive Cast Aluminum: No. 43 prime and secondary ingot; low copper content; corrosion resistant.
   5. Any holes or countersinks shall be machine-made; cored holes or countersinks are not acceptable. Screwheads shall not protrudeabove tread surface.
   6. Cross hatching and fluting shall be 1/16 inch (1.59 mm) deep minimum and shall be clean and well defined; treads and nosings shall be manufactured, packed and shipped so as to arrive at the jobsite ingood condition.

PART 3 - EXECUTION

3.1 PREPARATION

A. Transmit submittals required by this Section.

B. Furnish products as indicated.

C. Ensure substrates are in suitable condition to receive the work.

3.2 INSTALLATION

A. Install the stair treads in accordance with approved shop drawings, and manufacturer's installation standards.

B. Install the grating with a minimum 2" bearing surface at the support ends and in accordance with manufacturer’s recommendations. Fasten grating to the support substrate using grating clips supplied by the grating manufacturer and in accordance with the manufacturer's instructions.

C. Provide tolerances between sections for not more than 1/4" clearance between adjacent sections or between treads and frames.

D. Isolate aluminum from steel with materials approved by manufacturer and shown on shop drawings.

END OF SECTION

(This Page Left Intentionally Blank)

DIVISION 7
THERMAL AND MOISTURE PROTECTION

SECTION 07 13 00 - SHEET WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Division 1 General Requirements

1.2 SUMMARY

A. Requirements for sheet membrane waterproofing system.

1.3 REFERENCES

A. American Society of Testing and Materials (ASTM):
   1. D751
   2. E158-88

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A company that has produced waterproof membrane and accessories of the type included in this section with a documented history of providing products of similar size and scope.

B. Installer Qualifications: A company approved by the membrane manufacturer and which has completed installations of membranes similar to the type required.

C. Site conditions:
   1. Comply with manufacturer's recommendations regarding weather conditions before and during installation, condition of substrate to receive waterproofing, and protection of installed waterproofing system.
      a. Do not install membrane or primer during wet weather or when temperature is below 40 degrees F.
   2. Do not leave membrane or insulation exposed to sunlight or moisture.

D. Pre-installation Conference: Conduct pre-installation conference with Design-Builder, installer, Engineer, and a technical representative of the waterproofing system manufacturer, to review all special field conditions and to confirm the techniques and details applicable to this project. Verify with waterproofing system manufacturer's representative suitability of any accessory products by other manufacturers, that they will not void the warranty.

E. Single-Source Responsibility: Provide all specified waterproofing materials and accessories from a single manufacturer to the greatest extent possible as part of a single waterproofing system.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, installation instructions, and recommendations for use of each product required. Provide additional data as requested by Engineer to demonstrate products comply with project requirements.

B. Samples:
   1. Submit three 12-inch-square samples of membrane material.
   2. Submit three 6-inch-square sample of prefabricated drainage system with filter fabric attached.
   3. Submit three 6-inch-square samples of insulation.
   4. Submit three 6-inch-square samples of protection board.

C. All submittals are to be in accordance with Division 01 – Submittal Procedures.

D. Special Project Warranty: As standard: Submit a written warranty signed by manufacturer and installer, guaranteeing to correct failures in product and workmanship which occur within period indicated, without reducing or otherwise limiting any other rights to correction which the owner may have under the Contract documents. Failure is defined to include faulty workmanship, or product failure which contributes to failure of watertight condition.
   1. Warranty period duration: 5 years, starting at date of substantial completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials in manufacture’s unopened packages and bearing manufacturer’s label.

B. Storage and Handling:
   1. Store materials in a dry and well ventilated place, adequately protected from damage and exposure to the elements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Grace Construction Products

B. Tremco

C. Carlisle Coatings and Waterproofing

D. Approved Equal

2.2 MATERIALS

A. Sheet waterproofing – below slab: to be puncture resistant per 169 lbs using test method ASTM E 158-88; resistant to hydrostatic head of 150 ft of water using testing method ASTM D751

1. Miraclay bentonite: as manufactured by CCW-Carlisle;
    a. Uniform layer of sodium bentonite clay sandwiched between a puncture resistant non-woven polypropylene fabric and a high tensile woven polypropylene, needle punch together; 10 year warranty.
    b. Lap 3" minimum as per manufacturer
    c. Bentonite Mastic at penetrations in accordance with manufacturers recommendations
2. Paraseal GM: a manufactured by Tremco
    a. High Density Polyethylene (HDPE) bentonite sheet membrane at 150
    b. -200 mils thick.
    c. Para JT tape to be used at laps in accordance with manufacturers recommendations.
    d. Para Mastic to be used at penetrations in accordance with manufacturer's instructions
3. Preprufe 300R: as manufactured by Grace Construction Products
    a. Composite membrane of High Density Polyethylene (HDPE), pressure sensitive adhesive, and a protective coating
    b. Preprufe tape to be used at laps in accordance with manufacturers recommendations
    c. Bituthene Liquid Membrane to be used at penetrations in accordance with manufacturers recommendations

B. Waterproofing mastic: Solvent based rubberized asphalt mastic, as recommended by the waterproofing manufacturer.

C. Waterproofing vertical conditions
1. Miraclay bentonite: as manufactured by CCW-Carlisle
    a. Power actuated fasteners as per manufacturer's recommendations.
    b. Termination bar at top of sheet waterproofing and mastic coating.
2. TremProof 250 GC: as manufactured by Tremco – roll on applied; ParaMastic to be used at penetrations in accordance with manufacturers recommendations
3. Bituthene System 4000 as manufactured by Grace Construction Products – Composite membrane of rubberised asphaltic self adhesive compound and preformed waterproofing HDPE membrane.
    a. Terminate top of membrane with Bituthene Liquid Membrane termination or manufacturers termination bar.

D. Water-stop:
1. CCW MiraSTOP: self-adhering, flexible, coiled strip of butyl rubber and expandable bentonite clay waterproofing joint compound as manufactured by Carlisle Coatings and Waterproofing, or approved equal.
2. SikaSwel S: one part polyurethane, extrudable swelling waterstop (bentonite-free) that swells upon contact with water, by Sika or approved equal.
3. Volclay RX Waterstop: Specifically formulated joint sealant impregnated with Volclay bentonite that swells upon contact with water, and manufactured by American Colloid Company, or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Transmit submittals required by this Section.

B. Furnish products as indicated.

C. Ensure that substrates are in suitable condition to receive the work. Remove honeycomb, aggregate pockets, fins, ridges, and projecting rough areas. Grind horizontal surfaces lightly with terrazzo grinder to cleanly remove fins and projections.

D. Fill cracks, holes, depressions, and irregularities with latex patching mortar, sealant, or detailing mastic as recommended by membrane manufacturer. Concrete masonry walls: Fill rough areas and concave joints with latex patching mortar. If all joints are concave, apply a 1/8-inch-thick parge coat of latex patching mortar.

E. Apply one coat of primer at the rate of 200 to 300 square feet per gallon and allow to dry.

F. Form fillets (cants) at inside corners and around projecting elements using latex patching mortar or detailing mastic and install 10- to 12-inch-wide strip of membrane material.

G. Outside Corners: Apply 10- to 20-inch-wide strip of membrane material centered on corner.

3.2 INSTALLATION

A. Install per manufacturer's instructions using approved applicators certified by the manufacturer. A pre-installation meeting must be conducted with a representative of the manufacturer.

B. Apply waterproofing materials to clean and dry surfaces that are free from laitance, grease and projections.

C. Fit waterproofing tightly and without voids, cuts, holes, pockets, bulges, wrinkles, folds or creases in the surface.

D. Upon completion of application, inspect the waterproofing for cuts, holes, pockets, bulges, wrinkles, folds and creases. Repair defects as recommended by the manufacturer. If the waterproofing is damaged or becomes pervious, or both, and cannot be effectively repaired, remove to the extent necessary and repair using the same system.

E. Place and adhere membrane over entire area to receive waterproofing. Lap seams as per manufacturer's written installation instructions (minimum of 2-1/2 inches), and seal using a hand-held steel roller. Heat-weld end laps if recommended by manufacturer.

F. Slit and flatten fishmouths and blisters. Cover damaged area with patch of membrane material extending a minimum of 6 inches beyond damaged area in all directions.

G. Apply detailing mastic at membrane edges and at penetrations. Detailing mastic may be omitted where membrane terminates in a reglet.

3.3 PROTECTION COURSE

A. Install protection (as recommended by manufacturer) over membrane as soon as practicable after membrane installation to avoid damage to membrane from sunlight and subsequent operations.

3.4 INSPECTION

A. Do not cover the membrane before an inspection of the membrane by a membrane system manufacturer's technical representative.

3.5 PROTECTION AND CLEANING

A. Protect completed membrane installation from damage untilproject completion.

B. Do not permit traffic on exposed membrane.

C. Clean spillage and soiling from adjacent surfaces, using cleaning agents and procedures recommended by the manufacturer of the membrane and adjacent surfaces.

END OF SECTION

SECTION 07 41 33.01 – METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: The Work of this Section shall include but not be limited to the following:
   1. Aluminum standing seam plate roof panels with formed interlocking edges.
   2. Associated flashings, trims, and gutters.
   3. Underlayment materials.
   4. Structural metal deck.
   5. Snow guards at roof perimeter.

1.2 DEFINITIONS

A. Standing Seam Metal Roof Panel Assembly: Metal roof panels, flashings, gutter, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight roofing system.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of roof panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field- assembled work.
   1. Accessories: Include details of the following items, at a scale of not less than 1- 1/2 inches per 12 inches:
      a. Flashing and trim
      b. Guttering
      c. Snow Guard (FXS-11)

C. Samples for Initial Selection: For each type of metal roof panel indicated with factory- applied color finishes.
   1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
   1. Metal Roof Panels: 12 inches long by actual panel width. Include fasteners, clips, closures, and other metal roof panel accessories.
   2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
   3. Accessories: 12-inch- long Samples for each type of accessory.

E. Design Performance Submittal: For metal roof panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Snow Retention System Calculations: Include calculation of number and location of snow guards based on snow load, roof slope, panel length and finish, and seam type and spacing.

F. Coordination Drawings: Roof plans, drawn to scale, on which the following are shown and coordinated with each other, based on input from installers of the items involved:
   1. Roof panels and attachments.
   2. Roof-mounted items including any penetrations and snow guards.

G. Qualification Data: For qualified Installer.

H. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating the following:
   1. Materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

I. Maintenance Data: For metal roof panels to include in maintenance manuals.

J. Warranties: Samples of special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of metal wall panels or an entity that employs installers and supervisors who are trained and approved by manufacturer.
   1. Installer's responsibilities include fabricating and installing metal wall panel assemblies and providing professional engineering services needed to assume engineering responsibility.
   2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified Professional Engineer licensed in State of New York.

B. Fabricator Qualifications: Approved by metal panel manufacturer to fabricate and install roof panel system.

C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

D. Source Limitations: Obtain each type of metal roof panel through one source from a single manufacturer; market locations to be of same type, design and factory- applied color finish.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.

B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal roof panels with rain drainage work, flashing, trim, and construction of decks, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Special Weathertightness Warranty for Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
   1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS (RF-01)

2.1 DESIGN CRITERIA

A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Design Performance: Design metal roof panel assembly, including comprehensive engineering analysis by a qualified Professional Engineer, using performance requirements and design criteria indicated.

C. Water Penetration: No water penetration when tested according to ASTM E 331 at a minimum differential pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/ square foot and not more than 12 lbf/ square foot.

D. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 1680 at the following test-pressure difference:
   1. Test-Pressure Difference: Negative 1.57 lbf/sq. ft.
   2. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
   3. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift- pressure difference.

E. Wind- Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
   1. Uplift Rating: UL 30.

F. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
   1. Wind Loads: Determine loads based on the following minimum design wind pressures:
      a. Uniform pressure of 30 lbf/ square foot, acting inward or outward.
   2. Snow Loads: 30 lbf/ square foot.
   3. Deflection Limits: Metal roof panel assemblies shall withstand wind and snow loads with vertical deflections no greater than 1/ 180 of the span.

G. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

2.2 PANEL MATERIALS

A. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
   1. Surface: Smooth, flat finish.
   2. Finish: As- milled.

2.3 METAL ROOF PANELS

A. General: Provide factory -formed metal roof panels designed to be installed with interlocking side edges of adjacent panels with concealed clips in side laps. Include clips, cleats, pressure plates and accessories required for weathertight installation.

1. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1637.
2. Joints: Rout- and- Return system unless otherwise indicated.

B. Aluminum Plate Roof Panels with Formed Edges:
1. Material: Tension-leveled, aluminum sheet, minimum 0.125 inch thick.
2. Panel Depth: As indicated on the Drawings.
3. Panel Joints: Sealant joints.
   a. Color: As selected by the Engineer.
4. Back- up Plates, where required at joints: smooth aluminum sheet, ASTM B 209, thickness to suit application and meet performance requirements with as- milled finish.

C. Panel Sealants (Roof and Soffits):
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 UNDERLAYMENT MATERIALS

A. Self- Adhering, Polyethylene Faced Sheet (Ice and Water Barrier): ASTM D 1970, 40 mils thick minimum, consisting of slip resisting polyethylene film reinforcing and top surface laminated to SBS modified asphalt adhesive, with release paper backing; cold applied, where indicated.
1. Products: Subject to compliance with requirements, provide the following or equal as approved by the Commissioner:
   a. Carlisle Coatings & Waterproofing, Div. of Carlisle Companies Inc.; Dri Start "A."
   b. Grace, W. R. & Co.; Grace Ice and Water Shield.
   c. Johns Manville International, Inc.; Roof Defender.

B. Slip Sheet, where required by application: Manufacturer's recommended slip sheet, of type required for application.

2.5 METAL FRAMING DECK

A. Perforated structural metal decking mechanically fixed to structural steel members.

B. Base or Sill Angles Channels: 0.079-inch bare steel thickness, cold-formed, galvanized steel sheet.

C. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
1. Provide powder actuated fasteners or other fasteners, anchors or attachments as recommended by panel manufacturer for securing girts and liner panels to structural steel framing members.

2.6 SNOW GUARDS (FXS-11)

A. Flat- Mounted, Rail-Type Snow Guards:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal as approved by the commissioner:
      a. Alpine SnowGuards, a division of Vermont Slate & Copper Services, Inc.
      b. Berger Building Products, Inc.
      c. SnoGuard.
   2. Description: Units fabricated from metal baseplate anchored to fixed bracket and equipped with three bars.
   3. Brackets and Baseplate: Aluminum.
   4. Bars: Aluminum; mill finished.

B. Seal with silicone or polyurethane sealant as recommended by panel manufacturer.

2.7 MISCELLANEOUS MATERIALS

A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end- welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC or neoprene sealing washers.

2.8 ACCESSORIES

A. Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
   2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin- foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
   3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

B. Flashing and Trim: Formed from same material as roof panels, prepainted with coil coating, minimum 0.018 inch thick. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, rakes, corners, bases, framed openings, ridges, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

2.9 FABRICATION

A. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel and not telegraph to surface.

C. Fabricate metal roof panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. End Seams for Aluminum: Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
   4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   5. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the Work.

B. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

C. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

D. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Apply slip sheet, where required by metal manufacturer, before installing sheet metal roofing over membrane roofing and sheathing.

3.3 METAL ROOF PANEL INSTALLATION, GENERAL

A. Install flashings to cover underlayment to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

B. Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.

C. Fasteners Aluminum Roof Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

D. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

E. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
   1. Coat back side of roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.

F. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.
   1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.
   2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

3.4 METAL ROOF PANEL INSTALLATION

A. Fasten metal roof panels to supports with concealed clips at location, spacing and with fasteners recommended by manufacturer.
   1. Install clips to supports with self-tapping fasteners.
   2. Install pressure plates at locations indicated in manufacturer's written installation instructions.

3.5 ACCESSORY INSTALLATION

A. Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.6 SNOW GUARD INSTALLATION

A. Attach snow guards to metal roof panels as recommended by manufacturer.

B. Do not use fasteners that will penetrate metal roof panels unless unavoidable.

C. Attachment for Metal Roofing:
1. Flat- Mounted, Snow Guard Pads: Mechanical anchor and counterflashing sleeve system.

3.7 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8- inch offset of adjoining faces and of alignment of matching profiles.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: The City of New York will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Water Penetration: Test roof areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 6.24 lbf/ square foot.

C. Manufacturer's Field Service: Engage a factory- authorized service representative to inspect completed metal roof panel installation including accessories. Report results in writing.

D. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.

E. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

C. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074110

SECTION 07 50 00 - MEMBRANE ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Adhered ethylene-propylene-diene-monomer (EPDM) roofing system.
   2. Roof insulation.

B. Related Requirements:
   1. Section 06 10 00 "Rough Carpentry" for wood nailers, curbs, and blocking.
   2. Section 07 60 00 "Flashing and Sheet Metal" for metal roof flashings and counter flashings.
   3. Section 07 92 00 "Joint Sealants and Caulking" for joint sealants, joint fillers, and joint preparation.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:
   1. Base flashings and membrane terminations.
   2. Tapered insulation, including slopes.
   3. Roof plan showing orientation of steel roof deck and orientation of roofing and fastening spacing and patterns for mechanically fastened roofing.
   4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Samples for Verification: For the following products:
   1. Sheet roofing, of color required.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements".
   1. Submit evidence of complying with performance requirements.

C. Product Test Reports: For components of roofing system, tests performed by manufacturer and

witnessed by a qualified testing agency.

D. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

E. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed or FM Global approved for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
   1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, and other components of roofing system.

2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain components including roof insulation and fasteners for roofing system from same manufacturer as membrane roofing

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
   1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
   2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4470 as part of a roofing system, and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

D. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

2.3 EPDM ROOFING

A. EPDM: ASTM D 4637, Type I, nonreinforced, uniform, flexible EPDM sheet.
   1. Carlisle Syntec, Inc.
   2. GAF Materials Corp.
   3. Johns Manville
   4. Or approved equalhttp://www.specagent.com/LookUp/?ulid=5054&mf=04&src=wd

2.4 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
   1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil thick EPDM, partially cured or cured, according to application.

C. Bonding Adhesive: Manufacturer's standard, water based.

D. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch wide minimum, butyl splice tape with release film].

E. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.

F. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

G. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

H. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.

I. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.

J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.
   1. Provide white flashing accessories for white EPDM membrane roofing.

2.5 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured by EPDM roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.

C. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
   1. Modified asphaltic, asbestos-free, cold-applied adhesive.

D. Cover Board: DOC PS 2, Exposure 1, oriented strand board, 7/16 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
   1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
   4. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
   5. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.4 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

E. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

   1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

F. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
   1. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing

and maintaining insulation in place.

2. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

G. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together.

1. Fasten cover boards according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
2. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.5 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.

B. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

C. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.

D. Apply roofing with side laps shingled with slope of roof deck where possible.

E. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing terminations.

F. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

G. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal membrane roofing in place with clamping ring.

3.6 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings.

3.7 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Design Professional and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

END OF SECTION

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Division 1 General Requirements

1.2 SUMMARY

A. Requirements for metal flashing and trim.

1.3 REFERENCES

A. "Architectural Sheet Metal Manual," Latest Edition, as published by the Sheet Metal and Air Conditioning Design-Builder National Association, Inc. (SMACNA) and these specifications.

1.4 QUALITY ASSURANCE

A. Provide a fabricator regularly engaged in the fabrication of galvanized steel.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA'a "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
   1. Copper Standard: Comply with CDA's "Copper in Architecture Handbook."

C. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical roof eave fascia, fascia trim, approximately 48 inches long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
   2. Approval of mockups is for other material and construction qualities specifically approved by Engineer in writing.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Engineer in writing.
   4. Approval mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

E. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

F. Stack materials on platforms or pallets, covered with suitable weather tight and ventilated covering. Do not store sheet metal flashing and trim material in contact with other materials that might cause staining, denting, or other surface damage.

G. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leak proof, secure, and noncorrosive installation.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimension of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
   1. Identify material, thickness, weight, and finish for each item and location in Project.
   2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
   3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clip, cleats, and attachments to adjoining work.
   4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.
   1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
   1. Sheet Metal Flashing: 12 inches long. Include fasteners, cleats, clips, closures, and other attachments.
   2. Trim: 12 inches long. Include fasteners and other exposed accessories.
   3. Accessories: Full-size Sample.

E. All submittals are to be in accordance with Division 01 – Submittal Procedures.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials in manufacture's unopened packages and bearing manufacturer's label.

B. Storage and Handling:
   1. Store materials in a dry and well ventilated place, adequately protected from damage and exposure to the elements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sheet Metal: Galvanized steel conforming to ASTM A525 and A526 or A527 commercial quality G 90.

B. Flux for Solder: Conforming to FS O-F-506, Type I for galvanized metal.

C. Solder: ASTM B32, 63 percent tin and 37 percent lead.

D. Electrodes: AWS A5.22, Type E308L-16.

E. Nails, Screws and Rivets: 18-8 stainless steel.

F. Rosin-Sized Sheathing: Conforming to FS UU-B-790, Type I, inorganic fiber coated both sides and weighing not less than 4 pounds per 100 square feet.

G. Tin: New block material, commercial tin.

H. Plastic Cement: Conforming to FS SS-C-153.

I. Bituminous Coating: Conforming to FS TT-C-494

J. Stainless Steel – No 4 Finish

2.2 FINISHES

A. Exterior: 0.2 mil thick off-white corrosion-resistant primer (also applied to underside of standing seam roof) and 0.8 mil thick finish coat of Poly- vinylidene Fluoride (PVF_2), full 70% Kynar 500/Hylar 5000, or approved equal, for a total of 1.0 mil dry film thickness.

B. Color: Refer to architectural drawings.

2.3 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch- (100-mm-) wide flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. fasten gravel guard angles to base of scupper
   1. Fabricate parapet scuppers from the following material:
      a. Stainless steel 0.0250 inch thick.

2.4 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Caps: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long sections. Furnish with 6-inch- wide joint cover plates.
   1. Joint Style: Lap, 4 inches wide.
   2. Fabricate with scuppers spaced as shown, of dimensions required with 4- inch-wide flanges and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
   3. Fabricate scuppers from the following material:
      a. Aluminum: 0.050 inch thick.

B. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge

of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.

1. Joint Style: Butt, with 12-inch-wide concealed backup plate.
2. Fabricate copings from the following material:
   a. Aluminum: 0.050 inch thick.

C. Roof and Roof to Wall Transition Expansion-Joint Cover: Fabricate from the following material:
1. Copper: 16oz./sq. ft.
2. Lead-Coated Copper: 17.2 oz./sq. ft.
3. Aluminum: 0.050 inch thick.
4. Stainless Steel: 0.0250 inch thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: 0.0250 inch thick.
6. Galvanized Steel: 0.0336 inch thick.
7. Aluminum-Zinc Alloy-Coated Steel: 0.0336 inch thick.
8. Prepainted, Metallic-Coated Steel: 0.0336 inch thick.
9. Zinc: 0.031 inch, 0.040 inch thick.

D. Base Flashing: Fabricate from the following material:
1. Copper: 20 oz./sq. ft.
2. Lead-Coated Copper: 21.2 oz./sq. ft.
3. Aluminum: 0.040 inch thick.
4. Stainless Steel: 0.0187 inch thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: 0.018 inch thick.
6. Galvanized Steel: 0.0276 inch thick.
7. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.
8. Prepainted, Metallic-Coated Steel: 0.0276 inch thick.
9. Zinc: 0.031 inch, 0.040 inch thick.

E. Counterflashing: Fabricate from the following material:
1. Aluminum: 0.050 inch thick.

F. Flashing Receivers: Fabricate from the following material:
1. Aluminum: 0.050 inch thick**.**

G. Roof-Penetration Flashing: Fabricate from the following material:
1. Lead: 4.0 lb/sq. ft., hard tempered.

H. Roof-Drain Flashing: Fabricate from the following material:
1. Lead: 4.0 lb/sq. ft., hard tempered.

2.5 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:
1. Lead-Coated Copper: 17.2 oz./sq. ft.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Transmit submittals required by this Section.

B. Furnish products as indicated.

C. Ensure that substrates and in suitable condition to receive the work.

3.3 FABRICATION AND INSTALLATION

A. Fabricate and install in conformance with the "Architectural Sheet Metal Manual," Latest Edition, as published by the Sheet Metal and Air Conditioning Design-Builder National Association, Inc. (SMACNA) and these specifications.

3.4 FORMING

A. Form sheet metal to the dimensions and shapes required with molded and broken surfaces true and angles accurate.

B. Form flat-locked seams that are not subject to stress, 1/2 inch wide. Flat locked seams that are subject to stress, 1 inch wide.

C. Form lap expansion seams not less than 4 inches wide and fill with white lead or other caulking material.

D. Cap flat seams in the direction of flow where exposed to the weather.

E. Provide 1/2-inch hem (minimum) at exposed edges of sheet metal.

F. Provide a minimum of one lap expansion seam in any straight run of 4 feet or more, not more than 8 feet from any corner and at not more than 16 feet on center in straight runs.

G. Punch or drill and rivet, providing invisible rivets and seams, where multiple layers of metal occur. Continuously solder or weld the folded edges and wipe or grind smooth to provide texture to match surrounding metal.

H. Fabricate flashing for corners of the building at least 4 feet long in each direction.

I. Minimum radius of break in sheet metal shall be twice the thickness of the metal.

J. Miter corners and join by locked and soldered joints.

K. Furnish and install reglets for flashing in the forms for concrete and within other materials.

3.5 WELDING

A. Weld with direct current, reverse polarity equipment utilizing the minimum current to minimize distortion of the metal.

B. Utilize start and run-off tabs to assure uniformity of weld terminations.

3.6 SOLDERING

A. Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.
   1. Do not solder prepainted, metallic-coated steel and aluminum sheet.
   2. Pretinning is not required for lead-coated copper, zinc-tin alloy-coated stainless steel and lead.
   3. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
   4. Copper Soldering: Tin uncoated copper surfaces at edges of sheets using solder recommended for copper work.
   5. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
   6. Lead-Coated Copper Soldering: Wire brush edges of sheets before soldering.
   7. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

3.7 INSTALLATION, GENERAL

A. Install sheet metal with continuous concealed clips of the same gauge, in lengths not exceeding 8 feet, spaced 1/8 inch apart for expansion, and fastened to the structure at not more than 8 inches on center. Fold fastened edge of the clips back over the fastener.

B. Secure flashing in reglets with not less than two ¾-inch lead wedges spaced at not more than 24 inches on center. Apply sealant to cover the wedges and provide a weather-tight joint.

C. Apply rosin-sized sheathing as a barrier between asphalt products and the sheet metal. Lap sheathing not less than 4 inches and fasten to the structure.

D. Install sleeves for roof penetrations with 4-inch flanges and 10-inch high flared top counter flashing with 1/8 inch by 1-1/2 inch drawband. Sleeves shall match metal standing seam roofing configuration.

E. Provide pitch dams and install in plastic cement.

F. Separate dissimilar metals with fiber spacers or bituminous coatings.

G. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings,

separators, sealants,and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

H. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of uncoated aluminum stainless-steel and lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

I. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

J. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

K. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

L. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

M. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1- 1/4 inches for nails and not less than 3/4 inch for wood screws.

1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
2. Aluminum: Use aluminum or stainless-steel fasteners.
3. Copper: Use copper, hardware bronze, or stainless-steel fasteners.
4. Stainless Steel: Use stainless-steel fasteners.

3.8 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.

C. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches in direction of water flow.

3.9 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
   1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 24-inch centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
   1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 24-inch centers.
   2. Anchor interior leg of coping with screw fasteners and washers at 24-inch centers.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant.

F. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant.

G. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
   1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
   2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.10 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Openings Flashing in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.11 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.12 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

(This Page Left Intentionally Blank

SECTION 07 71 23 - MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Division 1 General Requirements

B. Section 05 50 00 Metal Fabrications, for downspout drainage boots.

C. Section 07 62 00 Sheet Metal Flashing and Trim, for flashing.

D. Section 07 72 00 Roof Accessories

1.2 SUMMARY

A. Requirements for gutters and downspouts.

1.3 REFERENCES

A. Requirements as specified and recommended by AA, ANSI and NAAMM.

B. Comply with the applicable provisions of the NAAMM "Metal Finishes Manual".

C. Building Code of New York State, 2010 Edition

1.4 QUALITY ASSURANCE

A. Provide Work fabricated by a firm specializing in aluminum fabrication. Employ experienced tradesmen for fabrication and installation.

B. Warranty: Guarantee work against defective materials and workmanship for a period of 10 years following Final Completion. Guarantee shall include repair or replacement of parts that do not withstand normal use.

1.5 SUBMITTALS

A. Manufacturer's specifications, recommendations and standard details including information on fabrication methods, attachment hardware and accessories, certified test reports indicating that units have been tested and meet performance requirements.

B. Manufacturer's standard finishes for Engineer's Initial Selection.

C. Samples of specified finish on 12-inch lengths for Engineer's Verification and Approval.

D. Shop Drawings: Submit shop drawings showing layout, profiles, methodsof joining, and anchorage details, including major counter flashings, trim/fascia units, gutters, downspouts, scuppers, and expansion joint systems. Provide layouts at ¼-inch scale and details at 3-inch scale.

E. All submittals are to be in accordance with Division 01 – SubmittalProcedures.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
1. Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials inmanufacture's unopened packages and bearing manufacturer's label

B. Storage and Handling:
1. Store materials in a dry and well ventilated place, adequately protected from damage and exposure to the elements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Manufacturers:
1. Englert Inc.
2. EDCO
3. ABC Seamless
4. Approved Equal

B. Color: Refer to Architectural Drawings.

2.2 GUTTERS AND DOWNSPOUTS

A. Sheet Aluminum: ASTM B 209, alloy 3003, temper H14.
1. Gutters to be .050" thickness. Finish to be standard Kynar coating. Selected by the Engineer from manufacturer's standard color selection.
2. Downspouts to be .050" thickness. Finish to be standard Kynar coating. Selected by the Engineer from manufacturer's standard colorselection.
3. Fasteners: Same metal as flashing/sheet metal or othernon-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
4. Mastic Sealant: Polyisobutylene; non-hardening, non-skinning,non- drying, non-migrating sealant.
5. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complyingwith requirements for joint sealants as specified in Division 7 Section "Joint Sealers".
6. Epoxy Seam Sealer: 2-part non-corrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interiornon- moving joints including riveted joints.
7. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, non-corrosive, size and gage required for performance.

8. For downspouts offset not flush with surface they will be attachedto, provide threaded rod type brackets to the length required.
9. Gutter and Conductor-Head Leaf Guards: 20-gage bronze or non- magnetic stainless steel mesh or fabricated units, with salvaged edges and non-corrosive fasteners. Select materials for compatibility with gutters and downspouts.

2.3 FABRICATED UNITS

A. General Metal Fabrication: Shop fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

B. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Form aluminum seams with epoxy seam sealer; rivet joints foradditional strength where required.

C. Expansion Provisions: Where lapped or bayonet type expansion provisions in work cannot be used or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed with joints). Provide manufacturer's standard elastomeric expansion joint assembly in gutters at intervals not to exceed 40 feet.

D. Sealant Joints: Where moveable, nonexpansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

E. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/ fabricator.

F. Finish: Gutters and Downspouts: Provide the following:
1. High-performance Organic Coating: AA-M12C41R1x
2. Prepare, pre-treat and apply coating to exposed surfaces to comply with coating and resin
3. Manufacturer's Instructions: Flouro-carbon 2 coat coating system: Manufacturers standard 2 coat thermo-cured composed of specialty formulated inhibitive primer and flouro-carbon color coat with bothcolor coat containing not less than 70% polyinylidene flouride resin by weight. (Kynar resins only) Color to match aluminum fascia panels.
4. Color: Refer to architectural drawings.

PART 3 - EXECUTION

3.1 INSPECTION

A. Job Conditions

B. Coordinate work of this section with interfacing and adjoining work forproper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

3.2 PREPARATION

A. Transmit submittals required by this Section.

B. Furnish products as indicated.

C. Ensure that substrates are in suitable condition to receive the work.

3.3 INSTALLATION

A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install continuous mesh type gutter guards on gutters, arranged as hinged units to swing open for cleaning gutters. Install "beehive"-type strainer-guard at conductor heads, removable for cleaning downspouts.

3.4 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. Protection: Advise Design Builder of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

END OF SECTION

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Division 1 General Requirements

B. Section 07 41 13 Metal Roof Panels

C. Section 07 54 23 Thermoplastic-Polyolefin Roofing

D. Section 07 62 00 Sheet Metal Flashing and Trim

1.2 SUMMARY

A. Requirements for roof vents, penetrations, and accessories.

1.3 REFERENCES

A. Building Code of New York State

B. Energy Conservation Construction Code of New York State

C. New York State Fire Prevention Code

1.4 QUALITY ASSURANCE

A. Products shall be provided by a firm specializing in the fabrication of the roof accessories indicated.

B. All roof accessories must be compatible with the roofing systemspecified, such that accessories will not void the warranty of the roofing system.

1.5 SUBMITTALS

A. Shop drawings for the fabrication and installation of custom fabricated roof accessory units. Show jointing, anchorage, accessory items and shop finishes. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other Work.

B. Manufacturer's or fabricator's standard drawings and installation instructions for each roof accessory.

C. Certification of fire-resistance ratings as required for the various assemblies.

D. Product Data: For each type of product indicated. Include construction details, materials, dimensions of individual components and profiles, and finishes.

E. Coordination Drawings: Roof plans drawn to scale and coordinating penetrations and roof-mounted items. Show the following:
   1. Size and location of roof accessories specified in this Section.
   2. Method of attaching roof accessories to roof or building structure.
   3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.

F. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for roof accessories with factory-applied color finishes.

G. Samples for Verification: For each type of exposed finish required, prepared on Samples in manufacturer's standard sizes, and of same thickness and material indicated for the Work. If finishes involve normal color or shade variations, include sample sets showing the full range of variations expected.

H. All submittals are to be in accordance with Division 01 – Submittal Procedures.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials in manufacture's unopened packages and bearing manufacturer's label.

B. Storage and Handling:
   1. Store materials in a dry and well ventilated place, adequately protected from damage and exposure to the elements.

PART 2 - PRODUCTS

2.1 ROOF CURBS

A. General: Provide roof curbs capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
   1. Top of roof curbs must be level for equipment installation, regardless of the slope of the roof plane on which the curb will be located; curb must provide a level surface for equipment installation.

B. Fabrication: Unless otherwise indicated or required for strength, fabricate units from minimum 18 ga. Galvanized steel with welded and mitered corner joints.
   1. Provide preservative-treated wood nailers at tops of curbs and formed flange at perimeter bottom for mounting to roof.
   2. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
   3. Provide manufacturer's standard rigid or semi-rigid insulation where indicated.
   4. Provide formed cants and base profile coordinated with roof insulation thickness.

5. Fabricate units to minimum height of 10 inches above finished roof, unless otherwise indicated.
6. Units shall be factory insulated 1-1/2" thick minimum three pound densityfiberglass insulation.

2.2 EQUIPMENT SUPPORTS

A. General: Provide equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

B. Fabrication: Unless otherwise indicated or required for strength, fabricate units from minimum 0.063-inch (1.6-mm-) thick, sheet aluminum with welded corner joints.
   1. Provide preservative-treated wood nailers at tops of curbs and formed flange at perimeter bottom for mounting to roof.
   2. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
   3. Fabricate units to minimum height of 8 inches (200 mm), unless otherwise indicated.
   4. Sloping Roofs: Where slope of roof deck exceeds ¼ inch per foot (1:48), fabricate support units with height tapered to match sloe to level tops ofunits.

2.3 ALUMINUM FINISHES

A. Finish designations prefixed by AA Comply with the system established by the Aluminum Association for designing aluminum finishes.

B. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating: Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's specifications for cleaning, conversion coating, and painting.
   1. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 603.8 except with a minimum dry film thickness of 1.5 mils (0.04 mm), medium gloss.
   2. Color: As selected by Engineer from manufacturer's full range.

PART 3 - EXECUTION

3.1 PREPARATION

A. Transmit submittals required by this section.

B. Furnish products as indicated.

C. Ensure that substrates are in suitable condition to receive the work.

3.2 INSTALLATION

A. Install roof accessory in accordance with the manufacturer's instructions. Set each unit level and plumb, true to line. Anchor accessories securely to the substrate.

B. Set flanges of units in roofing mastic, and leave surfaces smooth and clean for application of metal roofing and flashing. Provide manufacturer's recommended method for watertight attachment to pre-finished metal roofing.

3.3 INSTALLATION ROOF CURBS / EQUIPMENT SUPPORTS

A. General: Comply with manufacturer's written instructions. Coordinate installation of roof accessories with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other construction involving roof accessories to ensure that each element of the Work performs properly and that combined elements are waterproof and weather tight. Anchor roof accessories securely to supporting structural substrates so they are capable of withstanding lateral and thermal stresses, and inward and outward loading pressures.

B. Install roof accessory items according to construction details of NRCA's "Roofing and Waterproofing Manual," unless otherwise indicated.

C. Separation: Separate metal from incompatible metal or corrosive substrates, including wood, by coating concealed surfaces, at locations of contact, with bituminous coating or providing other permanent separation.

D. Flange Seals: Unless otherwise indicated, set flanges of accessory units in a thick bed of roofing cement to form a seal.

E. Cap Flashing: Where required as component of accessory, install cap flashing to provide waterproof overlap with roofing or roof flashing (as counter flashing). Seal overlap with thick bead of mastic sealant.

F. Ridge Vents: Install according to manufacturer's written instructions.

3.4 CLEANING AND PROTECTION

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

END OF SECTION

SECTION 07 81 00 - FIREPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Division 1 General Requirements

B. Section 07 90 00 – Joint Protection

1.2 SUMMARY

A. Requirements for the rated fireproofing at slabs and fire ratedwall penetrations.

1.3 REFERENCES

A. Building Code of New York State

B. Energy Conservation Construction Code of New York State

C. Fire Code of New York State.

D. Underwriters Laboratories Inc. (UL): UL 1479 – Fire Tests ofThrough- Penetration Firestops

E. NFPA No. 70 National Electrical Code, Latest Edition

F. ASTM E 814 – Standard Test Method for Fire Tests of PenetrationFirestop Systems

G. ASTM E 119 – Standard Test Methods of Fire Tests of Building Construction and Materials

H. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials

1.4 QUALITY ASSURANCE

A. Fireproofing shall be approved for use in New York.

B. Testing Requirements: Testing shall have been conducted or witnessed by an independent testing agency acceptable to governing authorities.
   1. Test methods: ASTM E 814 and ASTM E 119; as indicated foreach penetration seal.
   2. Conduct tests with a measurably higher pressure inside the chamber than outside.
   3. The listing of the assembly to be used in the current edition of one of the following classification guides will be considered evidence ofacceptable testing:
      a. Underwriters Laboratories Inc. "Fire Resistance Directory."
      b. Factory Mutual System "Approval Guide."
      c. Warnock Hersey "Certification Listings."

C. Coordinate delivery of products to minimize storage time at site.

D. Deliver products to project site in original unopened containers bearing the name of the manufacturer, product name, type, and testing agency's identification mark.

E. Store products in accordance with manufacturer's instructions.

F. Coordination Meeting: Prior to the start of work which involves cutting penetrations, conduct a meeting with installers of such work to identify fire and smoke barriers and required configurations of penetrations and to discuss the proper procedures and time schedule for cutting, patching, and sealing penetrations in such assemblies, with emphasis on avoiding unnecessary cutting and patching.

G. Perform fireproofing and smoke-stopping work after completion of work which penetrates fire and smoke barriers, but prior to covering up or eliminating access to the penetration. Coordinate with installers of such other work.

1.5 SUBMITTALS

A. Pre-installation Inspection Report: Identify penetrations, which need to be repaired using the original material of the assembly.

B. Schedule of Fireproofing: Complete list, for approval, of penetrations to be sealed, indicating location, fire rating of penetrated assembly, identification of penetration seal to be used, fire rating of penetration seal, and evidence of acceptable testing.

C. Schedule of Smoke-stopping: Complete list, for approval, of penetrations to be sealed, indicating location, construction of penetrated assembly, and identification of penetration seal to be used.

D. Product Data: Complete product and system description, including tested assembly details, installation instructions, and limitations on use.

E. Maintenance Data: Include detailed instructions for repair and for modification due to changes in penetrating items.

F. Final inspection report(s).

G. Project Record Documents: Drawings showing locations of all fire and smoke barriers, the actual penetrations through them, and the manner in which they have been sealed; cross-referenced to maintenance data.

H. All submittals are to be in accordance with Section 01 33 00 – Submittal Procedures.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials in manufacture's unopened packages and bearing manufacturer's label.

B. Storage and Handling:

1. Store materials in a dry and well ventilated place, adequately protected from damage and exposure to the elements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall comply with the following minimum standards:
   1. Flame spread: 25 or less when tested in accordance with ASTM E84.
   2. Smoke Density: 50 or less when tested in accordance with ASTM E84.
   3. Fuel Contribution: 25 or less when tested in accordance with ASTM E84.
   4. Nontoxicity: Nontoxic to human beings at all stages of application and during fire conditions.
   5. Provide products which:
      a. Allow normal expansion and contraction movement of the penetrating item without failure of the penetration seal.
      b. Emit no hazardous, combustible, or irritating by-products during installation or curing period.
      c. Do not require special tools for installation.
   6. Fire Resistance:
      a. Materials shall be capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E119 time-temperature fire conditions for one hour.
      b. Materials used to seal openings between floor slabs and exterior walls shall be capable of preventing flames and hot gases form passing when subjected to ASTM E119 time-temperature fire conditions for one hour at a 2-inch wide opening between floor slab edge and vertical wall assembly.
      c. Material shall not require a rise in temperature to install or activate seal.
   7. Labels: Red, permanent marking using the "Fire-Rated Assembly - Do not disturb - See maintenance instructions" and the testing agency designation, or equivalent as approved by the authority having jurisdiction:
      a. For marking fireproofing use self-adhesive tape or wired-on labels.
      b. For marking fire and smoke barriers themselves, use letters at least 2 inches high.

2.2 MANUFACTURERS

A. Fireproofing Materials:
   1. Manufacturers: Products made by the following manufacturers, provided they comply with requirements of the Contract documents, will be among those considered acceptable:
      a. Hilti Corp.
      b. Isolatek International
      c. Specified Technologies Inc.
      d. 3M Company
      e. United States Gypsum Company
      f. American Vamag Company, Inc.
      g. Bio Fireshield, Inc.
      h. Chase Technology Corporation.
      i. Dow Corning Corporation.
      j. Flamemaster Corporation.
      k. GE Silicones.

l. Insta-Foam Products, Inc.
m. International Protective Coatings Corporation.
n. Hevi-Duty/Nelson.
o. Semco Division/Products Research and Chemical Corporation.
p. Tremco.
q. Approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Pre-installation Inspection: Inspect all fire and smoke barriers for penetrations of any type; mark or otherwise identify all penetrations indicating action required: 1) repair or 2) fireproofing:
   1. Conduct inspection prior to covering up or enclosing walls or ceilings.
   2. Conduct inspection jointly with the Engineer.
   3. Submit a report detailing findings of inspection to the Engineer.

B. If the configuration of a particular penetration does not conform to the configuration necessary for the required fireproofing assembly, notify the installer of the penetration for modification of the configuration to suit the assembly; do not use the fireproofing assembly in other configurations except as specifically stated in the test report or as approved by the authority having jurisdiction.

3.2 PREPARATION

A. Transmit submittals required by this Section.

B. Furnish products as indicated.

C. Ensure that substrates are suitable to receive the work.

D. Prepare penetrations in accordance with the material manufacturer's instructions.

3.3 INSTALLATION

A. Install in accordance with manufacturers written instructions and fire test reports.

B. Fireproofing material shall completely fill void spaces regardless of geometric configuration, subject to tolerances established by the manufacturer. Fireproofing for filling voids in floors in which the smallest dimension of the void is 4-inches or more shall support the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in fireproofed area.

C. Insulated pipes and ducts penetrating fire-rated floors and walls shall be insulated with materials that provide the same performance as the fireproofing material. This material shall extend a minimum of 6-inches on each side of the opening. Vapor barrier of such insulation shall have a perm rating of .03 maximum.

D. Fireproofing at penetrations of electrical conduits shall comply with the requirements of NFPA No. 70.

3.4 PERMANENT IDENTIFICATION OF PENETRATIONS

A. Near fire and smoke barriers, mark each exposed penetration with label identifying it as a fire-stopped or smoke-stopped assembly.

B. Mark each fire and smoke barrier above lay-in ceilings with words identifying it as a fire or smoke barrier at intervals required by authorities having jurisdiction, but not less than 20 feet.

3.5 FIELD QUALITY CONTROL

A. Obtain the services of fireproofing material manufacturer's representative to instruct installers and to inspect the completed installations for correctness.

B. Inspect completed installations for completeness and correct installation.
   1. If installed work is to be covered in completed work, inspect and obtain approval prior to covering.
   2. Obtain the Engineer's approval; notify the Engineer that the work is complete and ready for inspection.
   3. Obtain the approval of the material manufacturer.
   4. Obtain the approval of the authority having jurisdiction.
   5. Submit report of inspection to the Engineer.

3.6 CLEANING

A. Clean up excess material adjacent to penetrations promptly; use methods and materials approved by the manufacturers of the penetration seals and of surfaces to be cleaned.

3.7 PROTECTION

A. Protect installed work during curing period.

B. Protect installed work from damage from construction operations using substantial barriers if necessary.

C. Repair damaged materials in accordance with manufacturer's instructions.

END OF SECTION

SECTION 07 90 00 - JOINT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Division 1 General Requirements

B. Section 03 30 00 Cast-In-Place Concrete

C. Section 03 41 00 Precast Structural Concrete

D. Section 07 81 00 Fireproofing

E. Section 07 92 00 Sealants and Caulking

1.2 SUMMARY

A. Section Includes:
   1. Interior joint sealants.
   2. Exterior joint sealants.

1.3 REFERENCES

A. ASTM C 717 – Standard Terminology of Building Seals and Sealants

B. ASTM C 790 – Standard Guide for Use of Latex Sealants

C. ASTM C 834 – Standard Specification for Latex Sealants

D. ASTM C 920 – Standard Specification for Elastomeric Joint Sealants

E. ASTM C 962 – Standard Guide for Use of Elastomeric Joint Sealants

F. Federal Specification TT-S-227 – Sealing Compound, Elastomeric Type, Multi- Component (for Caulking, Sealing, and Glazing in Buildings and other Structures)

G. Federal Specification TT-S-230 – Sealing Compound, Elastomeric Type, Single Component (for Caulking, Sealing, and Glazing in Buildings and other Structures)

H. Federal Specification TT-S-1543 – Sealing Compound, Silicone Rubber Base (for Caulking, Sealing, and Glazing in Buildings and other Structures)

1.4 QUALITY ASSURANCE

A. Installer Qualifications:

1. Execution of sealer installations of similar size and scope.
2. Similar installations completed within 5 years before start of this project.
3. Lead mechanic assigned from among those experienced on previous similar projects.

B. Substrate Tests: Have samples of actual substrate materials tested by manufacturer(s) of sealer products:
1. Test to determine what preparation procedures (if any are necessary to make sealers adhere properly under environmental conditions that may occur during installation.
2. Test to determine compatibility with substrates backers, and secondary seals, if any.
3. Use manufacturer's standard test methods.
4. Report the sealer manufacturer's recommendations for substrate preparation and sealer installation and identify specific primer(s) required.
5. The requirement for testing for this project will be waived if test reports based on previous testing of the products and substrates to be used are acceptable to the Engineer.

C. Field Installation Tests: Before installation, test the adhesion of all sealers to actual substrates:
1. Seal at least 5-foot lengths of joints and cure properly. Try to pull sealer out of joint by hand, by method recommended by sealer manufacturer.
2. Select test joints representative of joints to be sealed by the product to be tested.
3. Perform tests for each type of sealer.
4. Do tests in the presence of the Engineer.
5. Report acceptable results only.

D. Mock-ups: Before beginning installation, install sealers in joints in actual construction as directed by the Engineer, to show color, materials, and installation. Keep mock-ups intact as the standard for evaluating the completed work.

E. Pre-installation Meeting: Have the installer, sealer manufacturers' representatives, and other affected installers meet to review sealer installation and protection procedures and sequencing with other work.

F. Environmental Limitations: Do not install sealers if any of the following conditions exist:
1. Air or substrate temperatures exceed the range recommended by sealer manufacturer or are below 40 degrees F (4.4 degrees C).
2. Substrate is wet, damp, or covered with snow, ice, or frost.

G. Dimensional Limitations: Do not install sealers if joint dimensions are less than or greater than that recommended by sealer manufacturer; notify the Engineer and get sealer manufacturer's recommendations for alternative procedures.

H. Coordination Data: Compression gasket manufacturer's requirements for joint dimensional tolerances; provide to installers of joints to be sealed with compression gaskets.

1.5 SUBMITTALS

A. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:
1. Local/Regional Materials:
a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

b. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
c. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

2. VOC data:
a. Architectural Sealants:
1) Submit manufacturer's product data for sealants. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits.
2) Submit manufacturer's certification that products comply with Bay Area Resources Board, reg. 8, rule 51.

B. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

C. Samples for Color Selection: Cured samples of actual products showing manufacturer's full range of colors (Products exposed to view only.)

D. Samples for Color Verification: Cured samples of each color of each product used, prepared to simulate actual joints minimum 6 inches long; use substrates similar appearance to actual substrates. (Products exposed to view only.)

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
1. Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials in manufacture's unopened packages and bearing manufacturer's label.
2. Deliver materials in original containers or bundles with labels showing manufacturer, product name or designation, color, shelf life, and installation instructions.

B. Storage and Handling:
1. Store materials in a dry and well ventilated place, adequately protected from damage and exposure to the elements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Architectural Sealants:
1. Toxicity/IEQ:
a. Comply with applicable regulations regarding toxic and hazardous materials, and as specified. Sealants must meet or exceed requirements of Bay Area Resources Board, reg. 8, rule 51.
b. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.

B. Backer Rods: Provide composite backer rods.

PART 3 - EXECUTION

3.1 SITE ENVIRONMENTAL PROCEDURES

A. Indoor Air Quality:
   1. Temporary ventilation: Provide temporary ventilation during work of this Section.
      a. Coordinate interior application of joint sealants with interior finishes schedule.

END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Division 1 General Requirements

B. Section 07 90 00 Joint Protection

1.2 SUMMARY

A. Requirements for sealants and caulking.

1.3 REFERENCES

A. American Society of Testing and Materials (ASTM)
   1. D1752 Preformed Sponge Rubber and Cork Fillers

B. Federal Specifications (FS)
   1. FS TT-S-227E
   2. FS TT-S-1543

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Execution of sealer installations of similar size and scope.
   2. Similar installations completed within 5 years before start of this project.
   3. Lead mechanic assigned from among those experienced on previous similar projects.

B. Substrate Tests: Have samples of actual substrate materials tested by manufacturer(s) of sealer products:
   1. Test to determine what preparation procedures (if any are necessary to make sealers adhere properly under environmental conditions that may occur during installation.
   2. Test to determine compatibility with substrates backers, and secondary seals, if any.
   3. Use manufacturer's standard test methods.
   4. Report the sealer manufacturer's recommendations for substrate preparation and sealer installation and identify specific primer(s) required.
   5. The requirement for testing for this project will be waived if test reports based on previous testing of the products and substrates to be used are acceptable to the Engineer.

C. Field Installation Tests: Before installation, test the adhesion of all sealers to actual substrates:
   1. Seal at least 5-foot lengths of joints and cure properly. Try to pull sealer out of joint by hand, by method recommended by sealer manufacturer.
   2. Select test joints representative of joints to be sealed by the product to be tested.
   3. Perform tests for each type of sealer.

4. Do tests in the presence of the Engineer.
5. Report acceptable results only.

D. Mock-ups: Before beginning installation, install sealers in joints in actual construction as directed by the Engineer, to show color, materials, and installation. Keep mock-ups intact as the standard for evaluating the completed work.

E. Pre-installation Meeting: Have the installer, sealer manufacturers' representatives, and other affected installers meet to review sealer installation and protection procedures and sequencing with other work.

F. Environmental Limitations: Do not install sealers if any of the following conditions exist:
1. Air or substrate temperatures exceed the range recommended by sealer manufacturer or are below 40 degrees F (4.4 degrees C).
2. Substrate is wet, damp, or covered with snow, ice, or frost.

G. Dimensional Limitations: Do not install sealers if joint dimensions are less than or greater than that recommended by sealer manufacturer; notify the Engineer and get sealer manufacturer's recommendations for alternative procedures.

H. Coordination Data: Compression gasket manufacturer's requirements for joint dimensional tolerances; provide to installers of joints to be sealed with compression gaskets.

1.5 SUBMITTALS

A. Product Data: Manufacturer's data on each joint sealer, with instructions for substrate preparation and installation.

B. Samples for Color Selection: Cured samples of actual products showing manufacturer's full range of colors (Products exposed to view only.)

C. Samples for Color Verification: Cured samples of each color of each product used, prepared to simulate actual joints minimum 6 inches long; use substrates similar appearance to actual substrates. (Products exposed to view only.)

D. Substrate Test Report for Each Sealer.

E. Certified Product Test Reports: Independent testing agency reports showing compliance with all specified requirements.
1. Reports may be on tests conducted up to 24 months before submission, provided the products tested were aged specimens of the same formulation as that to be used.

F. Field Installation Test Reports.

G. Certificates: For each sealer, provide manufacturer's certificate stating that the product complies with the specifications and is appropriate for the use it is being put to.

H. Installer's Preconstruction Inspection Report: List all conditions detrimental to performance of joint sealer work.

I. Submit written warranty signed by Design-Builder and installer guaranteeing to correct failures in sealer work that occur within 5 years after substantial completion, without reducing or otherwise limiting any other rights to correction which the owner may have under the Contract documents. Failure is defined as failure to remain weather tight due to faulty materials or workmanship. Correction is limited to replacement of sealers.

J. All submittals are to be in accordance with Section 01 33 00 – Submittal Procedures.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials in manufacture's unopened packages and bearing manufacturer's label.
   2. Deliver materials in original containers or bundles with labels showing manufacturer, product name or designation, color, shelf life, and installation instructions.

B. STORAGE AND HANDLING:
   1. Store materials in a dry and well ventilated place, adequately protected from damage and exposure to the elements.

PART 2 - PRODUCTS

2.1 GENERAL

A. General: Provide only products which are recommended and approved by their manufacturer for the specific use to which they are put and which comply with all requirements of the Contract documents.
   1. For each generic product, use only materials from one manufacturer.
   2. Provide only materials, which are compatible with each other and with joint substrates.
   3. Colors of exposed sealers: Match color of adjoining materials; to be approved by Engineer.

2.2 MATERIALS

A. Sealants:
   1. Multi-part self-leveling sealant meeting FS TT-S-227E; Low V.O.C.
      a. Manufacturer: Bondaflex or approved equal.
      b. Product Name: Bondaflex PUR2 SL
   2. One-part silicone sealant meeting FS TT-S-1543, white color to match fixtures; Low V.O.C.
      a. Manufacturer: Bondaflex or approved equal. Color: White.
      b. Product Name: Bondaflex Sil100 GP
   3. Joint fillers: Non-extruding, non-staining, insoluble, synthetic rubber conforming to ASTM D1752 (resilient non-bituminous type). Closed cell polyethylene rod, size to allow 30% compressible on insertion into joint.

B. Primers: As recommended by the sealant manufacturer.

C. Bond Breakers: As recommended by the sealant manufacturer.

D. Toxicity/IEQ:
   1. Comply with applicable regulations regarding toxic and hazardous materials, and as specified. Sealants must meet or exceedrequirements of Bay Area Resources Board, reg. 8, rule 51.
   2. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium andtheir compounds, are not permitted.

2.3 JOINT TYPES

A. Between exterior metal walls and concrete.

B. Interior joints at plumbing fixtures.

C. Pipe penetrations of floor slab.

2.4 COMPRESSION SEALS

A. Compression Gaskets: Neoprene (polychloroprene) hollow gasket; complying with ASTM D 2628; sizes and shapes as indicated.
   1. Accordion Type
   2. Manufacturers:
      a. The D. S. Brown Company.
      b. Watson Bowman Acme Corp.
      c. Approved equal.

2.5 SEALANT BACKERS

A. Backers - General: Non-staining; recommended or approved by sealant manufacturer for specific use.

B. Backer Rods: Flexible, nonabsorbent, compressible polyurethane foam, either open-cell or non-gassing closed-cell, unless otherwise restricted by sealant manufacturer; preformed to appropriate size and shape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints for characteristics that may affect sealer performance, including configuration and dimensions.

B. For compression gaskets, joints should have straight, parallel sides within proper tolerances, free of spalls.

C. Do not begin joint sealer work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Transmit submittals required by this Section.

B. Furnish products as indicated.

C. Ensure substrates are in suitable condition to receive the work.

D. Joints and spaces that are to be caulked shall be clean and dry.

E. Cleaning: Just before starting sealer installation, clean out joints in accord with recommendations of sealer manufacturers and as follows:
   1. Remove all material that could impair adhesion, including dust, dirt, coatings, paint, oil, and grease. Exception: Materials tested to show acceptable adhesion and compatibility.
   2. Dry out damp and wet substrates thoroughly.
   3. Clean M-type and O-type substrates by suitable mechanical or chemical methods.
   4. Remove loose particles by vacuuming or by blowing with oil-free compressed air.
   5. Concrete: Remove laitance and form-release coatings.
   6. Clean A-type and G-type substrates by chemical or other methods, which will not damage the substrate.
   7. Use methods, which will not leave residues that will impair adhesion.
   8. Clean ferrous metals of all rust, mill scale and coatings. Remove oil and grease and temporary protective coatings.

F. Joint depth shall not exceed width of joint.

G. Priming: Prime substrates as recommended by sealer manufacturer.

H. Masking Tape: Use masking tape to keep primers and sealers off of adjacent surfaces, which would be damaged by contact or by cleanup. Remove tape as soon as practical.

I. Install fillers where needed to provide proper joint depth or support for sealant backers.

3.3 APPLICATION

A. Where joint backing is required, set at uniform depth.

B. Fill voids and joints solid to back up material.

C. Surface of sealant shall be a full, smooth bead, free of ridges, wrinkles, sags, air pockets and embedded impurities.

D. After all joints have been completely filled, tool to eliminate air pockets or voids and provide a smooth, neat finish.

E. Comply with sealer manufacturers' instructions and recommendations, except where more restrictive requirements are specified.

F. Gunnable and Pourable Sealants: Comply with recommendations of ASTM C 1193.

G. Sealants in Acoustical Assemblies: Comply with recommendations of ASTM C 919.

H. Backers:
   1. Install backers at depth required to result in shape and depth of installed sealant, which allows the most joint movement without failure:
      a. Make backers continuous, without gaps, tears, or punctures.
      b. Do not stretch or twist backers.
   2. If backers become wet or damp before installation of sealant, dry out thoroughly before proceeding.

I. Sealants: Use methods recommended by manufacturer completely fill the joint; make full contact with bond surfaces; tool non-sag sealants to smooth surface eliminating air pockets.
   1. Use concave joint shape shown in Figure 5A in ASTM C 1193, where not otherwise indicated.

J. Compression Gaskets: Use methods recommended by manufacturer; use as few end joints as possible; apply adhesive just before installing gaskets; make adhesively sealed joints at ends, corners, and intersections; install with top face approximately 1/8 to 1/4 inch below adjoining surfaces.

3.4 PROTECTION AND CLEANING

A. Clean surfaces adjacent to joints as work progresses and before sealants set using methods and materials approved by manufacturers of sealers and of surfaces to be cleaned.

B. Protect joint sealers from contamination and damage.

C. Remove and replace damaged sealers.

3.5 SCHEDULE OF JOINT SEALERS

A. General: Unless otherwise indicated, joints around perimeter of frames, where indicated to be sealed, are to be sealed using sealer specified for the substrate adjacent to the frame.

B. Exterior Joints for Which No Other Sealer Is Indicated:
   1. Use one of the following sealants:
      a. High movement silicone sealant.
      b. Medium movement silicone sealant.
   2. Backer: Backer rod.
   3. Joint shape: Concave joint configuration.

C. Exterior Joints Well Protected from Weather and Not Subject to Movement:
   1. Use one of the following sealants:
      a. Acrylic sealant.
      b. Butyl sealant.
   2. Backer: Backer rod.

D. Joints around Pipes, Ducts, and Conduit Penetrating Exterior Walls and Roofs:
   1. Use one of the following sealants:
      a. Same as used for adjacent substrates.

END OF SECTION

(This Page Left Intentionally Blank)

SECTION 07 95 00 EXPANSION CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Architectural joint systems for open-air structures.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for cast-in architectural-joint-system.
2. Division 07 Section "Joint Sealants" for liquid-applied joint sealants.

1.03 DEFINITIONS

A. Maximum Joint Width: Widest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

B. Minimum Joint Width: Narrowest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

C. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint.

D. Nominal Joint Width: The width of the linear opening specified in practice and in which the joint system is installed.

1.04 SUBMITTALS

A. Shop Drawings: Provide the following for each joint system specified and obtain approval prior to fabrication and shipment of materials to the job site:

1. Placement Drawings: Include line diagrams showing plans, elevations, sections, details, splices, blockout requirement, entire route of each joint system, and attachments to other work. Where joint systems change planes,

provide isometric or clearly detailed drawing depicting how components interconnect.

B. 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 seal for UV exposure.

C. Samples for Initial Selection: For each type of joint system indicated.

1. Include manufacturer's color charts showing the standard range of colors and finishes available for each exposed metal and elastomeric seal material.

D. Certificates – Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of fire-rated expansion joint assemblies with requirements indicated.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Approved by manufacturer.

B. Source Limitations: Obtain all architectural joint systems through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of architectural joint systems and are based on the specific systems indicated. Refer to Division 01 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Loading Characteristics: Standard loading refers to covers that are capable of withstanding up to 500 lb. point loads. Heavy duty refers to covers that are capable of withstanding up to 2000 lb. point loads.

E. Fire-Test-Response Characteristics: Where indicated, provide architectural joint system and fire-barrier assemblies identical to those of assemblies tested for fire resistance per UL 2079 and/or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction. Fire rating not less than the rating of adjacent construction.

F. Manufacturer to provide 5 year warranty for all joint covers.

1.06 COORDINATION

A. Coordinate installation of exterior wall joint systems with roof expansion assemblies to ensure that wall transitions are watertight.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Aluminum: ASTM B 221, Alloy 6005A-T61, 6063-T5, 6061-T5, 6105-T5 for extrusions; ASTM B 209, Alloy 6061-T6, 3003-H14, 5005-H34 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
2. Mill Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
3. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
4. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.
5. High-Performance Organic Finish (Two-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturers' written instructions.

B. Stainless Steel: ASTM A 666, Type 304 for plates, sheet, and strips.

1. Finish: No.4, directional satin.

a. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

C. Brass: ASTM B 36/B 36M, UNS Alloy C26000 for half hard sheet and coil.

D. Bronze: ASTM B 455, Alloy C38500 for extrusions; Alloy C28000 Muntz Metal for plates.

E. Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.

F. Compression Seals: ASTM D2000; preformed rectangular elastomeric extrusions having internal baffle system and designed to function under compression.

G. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required rating period.

H. Moisture Barrier: 7-ply laminate reinforced Polyethylene.

I. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.02 ARCHITECTURAL JOINT SYSTEMS, GENERAL

A. General: Provide architectural joint systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.

B. Design architectural joint systems for the following size and movement characteristics:

1. Nominal Joint Width: 2 inches
2. Maximum Joint Width: 2-1/2 inches.
3. Minimum Joint Width: 1-1/2 inches.
4. Lateral Shear Movement Capability:

2.03 ARCHITECTURAL JOINT SYSTEMS FOR OPEN-AIR STRUCTURES

A. Construction Specialties, Inc., P.O. Box 380 Muncy, PA, shall manufacture expansion joint cover assemblies specified herein and indicated on the drawings. Other manufacturers may be accepted as substitutions only if the manufacturer can demonstrate product compliance with the requirements of the contract documents. Substitution requests must be reviewed prior to bid and must include the following information:

1. Details
2. ASTM- E1399 test reports
3. Mock-ups
4. Reference list of projects with similar products as those specified herein.
5. Sample of written 5 year warranty

2.04 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces and blockouts where architectural joint systems will be installed for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to architectural joint system manufacturer's written instructions.

B. Repair concrete slabs and blockouts using manufacturer's recommended repair grout of compressive strength adequate for anticipated structural loadings.

C. Coordinate and furnish anchorages, setting drawings, and instructions for installing joint systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

D. Cast-In Frames: Coordinate and furnish frames to be cast into concrete.

3.03 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing architectural joint assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install joint systems.

1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.

2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper joint installation and performance.
3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
4. Locate in continuous contact with adjacent surfaces.
5. Standard-Duty Systems: Shim to level where required. Support underside of frames continuously to prevent vertical deflection when in service.
6. Heavy-Duty Systems: Repair or grout blockout as required for continuous frame support and to bring frame to proper level. Shimming is not allowed.
7. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

C. Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.

1. Provide in continuous lengths for straight sections.
2. Seal transitions according to manufacturer's written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer before installing compression seals.

E. Terminate exposed ends of joint assemblies with field- or factory-fabricated termination devices.

F. Fire-Resistance-Rated Assemblies: Coordinate installation of architectural joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.

1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

G. Water Barrier: Provide water barrier at exterior joints and where called for on Drawings. Provide drainage fittings where indicated.

3.04 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and

install temporary protection over joints. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION 07 95 00

DIVISION 8
OPENINGS

SECTION 08 11 00 - DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements for standard steel doors and frames.

1.2 REFERENCES

A. American National Standards Institute (ANSI):
   1. A115 Specifications for Steel Door and Frame Preparation for Hardware (A115.1-A115.17)
   2. A224.1 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames

B. American Society for Testing and Materials (ASTM):
   1. A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   2. C236 Test Method for Steady State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box
   3. C976 Test Method for Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box
   4. E152 Fire Tests of Door Assemblies

C. Door and Hardware Institute (DHI):
   1. Recommended Locations for Builders Hardware on Standard Steel Doors and Frames

D. National Fire Protection Association (NFPA):
   1. 80 Fire Doors and Windows

E. Steel Door Institute (SDI):
   1. 100 Recommended Specifications for Standard Steel Doors and Frames
      a. 105 Recommended Erection Instructions for Steel Frames
      b. 112 Galvanized Standard Steel Doors and Frames
      c. 117 Manufacturing Tolerances Standard Steel Doors and Frames

F. Underwriters Laboratories Inc. (UL):
   1. Building Materials Directory

1.3 QUALITY ASSURANCE

A. Applicable Standards: Specifications and standards of SDI 100-98.

B. Wind Load Performance Requirements: Comply with wind loadrequirements of Uniform Building Code. Deflection shall not exceed 1/175 of span.

C. Supplier Qualification: Qualified direct distributor of products to be furnished. The distributor shall have in their regular employment an A.H.C./C.D.C. or person of equivalent experience who will be available at reasonable times to consult with the Engineer, Design Builder and/or Owner regarding any matters affecting the total door and frame openings.

D. Installer Qualification: Experience with installation of similar materials.

E. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows", and have been tested, listed, and labeled in accordance with ASTM E152 "Standard Methods of Fire Tests of Door Assemblies" by nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

F. NOT USED

G. Temperature Rise Rating: At stairwell enclosures, provide doors which have Temperature Rise Rating of 450 degrees F maximum in 30 minutes of fire exposure.

1.4 SUBMITTALS

A. Product data for each type of door and frame specified.

B. Shop drawings including details of each frame type, elevations of door design types, and schedule of doors and frames.

C. Manufacturer's certifications for labeled construction.

D. All submittals are to be in accordance with Division 01 – Submittal Procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials in manufacture’s unopened packages and bearing manufacturer’s label.

B. Storage and Handling:
   1. Store materials in a dry and well ventilated place, adequately protected from damage and exposure to the elements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of the following:

B. Manufacturer of Steel Doors and Frames:
   1. Steelcraft
   2. Cornell Ironworks
   3. Curries
   4. Ceco
   5. Or approved equal.

2.2 DOORS

A. Exterior: Seamless, Grade III, Model 1, minimum 16 gage, in accordance with SDI 100, galvanized steel faces in accordance with SDI 112.

B. Internal Construction: Manufacturer's standard with internal sound deadener.

C. Provide to design indicated including: Flush panel doors, flush panel with cut- out as indicated, stile and rail type, stile and rail with door louver. Use galvanized steel at exterior doors.

D. Flush Doors: Reinforce, stiffen and sound deaden. Provide cut-outs for glass and louvers with stops as shown. Provide flush steel closure at top of exterior and interior doors and at bottom of exterior doors with drain holes in bottom closure. Provide seamless edge. Following door construction types are acceptable.

E. Exterior Doors: 20 gauge steel stiffener reinforced vertically 6 inches o.c. full height and width, spot welded 5 inches o.c. to both face sheets. Stiffeners welded together top and bottom. Insulate with 2 lb minimum density mineral wool insulation.

F. Composite Core Interior Doors: NOT USED.

G. Door Construction: Manufacturer's standard polystyrene, polyurethane foamed in place, vertical steel stiffeners, or rigid mineral fiber core with internal sound deadener on inside of face sheets where appropriate in accordance with SDI standards.

H. Labeled Doors: Insulate as required by Underwriters Laboratories. Build in special hardware and provide astragals as indicated. At one hour and at 1-1/2 hour doors at enclosures, maximum transmitted temperature end point shall not exceed 450 degrees F above ambient at end of 30 minutes of fire exposure per U.L.

I. Seamless Vertical Edges: Construct doors with smooth flush surfaces, without visible joints or seams on exposed faces or stile edges. Interior and exterior door edge seams shall be full height wire welded and ground smooth.

J. Exterior Metal Door Louvers: NOT USED.

K. Interior Hollow Metal Door Louvers: NOT USED.

L. Typical Reinforcement: Provide as required for hardware items. For lock reinforcement, provide manufacturer's standard reinforcement. Provide 12 gauge reinforcement for escutcheons or roses. centering clips to hold lock case in alignment. For door checks, provide 3/16 inch channel type reinforcements, 3-1/2 inch deep by 14 inches long, or as required. Hinge reinforcement minimum 7 gauge by 1-1/2 inch by 9 inch bar. Weld reinforcing to door. Reinforce doors for surface items such as surface and semi- concealed closers, brackets, surface holders and door stops. Drilling and tapping installation of these surface items shall be done in field by hardware installer.

M. Special Reinforcing: At exterior doors, reinforce inside of door on hinge side with high frequency hinge preparation. Weld to door.

N. Hardware: Mortise, reinforce, drill and tap for hardware furnished under Section 08 70 00 - Hardware, except drilling and tapping for surface door closers, door closer brackets and adjusters shall be done in field. Obtain templates from hardware supplier.

O. Finish: Provide prime coat finish on doors. Thoroughly clean off rust, grease and other impurities. Grind welds smooth, no marks shall show. Apply metallic filler as required to fill cracks and joints and to level any weld areas or similar imperfections. Sand filler coat smooth.

2.3 FRAMES

A. General: Form to profiles indicated. Where necessary, alternate details will be considered provided design intent is maintained. Consider and provide for erection methods.

B. Typical Reinforcing: Provide minimum hinge reinforcement 3/16 inch by 1-1/2 inch by 10 inch. Provide similar reinforcement for hardware items as required to adequately withstand stresses, minimum 12 gauge, including channel reinforcement for door closers and closer arms, door holders and similar items. Provide reinforcement and clearances for concealed in-head door closers and for mortise locks.

C. Cover Plates: For hinge and strike plate cutouts, provide fully enclosed pressed steel cover boxes spot welded to frames behind mortises.

D. Hardware: Mortise, reinforce, drill and tap for mortise hardware, except drilling and tapping for surface door closers, door closer brackets and adjusters shall be done in field.

E. Anchorage: Provide standard and special anchorage items as required. Provide formed steel channel spreader at bottom of frames, removable without damaging frame. At masonry, provide anchors (about 2 inch by 10 inch) approximately 24 inches on center.

F. Silencers: Provide specified silencers, except where stop does not occur and at smoke gasketed openings, 3 per jamb at single door and one for each door at double doors.

G. Extensions: Reinforce transom bars or mullions as necessary to provide rigid installation. Where required (as at multiple openings) to stabilize large frames, provide frame or mullion extensions to anchor to structure above, proper size to fit within overhead construction. Provide angle clips to fasten to structure.

H. Mullions: Provide mullions, straight and without twist, of tubular design. For removable mullions provide reinforcing at frame head.

I. Clearances: Provide and be responsible for proper clearances at metal frames, including for weatherstripping, soundstripping and smoke gasketing. Glass clearance shall be thickness of glass plus clearance each side (1/8 inch minimum exterior - 1/16 inch minimum interior), adjust for installation, glass thickness to allow for glazing and sealant. Where sealed double glazing is indicated, provide rebates minimum of 3/4 inch and provide 1/4 inch clearance at glass edges. Where units fit around concrete blocks (blocks built into

J. frames) obtain actual dimensions of blocks being used to establish minimum clearances.

K. Drip Cap: Galvanized steel field painted per 09 90 00. Secure to frameat exterior doors

L. Labeled Frames: Construct in accordance with requirements for labeled work. Attach proper U.L. label, Warnok Hersey. "B" labeled frames shall be 1-1/2 hour construction.

M. Joinings: At frames with equal width jambs and head, neatly miter on face (except locations as at transom bars and at frames with large head members). Cope and butt stops. Weld length of entire joint, including face and flat intersections. Grind smooth, at other frames, provide same mitered joint wherever possible (at intersection of jamb-head or jamb-sill) and at other locations butt metal neatly and full weld. If tight butt joints are utilized, joints shall be neatly caulked smooth.

N. Workmanship: Fabricate so no grind marks, hollow or other out-of-plane areas are visible. At joints of intermediate members (such as mullions and transom bars), provide tight joining, neatly accomplished without holes, burned out spots, weld build up or other defacing work. Fill to close cracks and to preserve shapes. Tightly fit loose stops, to hairline joints.

O. Finish: Clean frames by degreasing process and apply thorough coating of baked-on primer, covering inside as well as outside surfaces. At galvanealed frames, coat welds and other disrupted surface with zinc-rich paint containing not less than 90 percent zinc dust by weight.

2.4 FASTENINGS

A. Provide fastenings, anchors and clips as required to secure hollow metal work in place. Provide Jackson head screws, or flatter. Dimple metal work to receive screw heads. Set stops and other non-structural fastenings with #6 Jackson head self-tapping screws.

2.5 MISCELLANEOUS

A. Supports and Anchors: Minimum 18 gage sheet steel; galvanized where used with galvanized frames.

B. Inserts, Bolts and Fasteners: Manufacturer's standard units. Where built into exterior walls, hot-dip galvanized in accordance with ASTM A153, Class C or D.

C. Cold Rolled Steel Sheets: Commercial quality, stretcher leveled flatness, cold- rolled steel, free from scale, pitting or other surface defects, complying with ASTM A366 and A568 general requirements.

D. Galvanealed Steel Sheets: ASTM A924, A60 zinc coating. Usegalvanealed steel sheets for exterior hollow metal doors, door frames and door louvers. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM-A569.

E. Minimum gauges of hollow metal are specified below. Provide heavier gauge if required by details or specific condition. Entire frame and sidelight shall be of same gauge.
   1. 16 gauge: Interior door frames, and glazed opening frames. NOT USED
   2. 16 gauge: Labeled frames (or heavier if required by label).
   3. 18 gauge: Interior doors (or heavier if required by label). NOT USED
   4. 14 gauge: Exterior door frames, window-wall and window frames. NOT USED
   5. 16 gauge: Exterior doors.
   6. 20 gauge: Trim members.

F. Coating Materials, primer: Use manufacturer's standard rust inhibiting primer conforming to ANSI-A224.1-1990.

G. Thermal-rated (insulating) assemblies for exterior doors: U factor of 0.41 Btu/(hr x sq. ft x deg F) or better when tested in accordance with ASTM C236 or ASTM C976.

2.6 FABRICATION

A. Doors and frames prepared to receive hardware and in accordance with ANSI A115 Series.

B. Hardware cutouts located in accordance with DHI recommendations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Transmit submittals required by this Section.

B. Furnish products as indicated.

C. Ensure substrates are in suitable condition to receive the work.

3.2 INSTALLATION

A. Install frames in accordance with SDI 105 and fire-rated frames in accordance with NFPA 80.

B. Fit doors accurately in frames, maintaining clearances specified in SDI 100.

C. Install fire-rated doors with clearances as specified in NFPA 80.

D. Check and readjust operating hardware items.

END OF SECTION

SECTION 08 44 05 - GLASS RAINSCREEN WALL CLADDING SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This section includes requirements for the cladding system identified as GL-09 on Contract Drawings and consisting of exterior glass panels, aluminum fittings, and glazing accessories.

1.2 REFERENCES

A. Comply with applicable provisions of the following Rain Screen test criteria for design, materials, and installation of component parts:
   1. AAMA 509-09, AAMA 508-07, ASTM E 330-02, ASTM E 283-04, ASTM E 331, ASTM E 1233-06, AAMA 501.1-05, DIN 18516 Part 4. Visual characteristics for all fasteners and glass in accordance with glass manufacturer's product definition.

1.3 DEFINITIONS

A. The system provides flat glazing panels for a ventilated pressure equalized system without glass cut-outs or holes. The system prevents or helps minimize the horizontally driven rain from accessing the building envelope.

1.4 SYSTEM DESCRIPTION

A. Design Requirements:
   1. The Design Builder shall be responsible for conforming the system to the architectural plans, including anchorage to structural system and necessary modifications to meet specified requirements and maintain visual design concepts.
   2. Attachment Considerations: Accommodate project design concepts and provide for building movement anticipated from all possible causes. Provide for expansion and contraction in all components to eliminate the possibility of loosening, warping, buckling or bulging of all components.

B. Performance Requirements:
   1. Wall-F: The system must be structurally supported. The fastening system should absorb building movement up to 3/8" (10 mm) + or - 3/16" (5mm) and accept the specified glass thickness.

C. Glass Requirements:
   1. ANSI Z 97.1 - Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test.
   2. ASTM C 1036 - Standard Specification for Flat Glass.
   3. ASTM C 1048 - Standard Specification for Heat-Treated Flat Glass

4. ASTM C 1172 - Standard Specification for Laminated Architectural Flat Glass.

D. Fitting Support Requirements.
1. The aluminium angle supporting the fittings is pre-treated and powder-coated. Anchors attaching the fittings to the structure must be durable, weather-resistant, and in accordance with corrosion protection class III as per DIN EN 10088 or better. The glass panels must be structurally and durably supported.

1.5 SUBMITTALS

A. Product Data: Submit following:
1. Product data sheets for glass supporting fittings and each glass product to be used.

B. Shop Drawings:
1. Submit plan view, elevation details, connection details, and installation details including interface with adjacent construction.
   a. Drawings shall identify all fittings, gaskets, fasteners, shims, hardware, and accessories used to install the system as well as glass size and type. They shall clearly identify adjacent materials completely. The drawings shall show all dimensions for maximum allowable offset for adjacent components, overall facade alignment tolerance, and maximum allowable deviation of supporting construction from the dimensions shown on the architectural drawings, maximum shim space at anchors etc. Dimensions of all components, alloys, tempers, and finishes shall be clearly identified.
   b. The drawings shall be stamped with seal and signature by registered Professional Engineer licensed in the jurisdiction where the project is located with a minimum of five (5) years experience in the design of rain screen wall systems.

C. Samples:
1. Glass: Submit three 8” by 8” of standard production material.
2. Fittings: Submit samples for top, bottom and middle attachment.
3. Components: submit samples of all accessories (tapes, shims, gaskets, screws, etc.).

D. Informational Submittals: Submit following packaged separately from other submittals:
1. Engineering Calculation and Product Information: Submit following:
   a. Engineering Calculation showing compliance with specified design requirements and manufacturer’s typical Product Information. The calculations shall be stamped with seal and signature by registered Professional Engineer licensed in the jurisdiction where the project is located.
2. Manufacturer’s fabrication and installation instructions.

1.6 QUALITY ASSURANCE

A. Single Source Responsibility: Manufacturer shall be responsible for all fittings components supplied for the basic system and glass if supplied by the fittings manufacturer.

B. Manufacturer’s authorized representative shall make visits as required to validate warranty.

C. Welder Qualifications: AWS certified within past 12 months for each type of weld required.

D. Certifications:
   1. Certificates verifying AWS qualifications for each welder employed on Project.

1.7 SAMPLES
   1. Sample shall consist of four 12”X12” panes of specified glass and associated clips mounted on site. Location to be decided by the Engineer.

1.8 MOCK – UPS

A. Visual /Field Sample:
   1. Construct typical, full size mock-up panel.
   2. Locate as directed by Engineer.

1.9 PRE-INSTALLATION CONFERENCE

A. [Conduct pre-installation conference in accordance with project requirements.]

B. Identify access to site, storage, sequencing, and scheduling.

C. Establish requirements for visits by manufacturer’s representative.

1.10 DELIVERY, STORAGE, AND HANDLING

A. General: Store in manufacturer’s unopened packaging on a level surface, above ground, in a watertight enclosed space fully ventilated and protected from damage and in accordance with manufacturer’s recommendations.

B. All glass products to be fully protected from impact and staining or spotting

1.11 WARRANTY

A. Special Warranty:
   1. Warrant installed units to be free from defects in material and workmanship for a period of maximum of 5 years. Include coverage against crack, warp, pit, corrode, peel, or blister under normal use and service.
   2. Installation warranty of 1 year shall be supplied by selected glazing subcontractor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Basis-of-Design Product:
   1. The design is based on Bendheim Wall Systems, Inc. (BWS) with aluminum fittings by LängleGlas. BWS is Located at 61 Willett Street, Building J, Passaic, NJ 07055. Tel: 800-

221-7379 Fax: 973-458-0233 Email: rainscreens@bendheim.com Subject to compliance with requirements, provide the named product or a comparable product by one of the following.
a. LängleGlas
b. Approved equal

B. Glass Products:
1. Glass type, per BWS glass samples provided to the Engineer.

C. Fittings and glass products of other manufacture's matching the aesthetics, performance, and certifications of the above listed specified products will be considered for approval if submitted as part of the bid proposal and accompanied by samples, performance data, certifications and written statement that the manufacturer will conform to all requirements of these Specifications.

2.2 MATERIALS

A. Aluminum Fittings and Glass:
1. Wall-F aluminum fasteners are Alloy 6063-T6 in accordance with DIN 18516 Part 4. The bolt connecting the fasteners to the aluminum angle is stainless steel 5/16" (M8) diameter with washer in accordance with DIN 933 or per the Engineer.
2. Glass: Tempered laminated exterior glass with ribbed surface and color film interlayer. Sizes and layouts as shown on the Contract Drawings, color approved by the Engineer.

2.3 FABRICATION

A. Coordination of Fabrication: Check all field conditions for acceptable conformance to the architectural drawings.

B. General:
1. Install fittings as shown on the shop drawings and in accordance with the manufacturer's assembly instruction.
2. Isolate dissimilar metals and aluminum in contact with concrete utilizing protective coating or pre-formed separators which will prevent contact and corrosion.

C. Welding: Comply with recommendations of American Welding Society (AWS).
1. Use recommended electrodes and methods to avoid distortion and discoloration.
2. Grind exposed welds smooth and flush with adjacent surfaces; restore material finish.

2.4 FINISHES

A. Clear Anodized: AA-M12C22A41, Architectural Class 1, etched, medium matte, clear anodic coating, 0.7 mil minimum thickness.

PART 3 - EXECUTIONS

3.1 INSTALLERS

A. Engineer approved [with a minimum of (5) years experience in the installation of rain screen systems].

3.2 EXAMINATION

A. Do not begin installation until substrates have been suitably prepared to accommodate the system.

B. Examine and verify substrate surfaces to receive the Rain Screen system, associated work, and conditions where work will be installed are in conformance with approved plans.

C. Maximum deviation from vertical and horizontal alignment of substrate shall be no more than 1/4" in 20 feet.

D. Do no proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as installer's acceptance of surface conditions.

E. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

3.3 INSTALLATION

A. Install units in accordance with approved Shop Drawings, plumb, level, square, free from warp or twist while maintaining dimensional tolerances, alignment with surrounding construction.

B. Erect fasteners and glass in accordance with manufacturer's printed installation instructions. Clean glass immediately before installing.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:
   1. Employ manufacturer's representative as necessary to insure proper installation and to verify work is done in accordance with manufacturer's requirements.

3.5 CLEANING

A. Clean as recommended by manufacturer. Do not use materials or methods which may damage system components or surrounding construction.

3.6 PROTECTION

A. Protection: Protect finished surfaces from damage.

END OF SECTION

SECTION 08 44 05 – POINT SUPPORT FITTINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Spider fittings for glass awnings.

1.02 DEFINITIONS

1.03 REFERENCE STANDARDS

A. AAMA 501.4 - Recommended Static Test Method for Systems Subjected to Seismic and Wind Induced Interstory Drifts; 2009.

B. AAMA 501.6 - Recommended Dynamic Test Method For Determining The Seismic Drift

C. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; American Society of Civil Engineers; 2010.

D. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2003.

E. ASTM A743 - Standard Specification for Castings, Iron Chromium, Iron Chromium Nickel, Corrosion Resistant, for General Applications.

F. ASTM E330 - Standard Test Method for Structural Performance by Uniform Static Air Pressure Difference; 2002 (Reapproved 2010).

G. ASTM F 593 - Standard Specifications for Stainless Steel Bolts, Hex Cap Screws, and Studs.

1.04 SUBMITTALS

A. Product Data:
   1. Shop Drawings:
      a. Plans, sections, elevations, and details with point support fittings identified by manufacturer's part numbers, dimensions, materials, finishes, connections, method of anchorage to structure and glass thickness and type.
   2. Manufacturer's Qualification Statement.
   3. Test Reports: Submit results of full-size mock-up testing. Reports of tests previously performed on glass awning supported by point load fittings are acceptable. Test reports include tests performed in accord with ASTM E330, AAMA501.4, and AAMA 501.6.
   4. Manufacturer's Instructions:

1.05 QUALITY ASSURANCE

A. Field Measurements: Verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 5 years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of documented experience.

D. Provide point support fittings from a single source.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. C.R. Laurence Co, Inc
B. Approved Equal

2.02 POINT SUPPORT FITTINGS

A. General: Fittings are stainless steel 316 Alloy; in brushed (BS suffix)], or polished (PS suffix) finish. Regular Duty Spider Fittings can accommodate glass thickness from 3/8 inch to 1/2 inch. Glass must be tempered glass (do not use with annealed, float, or raw glass).
B. Regular Duty Spider Fittings
    1. Post Mount
        a. Single Arm Fitting used to attach a single glass panel to a structural end post.
            1) PMR1BS
            2) PMR1PS
        b. Double Arm Fitting used to attach two in-line glass panels to a structural center post.
            1) PMR2BS
            2) PMR2PS
        c. Single Long Arm Fitting used to attach a single glass panel to a structural end post and match over "V" fittings arms.
            1) PMR1LBS
            2) PMR1LPS
        d. Double Arm "V" Fitting used to attach a single glass panel to a structural end post, or two in-line glass panels to a structural center post.
            1) PMR2VBS
            2) PMR2VPS
        e. 3-Way Arm Fitting used to attach 3 in-line glass panels to a structural center post where they abut to a soffit corner.
            1) PMR3BS
            2) PMR3PS
        f. 4-Way Arm Fitting used to attach 2 in-line glass panels to a structural center post.
            1) PMR4BS
            2) PMR4PS
        g. Double Arm "V" 90 Degree Fitting used to attach two 90 degree glass panels at the top or bottom of a structural corner post.
            1) PMR2V90BS
            2) PMR2V90PS
        h. 4-Way Arm 90 Degree Fitting used to attach two 90 degree glass panels in the middle to a structural corner post.
            1) PMR490BS

2.03 GLASS ATTACHMENTS

A. Rigid Cap fittings for 1/2 inch to 5/8 inch thick tempered glass: [RCF12BS], [RCF12PS], [RRF10BS], [RRF10PS] rigid combination fastener for 3/8 inch to 5/8 inch thick tempered glass].

B. Countersunk fittings : [Part no. SPP0BS brushed finish, [Part no. SPP0PS polished finish].

C. Swivel fittings: [part no. SCF34BS for use with 3/4 inch thick tempered glass], [part no. [SCF34BS], [SCF34PS] for use with 3/4 inch thick tempered glass], [part no. [SCAP34BS] [SCAP34PS] for use with 1/2 inch to 1-1/16 inch thick tempered glass], [Part no. HS1GF14BS brushed finish, heavy duty for use with 1-1/4 inch Insulating Glass Unit], regular duty [Part no. RSFEX10PS polished finish, regular duty]. Up to 6 degrees in any direction on it's wall and socket joint. This allows for any stress applied to the glass to be evenly distributed across the entire panel of glass, rather than concentrating at the hole].

D. Combination Swivel fittings: For use with countersunk or standard hole for use with 3/8 inch to 5/8 inch thick tempered glass. [part no. RSF10BS], [pat no. RSF10PS]

E. Combination Swivel fittings: Adjustment up to 6 degrees in any direction on its ball and socket joint. This allows for any stress applied to the glass to be more evenly distributed across the entire panel of glass rather than concentrating at the hole. These are typically used in conditions where the glass will be subject to live loads.

1. For use with countersunk or standard hole with tempered glass up to 1/2 inch thick (RSF10BS), (RSF10PS).
2. For use with countersunk or standard hole with tempered glass from 1/2 inch - 1-1/8 inch thick (HSF14BS), (HSF14PS).2.03 SPIDER FITTINGS FOR GLASS AWNINGS

F. Mounting hardware:

G. Support rods:

2.04 MATERIALS

A. Austenitic Stainless Steel castings: ASTM A743; 316 Alloy, Grade CF 8 or CF

8M. B. Fasteners: Stainless Steel bolts: ASTM F593; 316

Alloy

2.05 SPIDER FITTING HARDWARE AND ACCESSORIES

A. Tools:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions, approved shop drawings, and engineering calculations.

B. Point support fittings to be mounted to structural steel tube 4”x4” structure.

C. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

D. Provide alignment attachments and shims to permanently fasten system to building structure.

E. Align assembly plumb and level, free of twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

3.03 TOLERANCES

A. Maximum Variation From True Position: [+/- 1/8 inch] maximum in 12 ft.- 0 inch runs, non-cumulative..

B. Maximum Offset From True Alignment Between Adjacent Members Butting or In-Line: +/-
1/32 inch.

END OF SECTION

SECTION 08 70 00 - HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Division 1 General Requirements

1.2 SUMMARY

A. This Section includes furnishing all items of finish hardware for allcanopies, railings, and other items in the Contract.

1.3 REFERENCES

A. Standards:
1. ANSI A156.1 – Butts and Hinges
2. ANSI A156.2 – Bored Locks and Latches
3. ANSI A156.3 – Exit Devices
4. ANSI A156.4 – Door Controls – Door Closers
5. ANSI A156.5 – Auxiliary Locks and Associated Products
6. ANSI A156.6 – Architectural Door Trim
7. ANSI A156.7 – Template Hinge Dimensions
8. ANSI A156.8 – Door Controls – Overhead Holders
9. ANSI A156.13 – Mortise Locks and Latches
10. ANSI A156.15 – Closer Holder Release Devices
11. ANSI A156.16 – Auxiliary Hardware
12. ANSI A156.18 – Material and Finishes
13. NFPA 80 – Fire Doors and Windows
14. UL10C – Positive Pressure Fire Tests of Door Assemblies
15. AIA A201 1997 – General Conditions of the Contract

B. Codes:
1. Building Code of New York State 2010
2. NFPA 101 – Life Safety Code
3. ANSI A117.1 – Accessible and Usable Buildings and Facilities
4. ADA – Americans with Disabilities Act
5. UFAS - Uniform Federal Accessibility Standards
6. UL - Underwriter's Laboratories
7. WHI - Warnock Hersey International, Division of InchcapeTesting Services
8. State and Local Codes including Authority Having Jurisdiction

1.4 ADMINISTRATIVE REQUIREMENTS

A. Design Builder to coordinate keying requirements with Metropolitan Transportation Authority.

1.5 QUALITY ASSURANCE

A. Substitutions
   1. All substitution requests must be submitted within the procedures and time frame as outlined in Division 01, General Requirements. Approval of products is at the discretion of the Engineer and his hardware consultant.

B. Supplier Qualifications
   1. A recognized architectural door hardware supplier who has maintained an office and has experience furnishing hardware in the project's vicinity.
   2. Hardware supplier shall have office and warehouse facilities to accommodate this project.
   3. Hardware supplier shall have in his employment at least one (1) Architectural Hardware Consultant (AHC) who is available at reasonable times during business hours for consultation about the project's hardware and requirements to the owner, Engineer and Design-Builder.
   4. Hardware supplier must be an authorized factory distributor of all products specified herein.

C. Installer: Firm with experience in installation of similar hardware to that required for this project, including specific requirements indicated.

D. Regulatory Label Requirements: Provide nationally recognized testing agency label or stamp on hardware for labeled openings. Where label requirements conflict with drawings or specifications, hardware conforming to label requirements shall be provided. Conflicts and proposed substitutions shall be clearly indicated in hardware schedule.

E. Pre-Installation Conference: Prior to the installation of hardware, manufacturer's representatives for locksets, closers, and exit devices shall (be available to) arrange and hold a jobsite meeting to instruct the installing Design-Builder's personnel on the proper installation of their respective products. A letter of compliance, indicating when this meeting is held and who is in attendance, shall be sent to the Engineer and Owner.

F. Provide hardware for fire-rated openings that comply with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of hardware that are listed by Underwriter's Laboratories (UL) or Warnock Hersey (WH) for use on types and sizes of doors indicated.

G. Marking and Packaging
   1. Properly package and mark items according to the approved hardware schedule, complete with necessary screws and accessories, instructions and installation templates for spotting mortising tools. Design-Builder shall check deliveries against accepted list and provide receipt for them, after which he is responsible for storage and care. Any shortage or damaged good shall be made without cost to the owner.
   2. Packaging of door hardware is the responsibility of the supplier. As hardware supplier receives material from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set and door numbers to match the approved hardware schedule. Two or more identical sets may be packed in same container.

H. Delivery
   1. The supplier shall deliver all hardware to the project site; direct factory shipments are not allowed unless agreed upon beforehand. Hardware supplier shall coordinate delivery times and schedules with the Design Builder. Inventory door hardware jointly with representatives of hardware supplier and hardware installer/Design Builder until each is satisfied that count is correct.

2. No keys, other than construction master keys and/or temporary keys are to be packed in boxes with the locks.

I. Storage
1. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of work will not be delayed by hardware losses both before and after installation.

1.6 SUBMITTALS

A. General Requirements
1. Submit copies of finish hardware schedule in accordance with Division 01 – Submittal Procedures.

B. Schedules and Product Data
1. Schedules to be in vertical format, listing each door opening, and organized into "hardware sets" indicating complete designations of every item required for each door opening to function as intended. Hardware schedule shall be submitted within two (2) weeks from date the purchase order is received by the finish hardware supplier. Furnish four (4) copies of revised schedules after approval for field and file use. Note any special mounting instructions or requirements with the hardware schedule. Schedules to include the following information:
a. Location of each hardware set cross-referenced to indications on drawings, both on floor plans and in door and frame schedule.
b. Handing and degree of swing of each door.
c. Door and frame sizes and materials.
d. Keying information.
e. Type, style, function, size, and finish of each hardware item.
f. Elevation drawings and operational descriptions for all electronic openings.
g. Name and manufacturer of each hardware item.
h. Fastenings and other pertinent information.
i. Explanation of all abbreviations, symbols and codes contained in schedule
j. Mounting locations for hardware when varies from standard.
2. Submit catalog cuts and/or product data sheets for all scheduled finish hardware.
3. Submit separate detailed keying schedule for approval indicating clearly how the owner's final instructions on keying of locks has been fulfilled.

C. Wiring Diagrams: Provide complete and detailed system operation and elevation diagrams specifically developed for each opening requiring electrified hardware, except openings where only magnetic hold-opens or door position switches are specified. Provide these diagrams with hardware schedule submittal for approval. Provide detailed point-to-point wiring diagrams with hardware delivery to jobsite.

D. Installation Instructions: Provide manufacturer's written installation and adjustment instructions for finish hardware. Send installation instructions to site with hardware.

E. Samples
1. Upon request, samples of each type of hardware in finish indicated shall be submitted. Samples are to remain undamaged and in working condition through submittal and review process. Items will be returned to the supplier or incorporated into the work within limitations of keying coordination requirements.

F. Templates: Furnish a complete list and suitable templates, together with finish hardware schedule to Design-Builder, for distribution to necessary trades supplying materials to be prepped for finish hardware.

G. Operations and Maintenance Manuals
   1. Upon completion of construction and building turnover, furnish two(2) complete maintenance manuals to the owner. Manuals to include the following items:
      a. Approved hardware schedule, catalog cuts and keying schedule.
      b. Hardware installation and adjustment instructions.
      c. Manufacturer's written warranty information.
      d. Wiring diagrams, elevation drawings and operational descriptions for all electronic openings.
      e. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
      f. Name, address, and phone number of local representative for each manufacturer.
      g. Parts list for each product.
      h. One complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

H. All items, except as noted below, shall be warranted in writing by the manufacturer against failure due to defective materials and workmanship for a minimum period of one (1) year commencing on the date of final completion and acceptance. In the event of product failure, promptly repair or replace item with no additional cost to the owner.
   1. Mortise locksets: Five (5) years
   2. Exit Devices: Five (5) years
   3. Door closers: Ten (10) years

I. Replace shortages and incorrect items with correct material at no additional cost to Owner.

J. At completion of project, qualified factory representative shall inspect closer installations. After this inspection, letter shall be sent to Engineer reporting on conditions, verifying that closers have been properly installed and adjusted.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Refer to Sections 1.5.I, 1.5.J, and 1.5.K above.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Only manufacturers as listed below shall be accepted. Obtain each type of finish hardware (hinges, latch and locksets, exit devices, door closers, etc.) from a single manufacturer.

2.2 MATERIALS

A. Screws and Fasteners

1. All required screws shall be supplied as necessary for securing finish hardware in the appropriate manner. Thru-bolts shall be supplied for exit devices and door closers where required by code and the appropriate blocking or reinforcing is not present in the door to preclude their use.

2.3 FINISHES

A. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 or traditional U.S. finishes shown by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Design-Builder shall ensure that the building is secured and free from weather elements prior to installing interior door hardware. Examine hardware before installation to ensure it is free of defects.

B. Ensure that walls and frames are square and plumb before hardware installation.

C. The installer shall notify the Engineer, in writing, of all unacceptable condition that could affect the proper operation of the finish hardware.

3.2 INSTALLATION

A. Mount hardware units at heights indicated in the following applicable publications, except as specifically indicated or required to comply with the governing regulations.
   1. “Recommended Locations for Builders Hardware for Standard Steel Doors and Frames” by the Door and Hardware Institute (DHI.)
   2. NWWDA Industry Standard I.S.1.7, “Hardware Locations for Wood Flush Doors.”

B. All hardware shall be applied and installed in accordance with best trade practice by an experienced hardware installer. Care shall be exercised not to mar or damage adjacent work.

C. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

D. Installation of hardware shall comply with NFPA 80 and NFPA 101 requirements.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment to substrate as necessary for proper installation and operation. Shim doors as required to maintain proper operating clearance between door and frame.

F. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

G. Install jamb-applied gaskets before closers, overhead stops, rim strikes, etc. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.

H. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant, forming tight seal between threshold and surface to which set. Unless otherwise specified or detailed, install thresholds with the bevel in vertical alignment with the outside door face. Notch and closely fit thresholds to frame profile. Securely and permanently anchor thresholds, using countersunk non-ferrous screws to match color of thresholds (stainless steel screws at aluminum thresholds).

I. Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

J. Locate floor stops not more than 4 inches from the wall.

K. Install door closers on corridor side of lobby doors and room side of corridor doors.

L. Use only fasteners supplied by or approved by the manufacturer for each respective item of hardware.

3.3 FIELD QUALITY CONTROL

A. The Design-Builder shall comply with AIA A201 1997 section 3.3.1 which reads as follows: “The Design Builder shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters.”

B. Prior to the installation of hardware, manufacturer's representatives for locksets, closers, and exit devices shall arrange and hold a jobsite meeting to instruct the installing Design-Builder's personnel on the proper installation of their respective products. A letter of compliance, indicating when this meeting is held and who is in attendance, shall be sent to the Engineer and Owner.

C. The hardware supplier shall do a final inspection prior to building completion to ensure that all hardware was correctly installed and is in proper working order.

D. The manufacturer’s representative shall do a final inspection prior to building completion to ensure that all hardware was correctly installed and is in proper working order.

E. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

3.4 ADJUSTING, CLEANING, AND DEMONSTRATING

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.

B. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final

check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore to proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

C. Instruct owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes and usage of any electronic devices.

D. At final completion, and when H.V.A.C. equipment is in operation, installer shall make final adjustments to and verify proper operation of all door closers and other items of hardware. Lubricate moving parts with type lubrication.

E. Adjust door closers to meet opening force requirements of Uniform Federal Accessibility Standards.

F. Clean adjacent surfaces soiled by hardware installation.

G. Demonstrate electrical, electronic and pneumatic hardware systems, including adjustment and maintenance procedures.

H. Deliver to the owner 1 complete set of installation and adjustment instructions, and tools as furnished with the hardware.

3.5 PROTECTION

A. Design-Builder shall protect all hardware, as it is stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase from paint, cleaning agents, weathering, carts/barrows, etc. Install any and all hardware at the latest possible time frame. Remove covering materials and clean hardware just prior to substantial completion.

B. Clean adjacent wall, frame and door surfaces soiled from installation/reinstallation process.

END OF SECTION

(This Page Left Intentionally Blank)

SECTION 08 80 00 – GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: The Work of this Section shall include, but not be limited to, glass and glazing for the following:
   1. Totem beacon.
   2. Glass curtain wall.
   3. Elevator enclosure for existing elevator.
   4. Elevator enclosure for proposed elevator.
   5. Elevator cab.
   6. Interior glass balustrade.
   7. Passenger shelter

1.2 SYSTEM DESCRIPTION

A. Provide glass and glazing that will withstand normal thermal movement, wind loading and impact loading (where applicable), without failure of glass, failure of gaskets to remain watertight and airtight, nor deterioration of glass and glazing materials.
   1. Normal thermal movement is defined as that resulting from an ambient temperature range of 120 degrees F and from a temperature range within glass and glass framing members of 180 degrees F.
   2. Deterioration of insulating glass is defined as failure of hermetic seal due to other causes than breakage which results in intrusion of dirt or moisture, internal condensation or fogging, resulting from seal failure, and any other visual evidence.
   3. Deterioration of coated glass is defined as the development of manufacturing defects including peeling, cracking or other indications of deterioration in coating due to normal use.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each glazing material and fabricated glass product required, including installation and maintenance instructions. Indicate glass thickness to be used.
   1. Submit glass manufacturer's wind pressure analyses and thermal stress analysis; glass manufacturer's review of glazing systems Shop Drawings stating that glazing details are suitable.
   2. Submit glass types and identification of glazing materials. Submit insulating glass unit certification.

B. Samples: Submit 12-inch square samples of each type of glass indicated, and 12-inch long samples of each color of gasket.

C. Certificates: Submit certificates from respective manufacturers attesting that glass and glazing materials furnished for Project comply with requirements of agencies having jurisdiction.

1. Separate certification will not be required for glazing materials bearing manufacturer's permanent labels that represent a quality control program of a certification agency or independent testing laboratory acceptable to authorities having jurisdiction.

D. Compatibility and Adhesion Test Report: Submit statement from sealant manufacturer that glass and glazing materials have been tested for compatibility and adhesion with glazing sealants and interpreting test results, with recommendations for primers and substrate preparation.

1.4 QUALITY ASSURANCE

A. Glazing Standards: Comply with recommendations of Flat Glass Marketing Association (FGMA) "Glazing Manual" except where more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined.

B. Safety Glazing Standard: Provide required safety glass which comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for category II materials.

C. Single Source for Glass: To ensure consistent quality of appearance and performance, provide materials produced by a single manufacturer or fabricator for each kind and condition of glass.

D. Insulating Glass Certification Program: Provide insulating glass units permanently marked with appropriate certification label of the Insulating Glass Certification Council (IGCC).

E. Glazing for Fire-Rated Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect glass and glazing materials during delivery, storage and handling to comply with manufacturer's directions and to prevent damage to glass and glazing materials from moisture, temperature changes, and direct exposure to sun, and from other causes.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with glazing when air and substrate temperatures are outside the limits permitted by glazing material manufacturer or when joint substrates are wet or dirty.

B. During concrete work, provide whatever protection is required to protect for glass and sealant material that has been installed. Replace any materials damaged, as determined by the Commissioner.

1.7 WARRANTY

A. General: Submit warranties to repair or replace defective glass and glazing materials or workmanship for a period of not less than 5 years after date of Substantial Completion, or longer where specified.

B. Insulating Glass: Submit a warranty to replace defective insulating glass for a period of 10 years after date of Substantial Completion. Defects include failure of insulating glass edge seal.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

B. Strength: Where float glass is indicated, provide annealed float glass, HS heat- treated float glass, or Kind FT heat-treated float glass**.** Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Primary Glass Standard: Provide primary glass which complies with ASTM C 1036 requirements for type, class and quality.

D. Heat-Treated Glass Standard: Provide heat-treated glass which complies with ASTM C 1048 requirements. Surface compression of heat strengthened glass shall be in the range of 3500 to 6500 psi.
   1. Provide heat treated glass where glass would be vulnerable to thermal breakage and where required for safety of persons.
   2. Provide fully tempered or heat strengthened glass where indicated or required by authorities having jurisdiction.
      a. Tempered glass shall comply with ANSI Z97.1.

E. Sizes: Fabricate glass to sizes required, with edge clearances and tolerances complying with recommendations of glass manufacturer. Provide thicknesses to comply with Building Code, and as recommended by glass manufacturer, unless greater thickness is indicated.

2.2 PRIMARY GLASS PRODUCTS

A. Clear Float Glass: Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select),thickness to meet code requirements.

2.3 HEAT-TREATED GLASS PRODUCTS

A. Uncoated Clear Heat-Treated Float Glass: Condition A, Type 1, Class 1, Quality q3, (glazing select), fully tempered except as noted.

B. Heat Strengthened Glass: Provide heat strengthened glass where required by design wind pressures or anticipated thermal stress, where fully tempered glass is not required.

C. Tempered Glass: Provide fully tempered glass only where safety glass is mandatory or where design pressures are beyond the capacity of heat strengthened glass. Tempered glass shall be free from inclusions.

1. Provide tempered glass at entrance doors, vestibule doors and glazed panels, at steel door vision panels.

2.4 COATED GLASS PRODUCTS

A. Low Emissivity Glass: Provide pyrolitically coated clear Low-E glass where indicated, as manufactured by one of the following or equal as approved by the Engineer
   1. Interpane Coatings, Inc.
   2. Libbey Owens Ford Co.
   3. PPG Industries, Inc.
   4. Saint-Gobain.
   5. Spectrum Glass Products, Inc.
   6. SPI Glass Corp.

2.5 LAMINATED GLASS PRODUCTS

A. General: Refer to primary and heat-treated glass requirements for properties of uncoated glasses making up laminated glass.

B. Laminating Process: Fabricate laminated glass using laminator's standard process to produce glass free from defects.

C. Laminated Tempered Glass: ASTM C 1036, ASTM C 1172. Two sheets of double- strength clear sheet glass; Type I, Class 1, quality q3; permanently laminated together with minimum 0.030 inch thick sheet of plasticized polyvinyl butyral, which has been produced specifically for laminating glass.
   1. Kind: LT (laminated tempered), unless otherwise indicated.
   2. Clear Glass: Class 1 (clear).
   3. Thickness: 3/ 8 inch, unless otherwise indicated; but not less than required by structural loads.

D. Interlayer: Interlayer material as indicated below, in translucent white, and of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.
   1. Interlayer Material: Polyvinyl butyral sheets.
   2. Products: Subject to compliance with requirements, provide one of the following or equal as approved by the Engineer
      a. Polyvinyl Butyral Interlayer:
         1) Saflex, Monsanto Co.
         2) Butacite, E. I. du Pont de Nemours & Co., Inc.

2.6 SEALED INSULATING GLASS UNITS

A. General: Provide insulating glass units complying with ASTM E 774 and with other requirements specified below, unless otherwise indicated. Provide insulating glass of 1 inch thickness unless otherwise shown.
   1. Insulating glass shall have double edge seals of polyisobutylene and an elastomeric sealant that are continuously bonded to both plates of glass, and compatible with glazing materials.

2.7 PATTERNED GLASS

A. Patterned Glass: ASTM C 1036, Type II (patterned glass, flat), Class 1 (clear), Form 3 (patterned), Quality q8 (glazing), Finish f1 (patterned one side); of pattern indicated in the Glass Schedule at the end of Part 3.

2.8 GLAZING GASKETS

A. Dense Gaskets: Extruded one piece gaskets of neoprene, complying with ASTM C 864, of profile required for a watertight seal, with a Shore A hardness of 75 + 5 for hollow profiles and 60 + 5 for solid profiles.

B. Cellular Gaskets: Preformed cellular neoprene gaskets of profile required for a watertight seal; complying with ASTM C 509, with a Shore A hardness of 40 + 5, to provide 20 to 35% compression.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. Compatibility: Provide materials with proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers and Sealers: Type recommended by gasket manufacturer.

C. Setting Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealants, 80 to 90 Shore A durometer hardness, 4 inches minimum length by width to suit glass thickness.

D. Shims: Shims used with setting blocks shall be of the same material, hardness, length and width as the setting blocks.

E. Edge Blocks: Same material as setting blocks, of 50-60 Shore A durometer, of size to limit lateral movement of glass.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify compliance with applicable tolerances; for functioning of weep system; for face and edge clearances; and for effective sealing of joinery. Report conditions detrimental to glazing work. Perform glazing work after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels immediately before glazing. Remove coatings which are not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with recommendations of glass manufacturers, of manufacturers of gaskets and other glazing materials, except where more stringent requirements are indicated by referenced glazing standards.

B. Glazing channels are intended to provide for necessary bite on glass, minimum edge and face clearances, with reasonable tolerances.

C. Protect glass from damage. Remove and dispose of glass units with damage or imperfections of kind that impairs performance or appearance.

3.4 GLAZING

A. Install glass as detailed. Use setting blocks where necessary to prevent movement.

B. Provide edge blocking to comply with referenced glazing standard. Install edge blocks securely, between the midheight and top of glass.

C. Set units of glass in each series with uniformity of appearance.

D. Install sponge and dense gaskets to protrude slightly out of channel, to eliminate dirt and moisture pockets. Provide adequate anchorage to ensure that gaskets will not "walk" out.

3.5 PROTECTION AND CLEANING

A. Promptly protect installed glass from breakage with crossed streamers attached to framing and held away from glass. Do not apply markers on glass. Remove nonpermanent labels and clean glass.

B. Protect glass from contact with contaminating substances. If contaminating substances do come into contact with glass, remove immediately as recommended by glass manufacturer.

C. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.

D. Wash glass on both faces not more than 4 days prior to date scheduled for inspections to establish date of Substantial Completion in each area of Project. Wash glass as recommended by glass manufacturer.

3.6 GLAZING SCHEDULE

A. GLS-01: Clear, vandal resistant acrylic with ribbed sides in a single block.

B. GL- 02: Insulated Glass for Station Entrance, Platform Waiting Room & Platform Stair Enclosure
   1. Outboard lite: heat-strengthened, laminated, low iron clear glass
   2. Inboard lite: : heat strengthened laminated, low iron clear glass
   3. 1/ 2 inch argon filled air space.
   4. Minimal silicone joint between panels
   5. Frameless, restrained by top and bottom clamp only
   6. Screen-printed ceramic manifestations.
   7. Glazing part of tested Storefront Assembly meeting U-value = Engineered by design builder and approved by Engineer

C. GL- 03: Enclosure 8for Existing Elevator - Shall perform as fire division.
   1. One (1) heat-strengthened, laminated, low iron clear glass thickness engineered by design builder and approved by Engineer
   2. Translucent interlayer
   3. Fire-rated.

D. GL- 04: Elevator Hoistway Enclosure (Proposed)
   1. One (1) heat-strengthened, laminated, low iron clear glass thickness engineered by design builder and approved by Engineer
   2. Translucent interlayer
   3. Fire-rated.

E. GL- 05: Elevator Cab Doors
   1. One (1): heat-strengthened, laminated, low iron clear glass thickness engineered by design builder and approved by Engineer

F. GL- 06: Interior Balustrade
   1. One (1) heat-strengthened, laminated, low iron clear glass thickness engineered by design builder and approved by Engineer

G. GL- 07: Glass Enclosure at Passenger Shelter
   1. One (1 heat-strengthened, laminated, low iron clear glass thickness engineered by design builder and approved by Engineer
   2. Screen-printed ceramic manifestations.

H. GL- 08: Industrial Design Panels
   1. One (1) heat-strengthened, laminated, low iron clear glass thickness engineered by design builder and approved by Engineer
   2. Ceramic frit in areas shown in the contract drawings
   3. Hinged as noted on Contract Drawings

I. GL- 09: Glass Rain Screen Wall
   1. One (1) heat-strengthened, laminated glass
   2. Frit at back face
   3. thickness engineered by design builder and approved by Engineer

J. GL- 10: Platform Glass Rainscreen:
   1. One (1) heat-strengthened, laminated, glass on aluminum clips on CMU wall.
   2. Frit at back face
   3. Thickness engineered by design builder and approved by Engineer

END OF SECTION

DIVISION 9 FINISHES

SECTION 09 90 10 – PAINTING AND FINISHING

PART 1 - GENERAL REQUIREMENTS

1.1 SCOPE OF WORK

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the painting and finishing as shown on the Contract Drawings and as specified herein, including, but not limited to, the following:
   1. Prime painting unprimed surfaces to be painted under this Section.
   2. Painting all items furnished with a prime coat of paint, including touching up of or repairing of abraded, damaged or rusted prime coats applied by others.
   3. Painting all ferrous metal (except stainless steel) exposed to view.
   4. Painting all galvanized ferrous metals exposed or partially exposed to view.
   5. Painting interior concrete block exposed to view.
   6. Painting plaster surfaces.
   7. Painting pipes, pipe coverings, conduit, ducts, insulation, hangers, supports and other mechanical and electrical items and equipment exposed to view.
   8. Painting surfaces above, behind or below grilles, gratings, diffusers, louvers, lighting fixtures, and the like, which are exposed to view through these items.
   9. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
   10. Painting of any surface not specifically mentioned to be painted herein or on drawings, but for which painting is obviously necessary to complete the job, or work which comes within the intent of these specifications, shall be included as though specified.

B. The scope of work specified in this section shall include all stations. but not be limited to the following locations:
   1. Pedestrian Bridge to elevator.
   2. Elevator tower.
   3. ADA pathway to Station center.
   4. Metal fence.

1.2 RELATED SECTIONS

A. Shop priming is required on some, but not all of the items scheduled to be field painted. Refer to other Sections of work for complete description.

B. All paint shall comply with the VOC requirements of Section 1WW Table 2.1 “VOC Content Requirements.”

C. Shop coat on machinery and equipment: Refer to the Sections under which various items of manufactured equipment with factory applied shop prime coats are furnished, including, but not necessarily limited to, the following Sections. All items of equipment furnished with prime coat finish shall be finish painted under this Section.

1.3 REVIEW ITEMS

1. Section 4 – Masonry
2. Section 5 – Metals
2. Section 23 – Heating, ventilation and air conditioning.
3. Section 22 – Plumbing.
4. Section 26 – Electrical
5. Section 27 – Communications

1.4 MATERIALS AND EQUIPMENT NOT TO BE PAINTED

A. Items of equipment furnished with complete factory finish, except for items specified to be given a finish coat under this Section.

B. Non-ferrous metals, except for items specified and/or indicated to be painted.

C. Finished hardware, excepting hardware that is factory primed.

D. Surfaces not to be painted shall be left completely free of droppings and accidentally applied materials resulting from the work of this Section.

1.5 QUALITY ASSURANCE

A. Job Mock-Up

1. In addition to the samples specified herein to be submitted for approval, apply in the field, at their final location, each type and color of approved paint materials, applied 10 feet wide, floor to ceiling of wall surfaces, before proceeding with the remainder of the work, for approval by the Engineer. Paint mock-ups to include door and frame assembly.
2. These applications when approved will establish the quality and workmanship for the work of this Section.
3. Repaint individual areas which are not approved, as determined by the Engineer, until approval is received. Assume at least two paint mock-ups of each color and gloss for approval.

B. Qualification of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces.

C. Paint Coordination: Provide finish coats which are compatible with the prime paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Upon request from other subcontractors, furnish information on the characteristics of the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the Engineer in writing of any anticipated problems using the coating systems as specified with substrates primed by others.

D. All paints must conform to the Volatile Organic Compounds (VOC) standards of prevailing Federal, State and local codes and ordinances including but not limited to the New York City Air Pollution Control Code.

E. Inspection

1. All paints, solvents, varnish and architectural coatings shall be subject to inspection at the place of manufacture and subject to such tests as may be ordered by the Engineer. The Engineer may be at the paint manufacturer's plant to witness the entire manufacturing process including filling and closing of the cans for each batch of paint manufactured.

Samples of the paint may be taken by the Engineer or forwarded to the Engineer as directed. The Engineer shall have access, at all times, to all places to inspect the methods of manufacture and shall have liberty to inspect the daily laboratory records and analysis of all such paints, solvents, varnishes or architectural coatings as are subject to his inspection. Such analyses as are required will be made by the Engineer.

2. The Contractor shall furnish the Engineer with certification, on the manufacturer's letterhead, stating the name of the Contractor or Subcontractor, the Contract number, and the point of delivery, in addition to stating that the paint meets the VOC requirements of the New York City Air Pollution Control Code as stated in Paragraph 1.3, Air Pollution Code, the New York State Environment Conservation Law - Part 205, and the requirements of the Contract Documents.

F. Before purchasing any paint or varnish the Contractor shall obtain approval of the manufacturer who is to furnish such paint and/or varnish in the manner set forth in Article 1.08, Subcontracts.

G. A manufacturer of paint and/or varnish in order to be acceptable shall have manufactured good grades of paint and/or varnish for at least 5 years. The manufacturer's plant shall be within 100 miles of New York City, unless approved by the Engineer, in order that the cost of inspection shall be a minimum.

1.6 SUBMITTALS

A. Materials List

1. Before any paint materials are delivered to the job site, submit to the Engineer a complete list of all materials proposed to be furnished and installed under this portion of the work, including Materials Safety Data Sheets (MSDS).

B. Samples

1. Accompanying the materials list, submit to the Engineer copies of the full range of colors available in each of the proposed products.
2. Upon direction of the Engineer, prepare and deliver to the Engineer two (2) identical sets of Samples of each of the selected colors and glosses painted onto 8-1/2" x 11" x 1/4" thick material; whenever possible, the material for Samples shall be the same material as that on which the coating will be applied in the work.

C. Manufacturer's Recommendations: In each case where material proposed is not the material specified or specifically described as an acceptable alternate in this Section of these specifications, submit for the Engineer's review the current recommended method of application published by the manufacturer of the proposed material.

D. Manufacturer’s certification that the paints are compatible with the surfaces upon which they will be applied.

1.7 PRODUCT HANDLING

A. Deliver all paint materials to the job site in their original unopened containers with all labels intact and legible at time of use.

B. Protection

1. Store only the approved materials at the job site, and store only in a suitable and designated

area restricted to the storage of paint materials and related equipment.

2. Use all means necessary to ensure the safe storage and use of paint materials and the prompt and safe disposal of waste.
3. Use all means necessary to protect paint materials before, during and after application and to protect the installed work and materials of all other trades.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.8 EXTRA STOCK

A. Upon completion of this portion of the Work, deliver to the Owner an extra stock of paint equaling approximately ten (10) percent of each color and gloss used and each coating material used, with all such extra stock tightly sealed in clearly labeled containers.

1.9 JOB CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50 degrees F. and 90 degrees F., unless otherwise permitted by the paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 45 degrees F. and 95 degrees F. unless otherwise permitted by the paint manufacturer's printed instructions.

C. Do not apply paint in snow, rain, fog or mist; or when the relative humidity exceeds eighty-five (85) percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.

D. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

1.10 MANUFACTURER’S WARRANTY

A. Provide manufacturer’s standard written warranty for minimum one year beginning from the date of Substantial Completion for the products of this Specification Section detailing the provisions of the warranty coverage.

PART 2 - PRODUCTS AND MATERIALS

2.1 PAINT MANUFACTURERS

A. Except as otherwise noted, provide the painting products listed for all required painting made by one of the manufacturers listed in the paint schedule (Paragraph 2.4). These companies are Benjamin Moore, MAB Paints, ICI Dulux and Sherwin Williams (S-W) or approved equal. Comply with number of coats and required minimum mil thicknesses as specified herein.

2.2 MATERIALS

A. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners

approved by the paint manufacturer, and use only to recommended limits.

B. Colors and Glosses: All colors and glosses shall be as indicated in the Contract Documents and approved by the Engineer Certain colors will require paint manufacturer to prepare special factory mixes to match colors indicated in the Contract Documents.

C. Coloring Pigment: Products of or furnished by the manufacturer of the paint or enamel approved for the work.

D. Linseed Oil: Raw or boiled, as required, of approved manufacture, per ASTM D 234 and D 260, respectively.

E. Turpentine: Pure distilled gum spirits of turpentine, per ASTM D 13.

F. Shellac: Pure gum shellac (white or orange) cut in pure denatured alcohol using not less than four (4) lbs. of gum per gallon of alcohol.

G. Driers, Putty, Spackling Compound, Patching Plaster, etc.: Best quality, of approved manufacture.

H. Heat Resistant Paint: Where required, use heat resistant paint when applying paint to heating lines and equipment.

2.3 GENERAL STANDARDS

A. The various surfaces shall be painted or finished as specified below in Paragraph 2.4. However, the Engineer reserves the right to change the finishes within the range of flat, semi-gloss or gloss, without additional cost to the Authority.

B. All paints, varnishes, enamels, lacquers, stains and similar materials must be delivered in the original containers with the seals unbroken and label intact and with the manufacturer's instructions printed thereon.

C. All painting materials shall bear identifying labels on the containers with the manufacturer's instructions printed thereon.

D. Paint shall not be badly settled, caked or thickened in the container, shall be readily dispersed with a paddle to a smooth consistency and shall have excellent application properties.

E. Paint shall arrive on the job color-mixed except for tinting of under-coats and possible thinning.

F. All thinning and tinting materials shall be as recommended by the manufacturer for the particular material thinned or tinted.

G. It shall be the responsibility of the Contractor to see that all mixed colors match the color selections shown in the Contract Documents and approved by the Engineer prior to application of the coating.

2.4 SCHEDULE OF FINISHES

A. Exterior Galvanized Ferrous Metal
   1. Primer:
      a. Moore IMC Acrylic Metal Primer (M04).
      b. MAB Rust-O-Lastic HydroPrime II (073-189).

c. Sherwin-Williams Galvite HS Primer, B50WZ30.

2. First Coat:
   a. Moore Urethane Alkyd Gloss Enamel (Z22).
   b. MAB Rust-O-Lastic Silicone Alkyd (069 line).
   c. Sherwin-Williams Industrial Enamel HS, B54Z-400.

3. Second Coat:
   a. Same as recommended first coat.
4. Or approved equal system from sole manufacturer and with written confirmation from the manufacturer of compatibility of each coat including the substrate.

B. Exterior or semi-exterior (unconditioned area) Ferrous Structural Metal
   1. Primer
      a. As indicated in 5A Structural Steel

C. Interior Ferrous and Galvanized Metal
   1. Satin Finish/Latex
      a. Primer:
         1) 1 coat Moore Acryliclkyd Metal Primer (P04Z06).
         2) 1 coat Rust-O-Lastic Anti-CorrosiveAcrylic Hydro Primer (073-18932) or touch-up shop primer.
         3) 1 coat Sherwin-Williams DTM Acrylic Primer/Finish B66W1.
      b. First Coat:
         1) 1 coat Water Borne Satin Impervo (314).
         2) 1 coat Rich Lux Low Lustre Latex Enamel (028 line).
         3) 1 coat S-W Super Paint Interior Satin, A87.
      c. Second Coat:
         1) 1 coat Water borne Satin Impervo (314).
         2) 1 coat Rich Lux Low Lustre Latex Enamel (028 line).
         3) 1 coat S-W Super Paint Interior Satin, A87.
            a) Total DFT not less than: 3.9 mils
      d. Or approved equal system from sole manufacturer and with written confirmation from the manufacturer of compatibility of each coat including the substrate.
   2. Semi-Gloss Finish/Latex
      a. Primer:
         1) 1 coat Moore Acyliclkyd Metal Primer (P04Z06).
         2) 1 coat Rust-O-Lastic Anti-CorrosiveAcrylic Hydro Primer (073-18932) or touch-up shop primer.
         3) 1 coat Sherwin-Williams, DTM Acrylic Primer/Finish B66W1.
      b. First Coat:
         1) 1 coat Regal Aquaglo.
         2) 1 coat Rich Lux Semi-Gloss (023 line).
         3) 1 coat S-W Super Paint Semi-Gloss, A88.
      c. Second Coat:
         1) 1 coat Regal Aquaglo.
         2) 1 coat Rich Lux Semi-Gloss (023 line).
         3) 1 coat S-W Super Paint Semi-Gloss, A88.
            a) Total DFT not less than: 4.0 mils.
      d. Or approved equal system from sole manufacturer and with written confirmation

from the manufacturer of compatibility of each coat including the substrate.

D. Interior Concrete Block

1. Provide only vapor permeable primers and finishes on any back-up block to exterior wall systems.
2. Flat Finish/Vinyl Acrylic Latex over filler
   a. Block Filler:
      1) 1 coat Moorcraft Super Craft Latex Block Filler (285).
      2) 1 coat MAB Block Kote #1000 (064-145).
      3) 1 coat S-W Preprite Block Filler, B25W25.
   b. First Coat:
      1) 1 coat Regal Wall SatinAura Matte (522215).
      2) 1 coat Rich Lux WalshieldEnviro-Pure (0401 line).
      3) 1 coat S-W Super Paint Latex Flat, A86.
   c. Second Coat:
      1) 1 coat Regal Wall SatinAura Matte (522215).
      2) 1 coat Rich Lux WalshieldEnviro-Pure (0401 line).
      3) 1 coat S-W Super Paint Latex Flat, A86.
         a) Total DFT not less than: 10.7 mils.
   d. Or approved equal system from sole manufacturer and with written confirmation from the manufacturer of compatibility of each coat including the substrate.
3. Eggshell Finish/Vinyl Acrylic Latex over filler
   a. Block Filler:
      1) 1 coat Moorcraft Super Craft Latex Block Filler (285).
      2) 1 coat MAB Block Kote #1000 (064-145).
      3) 1 coat S-W Preprite Block Filler, B25W25.
   b. First Coat:
      1) 1 coat Regal AquaVelvet Eggshell (319).
      2) 1 coat Rich Lux Latex Eggshell Enamel (029 line).
      3) 1 coat S-W Super Paint Latex Satin, A87.
   c. Second Coat:
      1) 1 coat Regal AquaVelvet Eggshell (319).
      2) 1 coat Rich Lux Latex Eggshell Enamel (029 line).
      3) 1 coat S-W Super Paint Latex Satin, A87.
         a) Total DFT not less than: 10.9 mils.
   d. Or approved equal system from sole manufacturer and with written confirmation from the manufacturer of compatibility of each coat including the substrate .
4. Semi-Gloss Finish/Vinyl Acrylic Latex over filler
   a. Block Filler:
      1) 1 coat Moorcraft Super Craft Latex Block Filler (285).
      2) 1 coat MAB Block Kote #1000 (064-145).
      3) 1 coat S-W Preprite Block Filler, B25W25.
   b. First Coat:
      1) 1 coat Regal Semi-GlossAquaGlo (333).
      2) 1 coat Rich Lux Semi-Gloss Latex Enamel (023 line).
      3) 1 coat S-W Super Paint Latex Semi-Gloss, A88.
   c. Second Coat:

1) 1 coat Regal Semi-GlossAquaGlo (333).
2) 1 coat Rich Lux Semi-Gloss Latex Enamel (023 line).

3) 1 coat S-W Super Paint Latex Semi-Gloss, A88.
a) Total DFT not less than: 10.7 mils.

d. Or approved equal system from sole manufacturer and with written confirmation from the manufacturer of compatibility of each coat including the substrate.

E. Interior Drywall and Plaster

1. Flat Finish/Vinyl Acrylic Latex
   a. Primer:
      1) 1 coat Moore Regal Fresh Start SuperiorFirstCoat (04216).
      2) 1 coat MAB Rich Lux Prime FastEnviro-Pure Primer (037-19538).
      3) 1 coat S-W Preprite 200Harmony Interior Latex Primer (B11), B28W200.
   b. First Coat:
      1) 1 coat Regal Wall SatinAura Matte (522215).
      2) 1 coat Rich Lux WalshieldEnviro-Pure Flat (0401 line).
      3) 1 coat S-W Super PaintHarmony Interior Latex Flat (B5), A86.
   c. Second Coat:
      1) 1 coat Regal Wall SatinAura Matte (522215).
      2) 1 coat Rich Lux WalshieldEnviro-Pure Flat (041 line).
      3) 1 coat S-W Super Paint Harmony Interior Latex Flat (B5), A86.
         a) Total DFT not less than: 3.6 mils.
   d. Or approved equal system from sole manufacturer and with written confirmation from the manufacturer of compatibility of each coat including the substrate.
2. Eggshell Finish/Vinyl Acrylic Latex (PT-01, PT04)
   a. Primer:
      1) 1 coat Regal FirstCoatMoore Fresh Start Superior (04216).
      2) 1 coat MAB Enviro-Pure Primer Rich Lux Prime Fast (037-19538).
      3) 1 coat S-W Preprite 200 Harmony Interior Latex Primer (, B11)28W200.
   b. First Coat:
      1) 1 coat Regal AquaVelvetAura Eggshell (524319).
      2) 1 coat Rich Lux Latex Eggshell EnamelEnviro-Pure Eggshell (04529 line).
      3) 1 coat S-W Super Paint Latex SatinHarmony Interior Latex Eggshell (B9), A87.
   c. Second Coat:
      1) 1 coat Aura Eggshell (524Regal AquaVelvet (319).
      2) 1 coat Enviro-Pure Eggshell (045Rich Lux Latex Eggshell Enamel (029 line).
      3) 1 coat S-W Harmony Interior Latex Eggshell (B9)Super Paint Latex Satin, A87.
         a) Total DFT not less than: 3.8 mils
   d. Or approved equal system from sole manufacturer and with written confirmation from the manufacturer of compatibility of each coat including the substrate.

2.5 EXISTING SURFACES TO BE PAINTED

A. Existing surfaces shall be painted in accordance with schedule given in Article 2.4 herein except that first or prime coat may be eliminated where existing paint is sound. Where existing paint must be removed down to base material, provide first or prime coat as specified.

2.6 PIPING AND MECHANICAL EQUIPMENT EXPOSED OR PARTIALLY EXPOSED TO VIEW

A. Paint all exposed and partially exposed piping, conduits, ductwork and mechanical, plumbing and electrical and communications equipment including all of these elements partially visible through any perforated or open jointed finishes. Use heat resisting paint when applied to heating lines and equipment. The Contractor is cautioned not to paint or otherwise disturb moving parts in the mechanical systems. Mask or otherwise protect all parts as required to prevent damage.

B. Finish color of all exposed or partially exposed equipment required to be painted shall be grey, dark grey or black as approved by the Engineer. Finish color of all partially concealed equipment required to be painted shall be black as approved by the engineer.

C. Exposed Uncovered or partially visible Ductwork, Piping, Hangers and Equipment: Latex Enamel Undercoater and one (1) coat Acrylic Latex Flat.

D. Exposed Covered or partially visible Piping, Duct Work and Equipment: Primer/Sealer and one (1) coat Acrylic Latex Flat.

E. Panel Boards, Grilles and Exposed Surfaces of Electrical Equipment: Latex Enamel Undercoater and two (2) coats Latex Semi-Gloss.

F. Equipment or Apparatus with Factory-Applied Paint: Refinish any damaged surfaces to match original finish. Do not paint over name plates and labels.

G. All surfaces of insulation and all other work to be painted shall be wiped or washed clean before any painting is started.

H. All conduit, boxes, distribution boxes, light and power panels, hangers, clamps, etc., are included where painting is required.

I. All items of Mechanical and Electrical trades which are furnished painted separately shall be carefully coordinated with the work of this Section so as to to be fully coordinated in paint performance, color and compatibility with the other items scheduled to be painted in accordance with this Section.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where painting and finishing are to be applied 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.

3.2 GENERAL WORKMANSHIP REQUIREMENTS

A. Only skilled mechanics shall be employed. Application may be by brush or roller. Spray application only upon acceptance from the Engineer in writing.

B. The Contractor shall furnish the Engineer a schedule showing when he expects to have completed the respective coats of paint for the various areas and surfaces. This schedule shall be kept current as the job progresses.

C. The Contractor shall protect his work at all times, and shall protect all adjacent work and materials by suitable covering or other method during progress of his work. Upon completion of the work, he shall remove all paint and varnish spots from floors, glass and other surfaces. He shall remove from the premises all rubbish and accumulated materials of whatever nature not caused by others and shall leave his part of the work in clean, orderly and acceptable condition.

D. Remove and protect hardware, accessories, device plates, lighting fixtures, and factory finished work, and similar items, or provide ample in place protection. Upon completion of each space, carefully replace all removed items by workmen skilled in the trades involved.

E. Remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.

F. All materials shall be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.

G. Coverage and hide shall be complete. When color, stain, dirt or undercoats show through final coat of paint, the surface shall be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage, at no additional cost to the Authority.

H. All coats shall be dry to manufacturer's recommendations before applying succeeding coats.

I. All suction spots or "hot spots" in plaster after the application of the first coat shall be touched up before applying the second coat.

J. Do not apply paint behind frameless mirrors that use mastic for adhering to wall surface.

3.3 PREPARATION OF SURFACES

A. Existing Surfaces: Clean existing surfaces requiring paint or finishing, remove all loose and flaking paint or finish and sand surface smooth as required to receive new paint or finish. No "telegraphing" of lines, ridges, flakes, etc., through new surfacing is permitted. Where this occurs, Contractor shall be required to sand smooth and re-finish until surface meets with Engineer's approval.

B. General
1. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom clean all spaces before painting is started. All surfaces to be painted or finished shall be perfectly dry, clean and smooth.
2. Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning. Program the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.

C. Metal Surfaces
1. Weld Fluxes: Remove weld fluxes, splatters, and alkali contaminants from metal surfaces in an approved manner and leave surface ready to receive painting.
2. Bare Metal: Thoroughly clean off all foreign matter such as grease, rust, scale and dirt before priming coat is applied. Clean surfaces, where solder flux has been used, with benzene. Clean surfaces by flushing with mineral spirits. For aluminum surfaces, wipe

down with an oil free solvent prior to application of any pre-treatment.

3. Shop Primed Metal: Clean off foreign matter as specified for "Bare Metal." Prime bare, rusted, abraded and marred surfaces with approved primer after proper cleaning of surfaces. Sandpaper all rough surfaces smooth.
4. Galvanized Metal: Prepare surface as per the requirements of ASTM D 6386.
5. Metal Filler: Fill dents, cracks, hollow places, open joints and other irregularities in metal work to be painted with an approved metal filler suitable for the purpose and meeting the requirements of the related Section of work; after setting, sand to a smooth, hard finish, flush with adjoining surface.

D. Plaster Surfaces: Scrape off all plaster nibs or other projections and sand smooth or finish to match adjoining surface texture. Cut out all scratches, cracks, holes, depressions and similar voids and fill with non-shrinking grout, spackles, patching plaster or other approved patching material; allow to dry, refill if necessary, then sand smooth (or refinish) to provide a flush, smooth surface of the same texture as the adjacent plaster surface.

1. Allow at least 28 days, from installation of final plaster coat, before starting work.

E. Gypsum Drywall Surfaces: Scrape off all projections and splatters, spackles all holes or depressions, including taped and spackled joints, sand smooth. Conform to standards established in 9R Gypsum Board Assemblies.

F. Wood Surfaces: Sand to remove all roughness, loose edges, slivers, or splinters and then brush to remove dust. Wash off grease or dirt with an approved cleaner. Fill all cracks, splits, nail holes, screw holes, and surface defects with putty after the priming coat has been applied. Putty shall be brought up flush with the surface and sanded smooth and touched-up with primer when dry.

G. Block Masonry Surfaces: Thoroughly clean off all grit, grease, dirt mortar drippings or splatters, and other foreign matter. Remove nibs or projections from masonry surfaces. Fill cracks, holes or voids, not filled under the "Masonry" Section, with Portland cement grout, and bag surface so that it has approximately the same texture as the adjacent masonry surface.

H. Testing for Moisture Content: Contractor shall test all plaster, masonry, and drywall surfaces for moisture content using a reliable electronic moisture meter. Contractor shall also test latex type fillers for moisture content before application of top coats of paint. Do not apply any paint or sealer to any surface or to latex type filler where the moisture content exceeds seven (7) percent as measured by the electronic moisture meter.

I. Touch-Up: Prime paint all patched portions in addition to all other specified coats.

3.4 MATERIALS PREPARATION

A. Mix and prepare painting materials in strict accordance with the manufacturer's directions.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.

C. Stir all materials before application to produce a mixture of uniform density, and as required during the application of the materials. Do not stir any film which may form on the surface into the material. Remove the film and, if necessary, strain the material before using.

D. Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are to be applied. Tint undercoats to match the color of the finish coat, but

provide sufficient difference in shade of undercoats to distinguish each separate coat.

3.5 APPLICATION

A. General

1. Apply paint by brush or roller in accordance with the manufacturer's directions. Use brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high pile sheep's wool as recommended by the paint manufacturer for material and texture required.
2. The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried. Sand between each enamel or varnish coat application with fine sandpaper, or rub surfaces with pumice stone where required to produce an even, smooth surface in accordance with the coating manufacturer's directions.
3. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Give special attention to insure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent to that of flat surfaces.
4. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.
    a. "Exposed surfaces" is defined as those areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, etc., are in place in areas scheduled to be painted.
5. Paint interior surfaces of ducts and plena, where visible through registers, louvers or grilles, with a flat, non-specular black paint, before final installation of equipment.
6. Paint all metal and concrete surfaces between inside face of dome and back of cable net above Level 4 with flat, non-specular black paint, powder coated where indicated.

7. Paint the back sides of access panels, removable or hinged covers to match the exposed surfaces.
8. Finish doors on tops, bottoms, and side edges the same as the faces, unless otherwise indicated.
9. Enamel finish applied to wood or metal shall be sanded with fine sandpaper and then cleaned between coats to produce an even surface.
10. Paste wood filler applied on open grained wood after beginning to flatten, shall be wiped across the grain of the wood, then with a circular motion, to secure a smooth, filled, clean surface with filler remaining in open grain only. After overnight dry, sand surface with the grain until smooth before applying specified coat.

B. Scheduling Painting

1. Apply the first coat material to surfaces that have been cleaned, pre-treated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
2. Allow sufficient time between successive coatings to permit proper drying. Do not re-coat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Prime Coats: Re-coat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

D. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage.

E. "Touching-Up" of Factory Finishes: Unless otherwise specified or shown, materials with a factory finish shall not be painted at the project site. To "touch-up," the Contractor shall use the factory finished material manufacturer's recommended paint materials to repair abraded, chipped, or otherwise defective surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by the painting and finishing work. Leave all such work undamaged. Correct any damages by cleaning, repairing or replacing, and repainting, as acceptable to the Engineer.

B. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

3.7 CLEAN UP

A. During the progress of the work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.

END OF SECTION

SECTION 09 91 14 - PREPARATION OF SURFACES

PART 1 - GENERAL

A. Scope

1. The Contractor shall prepare surfaces to be coated as outlined in the Steel Structures Painting Council's (SSPC) surface preparation specifications.
2. The Contractor shall furnish all manpower, equipment and services necessary and incidental to protect the environment by means of containment, collection and removal of old paint chips, corrosion residues, spent abrasives and newly applied paint hereafter referred to as waste material that results from blasting and other cleaning and painting operations performed in the field.

B. Products

1. All materials and equipment used for the performance of the Work must be submitted to and approved by the Resident Engineer prior to use.
2. All abrasives shall be free of corrosion producing contaminants as well as free of oil, grease or other deleterious contaminants. The abrasive material selected for blasting operations shall be such as to produce a cleaned surface and shall also produce a pattern depth suitable for the application of the specified coating(s). The use of silica sand will not be permitted.
3. Solvents, thinners, detergents and other cleaning materials for use in surface preparation work shall be as recommended by the coatings manufacturer and shall be identified by product number or generic type. They shall also conform to all applicable Local, State or Federal Laws, regulation or code.
4. Potable water for cleaning purposes must be supplied by the Contractor for all locations.
5. Materials and equipment used for environmental protection shall be approved by the Project Manager. Any material or equipment that is determined to be deficient or that becomes damaged to the extent that it no longer fulfills the requirements of this specification or its intended use shall be replaced or repaired as directed by the Resident Engineer, at the Contractor's expense.
6. All materials and/or containers shall be properly marked and labeled to allow verification with applicable material safety data sheets, application precautions and instructions which shall be submitted in accordance with these specifications.

C. Execution - There will be two means of surface preparation on this Contract.

1. Steel Structures Painting Council (SSPC); Surface Preparation Specifications; SP-6/NACE No. 3 (Commercial Blast) with Recycled Ferrous Metallic Abrasives
   a. A definition of Commercial Blast cleaned surface is when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion, products, and other foreign matter, except for staining. Staining shall be limited to no more than 33 percent of each square inch of surface area and may consists of light shadows, slight streaks, or minor discoloration’s caused by stains of rust, stains of mill scale, or stains of previously applied paint. All blast cleaned surfaces shall conform to SSPC VIS 1 - “Guide and Reference Photographs for Steel Surfaces Prepared by Dray Abrasive Blast Cleaning”.
   b. Abrasives- Provide recyclable abrasives that are dry and free of oil, grease, and corrosion producing, or their deleterious contaminants. The use of silica sand in prohibited.

c. When using recyclable abrasives, provide all equipment needed to recover and clean the abrasives for reuse in compliance with SSPC Abrasive Specification No. AB-2 “Cleanliness of Recycled Ferrous Metallic Abrasives”.

2. Steel Structures Painting Council (SSPC); Surface Preparation Specifications; SP-3 (Power Tool Cleaning)
   a. A definition of Power Tool cleaned surface is the removal of all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter. It is not intended that adherent mill scale, rust and paint be removed by this process. Mill scale, rust, and paint are considered adherent if they cannot be removed by lifting with a dull putty knife.

D. General Requirements

1. The prime coat shall be applied before the surface starts to rust and/or as specified in Section 1.23, "Paint Requirements" of this Contract.
2. For dry abrasive blasting, the Contractor is prohibited from making final surface preparations to steel surfaces when the relative humidity is above 85% or when the relative humidity is expected to exceed 85% before the prime coat or paint is applied. The Contractor shall, at his own expense, re-work the steel surface in the event rust appears. The Contractor shall consult with the Resident Engineer who is responsible to monitor the relative humidity and other weather conditions.
3. Before applying any coatings, all fine dust and residue remaining on the surfaces after performing the specified surface preparation shall be removed from the prepared surfaces by vacuuming with High Efficiency Particulate-Air (HEPA) filters.
4. Sample areas of surface preparation shall be prepared by the Contractor for the various cleanliness levels to be used as a standard for the job. The Painting Contractor must obtain the Resident Engineer's approval, for the degree of cleanliness, for all sample areas prior to proceeding with work.

E. Public Safety & Environmental Protection

1. Environmental Ground Protection.
   a. Coverage shall be provided on or over the ground under all structures that are to be cleaned and painted.
   b. Depositing or dropping waste materials into water and onto the ground or roadways below the structure outside the specified containment areas will not be permitted. Ground tarps shall also be used in the general work or storage area on Metro-North property. Water that collects in ground tarps must be tested and properly disposed of.
   c. Cleaning or painting operations shall not be performed when the direction or velocity of prevailing winds causes waste materials to fall outside the containment area. If wind or other factors prevent containment acceptable to the Resident Engineer the Contractor shall use drapes or other means to prevent drift beyond all containment areas.

F. Ground Protection

1. Ground Protection shall consist of the following:
   a. Covers or other methods approved by the Resident Engineer, capable of catching and holding waste materials shall be provided on or over the ground under the structure and in other areas where material and equipment are stored.

b. The cover provided shall include all areas beneath the structure. The length of the cover shall be determined by the length of the work location, and the width shall be at least 10 feet greater than each side of the area directly being worked on. The cover shall be positioned in such a manner as to contain and prevent the loss of waste materials.

c. Cover on or over roadways, railroads, sidewalks or other similar areas shall not present a hazard of any kind, as determined by the Resident Engineer, and no cover shall remain in place overnight unless otherwise authorized by the Resident Engineer.

d. All waste materials that collect on a bridge deck or on a highway pavement and paved shoulder under a structure or on covers shall be removed at least once a day or more frequently if directed by the Resident Engineer. No waste material shall remain on the bridge deck, pavement or containment covers overnight.

e. If approved by the Resident Engineer, the Contractor may use other methods or modifications for ground protection that will accomplish the results required by this specification.

f. The reuse of tarps contaminated with dried paint or other foreign matter, will be prohibited unless approved by the Project Manager.

g. Gray water from the decontamination facility or other facilities shall be tested and disposed of in accordance to instructions provided by the Project Manager.

G. Containment System(s)

1. Prior to blasting and for the duration of any abrasive blasting operation the Contractor shall provide a Class 1 containment system as described in part "b" of this section, including covers, tarps, scaffolds, supports and shrouds or other means which will totally enclose the work area to contain all waste material within the enclosure in order to prevent the material from becoming airborne or contaminating the environment in any fashion. This shall include any water used for wet abrasive blasting or power washing. The Contractor shall remove all waste material from containment structure at least once a day or as directed by the Resident Engineer. Materials used to construct the containment structure shall be air impermeable and properly reinforced to safely hold all anticipated loads.
2. The Contractor shall provide the above mentioned containment structure and ventilation system in accordance with the Steel Structures Painting Council SSPC-GUIDE 6I (CON) - "Guide for Containing Debris Generated during Paint Removal Operations", Table 1 Containment Classification "Class 1" Metro-North's Specifications for Treatment of Lead Based Painted Surfaces.
3. Metro-North Railroad shall provide the services of a qualified environmental sub-contractor to monitor the quality of emissions which may be emitted into the surrounding environment. Ambient air testing will be performed every day of commercial blasting.
4. At the beginning of the blasting operation the Painting Contractor shall conduct personnel air samples in the worker's breathing zone to assure that workers are not being exposed to levels of lead above the Permissible Exposure Level (PEL). Air samples will be conducted on each job classification that has potential exposure to lead. These test results shall be supplied to Metro-North within seven (7) days after the results are submitted to the Contractor. Personnel air sampling shall be repeated every thirty (30) days or at every new bridge location which ever sooner to verify and confirm compliance with the PEL and protective equipment.
5. Metro-North will engage the services of a sub contractor to conduct ambient air monitoring. If any of the methods used to monitor emissions exceeds the acceptable limits including limits calculated as per the National Ambient Air Quality Standards, the blasting

operation being monitored shall immediately cease and the Contractor shall rework, upgrade, the containment system to lower emissions to be within acceptable limits at no additional cost to Metro-North.

6. The Contractor shall submit the enclosure schemes (containment and ventilation designs), and hazardous waste collection methods for each bridge requiring abrasive blasting for approval. Enclosure schemes with the use of power tool surface preparation SP-3 shall also be submitted for approval for each bridge.
7. Only solid floor platforms or rigid hanging structures will be allowed to contain the underside of the bridge. The Contractor shall submit working drawings showing containment details. These drawings shall be stamped by a NYS Licensed P.E. and copies of all calculations shall also be submitted for review by the Project Manager for approval.
8. Where Class 1 containment platforms are installed under a structure and over active roadways for SP-6 surface preparation, a minimum clearance must be maintained at all times for the safe passage of vehicles as per the approved Maintenance and Protection of Traffic Plan.
9. The handling of waste shall be in accordance with the attached Metro-North Specifications for Treatment of Lead Based Painted Surfaces Section" Waste Handling" of this Contract.

H. Alternates

1. The Contractor may choose an alternative method of surface preparation to those specified herein, if evidence is given that the final results are compatible and acceptable for paint application.
2. To implement an alternate method of surface preparation the Contractor shall submit the alternative method for approval with details as to the savings and evidence that the results will be the same. The savings may be in reducing the amount of airborne contaminants, reducing the amount of hazardous waste generated, safer working conditions, etc. No alternative, which has been proposed by the Contractor, shall be performed without prior written approval of the Resident Engineer.

I. Worker Safety

1. The Contractor is responsible to maintain a program that satisfies the latest OSHA standards for the Construction Industry (29CFR1926) at a minimum and shall be responsible to protect and train his employees on worker safety, health hazards, etc.
2. The Contractor shall have a written Safety Program specific to this project which is to be submitted to Metro-North for approvals per the Contract Terms and Conditions.
3. In addition the Painting Contractor shall have a written Lead Health and Safety program which is to be submitted to Metro-North for approval and imposed on all his employees involved in lead paint removal operations for this Contract as per Section 02 83 19 “Lead Abatement””.

J. Measurement and Payment

1. No separate measurement or payment will be made for fulfilling any of the requirements set forth in the Section. The Costs for all labor, materials, tools, equipment, scaffolding, supplies, plans, programs or incidentals to properly perform and complete the Work specified in this Section shall be included in the prices bid for appropriate bid items of work.

SECTION 09 91 15 - PAINT REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE

A. Under this section the Contractor shall furnish, handle, store, prepare and apply coatings as described herein.

1.2 MANUFACTURE OF PAINT:

A. All paint furnished under this Contract shall meet the Volatile Organic Compound (VOC) restrictions set by the New York State Department of Environmental Conservation and be non-lead paint. The paint shall be produced by a reputable paint manufacturer, to be approved by the Resident Engineer.

B. All paint of the same type used for this Contract shall be made by the same manufacturer.

C. All finish coat paint shall be low-gloss Blue or as directed by the Project Manager. A draw-down of all color samples shall be submitted to the Resident Engineer for approval of the color prior to application. When required to match existing paint, the Contractor shall obtain sample color chips of the existing finish coat paint from the structure prior to the batching of paint and deliver sample chips to the paint manufacturer in order to match the color of finish coat paint.

D. All paints shall be produced by an experienced, properly equipped manufacturer who has had prior experience in manufacturing paints of the general character specified. The manufacturer shall provide references to structures painted with paints of the same character on which satisfactory service has been rendered for a period of not less than fifteen years.

E. The paint manufacturer shall notify the Resident Engineer prior to the grinding and mixing of any paint so that at the Resident Engineers discretion a representative can be present to take samples of the paint for analysis. The manufacturer shall furnish to the Resident Engineer for analysis, free of cost, samples of all raw materials used in the manufacture of paint if requested by the Resident Engineer. Analysis of the raw materials may be made from time to time as the Work progresses to ensure that all materials used are of a uniform quality and meet the requirements of the specifications.

F. The vehicles, pigments and finished paint covered by these specifications are to be produced from raw materials of the highest quality only and carefully selected and combined by the most modern quality control compliance methods, in plants sufficiently equipped with the necessary scientific controls to produce satisfactory products of a uniform consistency within the tolerances specified.

1.3 PACKAGING AND SHIPPING

A. All of the finished products shall be delivered to their destination in metal containers clearly marked with the Lot and Batch numbers, type and color, quantity, gross, tare and net weights, as well as the name of the manufacturer and Contract or order number under which the shipment is made. All materials furnished shall have a certified material test report (CMTR) stating that the material furnished complies with

Contract Specifications, or Manufacturers technical data sheet)s). Copies of all CMTR's shall be sent to the Resident Engineer for each different batch.

B. All paints shall be received at the point of use in original containers and carefully stored. All paint used shall be freshly mixed and shall be ordered in advance of its use to insure an adequate supply of paint being on hand at all times so as not to delay the work.

C. The paints specified are packaged for application under normal conditions without further reduction. There shall be no thinning or other modification of the paint except upon, and in accordance with, express written stipulation by an authorized representative of the manufacturer of the paint, and with the specific written approval of the Resident Engineer.

1.4 STORAGE OF PAINT

A. The Contractor shall store all flammable materials in approved storage containers and at locations as approved by the Resident Engineer. Storage containers shall be a minimum of 50 feet from any facility.

B. Paint in storage at the shop or in the field shall be stored so as to be protected against freezing, excessive heat and in accordance with manufacturer’s recommendations. Suitable devices shall be maintained at the point of storage and use of the paint for agitating and thoroughly mixing the paint prior to its use for the work. These mixing devices shall consist of some mechanical rotary machine equipped with paddles which can be inserted into the containers to agitate and emulsify the contents thoroughly.

1.5 PAINT INSPECTION AND TESTING

A. All raw materials and finished products (paints) are subject to inspection and testing by the Resident Engineer to verify compliance to referenced specifications or his authorized representative. Metro-North shall be the sole judge as to their satisfactory quality and efficiency based on approved methods of inspection and testing.

B. All finished products may be sampled at the place of manufacture and analyzed by the Resident Engineer's testing laboratory. All finished products shall be subject to testing and analysis; samples will be taken by MN's Consultant Firm from painter's buckets at any point at which the painting work is being done or on the samples secured from the original containers delivered to the work site for application to the structure. No paint shall be applied to the structure until the paint has been tested and approved by MN's Consultant Firm's designated testing laboratory. Paint tested and found to be unacceptable shall be labeled in such a manner to prevent its use and removed from the job site in a timely fashion.

1.6 TESTING METHODS

A. All percentages given in these paint specifications are by weight unless otherwise specified. Limits are expressed as percent of total.

B. Federal Test Method Standard No. 141 "Paint, Varnish Lacquer and Related Materials:
   1. Sampling and Testing" form an integral part of these paint specifications. Specific Federal and ASTM references are listed:

Title _____
Fineness of grind.....ASTM-D-1210
Color ASTM-D-2244
Coarse particles and skins in .....Federal Test
oil base paints & pastes.....Method 141.....4091
Drying Time.....ASTM-D-1640
Gloss ASTM-D-523
Phthalic anhydride content in Resins.....ASTM-D-563
Pigment content ASTM-D-2698
Solids by weight..... ASTM-D-2369
Solids by volume..... ASTM-D-2697
Sampling for inspection ASTM-D-3925
Self lifting test Federal Test .....Method 141.....6252
Sag resistance (mils) ASTM-D-4400
Skinning ASTM-D-1849
Non-volatile vehicle Federal Test .....Method 141....4053
Viscosity ASTM-D-562
Weight per gallon.....ASTM-D-1475
VOC Content ASTM-D-2369

1.7 APPLICATION OF PAINT

A. No paint shall be applied when the ambient temperature is below 40 degrees F or the relative humidity is greater than 85% unless allowed by the paint manufacturer. No paint shall be applied when the receiving surface temperature is less than 40 degrees F nor more than 100 degrees F. Paint shall not be applied upon dirty, dusty or damp surfaces or upon metal containing frost, nor shall it be applied when the air is misty or (in the opinion of the Resident Engineer) otherwise unsatisfactory for work.

B. All pockets shall be thoroughly cleared of water, mud, dirt, and other accumulations, and the surfaces to receive paint shall be thoroughly dry and clean before paint is applied.

C. All surfaces to be painted shall be approved by the Resident Engineer prior to the application of paint.

D. At the start of the painting operations and as requested by the Resident Engineer the Contractor shall arrange for a Technical Representative (not a Sales Representative) from each paint manufacturer to be present to verify that proper methods are being implemented and that the coating systems will perform as expected. The representative shall check surface preparation, mixing, application and other aspects of the cleaning and painting operations and make any necessary recommendations to the Resident Engineer in writing.

E. Paint shall be thoroughly stirred, by means of mechanical mixers, before being removed from the containers, and to keep the pigments in suspension it shall also be stirred while being applied.

F. Paint shall be applied by round or oval brushes. Flat brushes or rollers may be used on the large plate surfaces between connections as approved by the Resident Engineer. When rollers are used, the nap size and type shall be of such quality to properly wet the substrate and produce a smooth uniform coating. Spraying of paints will be permitted in a contained area only. On all metal surfaces which are inaccessible for paint brushes, the paint shall be applied with sheepskins or daubers especially constructed for the purpose.

G. The paint shall be manipulated so as to produce a uniform even coating in close contact with the metal or with previously applied paint; in general the primary movement of the brush shall describe a series of small circles to thoroughly fill all the irregularities in the surface, after which the coating shall be smoothed and thinned by a series of parallel strokes. On vertical surfaces the final strokes shall be vertical. When rollers are used they shall, in general, be moved in such a way to ensure complete coating of the surface, after which the coating shall be back rolled to create a smooth uniform finish.

H. All painting shall be performed in a neat and workmanlike manner. The paint shall be thoroughly applied and well brushed onto the cleaned surfaces and into all cracks and fissures without leaving fins or runs.

I. Prior to the application of any coat of paint, all damage to the previous coat shall be touched up with the corresponding specified paint for that coat, each coat being allowed to dry thoroughly before the subsequent coat is applied. The Contractor shall restore in accordance with paint specifications and with the number of coats herein specified, any damaged paint marred by his operations, regardless of the condition of the paint at the time the operation began.

J. All paint shall be applied in strict accordance with the manufacturer’s recommendations.

K. The dry film thickness (DFT) will be determined in accordance with SSPC-PA2, Paint Application Specification No. 2 - Measurement of Dry Film Thickness with Magnetic Gages.

L. Areas failing to meet the specified minimum dry film thickness shall be over-coated with the same type of coating to produce at least the total DFT required.

M. Coatings applied containing unauthorized thinners, coatings applied over unapproved surfaces and coatings applied contrary to this specification shall result in the re-cleaning and repainting the surface. Re-cleaning, repainting or over-coating, if required, shall be performed by the Contractor to the satisfaction of the Resident Engineer and at no additional costs to Metro-North.

N. Primer coats shall be applied within the same day as the abrasive cleaning operation and before flash rusting occurs to the cleaned surface. Re-cleaning will be required when the Painting Contractor fails to coat the prepared surfaces within the same day at no additional costs to Metro-North.

O. The Contractor shall comply with all minimum and maximum time limits for coating and re-coating over the primer or intermediate coats as specified by the paint manufacturer for the various types of coatings being utilized. When primer and intermediate coatings are applied and not re-coated within thirty (30) days the surfaces shall be thoroughly washed or cleaned as specified by the Resident Engineer prior to the application of the next coat of paint. Surfaces that were coated, not completed, and left over the winter months shall be cleaned to the satisfaction of the Resident Engineer and re-primed or re-coated with an additional coat of previously applied paint. All necessary work, required due to the Painting Contractor's failure to meet specified time limits stated herein, shall be performed to the Resident Engineer's satisfaction and at no additional costs to Metro-North.

1.8 COATING SYSTEMS

A. Following the surface preparation as described in Section 09 91 14 - "Preparation of Surfaces" the specified coating system shall be applied so as to produce the dry film thickness (DFT) within the range specified.

B. All coating systems shall be applied as specified for each coating system. Each coat of paint shall be tinted or shaded to distinguish it from previously applied or existing coatings.

C. All nuts, bolts, rivets, welds, edges and other irregular surfaces, shall have a stripe coat of the specified coating applied by brushing prior to applying the primer coat as specified below to assure proper coverage of these surfaces:

1. Thoroughly coat all surfaces with special attention to hard-to-reach areas, and irregular surfaces such as lacing bars and rivets. When coating configurations such as bolts, apply the material from multiple directions to assure complete coverage. o Unless stipulated otherwise in the Specifications, thoroughly apply a stripe coat to all edges, welds, crevices, rivets, bolt threads, bolt heads, areas of pitted steel and other surface irregularities. o Apply the stripe coat by brush or spray. When spraying, supplemental brush application is mandatory to ensure complete and thorough coverage. When brushing organic zinc primers, repeatedly stir the material with the brush during use to prevent settling of the zinc.
2. When applying the stripe coat prior to the full coat, do not apply the full coat until the stripe coat has dried according to the recoat times in the Paint System Tables.
3. When applying the stripe coat after the full coat, do not apply the stripe coat until the full coat has cured sufficiently to withstand foot traffic. Do not apply the next coat until the stripe coat has cured for the recoat times shown in the Paint System Tables.

D. The various coating systems to be utilized for this Contract are shown below. The manufacturers specified are only used to indicate paint that meets the performance requirements of this specification.

1. PAINT SYSTEM No.1 Used with SSPS-6 - Shall be one complete prime and finish coat of a two component, low VOC, epoxy barrier coat.
   a. Manufacturer: Sherwin Williams Edison, New Jersey (201) 287-4000
      1) Coat: Prime and finish: 1 coat
      2) Coatings: Dura-Plate 154 Epoxy Splash Zone Coating
      3) DFT (mils): 20-25
   b. Manufacturer: International Paint Houston, Texas (713)682-1711
      1) Coat: Prime and finish: 1 coat
      2) Coatings: Interzone 954
      3) DFT (mils): 20-25
   c. Colors : Federal Standard Color Blue, FS35187 or as approved by the engineer.
2. PAINT SYSTEM No.2 Used with SSPS-3 - Shall be one complete prime coat of a two component epoxy; full intermediate coat of an epoxy , and one complete finish coat of a two component urethane.
   a. Manufacturer Sherwin Williams Cleveland, Ohio (216) 566-2000
      1) Prime Coat: Macropoxy 920 Preprime, DFT 1.5-2 mils
      2) Int. Coat: Macropoxy 646, DFT 4-6 mils
      3) Finish Coat: Acrolon 218 HS Acrylic Polyurethane, DFT 3-6 mils
   b. Manufacturer International Paint Houston, Texas (713) 682-1711
      1) Prime Coat: Interseal 670, DFT 4-6 mils
      2) Int. Coat: Interseal 670, DFT 3-4 mils
      3) Finish Coat: Interthane 870 UHS, DFT 3-4 mils
   c. Colors
      1) Primer -as per manufacture (excluding white)
      2) Intermediate- white
      3) Top - Federal Standard Color Blue, FS35187.

3. PAINT SYSTEM No.3 Used with SSPS-6 - Shall be one complete prime coat of a zinc rich organic lead free epoxy; one complete intermediate coat one complete finish coat of a two component acrylic urethane enamel.
    a. Manufacturer Sherwin Williams Cleveland, Ohio (216) 566-2000
        1) Prime Coat: Zinc Clad III HS Organic Zinc Rich Epoxy Primer, DFT 2-3 mils
        2) Int. Coat: Macropoxy 646, DFT 4-6 mils
        3) Finish Coat: Acrolon 218 HS Acrylic Polyurethane, DFT 3-6 mils
    b. Manufacturer International Paint Houston, Texas (713) 682-1711
        1) Prime Coat: Interzinc 315 B, DFT 3-4 mils
        2) Int. Coat: Interguard 475H, DFT 4-6 mils
        3) Finish Coat: Interthane 870 UHS, DFT 3-4 mils
    c. Colors
        1) Primer -as per manufacture (excluding white)
        2) Intermediate- white
        3) Top - Federal Standard Color Blue, FS35187.

1.9 PROTECTION

A. The following provisions shall be used in conjunction with other applicable Sections of these Specifications.
    1. The Contractor shall furnish and install tarpaulins or other means enclosing the immediate site or area of all painting operations to insure complete protection of the public, and property both on and below the bridges, against possible damage from scrapings, paint drippings and from wind-blown paint. The type, quantity and placement of tarpaulin protection must be submitted for approval of the Resident Engineer before start of painting operations. The Contractor shall have a sufficient quantity of tarpaulins in reserve, and shall be prepared to install same, to provide for unexpected variations in winds and for other contingencies. These requirements will be rigidly enforced, and the Contractor accordingly will not be permitted to proceed with field operations unless the required tarpaulins are in place.
    2. Any material or equipment that is determined to be deficient or that becomes damaged to the extent that it no longer fulfills the requirements of this specification or its intended use shall be replaced or repaired as directed by the Resident Engineer, at the Contractor's expense. Tarpaulins coated with dried flaking paint may not be reused.
    3. The Contractor shall require workers to wear the proper personal safety equipment while performing painting activities. At a minimum the personal safety equipment shall be as specified in the manufacturer’s literature for the material(s) being handled and/or applied.

B. At the end of each work shift the Contractor shall remove all paint, paint cans and painting equipment from the work area and properly dispose of or store these items in an approved location. All equipment and rigging that is left in-place shall be properly secured. Storage of paint and equipment on or around the bridge structures is strictly prohibited.

1.10 Measurement and Payment

No separate measurement or payment will be made for fulfilling any of the requirements set forth in this Section. The cost for all labor, tools, equipment, paints, materials, scaffolding, supplies, plans, programs, or incidentals to properly perform and complete the Work specified in this Section shall be included in the price bid for the appropriate bid items of work.

DIVISION 10
SPECIALTIES

SECTION 10 14 00 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Division 1 General Requirements

1.2 SUMMARY

A. Signage under this section is intended to include items for identification, direction, control and information of building, and to be installed as a complete integrated system. Signs include, but are not limited to:
   1. Interior station sign plaques,
   2. Wayfinding signs,
   3. Dedication plaque,
   4. All doors/entryways with room name and/or universal symbol,
   5. Wall mounted engraved directional and identification signs,
   6. Raceway mounted backlit LED channel letters for Main Exterior Building Signage,
   7. Parking garage/parking lot directional signage,
   8. OSHA compliant equipment signage,
   9. Building identification signs, and
   10. Miscellaneous site signage.

1.3 REFERENCES

A. MTA Metro-North Signage Manual, Current Edition

B. MTA Metro-North Standard Signs for Parking Facilities, Current Edition

C. Comply with all applicable codes and regulations of governmental agencies having jurisdiction.
   1. American National Standards Institute (ANSI)
   2. NYSBC – New York State Building Code latest addition

D. Industry Standards:
   1. Department of Justice, Office of the Attorney General, "Americans with Disabilities Act", Public Law 101-336 (ADA).
   2. ANSI A117.1: Providing Accessibility and Usability for Physically Handicap People, 1986 edition.
   3. Federal Register Part III, Department of Justice, Office of the Attorney General, 28 CFR Part 36: Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities, Final Rule, July 26, 1991.
   4. Federal Register Part II, Architectural and Transportation Barriers Compliance Board, 36 CFR Part 1191: Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Amendment to Final Guidelines, September 6, 1991.
   5. American Society for Testing and Materials (ASTM):
      a. B209 Aluminum and Aluminum Alloy Sheet and Plate.

b. B221 Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
c. D 4956-04, Standard Specification for Retroreflective Sheeting for Traffic Control
d. D638 Tensile Properties of Plastics
e. D790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
f. D695-08 Standard Test Method for Compressive Properties of Rigid Plastics
g. D732-02 Standard Test Method for Shear Strength of Plastics by Punch Tool
h. D3841 Standard Specification for Glass-Fiber-Reinforced Polyester Plastic Panels

6. American Welding society (AWS)
   a. D1.1 2008 Structural Welding Code Steel
   b. D1.2-97 Structural welding Code Aluminum
7. Aluminum Association (AA):
   a. DAF-45 Design System for Aluminum Finishes, 1976.
8. New York State Department of Transportation (NYSDOT):
   a. Standard Specifications – Construction and Materials
9. U.S. Department of Transportation (USDOT):
   a. 49 CFR 37 Transportation Services for Individuals with Disabilities (ADA)

1.4 ADMINISTRATIVE REQUIREMENTS

A. Schedule system installations after related finishes have been completed, and in schedule with the project phased construction.

B. ADA design requirements:
   1. Signage requiring tactile graphics:
      a. Wall mounted signs designating permanent rooms and spaces,such as room numbers, restrooms, electrical closets, and mechanical rooms.
      b. Individually applied characters are prohibited.
   2. Signage not requiring tactile graphics but requiring compliance to other ADA requirements: All other signs providing direction to or information about function of space, such as directional signs (signs with arrow), informational signs (operating hours, policies, etc.), regulatory signs (no smoking, do not enter) and ceiling and projected wall mountedsigns.

C. ADA performance requirements:
   1. Tactile graphics sign mounting requirements:
      a. Openings: Mount 60" to sign centerline above finished flooradjacent to opening.
      b. No wall space adjacent to latch side of door, opening or double doors: Mount 60" to centerline above finished floor on nearest adjacentwall.
      c. An interior sign plaque shall be installed adjacent to each new door. The final room description on each sign shall be determined bythe Owner. A list generated from room names noted on drawings shall be submitted to the Owner for review and comment.

1.5 QUALITY ASSURANCE

A. Manufacturer qualifications: Work under this section from manufacturers regularly engaged in work of this magnitude and scope withdocumented experience on projects of similar size and scope.

B. Pre-installation conference: Closely coordinate tolerances required in this section for completely coordinated and smooth installation.

C. Installer must be regularly engaged in work of this magnitude and scope with a documented successful history installing work of this section.

D. All work shall conform to applicable codes.

E. Deliver all signs in fiber board foam, packed and protected fortimely installation, minimizing on-site storage time.

F. Sign Contractor to store all signs in a secured area, out of weatherand protected, during installation.

G. Metro-North reserves the right to retain an independent testing service to inspect the manufacturing process to ensure conformity with the Contract Documents.

H. The Contractor shall provide an eighteen-month guarantee of all ofthe variable-message signs against any defects in workmanship or design. The Contractor shall be responsible for supplying replacement parts, on a one- for-one no charge basis, to Metro-North for installation for any defective components that fail.

1.6 SUBMITTALS

A. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:
   1. Recycled Content:
      a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
      b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
      c. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly byweight.
      d. If recycled content product is part of an assembly, indicaterelative dollar value of recycled content product to total dollar value of assembly.
   2. Local/Regional Materials:
      a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
      b. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the projectsite.
      c. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
      d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weightof each component per unit of product.

B. Submit environmental data in accordance with Table 1 of ASTM E2129for products provided under work of this Section.

C. Operating And Maintenance Manuals

D. Verify that plastic products to be incorporated into the Project are labeled in accordance with ASTM D1972. Where products are not labeled, provide product data indicating polymeric information in Operation and Maintenance Manual.
   1. Type 1: Polyethylene Terephthalate (PET, PETE).

2. Type 2: High Density Polyethylene (HDPE).
3. Type 3: Vinyl (Polyvinyl Chloride or PVC).
4. Type 4: Low Density Polyethylene (LDPE).
5. Type 5: Polypropylene (PP).
6. Type 6: Polystyrene (PS).
7. Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

E. Sign listing and schedule, lettering and locations, and overall dimensions of each sign.

F. Shop drawings indicating size, materials and method of attachment to door and/or wall or suspension method. Typography sample for message strips and header copy and any artwork for special graphics. Provide details of all sign types and plans locating each type of sign, detailing quantity, for submission for approval by Metro-North.

G. A schedule of completion and sequence of delivery of the work to be furnished and installed under this Section. This schedule shall include at least:
1. Preparation of Shop Drawings and Metro-North's review period for approval.
2. Prototype construction, review, final approval, manufacture and sequence of delivery

H. Sample of each sign type, in color specified. Samples will not be returned. Submit color samples as required by the Engineer.

I. Contract Close Out
1. Furnish appropriate checklist for aiding in reordering after Date of Substantial Completion. Maintain computer schedule program for ordering new signage as required by Owner.
2. Provide an 8½" x 11" re-order form for each sign type and component of each sign type. Forms must be keyed to sign type shown in bid documents using same sign type number.

J. All submittals are to be in accordance with Division 01 – Submittal Procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
1. Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials in manufacture's unopened packages and bearing manufacturer's label.

B. Storage and Handling:
1. Store materials in a dry and well ventilated place, adequately protected from damage and exposure to the elements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Beyond Signs, Inc.

B. Kaltech Industries Group Inc., New York, NY

C. Nova Polymers

D. Steel Art Company

E. North Shore Neon Sign Co.

F. Signal-Tech

G. Approved equal.

2.2 GENERAL:

A. Sign material, unless noted otherwise, shall be aluminum, conforming to the materials requirements of Metro-North Railroad Standard (MNR) Specifications. Provide extruded shapes, flat plate, angle, channels, tubes, and the like, of the dimension, alloy, temper, and thickness indicated. Materials shall conform to the requirements of ASTM B209, B211, and B221.

B. Materials shall be free of pitting, seam marks, roller marks, oil-canning, stains and discolorations on exposed surfaces after application of specified finishes. Provide aluminum alloy and temper as recommended by the aluminum producer or finisher.

C. Sign panels (extrusion and plate) and fabrication accessories shall have a clear anodized finish complying with AA DAF-45 designation AA-C22A41, Class I, (Coating thickness greater than 0.7 mils).

D. Signs shall be free of defects including, but not limited to: buckles, dents, warps, wrinkles, and burrs. Sharp edges and corners shall be smoothed.

E. Hardware shall be stainless steel and tamper-proof, unless otherwise noted.

F. Mounting hardware for pole mount extruded aluminum panel signs shall include aluminum clips, stainless steel bolts, washers and locknuts and/or aluminum bar.

G. Mounted hardware for rail mount extruded aluminum panel sign shall include aluminum angles, stainless steel hex bolts, lock washers, hex nuts and aluminum sleeve.

H. Extrusions for a given shape shall be fabricated from dies of identical cross section. Built up sections shall not be used.

I. The sign lettering shall be Helvetica Bold or Helvetica Medium Condensed in accordance with the chapter titled “Graphic Standards” in the MTA sign Manual, unless otherwise specified.

J. The color chart shall be used to assure correct and consistent color of signs throughout MNR’s rail system and shall be in accordance with the chapter title “Graphic standards” in the MTA sign Manual 2004.

K. The Vendor’s Shop Drawings and Sign Schedule shall be used for detailed text and symbol layout, sign format and sign nomenclature guidance for all signs.

L. Manufacturer's name plates, trademarks or mill marks shall not be visible on exposed sign surfaces.

2.3 TOLERANCES:

A. Tolerance of signage:
1. Thickness: ± 0.015".
2. Length and width: Overall: ± 1/32".
3. Squareness: Difference in diagonal corner measurement shall not exceed 0.5 percent.
4. Camber: Edge of flat signage shall not deviate from a straight line connecting adjacent corners by more than 0.5 percent.
5. Flatness: Deviation of signage from a plane surface shall not exceed 0.25 percent in 12" at any location and not to exceed 0.5 percent for entire sign.
6. Surface finish: Free of dents, creases or waviness with no transfer of pattern or grain of core entire sign.

B. Tolerance of messages:
1. Message Location: ± 1/16" from the location as shown.
2. Line to Line: ±1/32" between each line and ±1/16" over the entire message.
3. Letter to Letter or Symbol (horizontally and vertically): ±1/32" between each letter or symbol and ±1/16" over an entire line.

C. Where multiple panels adjoin, faces and edges shall be milled to a tolerance of ±1/32" from a strait plane. When assembled, no gap over 1/16" shall be visible between adjoining panels.

D. Components shall allow for expansion and contraction for temperatures ranging between -20°F and +100°F, without causing buckling, opening of joints other than control joints or over stressing of fasteners.

2.4 SIGNS

A. General / Room Identification Signage: As approved by MTA Metro-North
1. Type: Hot stamped letters and numbers on matte finish plexiglass plaque with square corners.
2. Letter Style: "Helvetica" (generic) caps and lowercase.
3. Lettering shall be engraved through face to expose core.
4. Copy Size for Room Numbers: "Helvetica" medium, 1-1/2 inches high, flush left.
5. Copy Size for Room Name: "Helvetica" regular, ½ inch high, flush left.
6. Room Identification Plaque Size: 6 inch x 6 inch x 1/8 inch thick.
7. Background Color: Black matte.
8. Tactile Copy and Grade II Braille are to be precision embossed and raised a minimum of 1/32" and formed as an integral part of the sign face. Braille is to be the same color as the sign background with no interruption of the smooth, clean surface of the sign. All plaque edges to be clean, smooth, and free of all saw and tooth marks, and painted to match the background color of the sign. ADA compliant fabrication is required for all signs. Phenolic photopolymer and surface applied glued on letters will NOT be accepted. Lettering, Braille and symbols to be raised 1/32". Braille cell to be 1/4", character height to be 5/8" min., 2" max. Interline spacing to be half of cap height. Braille cell to be 1/4" min. below line of copy above.

B. Illuminated Channel Letters:
1. Size: 5" depth, height and width of characters and logos as indicated on Contract Drawings.

2. Material: Clear Anodized Aluminum, 0.125” minimum thickness
3. LED: Standard Clear Color with UL approved power supplies
4. Raceway: Mount channel letters to extruded aluminum raceway, 7”x7”x.125”, painted custom color acrylic polyurethane to match adjacent roofing material
5. Font: As indicated on Contract Drawings.

C. Wayfinding Signage: Provide wall mounted wayfinding or informational signage with lettering as noted above. Sign to consist of matte finish Plexiglas panel 11”x6”. Lettering style shall be the same as listed above, in general signs.

D. Dedication Plaque: Brushed stainless steel 14”x14” building dedication plaque. Fabricate from tempered 3/16” stainless steel plate, alloy #304 with a #6 horizontal grain finish. Graphics to be acid etched to 1/32’ minimum. All copy to be clear and free of ragged edges or other imperfections. Fill copy with a two part epoxy ink suitable for the use intended. All edges to be clean, smooth and free of any tooling marks. Clear coat entire plaque with a semi gloss sealer suitable for both interior and exterior use. Plaque to mount with concealed ¼” diameter stainless steel pins welded or drilled and tapped to the rear surface.

E. ADA Ramp Signage: Provide wall mounted directional signage at top and bottom of stairway with ¾” high lettering as noted above. Sign to consist of matte finish Plexiglas panel 7”x9”. Lettering style shall be the same as listed above, in general signs, with stair symbol above.

F. Elevator Signage: Provide wall mounted informational signage at all levels of elevator with 5/8” high lettering as noted above. Sign to consist of matte finish Plexiglas panel 9”x8”. Lettering style shall be the same as listed above, in general signs.

G. Canopy Glass Panel Distraction Marks: Provide vinyl window film as indicated on Drawings at all full height glass panel windows and doors. Film to have the appearance of frosted glazing.

H. No Smoking: Provide wall mounted signage with tactile No Smoking symbol as noted above. Sign to consist of matte finish Plexiglas panel 6”x6”. Grade II Braille copy to be the same as listed above, in general signs.

I. Preformed Thermoplastic Pavement Signs (“Watch the Gap”)
1. The material must be a resilient preformed thermoplastic product, with a top surface pattern in which every other shaped portion contains glass beads or non-skid/non-slip material with a minimum hardness of 7 (mohs scale). The material must be resistant to the detrimental effects of motor fuels, lubricants, hydraulic fluids etc. The material shall be capable of being installed on bituminous and/or Portland cement concrete pavements by the use of a hand held heat torch, an infrared heater, or a blue-flame radiant heater.
2. The material must be capable of conforming to pavement contours, breaks and faults through the action of traffic at normal pavement temperatures. It shall not be necessary to inlay the material in grooves or indentations in the substrate.
3. The individual pieces in each material segment (typically up to 24 in. by 36 in.) Must be factory assembled with a compatible material and interconnected so that in the field it is not necessary to assemble the individual pieces within a material segment.
4. The material must be able to be applied in temperatures down to 45 deg f without any special storage, preheating or treatment of the material before application.
5. The material must be able to be applied to asphalt and concrete surfaces without preheating the application surface to a specific temperature. The material must be capable of being affixed to green concrete (concrete that has set but not appreciably hardened). The material

shall not require the portland cement concrete application areas to be cured or dried out. The material must be capable of being affixed to bituminous and/or portland cement concrete pavements by the use of the heat of a propane torch, infrared heater, or blue-flame heater.

6. The material must be able to be applied to asphalt and concrete surfaces without using a grid template and without forming a pattern in the application surface. Heating indicators must be evenly distributed to the surface of the material in order to ensure correct application.
7. The material must cover the entire application area. Once applied, no part of the pavement surface must be visible in the application area.
8. Manufacturing control and ISO certification: The manufacturer must be ISO 9001:2000 certified and provide proof of current certification.
9. Material: must be composed of an ester modified rosin impervious to degradation by motor fuels, lubricants, etc. in conjunction with aggregates, pigments, binders, non-skid/non-slip material, and glass beads. Pigments, glass beads, and nonskid/non-slip material must be uniformly distributed throughout the material, except for black material, which shall contain no beads. The thermoplastic material conforms to AASHTO designation M249-98, with the exception of the relevant differences due to the material being supplied in a preformed state, and potentially being of a color different from white or yellow.
10. Pigments:
    a. Yellow: the material shall be manufactured with sufficient pigment to meet FHWA Docket No. FHWA-99-6190. Table 5 and Table 6 as revised and corrected. The pigment system must be heavy-metal free.
    b. Black: the pigment must be heavy-metal free.
11. Heating Indicators: The top surface of the material shall have regularly spaced indents. These indents shall act as a visual cue during application that the material has reached a molten state so satisfactory adhesion and proper embedment of beads and non-skid/non-slip material has been achieved, and a post-application visual cue that the application procedures have been followed.
12. Skid resistance: The surface of the preformed thermoplastic material shall contain factory applied non-skid material with a minimum hardness of 7 (mohs scale). Upon application the material shall provide a minimum skid resistance value of 55 bpn when tested according to ASTM E 303.
13. Slip resistance: The surface of the preformed thermoplastic material shall contain factory applied non-skid material with a minimum hardness of 7 (mohs scale). Upon application the material shall provide a minimum static friction of coefficient of 0.6 when tested according to ASTM C 1028 (wet and dry), and a minimum static coefficient of friction of 0.6 when tested according to ASTM D 2047.
14. Thickness: The material must be supplied at a minimum thickness of 90 mil.
15. Retroflectively: The material shall exhibit adequate and uniform nighttime retroreflectivity. White material shall have a minimum retroreflectivity of 275 mcdm-2ix-1 as measured using a Delta ltl-x or ltl 2000 retroreflectometer. Darker colors will exhibit lower retroreflectivity levels.
16. Environmental resistance: The material must be resistant to deterioration due to exposure to sunlight, water, salt or adverse weather conditions and impervious to oil and gasoline.
17. Interconnected: the material must consist of interconnected individual pieces of preformed thermoplastic pavement material, which through a variety of colors and patterns, make up the desired design. The individual pieces in each material segment (typically up to 24 in. by 36 in.) must be factory assembled with a compatible material and interconnected so that in the field it is not necessary to assemble the individual pieces within a material segment.

J. All other signage per MTA Metro-North Standard Signs for Station Facilities in type and quantity required to create a complete signage and wayfinding package for approval by Metro-North. Package will include signage above, as well as, but not limited, to the following:
   1. Trailblazing Sign at each station entry/exit
   2. Station Facility Entrance Signs
   3. Station Directions sign
   4. ADA Ramp Signage
   5. Additional Wayfinding Signage directing passengers to the elevator/ ADA Accessible Path into and out of the station

2.5 MATERIALS

A. Plastic Signs and supports:
   1. Recycled Content: Minimum 80 percent post-consumer recycled content.

B. Aluminum Signs:
   1. Recycled Content: Minimum 25 percent post-consumer recycled content.

C. Steel posts and/or supports:
   1. Recycled Content: Minimum 16 percent post-consumer recycled content.

2.6 EXECUTION

A. Station Signs: As shown on drawings and approved by Metro-North.

B. Supply and install all required conduit, wiring for power, and pull lines for communication connections for the signage listed in this Section. All communication wire and final connection of communication shall be installed and executed by Metro-North.

2.7 OTHER MATERIALS

A. All materials, including those not specifically described, but required for a complete and proper installation, shall be new, first quality of their respective kinds.

2.8 FABRICATION

A. Shop Assembly:
   1. Fabricate units to configurations indicated on reviewed shop drawings. Internally reinforce units in accord with reviewed shop drawings.
   2. Provide copy required on inserts, message strips, headers or bases and covers required on reviewed shop drawings and in accord with ADA requirements.
   3. Fill directories with combination of reviewed copy on message strips on blank message strips.
   4. Wrap each individual unit with clear polyethylene (see-through) pack and ship by floor in numerical order, tagged sequentially to message schedule.
   5. A final copy of the message schedule is to be provided to the client for their review and approval prior to any fabrication.

DIVISION 12
FURNISHINGS

SECTION 12 93 40.10 - ENTRY TOTEMS

PART 1 - GENERAL REQUIREMENTS

1.1 SCOPE OF WORK

A. Furnish and install entrance totems as indicated on the Construction Drawings and as specified herein.

1.2 RELATED WORK

A. Division 1 General Requirements

B. Section 05 50 00 Metal Fabrications

C. Section 05 12 00 Structural Steel Framing

1.3 CODES AND STANDARDS

A. ASTM - ASTM INTERNATIONAL

1. A ASTM B117-11 - Standard Practice for Operating Salt Spray (Fog) Apparatus
2. ASTM D522/D522-M-13 - Standard Test Method for Mandrel Bend Test of Attached Organic Coatings
3. ASTM D523-14 - Standard Test Method for Specular Gloss
4. ASTM D2247-11 - Standard Test Method for Testing Water in 100% Relative Humidity
5. ASTM D3359-09e2 - Standard Test Method for Measuring Adhesion by Tape Test
6. ASTM D3363-05(2011)e2 - Standard Test Method for Film Hardness by Pencil Test
7. ASTM G155-13 - Standard Practice for Operating Xenon Arc Light Apparatus or Exposure of Non Metallic Materials
8. ASTM A564. Grade MT (316). (B)
9. ISO International Organization for Standardization
    a. ISO 1520:2006 - Paints and Varnishes – Cupping Test
    b. ISO 2815:2003 - Paints and Varnishes - Buchholz Indentation Test
    c. ADAAG - Americans with Disabilities Act Guidelines

1.4 QUALITY ASSURANCE

A. All work as much as practicable, shall be built up and assembled in the shop and shall conform to the actual measurements taken by the Contractor at the site where the work is to be installed. All work shall be plumb and true and in conformity with the Construction Drawings.

B. Tool and die marks, burrs, stretch lines and sharp edges to be removed or blended in to surface finish. All surfaces to be ground and polished to uniform finish as indicated, free of cross scratches or marks that will appear through the finish coating. After polishing, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

C. Fabricated Items: The Fabricator shall have a minimum of five (5) years of experience in the fabrication of items of the types specified.

1.5 SUBMITTALS

A. Submit the following samples to the Design Professional and Engineer for approval prior to fabrication and installation.
   1. 12 inch by 12 inch porcelain enamel panel, with side returns and threaded attachments bonded as specified.
   2. (1) 6 inch UV stable acrylic, tinted to match specified color (GLS-05).
   3. 5 inch square by 3/4" inch thick stainless steel plate, bead blasted (MTL-04).
   4. 5 inch square porcelain enamel satin white to match porcelain enamel MNR Unimark signage (MTL-05).
   5. Mock-Up of a complete section of totem, 31” X 6” X 18” (minimum)
   6. Prototype of digital screen totem.

B. Product Data: Manufacturer’s printed specifications and installation instructions for each type of metal framing, paneling, and electronic accessory, including data required to show compliance with the Drawings and Specifications.

C. Submit shop drawings to the Design Professional for approval which shall include plan, section, elevation and details of all totem components and accessories noting dimensions, materials, finish and anchoring means and methods at not less than 1/4 inch to 1’-0” scale, and details at not less than 1-1/2 inch to 1’-0” scale. Plans to include location of totem installation as specified on the architectural and structural drawings. Shop drawings shall indicate orientation of digital screen relative to site conditions at each station where totems shall be installed.

1.6 MANUFACTURER'S WARRANTY

A. Provide manufacturer's warranty agreeing to repair or replace materials that are defective or fail due to substandard workmanship, within the one (1) year warranty period from the date of Substantial Completion.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver the shop fabricated totems to the contractor as specified in the contract.

B. Provide factory installed protective means and methods.

C. Store the totem frames under cover in a dry and clean location off the ground and remove from job site materials which are damaged or otherwise not suitable for installation and replace them with acceptable materials.

D. Store the fully assembled porcelain enameled steel panels in crates.

E. Store the digital screens with attached brackets in protective crates with rigid Styrofoam packaging and with protective film on screen and housings intact.

F. The Authority reserves the right to reject any material that is stored improperly.

PART 2 - MATERIALS

2.1 TOTEM FRAMEWORK

A. Fabricate and assemble all components necessary to furnish one fully assembled totem framework, of the nominal dimension shown on the construction documents, and meeting the material and performance as per the specifications.

2.2 VERTICAL SUPPORT POST STRUCTURAL COLUMN (MTL-0_)

A. Fabricated stainless steel vertical support post configured and to actual dimensions as indicated on the construction drawings, comprising:
   1. 3/4” thick stainless steel plate stock full penetration welded to stainless steel angle.
      a. Material and Finish: Flat stainless steel plate, with bead-blasted finish (MTL-09) to external faces and exposed panel edges.
      b. Thickness: 3/4" plate, with additional 3” to inside of angle, for 3 3/4” total thickness of post.
      c. Width: 8”
      d. Height: Refer to construction drawings for dimensions
      e. Edges: Exposed edges to be polished and machined to receive 1/16” arrissed edge detail to profiles. All edges to be machined to be square, straight and true. Grinding will not be accepted.
      f. Drilled and Tapped holes: Must not pass through the full flange depth, to indicative depth and positions as noted on construction drawings.
      g. Drilled Holes: To be centered - measured across the flange width – pass through the full depth of the flange plate and countersunk to exposed (public) face as indicated on the construction drawings.
      h. Spot Welded to connection bracket in accordance with specifications and construction drawings
      i. Seam Welds to internal Web and Connection Tab in accordance with specifications and construction drawings.
      j. Bolted connections to be socket head stainless steel unless stated otherwise, to indicative positions and sizing as noted on construction drawings.

2.3 BACK SIGNAGE PANEL

A. Glass Panel (GLS-06)
   1. Material and Finish: Low iron heat strengthened laminated glass with anti-reflective coating to exposed (front public side face) surface

2. Ceramic frit printed border along all four sides of glass to conceal structural bonding agent and supporting door frame, see design drawings for location, color to match vinyl graphics.
3. Nominal Thickness: 10mm (Approximately 9/16”) – two lites of 1/4" with .060 ionoplast interlayer.
4. Width: 29 1/4”.
5. Edges: All edges to be arrissed and polished
6. Positioning/Alignment: Panels to be centered on totem axis, vertical open joints to be of equal dimension on either side with adjacent vertical support post
7. Height: Refer to construction drawings for dimensions
8. Edges: Exposed edges to be polished and machined to receive 1/16” arrissed edge detail to profiles. All edges to be machined to be square, straight and true. Grinding will not be accepted.

B. Bonding Agent
1. Shall meet and exceed structural requirements including safety factors. Fabricator to provide demonstrated structural suitability to satisfaction of MNR of bonding agent to sustain dead loads, live and negative pressure wind loads, torsional loads as required, extreme temperatures and temperature fluctuations. All manufacturer preparation, application and cure time processes to be recorded and maintained for quality control.

C. Vinyl Signage Graphic – Supplied by MNR
1. Large format digital printing on vinyl that is applied to glass using adhesive.
2. Material and Finish: Vinyl Optically clear polyester front which receives printing onto in reverse
3. Printing Method: Large Format Digital.
4. Mounting: Bonded to glass using heat rollers.
5. UV stability of the materials and ink shall be guaranteed for a minimum of 3 years.
6. A print sample will be required to match control sample prior to approval

2.4 DIGITAL SIGNAGE PANEL AND HINGED DOOR ASSEMBLY

A. OUTFRONT Videri 5U Screen
1. Dimensions: 55.31 inches X 27.362 inches X 3.5 inches
2. Weight: 150 lbs.
3. To be handled and installed in accordance with the manufacturer’s specifications and as indicated on the Construction Documents.
4. Cable dressing and connectivity routed and managed to avoid conflicts with ventilation baffles and internal structure.

B. Stainless Steel Door Frame Assembly
1. Material and Finish: 1/8” / 11 ga. plate powder coated black.
2. Nominal Thickness: 11 ga. / 1/8” As drawn
3. Width: Laser-cut profile and folds as described in Construction Drawings, with tabs and holes to coincide with threaded mounting holes within back of screen.
4. Edges: All edges to be polished and eased.

2.5 SIGNAGE AND CLADDING PANELS

1. Formed cladding panels to be made from 14 ga. 424 Type 3 steel folded into pans with 1/2” returns on all four sides.
2. Dimensions: As detailed on Construction Drawings.
3. Finish: Porcelain enamel coating to match white MNR Signage.
4. Channels tacked to the back face of cladding panels to align with pre-drilled oversized.

2.6 GLASS PANEL LOCKING SYSTEM MECHANISM

Comprising the following:

A. Mortise Deadlock
1. Material and Finish: Stainless Steel with mill finish, suitable for outdoor application
2. Number: 1 total per Totem on back side of access panel below digital display.
3. Location: To indicative positions as illustrated in the construction drawings.

B. Lock Spindle
1. Material and Finish: Stainless steel with mill finish
2. Nominal Diameter: To be developed with appointed contractor following selection of mortise lock
3. Number: 1 total per Totem.
4. Lock Key: To be vandal resistant, approved by MNR through sampling prior to fabrication.

C. Guide Bracket
1. Material and Finish: Stainless steel with mill finish
2. Details: To be coordinated by contractor following the development and final specification of the Signage Panel Locking Mechanism

2.7 BASE KICK PLATE (MTL-05)

A. Brake-Formed 424 Type 3 Steel Pan
1. Material and Finish: porcelain enamel white to match Unimark MNR signage.
2. Nominal Thickness: 3/4”
3. Width: Refer to construction drawings
4. Height: Refer to construction drawings
5. Edges: All edges to be polished and rounded off
6. Edges: All edges to be polished and rounded off
7. Return at bottom extent of plate to be notched around edge of totem base plate
8. Attachment brackets casted into to back side (interior face) of panel to coincide with locking mechanism and locator slots in base plate. Refer to connection details as shown on construction drawings.

2.8 BACK- FACING BREAK FORMED STEEL PANEL (MTL-05)

1. Material and Finish: 424 Type 3 steel plate with mill finish, with black porcelain enamel to match MTA Signage.
2. Nominal Thickness: 14 GA

3. Edges: All edges to be polished and rounded off
4. Fixings: Welded to mounting plate / tray

2.9 BACKLIT ACRYLIC (GLS-04)

A. Clear acrylic machine profiled block bonded and mechanically fixed to aluminum fixing plate, configured and to nominal dimensions as indicated on the contract drawings and specifications. Beacon to be tinted to match associated MNR line color (red, green, or blue) to match existing signs.
   1. Material: Colorless and clear cast acrylic impact resistant, UV stable PLEXIGLAS GS or approved equal, with tinting to match MNR line color. Color samples to be provided by manufacturer for design professional and engineer approval.
   2. Finish:
      a. All exposed surfaces and grooves on underside of beacon to be polished
      b. Concealed end faces (adjacent to vertical support posts) to receive acid etched brushed surface treatment. Surface finish to be approved through sampling prior to fabrication
   3. Surface to receive bonding tape to be cleaned and /or polished in accordance with supplier's recommendations
   4. Edges: To be smooth and incorporate cast formed radiuses, radii to be agreed with NYCDOT through provision of samples from contractor prior to fabrication
   5. Fixings: Holes to be drilled and tapped to receive mechanical screw fixing. Size, depth and thread count of screw to be in accordance with acrylic manufacturers recommendations.

B. Aluminum Fixing Plate
   1. Material and Finish: Aluminum with mill finish
   2. Surface to receive bonding tape to be cleaned and /or polished in accordance with manufacturer's recommendations
   3. Nominal Thickness: 1/4"
   4. Width: varies depending on totem type 16", 32", 48"
   5. Depth: 3-1/4"
   6. Edges: All edges to be polished and rounded off
   7. Through Bolt Holes: To be oversized to allow for differential expansion rates of aluminum fixing plate and Acrylic above

C. Bolt Fixings
   1. Stainless steel bolts fix into threaded holes in cast acrylic, details need to be coordinated with acrylic supplier.

D. Leveling Skims (if required)
   1. Material and Finish: Stainless Steel with mill finish
   2. Nominal Thickness: As required by contractor to ensure height alignment of totem beacon.

E. Surface to receive bonding compound to be cleaned and /or polished in accordance with supplier's recommendations

F. Fixings: Holes to be drilled and tapped to receive mechanical screw fixing. Size, depth and thread count of screw to be in accordance with acrylic manufacturers recommendations.
   1. Bolt Fixings:
      a. Stainless steel bolts fix into threaded holes in cast acrylic, details need to be coordinated with acrylic supplier
      b. Levelling shims (if required)
      c. Material and Finish: Stainless Steel with mill finish
      d. Nominal Thickness: As required by contractor to ensure height alignment of totem beacon.

G. Backlit LED Lighting for Beacon
   1. LED linear light IP-55 rated minimum.
   2. Dimensions: 4 1/4 inches X 28 5/8 inches X 1/2 inch thick.
   3. See Lighting Section for specification of lighting element.

PART 3 - EXECUTION

3.1 Fabrication

A. Totem Framework
   1. Vertical Support Post / Structural Column
      a. 1” X 6” stainless steel plate and 3” X 3” stainless steel angle to be joined with full penetration welds for the entire length.
      b. All exposed edges to be eased a minimum of 1/16”.
      c. All holes to be pre-drilled and tapped as specified in Construction Drawings prior to powder coating.
   2. Cladding/Signage Panel Support Brackets
      a. To Internal Structural Infill Back Plate: Plate to be drilled to accommodate oversized holes to accept structural bolted connection as indicated on the construction drawings
      b. To access panel locking mechanism: plate to be drilled to accommodate oversized holes to accept rigid bolted connections of access panel locking mechanism.
      c. Bolted connections: To be low profile, socket head stainless steel unless stated otherwise, to indicative positions and sizing as noted on construction drawings.
   3. Hooking Channel Bracket
      a. To vertical support posts: bracket to be drilled to accommodate oversized holes to accept bolted connections as indicated on the construction drawings.
   4. Bolted connections: To be stainless steel unless stated otherwise shown.
   5. Panel and Digital Screen Hooking Bracket:
      a. To Internal Web and Connection Tab: plate to be drilled to accommodate oversized holes to accept structural bolted connections as indicated on the construction drawings.
   6. Signage Panel Locking Mechanism
      a. All components to be socket head stainless steel unless stated otherwise, sizes to be confirmed by contractor and agreed with MNR
   7. Attachment Rods
      a. Attachment rods are welded to washers and fully bonded with high-strength, weather stable epoxy to back (internal-facing) face of each cladding panel.

8. Signage Panel Vertical Edge Support
    a. To vertical support posts internal web: Vertical edge support profile needs to be drilled with oversized holes to allow for lateral movement to give on site / factory adjustment to ensure correct alignment with the rear of the glass signage panel.
9. Structural Infill Back Plate
    a. Bolted to Structural Posts through fully-welded angle.
    b. To be laser cut with holes as described on Construction Drawings for screen ventilation and for attachment of various internal components. Holes to allow for lateral movement to give on site factory adjustment to ensure correct alignment with the screen, signage and cladding panels.
10. Final Assembly of Totem Framework
    a. Final assembly of the totem framework must be done in a custom-made jig to ensure consistent tolerances from one assembly to another and to ensure quality control.

B. Cladding Panels
1. Positioning/Alignment: Panels to be centered on totem axis, vertical open joints to be of equal dimension on either side with adjacent vertical support posts.
2. Assembly of Access Panel
    a. Framing assembly and hook-on edge bracket to be bonded directly to rear of mounting plate
    b. Structural Infill Back Plate to oversized have holes to receive rods. Panels to be secured with washer plate on interior face of Structural Back Plate
3. Installation of Access Panel Support Bracket to Totem
    a. To vertical support post external flange: Plate to be drilled to receive countersunk socket head bolt connections, to indicative positioning and sizing as noted on the construction drawings.
    b. Bolted connections: To be socket head stainless steel unless stated otherwise, to indicative positions and sizing as noted on construction drawings.
4. Installation of Access Panel Locking Mechanism (Sliding Lock Plate)
    a. Slotted Holes: plate to be drilled / cut to accommodate oversized slotted hole to accept bolted connection to guide horizontal locking action
    b. Bolted connections to signage panel support bracket: Stainless steel socket head bolts and nylon insert jam lock nuts with stainless steel washer/spacers to allow for sliding horizontal movement.

C. Acrylic
1. Folded stainless steel beacon box with internal flanges to receive P1 fixture and 2108 green tinted acrylic sheet front plate.
2. Acrylic sheet to have bonded fixing tabs on inside face of beacon sheet.
3. Acrylic sheet bonded into face of beacon box with silicone sealant. No residue of sealant shall appear on beacon face.

PART 4 - Submittal Approvals

Item No.	Paragraph No.	Submittals	Approval By (Engineer or Designer)
1	1.5, a.	Samples	Design Professional and Engineer
2	1.5, b.	Shop Drawings	Design Professional
3	1.5, a	Mock-up	Design Professional and Engineer
4	1.5, a	Prototype	Design Professional and Engineer
5			
6			
7			
8			
9			

Notes: This table does not include approvals for “or-equal” proposals.

END OF SECTION

PART 3 - EXECUTION

3.1 PREPARATION

A. Transmit submittals required by this Section.

B. Furnish products as indicated.

C. Ensure that substrates are in suitable condition to receive thework.

3.2 INSPECTION

A. Examine surfaces scheduled to receive signage units forunevenness, irregularities that would affect quality and execution of work.

B. Approved List: Proceed only with final approved submittals based on assigned identifications reviewed by the Engineer and Owner.

3.3 INSTALLATION

A. Install work in strict accordance with manufacturer's recommendations.

B. Locate signs in a straight and aligned manner using manufacturedadhesive and/or fastening methods.

C. Contact the Engineer if there are any questions as to suitability of the installation location or installation surface.

D. Conform to ADA requirements for tactile graphics signage.

3.4 CLEANING

A. Clean exposed surfaces using non-abrasive cleaning agents such as soap and water or as recommended by manufacturer not more than 48 hours prior to date of Substantial Completion in accord with manufacturer’s written cleaning instructions.

B. Maintain signs according to maintenance instructions as provided by the manufacturer.

END OF SECTION

DIVISION 14
CONVEYING EQUIPMENT

SECTION 14 24 00 - HYDRAULIC ELEVATOR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 GENERAL DESCRIPTION

A. This provides design guidelines for the fabrication, installation, and testing of one (1) in-ground hydraulic elevator at the Metro North Railroad at Purdy's Station.

1.3 ELEVATOR DEFINITIONS

A. Heavy duty elevator: An elevator designed specifically for the harsh environment and duty load cycles common to transportation system usage.

B. Elevator: a hoisting and lowering mechanism, equipped with a car or platform, which moves in guide rails and serves two landings.

C. Elevator, passenger: an elevator used primarily to carry persons other than the operator and persons necessary for loading and unloading.

D. Elevator, hydraulic: a power elevator where energy is applied by means of liquid under pressure in a hydraulic jack or jacks

E. Defective Elevator Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions

F. Installer: The responsible party who installs the elevator.

G. OEM: Original Equipment Manufacturer.

H. Owner: Metro North Railroad.

I. Substantial completion: The point at which the elevator is ready for use, whether the site is finished or not. This is where the jurisdictional inspection usually takes place.

J. Final Acceptance: The point at which the owner accepts the elevator project as being complete including all submittal requirements. This may be a different point in time than substantial completion.

K. Interim Maintenance: Planned monthly maintenance during the warranty period.

L. Beneficial Use: When the elevator is placed into service, may be prior to the site being ready for public use.

M. Revenue Service: The station or facility opening date.

N. Notice to Proceed (NTP): within this document shall mean the date which the elevator installer is notified to proceed with the project.

O. Authority Having Jurisdiction (AHJ): as defined by ASME A17.1.

P. MSDS: Material Data Safety Sheets, as defined by OSHA

Q. OSHA: Occupational Safety and Health Administration

R. Definitions in ASME A17.1 - 2013

1.4 APPLICABLE CODES, STANDARDS, ORGANIZATIONS AND PUBLICATIONS

A. Elevator designs and installations shall be of the heavy duty type, and shall comply with the following.
   1. American Society of Mechanical Engineers (ASME), ASME Al7.1 2013
   2. National Fire Protection Association (NFPA)
      a. NFPA No. 130, “Fixed Guideway Transit and Passenger Rail Systems”
      b. NFPA No. 13 and 72
   3. National Electrical Code (NEC)
   4. American Welding Society (AWS)
   5. American Society of Testing and Material (ASTM)
   6. International Standards Organization, ISO 281/I-1997
   7. American Federation of Bearing Manufacturers Association, AFBMA, Std. 9 and 11
   8. National Electrical Manufacturers Association (NEMA)
   9. The American Insurance Association
   10. Occupational Safety & Health Act (OSHA)
   11. International Code Council/ American National Standards Institute, (ICC/ANSI), A117.1-2004
   12. American Disabilities Accessibility Guidelines for Buildings and Facilities (ADAAG), 2010
   13. Building Officials & Code Administrators International, Inc. (BOCA)
      a. Any additional requirements imposed by local agencies shall be incorporated into elevator installations.
      b. In case of a conflict between codes, regulations, or standards, the most stringent requirement shall take precedence.

1.5 SUBMITTALS

A. Submit OEM’s product data and samples for the system proposed for use.
   1. Product Data
      a. Include capacity, size, performance, operation safety features, finishes and similar information.

b. Include product data for car enclosures, hoistway entrances, and operation, control and signal systems.

2. Shop Drawings
   a. Include plans, elevations, sections, and large-scale details indicating service at each landing; machine room layout; coordination with building structure; relationships with other construction; and locations of equipment.
   b. Include large-scale layout of all fixtures.
   c. Indicate maximum dynamic and static loads imposed on building structure at points of support as well as maximum and average power demands.

B. Samples for Initial Selection: Samples of all exposed finish materials, including car and hoistway doors, car flooring, walls, ceiling and glazing.

C. Samples for Verification: For exposed car, hoistway door and signal equipment finishes, 3-inch-square samples of sheet materials and lengths of running trim members.

D. Information Submittal
   1. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on drawings, and electrical service, as shown and specified, are adequate for the elevator system being provided.

   2. As-Built Drawings for the elevator installation, including:
      a. Detailed drawings, control diagrams and schematic electrical wiring diagrams of controller, including safety devices, remote indicating devices, control panel, fault indicating device, and annunciator panel.
      b. Electrical layouts, showing placement of lighting fixtures, switches, receptacles and disconnect switches in machine rooms and pits.
      Four (4) sets of 11” x 17” laminated copy of schematic wiring diagrams for controller and associated devices.

1.6 OPERATING AND MAINTENANCE MANUALS

A. Maintenance Manuals: Prior to installation, Elevator Contractor shall submit two (2) complete sets of operation and maintenance manuals for approval. After Metro North Railroad approval and prior to the beginning of acceptance testing, four (4) sets of the approved manuals shall be provided by the Elevator Contractor.

1.7 TRAINING OF OWNER’S PERSONNEL

A. The Contractor shall train the owner’s personnel in maintenance.

B. Training shall be given by personnel qualified, in the care, adjustment and operation of the elevator system.

C. Training shall include, but not be limited to, the car, adjustment, operation and sequence function of the operation and control systems.

D. Training shall be given during normal working hours of normal working days. The training period shall be assumed to be four-hours.

1. The owner shall also have the option to assign personnel to observe and be retrained during the final tuning and adjusting of the elevator.
2. Five copies of the operating and maintenance manuals shall be prepared by the Contractor and shall be utilized by the Contractor for instruction purposes.
    a. After completion of all instructions, the five copies of the complete manual shall be turned over to the owner.
    b. The time and place of the instructions shall be coordinated with the owner.

E. Training shall also include but not be limited to the following:
1. Operation of elevator under emergency condition.
2. Operation and maintenance of the elevator Fire Fighters' system.
3. Safety procedures in gaining access to elevator pit.
4. Safety procedures in gaining access to elevator hoistway.
5. Safety procedure in removing passengers from stalled elevator.
6. Operation of top of car operating station, elevator communication, safety edge, pit stop switch, leveling device, etc.

1.8 MAINTENANCE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months full maintenance by skilled employees of elevator Installer under the supervision and in the direct employ of the Contractor. Include bi-weekly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Repair or replace any parts of equipment whenever required during the maintenance period and use only genuine standard parts produced by the manufacturer of the equipment installed.

B. After the 12 month Maintenance Period there shall be an additional 30 day trouble free period. If any elevator outages or unscheduled repairs are performed during this period, not including those due to vandalism of force majeure, then the Maintenance period is extended for an additional 30 days.

C. All normal work, including regular examination and scheduled repair in accordance with this contract, is to be made during the regular business hours of the Contractor.

D. Contractor shall perform the required mandated inspections and tests as required per local jurisdictions during the term of the included one (1) year maintenance contract.

E. The piston packing seal should be changed at the following intervals:
1. Prior to putting the cab into service under beneficial use;
2. After the 12 month warranty period.

F. Bi-weekly systematic examination, adjustments, cleaning and lubrication of all machinery, machinery space, hoistway and pit. The Contractor shall maintain all parts of the elevator, consisting of, but not limited to machine, motor, controller, selector, pump unit, piston cylinder assembly, valve unit, bearing, winding, rotating element, contact, coil, resistance for operating and motor circuit, leveling device, cam, hoistway door, track and guide, door operating device and door motor, car light, push button, indicator, car lantern and all other elevator signal scheduling and accessory equipment complete.

1. Lubrication: Lubricate bi-weekly (26 times per year at regularly scheduled intervals) all of those mechanical parts recommended to be lubricated by manufacturer of the equipment, or to otherwise lubricate as often as and in the manner specified by said manufacturer.
2. Lubricant and Cleaning: Lubricant shall consist of oil, grease and compound furnished by Contractor, and shall be of the highest quality, the consistencies of which shall be proper for the purposes employed and for the part to which applied. Contractor shall keep guide rails clean. When necessary, the Contractor shall renew guide shoe as required to ensure smooth and quiet operation. All oil reservoirs shall be kept properly sealed to prevent leakage. Approved metal containers shall be provided by the Contractor for the storage of wiping cloths.
3. Cleaning Materials: Cleaning compounds, waste, cloths and other materials are to be supplied by Contractor, it being understood and agreed that cleaning agent employed shall not be flammable or noxious, and must always be stored in approved metal container provided by the Contractor.
4. Cleaning: Contractor shall, remove and discard immediately, all accumulated dirt and debris from the pit areas. Prior to beneficial use and immediately before the end of the Maintenance Period the Contractor shall thoroughly clean down the entire hoistway of all accumulated dirt, grease, dust and debris.
5. Testing: Examine quarterly all safety device including governor, safety, piston cylinder assembly, and conduct annual no load test, annual inspection in accordance with ASME A17.1 and A17.2.
6. Wiring: Repairing and/or replacing all electrical wiring and conductor extending to the elevator from main line switch in the machine room and outlet in the hoistway. The fuses of the main line switch shall be maintained and replaced.
7. Keeping the exterior of the machinery and any other part of the equipment subject to rust, properly painted, identified and presentable at all times. Motor winding and controller coil are to be periodically treated with proper insulating compound.
8. Hydraulic system of pump unit, valve unit, and piston cylinder assembly: Examine and repair as required to maintain in smooth operating condition without any oil leak.

G. Full protective maintenance requirements:
1. Regularly and systematically examine, adjust, lubricate, clean and when conditions warrant repair or replace the following items and all other mechanical or electrical equipment.
2. Hydraulic power unit and accessories: pump, motor, valves, operating valves, pulleys, drive belts, flexible hydraulic hose and fitting assemblies, oil tank, muffler, strainer, sound isolating coupling, plunger, packing gland, scavenger system, piping and other components.
3. Cylinder piston assembly.
4. Controller, Selector and Dispatching Equipment: all components including all relays, solid state components, resistors, condensers, transformers, contacts, leads, dashpots, computer devices, selector switches, mechanical or electrical driving equipment, coils, magnet frames, contact switch assemblies, springs, solenoids, resistance grids, hoistway vanes, magnets and inductors.
5. Hoistway door interlocks or locks and contacts, hoistway door hangers and tracks, bottom door gibs, cams, rollers, and auxiliary door closing devices for power operated doors. Chains, tracks, cams, interlocks, sheaves for vertical bi-folding doors.
6. Hoistway limit switches, slowdown switches, leveling switches and associated cams, vanes, and electronic components.
7. Cab door operator and car door control, door protective device, car frame, car safety mechanism, governor, cable rope, platform, platform flooring, elevator car guide shoes including rollers or replaceable gibs, etc.

8. Car guide rails, top and bottom limit switches.
9. Hoistway door interlocks, track, roller, drive block, door gib etc.
10. All car and hoistway operating fixtures including Main Lobby fixtures, main car operating panels, safety edge, and starter's panels.
11. Automatic power operated door operators, door protective devices, car door hangers, tracks and car door contacts for both side slide and vertical bi-folding doors.
12. Traveling cables.
13. Elevator control wiring in hoistway and machine room.
14. Car safety mechanism and load weighing equipment.
15. Buffers.
16. Fixture contacts, push-buttons, key switches, locks, lamps and sockets of button stations (car and corridor), corridor lanterns, position indicators (car and corridor), direction indicators.
17. The guide rails shall be kept free of rust. Where roller guides are used, rails shall be kept dry and properly lubricated when sliding guides are used. Renew guide shoe rollers and gibs as required to insure smooth and satisfactory operation.
18. Examine, and make necessary adjustments or repair to the following accessory equipment including relamping of signal equipment: corridor lanterns, car and corridor position indicators, car stations, traffic director station, electric door operators, interlocks, door hangers, safety edge, and intercom systems.
19. The Contractor shall check the group dispatching systems (if applicable) and make necessary tests to insure that all circuits and time settings are properly adjusted, and that the system performs as designed and installed.

H. Contractor shall, at all times during the term of this Agreement, maintain locally an adequate supply of replacement parts in order to perform his obligations pursuant to the terms of this Agreement without any delay whatsoever.
1. The following spare parts shall be provided and kept on-site in a parts cabinet provided by the Contractor. All spare components shall be replenished as required.
    a. Ten (10) gallons of hydraulic oil in two (2) - 5 gallon sealed pails
    b. One (1) solenoid valve coil
    c. One (1) roller guide
    d. Two (2) door operator belts
    e. Two (2) sets of release rollers
    f. Two (2) hanger rollers
    g. Two (2) door gibs
    h. Spare cable for infra-red detector
    i. Two (2) pushbutton units
    j. One (1) gate switch contact
    k. One (1) door interlock contact

I. The Contractor shall keep the elevator maintained to operate at the original contract speed, keeping the original performance time, including acceleration and retardation as designed and installed by the manufacturer. The door operation shall be adjusted as required to maintain the original door opening and door closing times, within legal limits.

J. Metro-North reserves the right to make inspections and tests as and when deemed advisable. If it is found that the elevator and associated equipment are deficient either electrically or mechanically, the Contractor will be notified of these deficiencies in writing, and it shall be his responsibility to make the necessary corrections within 30 days after his receipt of such notice.

K. Approximately six months prior to the end of the contract term, Metro-North may make a thorough maintenance inspection of the elevators covered under the contract. At the conclusion of this inspection, Metro-North may give the Contractor written notice of any deficiencies found. The Contractor shall be responsible for correction of these deficiencies within 30 days after receipt of such notice.

L. Metro-North reserves the right to accept or reject any or all alternates.

M. A complete permanent record of inspections, maintenance, lubrication and callback service for the elevator under service shall be maintained by the contractor in a location determined by the owner. These records are to be available to owner at all times. The records shall indicate the reason the mechanic was in the building, arrival and departure time, the work performed, etc. In addition, a chronological record of all work performed shall be kept in each machine room. Signed work tickets shall also be provided.

N. Contractor shall maintain a complete set of updated electrical wiring diagrams and drawings for the elevator on file with owner and these to become the property of the owner.

O. Contractor shall be responsible to re-lamp all lighting fixtures in the pit, machine room and hoistway as required.

P. Sole Responsibility: The maintenance work shall be performed by only the elevator men directly employed and supervised by the Contractor, who are experienced and skilled in maintaining and shall not be assigned or transferred to any agent or subcontractor.

1.9 WARRANTY

A. Provide project warranty effective for one (1) year from the final acceptance of the elevator, which shall be signed by Contractor, Installer and Manufacturer, agreeing to replace/repair/restore defective materials and workmanship of elevator during warranty period.
   1. “Defective” is hereby defined to include, but is not limited to: operation or control system failures, excessive wear, excessive malfunctions, unusual deterioration or aging of materials or finishes, unsafe conditions, the need for excessive maintenance, abnormal noise or vibration, and unusual, unexpected and unsatisfactory conditions.

B. After the one (1) year Warranty Period concludes there shall be an additional 30 day trouble free period. If any elevator outages or unscheduled repairs are performed during this period, not including those due to vandalism of force majeure, then the Warranty period is extended for an additional 30 days.

C. The Contractor shall warrant to the owner that all work furnished under this contract shall be:
   1. Free from defects in design, material, and workmanship.
   2. Adequate and suitable for any use and purpose specified or referred to in this contract.
   3. Suitable for any other use or purpose as represented in writing by the Contractor.
   4. In conformance with the drawings, specifications and design criteria supplied to the Contractor by the Engineer.

1.10 EMERGENCY CALL BACK

A. Emergency Callback Service: Provide emergency callback service which consists of promptly dispatching qualified employees in response to requests from the Owner by telephone or otherwise, for emergency callback service on any day of the week, at any hour, day or night, 24-hour-per-day, 7-day-per-week during the Warranty and Maintenance periods.

B. Emergency repair shall be made to restore the equipment to operating order. If repair cannot be made immediately, the mechanic shall notify the Owner or his designated representative as to the reason why.

C. Response time for emergency callback service shall not exceed one (1) hour when the Contractor is advised that a trapped passenger is involved, and two (2) hours when an elevator malfunction occurs which does not involve a trapped passenger.

1.11 GUARANTEES

A. Notwithstanding the Specifications forming a part of this Contract, any inspection or approval of the Work by the Engineer, or the existence of any patent or trade name, the Elevator Contractor nevertheless unconditionally guarantees that the equipment furnished and installed hereunder shall be of the best quality and shall be fully fit for the purpose for which it is intended.

1.12 DESIGN CRITERIA

A. General
   1. Elevator shall be designed with provisions for thermal expansion and contraction of complete elevator assemblies.

B. Operational Requirements
   1. Hours of operation shall be considered as twenty-four (24) hours per day, seven (7) days per week.
   2. Specified speed shall be maintained during operating regardless of direction or loading.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. Qualifications
   1. The work of this Section shall be performed by a firm that is regularly engaged in the business of manufacturing, installing and servicing conveying systems of the type and character required by these specifications. Contractor shall manufacture all major parts of the equipment and shall so state in the request for acceptance listing the items Contractor manufactures.
   2. Prior written acceptance is required for manufacturers other than the ones listed, before quoting this project. Requests for acceptance will not be considered unless they are submitted before bid date and are accompanied by the following information:

a. List of five (5) similar installations having exact equipment being proposed for this project arranged to show name of project, system description and date of completed installation.
b. Complete literature, performance and technical data describing the proposed equipment.
c. List of ten service accounts by building name, building manager or Metro-North, including phone numbers.
d. Location of closest service office from which conveying system will be maintained.
e. Location of closest parts inventory for this installation.

B. Subject to compliance with the requirements of this Section, provide hydraulic elevators of one of the following manufacturers:
1. Minnesota Elevator, Corp.
2. Canton Elevator Inc.
3. Elevator Equipment Corp. (EECO)
4. Approved equal.

2.2 MATERIAL

A. Except where product conformance to specific standards is indicated on the Contract Drawings and in ASME/ANSI A17.1, OEM's standard materials and equipment may be used in elevator construction, subject to approval. Materials cited below are intended to establish the standard of quality for comparable materials used by the manufacturer.

B. Structural Shapes, Plates, Sheets, and Tubing: ASTM A36 Steel.

C. Sheet Steel: ANSI/ASTM A446, Grade B.

D. Stainless Steel: ASTM A167, Type 304

E. Aluminum: ASTM B211 or ASTM B221, Alloy 6061, T6.

F. Flooring: Provide finish flooring as specified herein.

G. Glass: ANSI Z97.1

2.3 SPECIAL FEATURES

A. General:
1. Elevator shall be of size, arrangement, capacity and shall comply with design criteria specified in this Section and as shown on the Contract Drawings, and in accordance with the requirements of the ANSI/ASME A17.1.
2. Provide all material and equipment necessary for the complete execution of all elevator work as specified in this Section and as shown on the Contract Drawings.
3. Provide hoistway guards for protecting hoistway during construction. Hoistway protection shall include high solid panels surrounding each hoistway opening at each floor.
4. All electric equipment, conduit, fittings and wiring shall conform to the requirements of ANSI/NFPA No. 70 National Electric Code.

5. Provide concrete inserts and other similar anchoring devices for the installation of guide rails, machinery and other elevator components.
6. Clearance around equipment located in each elevator control room and machine area shall comply with the applicable provisions of ANSI/NFPA No. 70 National Electrical Code.
7. Each elevator system is to be provided with a hands free wireless maintenance communication system that provides for communication from within each elevator car enclosure, car top and control room.

2.4 SUMMARY OF FEATURES:

A. Elevator Quantity: One (1)

1.	Elevator Use:	Passenger
2.	Contract Load, in pounds:	4000
3.	Contract Speed, in FPM	125 (with full load)
4.	Travel Distance:	32’-0” (Contractor must V.I.F. prior to fabrication)
5.	Car Size:	per contract drawings
6.	Number of Stops:	2
7.	Number of Openings:	2
8.	Operation:	Simplex Selective Collective
9.	Machine Location:	Adjacent First Floor
10.	Controller Location:	Adjacent First Floor
11.	Machine Type:	Hydraulic Pump Unit
12.	Motor Horse Power:	40 H.P.
13.	Power Supply:	208/480 V, 60Hz , 3 Phase (V.I.F.)
14.	Lighting/ Signal Power Supply:	120V, 60Hz, 20A
15.	Ancillary/Auxiliary Power Supply:	120V, 60Hz, Amperage
16.	Car/Hoistway Door Size:	per contract drawings
17.	Car/Hoistway Door Type:	per contract drawings
18.	Car/Hoistway Door Operation:	Power High-speed, heavy duty
19.	Maximum opening speed:	3.0 FPS
20.	Hoistway Entrance:	As specified.
21.	Cab Enclosure:	As specified.
22.	Cab Flooring:	Poured Acrylic Epoxy or Polymer
23.	Door-Reversal Device:	Non-Contact (Weather Resistant) door reversal device
24.	Signal Equipment:	Type 304 stainless Steel #4 finish with vandal resistant features
25.	Communication System:	Two-way “Hands-Free”
26.	Maintenance Term:	One (1) year

2.5 DOOR OPERATOR EQUIPMENT

A. Provide a water-resistant heavy-duty door operator with encoder-less VVVF drive. Closed loop door operator designed to operate car and hoistway doors simultaneously at the speed specified. Door operator shall be model MOVFR purchased from GAL or approved equal.

1. Provide a three-phase induction motor with a VVVF drive system using a pulse width modulation. A digital closed-loop system shall monitor and control door speed and performance profile.
2. The door shall operate smoothly without a slam during both opening and closing cycles. Door velocity shall be adjustable and continuously monitored to maintain minimum floor-to-floor performances and door operation times.
3. Use a spirator or a weighted door closer to automatically close the hoistway door if the car, for any reason, leaves the landing zone.
4. The car and the hoistway doors shall open as the car stops at the landing and close before the car can leave the floor.
5. Door Contact - Equip the car door with an electric contact, which will prevent operation of the car, unless the car door is in the closed position. The door contacts shall not be readily accessible from the inside of the car.
6. Nudging - If the doors are held open for a predetermined time (15 to 20 seconds; individually adjustable) by interrupting the light rays/detector field, or by holding the door, or by pressing the door open button, a buzzer will sound, and the doors shall start to close at a gentle slow speed.
7. Repeated attempts by the power car door operator mechanisms to open or close the car door at any landing shall be monitored by the new microprocessor control system. In the event the door should fail to cycle properly after a preset (adjustable) number of attempts, the car shall either travel to the next stop or remove itself from service, depending upon whether the malfunction is in the open or close cycle.
8. Provide a door hold open features for the service elevator that shall be activated by a push button in the car station. Activation of the push button shall reset the door hold open timer by an adjustable time delay (between 10 and 60 seconds).
9. Door Reopening Device – “3D”
    a. Provide a combination infrared curtain and 3D door protection system.
    b. The door shall be prevented from closing from an open position if a person interrupts any one of the curtain light rays or enters the 3D detection zone. When the door is closing, any interruption of either protective light field shall cause both the car and corridor door to reverse. The door shall start to close when the protection system is free of any obstruction.
    c. The infrared curtain and 3D zone protective system shall have:
    d. Height of protective curtain field not less than 71” above the sill.
    e. Height of 3D protective zone field not less than 61” above the sill.
    f. Where a horizontal infrared light beam system is used, provide a minimum of 40 light beams and accurately positioned infrared lights to conform to the requirements of the applicable handicapped code.
    g. Modular design to permit on board test operation and replacement of all circuit boards without removing the complete unit.
    h. Self-contained, selectable 3D zone timeout feature to allow for closing at nudging speed with audible signal.
    i. Automatic turning-off of the 3D zone in the event of three (3) consecutive 3D triggers. Light curtain shall continue to operate after 3D system timeout.
    j. Selectable control of the 3D zone operation on an “always-on” or “as doors close” basis.
    k. Controls to shut down the elevator when the unit fails to operate properly.
    l. Door Hold button to allow lockout for 90 seconds/locking out hall calls

2.6 FIXED HOISTWAY EQUIPMENT

A. Guide Rails:
   1. Guides shall be steel T-section rails. Rail surfaces shall be machined smooth to insure proper operation of guides. Use not less than 15.0 pound per foot car rails.
   2. The section modulus and moment of inertia of the fishplates shall not be less than that of the guide rail. Connect rails to fishplates with eight (8) bolts.
   3. For concrete and concrete block hoistways furnish rail brackets and provide inserts and an insert location drawing to the Construction Manager or General Contractor.
   4. Brackets shall be used to support the rails from the hoistway framing and/or inserts. The rails shall be attached to the bracket by heavy clamps or clips. Bolting or welding rails to brackets shall only be allowed in certain instances. Do not attach brackets to the top flange of hoistway framing steel.
   5. All guide rails shall be erected plumb and parallel to a maximum deviation of 1/8 inch (plus or minus 1/16 inch.)
   6. Provide rail backing and connect rails to the top and bottom of structural members as shown on the structural drawings where the vertical distance between support framing is greater than 14’-0”, and no intermediate

B. Car Buffers:
   1. Minimum two (2) spring type with blocking and support.
   2. The buffers shall comply in all respects with the requirements of the ASME A.17.1 Code.
   3. Provide permanent buffer marking plate which indicates the manufacturer's name, identification number, rated impact speed and stroke.
   4. Buffers shall be designed for minimum gross weight of 8000lb load per buffer.

C. Roller Guides: Roller guides shall be mounted on top and bottom of the car frame to engage the guide rails. Provide ELSCO Model B with neoprene roller wheels.

D. Normal Terminal Stopping and Devices:
   1. Provide upper and lower normal terminal stopping devices to slow down and stop the car automatically from any speed obtained under normal operation, at or near the top and bottom terminal landings independent of the normal stopping means. The activation of these devices shall cause the elevator, with any load up to and including rated load, to automatically come to a smooth stop.
   2. The normal terminal stopping switches shall have rollers with rubber or other approved composition tread to provide silent operation when actuated by the fixed cams in the hoistway. Locate the terminal cams so that they will activate the stopping switches when the elevator travels a predetermined distance above or below the corresponding terminal landings. The switch roller shall engage the full surface area of the cam.

E. Door Interlocks and Emergency Exit Contacts:
   1. Equip each elevator hoistway door with a positive interlock which shall prevent the operation of the elevator unless all elevator doors are closed and maintained closed when elevator is away from the landing. The interlocks shall prevent the opening of a hoistway door from the landing side unless the car is within the landing zone and is either stopped or being stopped at that level. Retiring cams used to actuate interlock shall be securely fastened to car construction and be designed to operate without objectionable noise, shock or jar. Design and locate interlocks so that they are not easily accessible from the landing side.

2. Electric contacts shall be provided on all emergency exits to prevent the operation of the elevator when the exit doors or panels are open.

F. Hoistway and Car Door Hangers, Sheaves and Tracks:
1. Provide a sheave type two-point suspension hanger and track for each hoistway and car door. Sheaves shall be hardened steel, not less than 3-1/4 inches in diameter with sealed, grease packed, precision ball bearings.
2. The upthrust shall be taken by a roller mounted on the hanger and arranged to ride on the underside of the track.
3. The track shall be of formed cold rolled steel or cold drawn steel and be rounded on the track surface to receive the hanger sheaves. The track shall be removable and not be integral with the header.
4. The hanger track shall be adjustable. The track shall be capable of being moved up from its final position.

G. Hoistway Entrances:
1. Hoistway entrances shall be the size and type as indicated on the Contract Drawings.
2. Frames: Frames shall be constructed of 14-gauge stainless steel with a #4 satin finish. Frames shall be welded type. At outdoor landings, the frames shall be furnished with weather stripping.
3. Hoistway Doors:
   a. The doors shall be full glass doors with a stainless steel frame as shown on the Contract Drawing. The frame shall be constructed of Type 304, 14-gauge stainless steel, with a #4 satin finish. The door panels shall be 1-1/4" thick, reinforced to accept hangers, interlocks or door closers. A hoist door-unlocking device shall be installed on all hoistway doors for emergency purposes. The glass panel of the door shall conform to Division 8.
   b. Provide door panel with three (3) removable laminated plastic composition guides, arranged to run in sill grooves with a minimum clearance. The guide mounting shall permit their replacement without removing the door from the hangers. A steel fire stop shall be encased in each guide.
   c. Door panels shall be provided with replaceable astragals.
   d. Provide stainless steel retainers on hoistway doors in accordance with New York State Building Code.
   e. The bottom of the door shall have stainless back up plate.
4. Sills: Provide solid nickel sills with the nosing approximately one (1) inch deep and running the full length of door travel. The sills shall be at least 3/8 inch thick. The wearing surface shall be of a non-slip type with the door guide grooves providing a minimum clearance for the guides. Provide all sill support angles and coordinate their mounting with the other trades. Rigidly bolt sills to the support. Underside supports for sills must extend throughout the full width of the sill area.
5. Entrance sill and its support angles shall be through slotted. A stainless-steel reflector shall be provided and installed under the sills. The reflector shall act as a drain gutter to collect any drained fluid through the sill slots. The reflectors shall be enclosed on one side and pitched towards the open side which shall be the same side as the sump pit of the elevator.
6. Struts: Struts shall be hot rolled steel angles not less than 3 inches by 3 inches by 1/4 inch. Extend the struts from top of sill to either the bottom of floor beam or intermediate framing above. Bolt struts in place with not less than two (2) bolts at each end. Strut clip angles or brackets shall have a thickness not less than the thickness of the supported strut.
7. Track Support: 3/16 inch thick steel track support plate shall extend between and be bolted to the vertical steel struts with no less than two (2) bolts at each end.

8. Track Covers: 14 gauge galvanized steel coverplates shall extend the full travel of the doors. Covers shall be made in sections for service access to hangers, sheaves, tracks and interlocks. The sections above the door opening shall be movable from within the elevator car. Cover fastening devices shall be non-removable from the cover.
9. Fascia: Provide fascia plates on the loading side of elevators, only when the distance between the car sill and hoistway wall is more than 5 inches. When provided, fascia shall be 14-gauge stainless steel and extend at least the full width of the door and be secured as necessary with machine screws. Fascia shall be perforated to provide visibility when they are installed in front of glass walls or a hoistway door.
10. Toe Guards: Provide 14-gauge galvanized steel toe guards to extend a minimum 12 inches below any sill not protected by fascia. The toe guards shall extend the full width of the door and return to the hoistway wall at a 15-degree angle and be firmly fastened.
11. Dust Covers: Provide 14-gauge galvanized steel dust covers to extend 6 inches above any header not protected by fascia. The dust covers shall extend to a full width of travel of the doors, return to the hoistway wall at a 15-degree angle and be firmly fastened.
12. The bottom of each horizontally sliding hoistway door panel shall be equipped with guiding members and safety retainers in accordance with code requirement.
    a. The bottom hoistway door panel safety retainers shall be of stainless steel "T" bar or "Z" bar design or shall be otherwise designed to prevent displacement of the door panel.
13. Finishes: All exposed surfaces excluding galvanized steel, stainless steel and sills shall be painted as specified in Division 09. Protect finished surfaces at all times during delivery, storage and installation. Repair finishes which become marred, scratched, abraded, chipped or otherwise not acceptable to the Engineer.
14. Tactile Jamb Plates: Provide tactile jamb plates on each side of each hoistway entrance. Plates shall have 2-inch high white uppercase, sans serif or simple serif type characters on a black background, be raised 1/32-inch from the surface, be accompanied by grade 2 Braille, and be centered at 60 inches above the landing sill. The plates shall have designations matching the Car Operating Panel and Car Position Indicator designations, but may be abbreviated. Plates shall be mounted using Dow Corning No. 999 black adhesive, or approved equal. Mounting studs are not permitted.

H. Stop Switches
1. Provide readily accessible switches to stop and keep the elevator out of service in the pit, on the top of car station, and on the in-car operating panel.
2. Emergency/Stop switches shall be of the pull-out type to prevent accidental activation.

I. Scavenger Pump
1. Provide a positive displacement, rotary type pump for the hydraulic elevator. The pump shall have a discharge pressure of 200-psi maximum and capacity of 10-gallons per hour.
2. The pump shall be self-priming and self-lubricating. The pump shall be equipped with a 100-mesh screen strainer.
3. The pump housing shall be constructed of brass with stainless steel internal parts.
4. Mount oil return pump off the pit floor and connect it to the jack unit and the oil tank with copper tubing.

J. Sump Pump:
1. Pump shall be as specified in specification Division 22.
2. Sump Cover: Hot dip galvanized or stainless-steel grating, minimum ¼” thick.

K. Pit Float Switch:

1. Provide a pit float switch NEMA 4X.

2.7 MACHINE COMPONENTS

A. Power Unit:
   1. Provide a self-contained, submersible power unit. It shall include: a structural steel outer base, including tank supports; an oil tight drip pan; an electrically isolated floating inner base for mounting the motor pump assembly underneath the storage tank and sound isolation devices to reduce airborne noises.
   2. Provide a reinforced oil reservoir with a tight fitting tank cover over the oil pump unit. Included in the reservoir shall be an oil fill strainer with air filter and a self-cleaning strainer in the suction line. The tank shall have a removable thermostatically controlled 500W screwed on heater. The tank shall have a reserve capacity of not less than 10 gallons. Provide a sight glass with markings for minimum and maximum oil level when the elevator is at the bottom landing.
   3. The pump shall be specifically designed for oil hydraulic elevator service and be driven by a single motor, having a maximum speed of 1800 RPM. The motor shall drive the pump with a single, multiple groove, V-belt with sheaves. The motor shall be designed for 120 starts per hour, a 50°C temperature rise and shall have Class F insulation.
   4. The motor shall be designed specifically for hydraulic elevator operation.
   5. The oil control unit shall be of the manufacturer's own design but shall include relief, safety check, start and slow down valves.
      a. Use lowering and leveling valves for drop away speed, lowering speed, leveling speed and stopping speed to insure smooth down starts and stops.
      b. Provide a valve for manual lowering of the elevator car in event of power failure and for use in servicing and adjusting the elevator mechanism.
      c. Design the tank shut-off valve for isolating oil in the power unit tank to ensure each of servicing and adjusting the elevator mechanism without removing oil from the tank.
      d. All valves shall be accessible for adjustment. All adjustment shall be made without removing the assembly from the oil line.
      e. Valves shall be model UV-5AT purchased from EECO or approved equal.
   6. Provide pump unit isolation as manufactured by Mason Industries or approved equal. In addition, contractor shall provide new pump unit tie-down to the machine room floor to prevent displacement.
   7. All hardware used to be made of stainless steel

B. Jack Unit:
   1. Design and construct the jack in accordance with the applicable requirements of the ASME A.17.1 Code. No brittle material, such as gray cast iron, shall be used in the jack construction.
   2. Cylinders: Seamless steel pipe. One (1) hydraulic cylinder designed to be in-ground and mounted in the bottom of the car. Design head to receive unit-type packing and provide means to collect oil at cylinder head and return automatically to oil reservoir. The cylinder shall be finished with rust-inhibiting air-dry enamel. Apply two coats by brush, or spray according to manufacturer’s recommendations.
   3. The cylinder shall have a machined steel flange at the upper end and a heavy steel bulkhead at the lower end.
   4. A packing gland with guide bearing, wiper ring and packing especially designed for the hydraulic elevator service shall be mounted at the top of the cylinder along with an oil

collector ring and drain hole. The plunger seals shall be urethane cup design with integral wipers or approved equal. Replace the packing glands after all construction is completed.

5. Provide a thermostatically controlled insulated heat tracing assembly on each cylinder to maintain the operating temperature of the oil within acceptable manufacturer's operating range. Provide product details, ambient operating temperature guidelines and design drawings for review and approval.
6. Plungers: Polished seamless steel tubing or pipe. The plunger surface shall be a minimum of 20 micro-inches RMS and shall not exceed 35 micro-inches RMS for the entire plunger length in engagement with the cylinder seals. Provide a stop-ring, electrically welded to the plunger, to positively prevent the plunger from leaving the cylinder.
7. Steel Liner: Schedule 80; inside diameter 2" larger (min.) than the O.D. of the cylinder casing; installed to protect the cylinder/piston unit from exposure to groundwater and electrolytic action.
8. Cylinder Support Frame: Galvanized structural steel channel frame, anchored directly to the pit floor, including baseplate for mounting buffer assemblies.

C. Piping
1. Provide all necessary pipes and fittings to connect the power unit to the jack. Use minimum Schedule 80 steel pipe. Provide a shut off valve in the machine room for maintenance service.
2. Adequately support the full run of pipe with isolation type support.

D. Overspeed Valve (PRV)
1. A safety valve shall be provided to retard the downward motion of the elevator to bring it to a gradual stop in case of a mainline separation or other noncylinder related overspeed condition.
2. The valve shall have a fully adjustable flow rate and be set to actuate at a flow rate which is 125% of the flow rate required to produce the operating speed in the down direction. The valve shall also have an adjustable closing rate and allow manual lowering around the valve when set.
3. The safety valve shall be mounted directly to the jack with threaded connection.
4. The valve shall be provided with a switch to monitor valve position. The switch shall be monitored by the controller.

E. Muffler
1. Provide a new muffler installed in the discharge oil line near the pumping unit. Design shall dampen and absorb pulsation and noise in the flow of hydraulic fluid.

F. Isolation Coupling
1. Provide a new isolation coupling installed in the oil line in the elevator machine rooms.

G. Shut-off Valve
1. Provide new shut off valve in the machine room and pit.

H. Mainline Strainer
1. Provide a mainline strainer of the self-cleaning, compact type, equipped with a 40-mesh element and installed in the oil line.

I. Auto Lowering

1. Provide automatic battery powered lowering feature for the elevator. In the case of normal power outage, an emergency operation shall be activated, lowering the car to the lowest landing. The doors shall be openable manually.
2. The control panel shall be located in the machine room. Include two (2) gel batteries, solid-state controls, charger, monitor lights and a test button and shall be fed by a 120-volt, 20 Ampere branch or circuit.
    a. When normal power is restored, the elevator shall return to normal service only after the completion of the automatic lowering operation.
    b. Provide a test button in the control panel to simulate this operation.

J. Oil Cooling System
1. Provide an oil cooler for the elevator. The oil cooler shall be capable of removing 17,500 BTUH. The unit shall be provided with a 10-micron filter in the oil line.
2. The oil cooler shall be as manufactured by Minnesota Elevator, Inc., or approved equal.
3. The oil cooler shall be turned on and off by the controller, which monitors the temperature of the oil in the tank.

2.8 CONTROLLER COMPONENTS

A. The elevator shall have "non-proprietary" microprocessor-based controller/dispatchers. The controller shall be designed to control the acceleration, deceleration and stopping of the elevator and to prevent damage to the motor from overload or over current condition. Arrange controls to prevent the operation of the elevator in case of phase reversal, phase failure or low voltage in the power supply. Provide controller manufactured by GAL or approved equal.

B. Place controllers in a totally enclosed NEMA 4 enclosure with a self-supporting steel frame. Provide hinged doors to facilitate service. Within each enclosure provide a locally controlled fluorescent light and a duplex GFCI receptacle.

C. Provide natural or mechanical ventilation for the controller cabinets. Equip ventilate openings and exhaust fans with filters.

D. Mount equipment to moisture-resistant, noncombustible panels. Support these panels from steel frame.

E. Provide "noise filter" between hoistway wiring and controller/dispatchers to eliminate interference.

F. Optically isolate communication cables between components.

G. Controller shall be provided with the capability of communication and the integration with remote monitoring and control system. Contractor shall provide all required ports and outlets in the controller for the connection with the Lift-Net or approved equal system.

H. Wiring: Wiring on the units, whether factory or field wiring, shall be done in neat order, and all connections shall be made to studs and/or terminals by means of grommets, solderless lugs or similar connections. All wiring shall be copper.

I. Terminal Blocks: Provide terminal blocks with identifying studs on units for connection of board wiring and external wiring.

J. Marking: Identifying symbols or letters shall be permanently marked on or adjacent to each device on the unit, and the marking shall be identical with marking used on the wiring diagrams. In addition to the identifying marks, the ampere rating shall be marked adjacent to all fuse holders.

K. Provide a solid-state starter for the pump motor.

L. Diagnostics: For diagnostic work, provide the elevator control system with its own built-in LED or LCD display unit or furnish a service tool. When a fault is detected, the diagnostic system will record the fault code in a nonvolatile memory along with the location of the elevator and the time of day. The display unit shall be used to retrieve this information on every car. The fault information shall include, but not limited to:
   1. Elevator position, travel direction and mode of operation.
   2. Car and hall calls that currently exist within the system
   3. All safety circuits.
   4. Processor power supply and processor and Input/Output status.
   5. Door safety circuits.
   6. Door zone signals.

M. In the event diagnostics and monitoring is accomplished via Field Service Tools, provide the required Field Service Tools with related control system appurtenances for diagnostic evaluations, system monitoring and field adjustments.
   1. Provide instructions for proper use of such diagnostic tools and/or equipment with all coding and other operational requirements.
   2. Maintain and calibrate the diagnostic tools, and update the associated instructions and other related documents under the service agreement. Should the agreement be cancelled for any reason by either party, maintenance and updating of diagnostic tools shall be provided to Metro-North at the Contractor's cost without the need to purchase or lease additional diagnostic devices, special tools or instructions from the original equipment provider. Metro-North may request field and technical instructions be provided by the original installation contractor or manufacturer for proper servicing by other qualified elevator company personnel. The established cost plus profit, as previously specified, shall be applicable for the life of the system.
   3. If the equipment for fault diagnosis is not completely self-contained within the controllers but requires a separate detachable device, that device shall be furnished to Metro-North as part of this installation. Such device shall be in possession of and become property of Metro-North.

N. Microprocessor Documentation
   1. Provide and/or obtain complete information on systems' design, component parts, installation and/or modification procedures, adjusting procedures and associated computer conceptual logic circuitry and field connection.
   2. Provide microprocessor upgrading and/or modifications to programs that have been assigned to enhance the operation of the equipment for a period of 10 years after project approval.

O. Selector: A floor selector shall be part of the controller microprocessor. Position determination in the hoistway may be through fixed tape in the hoistway. Design the mechanical features and electrical circuits to permit accurate control and rapid acceleration and retardation without discomfort.

P. Provide an automatic stopping device and self-leveling system to ensure that the car lines up with each landing served with a tolerance of no more than plus or minus 1/4" for elevator under all conditions of load for both "up" and "down" travel.
   1. The automatic self-leveling system shall correct for overtravel or undertravel and drift.

Q. Simple Selective Collective Operation: As defined by ASME A17.1.

R. Protective Device
   1. Should a hydraulic elevator stall due to motor starter failure, low oil condition, or the elevator failing to reach the target landing in the up direction, a protective device shall automatically return the elevator to the bottom landing, open the door and shut down the system.
   2. Pressure Switch: Where the top of the cylinder head is above the top of the tank, provide a pressure switch between the cylinder and the valve which shall be activated by the loss of pressure at the top of the cylinder, and control the operation of the elevator as required by the Code.

S. Emergency Control for Fire Department Use
   1. Provide Phase I and Phase II firefighter operation in accordance with requirements of Code and local authorities.

2.9 CAB ENCLOSURE COMPONENTS

A. Elevator Car:
   1. General:
      a. Elevator car and car components shall meet the applicable requirements of the Code. Car control station and position indicator shall be as specified herein.
   2. Car Frame and Platform:
      a. The car frame shall be made of galvanized steel members, with a factor of safety as required by the ASME A.17.1 Code.
      b. The frames and platform shall be braced and reinforced so that no strain will be transmitted to the elevator car.
         1) Provide platform with (1) layer sub-flooring of 3/4" thick marine grade plywood with no knots or filler holes. Cover the underside of the car platform with sheet steel.
         2) Provide work lights, with wire guards and local switch, as well as a 110-volt GFCI receptacles at bottom of platform.
      c. Flooring shall be a five-layer methyl methacrylate (MMA) based decorative chip flooring system. System shall be Cryl-A-Quartz Triple Broadcast floor with Q-28 aggregate, manufactured by Dur-A-Flex, Inc., or approved equal. Colors to be selected by Metro-North.
      d. Allow for a 7’-6” clear cab height.
      e. Design the elevator frame and platform for a Class “A” loading.
   3. Appurtenances:
      Handrails: Stainless steel No. 4 finish, flat beam type, 2½” x ½”, installed at the side walls of the cab with the handrail top height to meet ADA requirement.
   4. CCTV:
      a. Provide provision for this option.

B. Fabrication and Installation

1. Provide elevator cars as shown on the Contract Drawings and as specified herein.
2. The manufacturer of the elevator cars shall have at least five years of experience in providing cars of the type required by this Contract.
3. Wall Panels: Unless otherwise noted on the Contract Drawings, all stainless-steel panels shall be Type 304, 14 gauge, with a 5WL pattern and a #4 finish and all glass shall be 9/16" thick laminated safety glass, complying with ANSI Z97.1. The ANSI Z97.1 markings shall be visible on each individual piece of glass. The public side of all glass shall be provided with a sacrificial coating, as indicated on the Contract Drawings.
4. Ceiling: Unless otherwise noted on the Contract Drawings, ceiling panels, which may be stood on from the car top, shall be 12-gauge stainless steel. The underside of all exposed ceiling panels shall be Type 304 stainless steel with a #4 finish.
5. Front Returns and Entrance Columns: Unless otherwise noted on the Contract Drawings, front returns and entrance columns shall be Type 304 14-gauge stainless-steel, with a 5WL pattern and a #4 satin finish.
6. Ventilation: Two speed, 250/350 cfm, centrifugal exhaust fan, mounted securely to top of ceiling and isolated to prevent vibration and noise within car.
7. Cab Doors: Cab doors shall be full glass with a stainless steel frame as shown on the contract drawings. The frame shall be constructed of formed Type 304, 14 gauge rigidized stainless steel, with a 5WL pattern and No. 4 satin finish, hollow metal flush construction. Door panels shall be reinforced for power operation and furnished with sound deadening. Opening sizes shall be as shown on Contract Drawing and doors shall be of at least 1 1/4" thick construction. Laminated glass vision panels shall be provided in each door panel to match hoistway door. Doors shall be provided with stainless steel sills.
8. Emergency Exit: Provide a top emergency exit which complies with Code requirements.
9. Car Lighting: LED ceiling light fixtures shall be used. The LED lighting system shall be manufactured by Man-D-Tec, UL Listed, Model SoloBeam-6 (4100k), or approved equal. In case of power loss, a minimum of two (2) lighting fixtures shall be "ON" using the integrated power supply and emergency battery backup system, providing minimum illumination and duration requirement as per Code.
10. The metal car enclosure shall have no sharp edges.

2.10 SIGNAL DEVICES AND FIXTURES

A. General: Provide signal fixtures and control devices for each elevator.

B. Car Operating Station:
   1. Provide one (1) main station in the front. This station shall include:
      a. A toggle switch designated "Inspection", and Up and Down direction buttons;
      b. A stop switch;
      c. A 110-volt GFCI duplex receptacle;
      d. A work light with wire guard and an "off"-"on" switch;
      e. An indicator light and a warning buzzer that shall signal Phase I – Fire Emergency Recall Operation.

   2. When the station is operational all operating devices in the cab shall be inoperative.

C. Hall Stations:
   1. As shown on Contract Drawings.

2. Hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Hall fixtures shall be surface mounted and integral hall fixtures shall feature round stainless steel, mechanical buttons marked to correspond to the landings.
3. Include firefighter key switch and designations in the hall station at the designated landing.

D. Hall Lanterns:
1. Tamper resistant hall lanterns shall be equipped with illuminated UP and DOWN signal arrows.
2. Provide a visual and audible signal at each entrance to indicate which car shall stop in response to the hall call.

E. Main Car Operating Panel
1. Provide a main car operating panel surface mounted in the inside car as shown on Contract Drawings.
2. The call buttons provided for each floor served shall cause the car to travel to the floor on momentary pressure of the call button.
3. The call buttons shall become individually illuminated as they are pressed. The button lights shall be extinguished as the calls are answered.
4. The panel shall include:
   a. A call button for each floor served.
   b. Door open button/door close button.
   c. "Alarm" button (illuminating jewel).
   d. "Emergency Stop" keyswitch.
   e. Door hold open button. Door hold button shall lock out the elevator for 90 seconds or until door closed button is pressed
   f. An intercom station complying with ADA requirements.
5. Service cabinet
   a. The locked service cabinet, located below the call buttons, shall be flush and contain the key switches required to operate and maintain the elevator, including, but not limited to:
      1) Independent and attendant service switches.
      2) Light switch.
      3) Fan switch.
      4) 110V GFCI duplex receptacle.
      5) Out-of-service key switch.
      6) Emergency light test button and indicator.
6. Fire Service Cabinet with instructions engraved on back of door.

F. Engraved and epoxy filled elevator capacity, elevator number, “No Smoking”, and warning and caution messages as required by the Code.

G. Car position indicator without a separate faceplate.

H. The auxiliary car operating panel shall include:
1. Everything contained on the main car operating panel except:
   a. Service Cabinet
   b. Fire service cabinet

I. Car Position Indicator
1. The position of the car in the hoistway shall be indicated by the illumination of the position indicator numeral corresponding to the floor at which the car has stopped or is passing.

a. The position indicator shall have illuminated direction arrows to indicate the direction of travel.
b. Shall be integrated into the COP.

J. Fixture Schedule
1. All hall and car fixtures shall be selected from the manufacturer's heavy-duty fixtures.
2. Custom designed operating and signaling fixtures shall be as shown on the drawings or as approved by Metro-North.
3. Main Car Stations:
a. Stainless steel with satin finish, surface mounted, swing type, one-piece faceplate with heavy duty concealed hinges.
b. The layout of the panel and all engraving shall be subject to the approval of Metro-North.
4. Car Position Indicators
a. Provide 2" high liquid crystal or LED indicators with direction arrows, integral with each car operating panel and in each hall lantern at all floors.
5. Car and Hall Call Buttons
a. Round stainless steel convex tamperproof type with an illuminating LED halo.
6. Hall Call Stations
a. Provide Manufacturer standard hall call station
7. Hall Lanterns
a. 2 ½" high by 2 ½" wide circular or arrow lens constructed of solid sandblasted plexiglass arranged horizontally with faceplate as selected by Metro-North. Arrange lens for ½" projection from faceplate and provide a 1/8" thick metal separator and a light baffle to form up and down indications. The metal separator shall match the faceplate.

K. Fixture Attachment, Finish and Design
1. Refer to drawings for other design requirements. Where no special design is shown the faceplates shall be as follows:
a. All floors: 1/8" thick stainless steel with satin finish and tamperproof screws
2. Mount all elevator fixtures with tamperproof fasteners. The screw and key switch cylinder finishes shall match faceplate finish.
3. Where key-operated switch and or key operated cylinder locks are furnished in conjunction with any component of the installation, four keys for each individual switch or lock shall be furnished, stamped or permanently tagged to indicate function.
4. All caution signs, code mandated instructions and directives shall be engraved and filled with epoxy.

L. Wiring
1. Provide all wiring and conduit required for the operation of the elevators.
2. Run all wiring in galvanized conduit or in metal wireways.
3. Flexible metal conduit with ground wiring may be used for short runs from main hoistway wireway to interlocks, fixtures, limit switches and between control panels, motors and brakes.
4. Provide new traveling cables that shall be capable of bending 360 degrees with an inside radius of one foot without any permanent set and without cracking of the outer covering. The open loop shall show no tendency to twist upon itself. Abrupt bending or twisting producing distortion of cable shall not be allowed. Outer covering must remain intact between junction boxes or to controller. Suspend traveling cables with nonmetallic fillers by looping cables around supports. Traveling cables shall include telephone cabling.

Cables shall be free from any possible contact with hoistway structure, car, or other equipment. Install shields and pads necessary to prevent chafing and to protect the cables. The loop in the traveling cables shall be not less than 2 feet unless otherwise approved. Each traveling cable conductor shall have a distinctive color-coded outer covering for identification.

a. Traveling Cables: Flame and moisture-resistant outer cover.
b. Traveling cables from junction box on car to junction box in hoistway or directly to controller shall consist of flexible traveling cables conforming with requirements of NEC (NFPA 70). Junction boxes in hoistway and on car shall be equipped with terminal blocks. All connections too terminal blocks shall be made with either terminal eyelet connections or pressure wire connectors of the clamp type that meet UL 486A requirements for stranded wire. Terminal blocks shall have permanent indelible identifying numbers for each connection.
c. Provide 10 percent, but not less than 2, spare conductors in each traveling cable. Tag spares such that they can be identified.
d. Provide two sets of shielded coaxial conductors in the traveling cable in addition to those wires specified for the two-way communication device in the elevator car or supply a separate cable for the two-way communication device. Cable shall extend from junction box in hoistway or controller to two-way communication device in the car.

2.11 COMMUNICATION & SIGNALING SYSTEM

A. General: Communication and signaling equipment in locations unprotected from weather and/or accessible to the general public, including but not limited to equipment and fixtures installed in elevator cars and hoistways, or at platform and street level landings, shall be of tamper-resistant, heavy-duty stainless-steel construction; enclosures and exposed faces shall be watertight and rated NEMA 4X.
   1. All fixtures shall be mounted with concealed hinges and J200 cylinders for the COP, phone, and hall stations. No screws shall be used.
   2. Key switches shall be chrome-plated.

B. Car Emergency Communication Panel: As delineated in 2.10 of this Section.
   1. Communications & Signaling functions in this panel include:
      a. "HELP" button
      b. Modified “hands-free” intercom, activated by pressing and releasing the “HELP” button, and including an "ACKNOWLEDGEMENT” light

C. Intercom: 2-way multi-path communication capability between the elevator car and authorized rescue personnel shall be provided via an ADA-compliant, phone line powered intercommunication system; Model G3 by Janus Elevator Products, Inc.
   1. The system shall include the following stations:
      a. A Car Station, located in the Emergency Communication Panel, which includes a loudspeaker and an adjustable microphone to provide hands-free communication.
      b. An Elevator Alarm Panel station, located in the Elevator Machine Room, which will establish communication with authorized rescue personnel via a telephone line maintained by the Railroad.
         1) The Alarm Panel shall be programmed to call a minimum of 2 Railroad-designated local response numbers, in a specified order.

2) The external communications cables of the Alarm Panel shall be extended to a junction box in the Machine Room, for connection to the Railroad's existing communications infrastructure by the General Contractor.
3) The Alarm Panel shall include provisions for 2-way voice communication between the Machine Room and the elevator car.

2. A call shall be placed from the elevator car by pressing and releasing the "HELP" button. This action shall cause the Elevator Alarm Panel to call the designated response number(s), and the "ACKNOWLEDGMENT" light to flash.
   a. When the call is answered, the flashing "ACKNOWLEDGMENT" light shall go to a steady condition.
   b. Calls shall be disconnected only by authorized personnel outside the car, which will extinguish the "ACKNOWLEDGMENT" lamp.

2.12 MISCELLANEOUS MACHINE ROOM EQUPIMENT:

A. Storage Cabinets
1. Provide one lockable storage cabinet with 30-gallon capacity in the elevator machine room, as shown on the Contract Drawings.
2. The cabinet shall be suitable for storage of cans containing flammables, combustibles, and have factory mutual approval and comply with OSHA regulations for such use. The cabinet shall be Justrite model 892200, or approved equal.

B. Garbage Cans
1. Provide one red fire resistant garbage can with minimum 6 gallon capacity in the elevator machine room, as shown on the Contract Drawings. The garbage can shall be Justrite model 09100 or approved equal.

C. Fire Extinguisher
1. Provide one 'ABC'-class fire extinguisher to be mounted in the machine room as shown on Contract Drawings.

D. Light Switch
1. Provide one machine room light switch. Light switch for elevator light shall be located adjacent to the jamb side of the machine room entry door. NEC 620.23(B).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Condition Inspection
1. Prior to beginning installation of equipment, examine hoistway and machine room areas. Verify no irregularities exist which affect execution of work specified. Do not proceed with installation until work in place conforms to project requirements.
2. Verify dimensions of supporting structure at the site by accurate field measurements. The work shall be accurately fabricated and fitted to the structure, Elevator contractor shall confirm by review of the working drawings and field observation that the clearance and the alignments are proper for the installation of this work.

3. Coordinate work with the work of the other trades, and provide items to be placed during the installation at the proper time to avoid delays in the overall work. Use contactor's bench marks where necessary.

B. Product Delivery, Storage, and Handling
   1. Deliver material in Contractor's original, unopened protective packaging.
   2. Store material in original protective packaging. Prevent soiling, physical damage, or moisture damage.
   3. Protect equipment and exposed finishes from damage and stains during transportation, erection, and construction.

C. Installation
   1. Install all equipment in accordance with Contractor's instructions, referenced codes, specification, and approved submittals.
   2. Install machine room equipment with clearances in accordance with referenced codes, and specification.
      Install all equipment so it may be easily removed for maintenance and repair.
   3. Install all equipment for ease of maintenance.
   4. Install all equipment to afford maximum accessibility, safety, and continuity of operation.
   5. Remove oil, grease, scale, and other foreign matter from the following equipment and apply one coat of field-applied machinery enamel.
      a. All exposed equipment and metal work installed as part of this work which does not have architectural finish.
      b. Machine room equipment, and pit equipment.
   6. Neatly touch up damaged factory-painted surfaces with original paint color. Protect machine- finish surfaces against corrosion.
   7. Final payment, for retainage of 10%, shall not be made for the installation work prior to the conclusion of the Warranty / Maintenance period.

D. Field Quality Control
   1. Tests:
      a. Perform as required by Code and as required by authorities having jurisdiction.
      b. Provide labor, materials, equipment and connections.
      c. Repair or replace defective work as required.
      d. Pay for restoring or replacing damaged work due to tests.
   2. Final Inspection: When all work is completed, and tested, notify Department personnel in writing that the elevator is ready for final inspection and acceptance test. A testing and inspection date shall then be arranged.

E. Adjustments, Painting and Cleaning
   1. All equipment shall be adjusted prior to final testing and acceptance.
   2. Paint all exposed work which is soiled or damaged during installation. Repair to match adjoining work prior to final acceptance. At a minimum all hoistway and machine room components shall be field painted with at least one coat of machine grade enamel. Paint the machine room and pit floors in a standard grey. The intent is to provide a complete final product that is neat, clean and painted.
   3. Keep work areas orderly and free from debris during progress of project. Remove packaging materials daily.
   4. Remove all loose materials and filings resulting from work.
   5. Clean machine room equipment and floor.
   6. Clean hoistways, car, car enclosure, entrances, operating and signal fixtures.

F. Final Service and Inspection
   1. Perform specified field testing upon completion of installation of the elevator, prior to acceptance by the Railroad. Field testing shall be performed by a QEI-1 qualified individual, and witnessed by the Railroad's representative.
   2. 2 weeks prior to the expiration of its Maintenance Period, the elevator shall be fully serviced, lubricated, and adjusted; and all controls and safety devices shall be checked.
   3. A complete inspection will be made by the Metro-North Railroad's representative.

G. Warranty
   1. Satisfaction of the testing, startup, training, and maintenance requirements of this Section shall not relieve the Contractor of its obligations under the Warranty provisions of the Contract.

END OF SECTION

DIVISION 22
PLUMBING

SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Related Documents
   1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section includes materials and methods common to other Sections of this Division:
   1. Vibration and Seismic Controls for Plumbing, Piping & Equipment
   2. Identification for Plumbing, Piping & Equipment
   3. Sleeves
   4. Mechanical Sleeve Seals
   5. Formed Steel Channel
   6. Flashing
   7. Field Painting
   8. Motors
   9. Mechanical Demolition
   10. Cutting and Patching

1.2 REFERENCES

A. The publications listed below form a part of this section to the extent referenced. The publications are referred to within the text by the basic definition only. Use latest edition of publication.

B. American National Standards Institute (ANSI/ASME):
   1. Codes for Pressure Piping.
   2. A 13.1 Scheme for the Identification of Piping Systems.

C. American Society of Mechanical Engineers (ASME):
   1. Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.

D. American Welding Society (AWS):
   1. Soldering Manual, 2nd edition, 1977.
   2. Brazing Manual, 4th edition, 1991.
   3. A 5.8 Specifications for Filler Metals for Brazing.
   4. D 1.1 Structural Welding Code for Steel.

E. National Electric Manufacturer's Association (NEMA) Standards as apply to specified products.
   1. NEMA MG1; Motors and Generators.

F. Steel Structures Painting Council (SSPC):

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections. Submit in sufficient detail to show full compliance with Contract Documents.

B. Product Data:
1. Submit manufacturer's product data for each product and material
2. Indicate manufacturer, trade names, and model numbers, components, arrangement, and accessories being provided.
3. Include applicable literature, catalog material or technical brochures.
4. Include material and equipment specifications, sizes, types, dimensions, weights, rated capacities, and performance tables or performance curves.
5. Include utility requirements for wiring, piping, and service connection data, motor sizes complete with electrical characteristics.

C. Shop Drawings: Submit shop drawings where required under other individual Sections of this Division
1. Include dimensional data for rough in and installation instructions.
2. Indicate typical layout including dimensions and utility connections.
3. Submit Fabrication Drawings for construction and connections to equipment.
4. Submit drawings showing field measured conditions.
5. Shop drawings detailing fabrication and installation for equipment pads, metal and wood supports and anchorage for materials and equipment.
6. Coordination drawings for access panel and door locations.
7. Submit for piping and equipment identification list of wording, symbols, letter size, and color coding for pipe identification and valve chart and schedule, including valve tag number, location and function.

D. Samples:
1. Submit samples where required under other individual Sections of this Division.

1.4 CLOSEOUT SUBMITTALS:

A. Record Documents
1. Record installed locations and position of systems, components, and accessories.
2. Maintain and update documents on a daily basis.
3. Provide electronic files of Record Documents in addition to Printed copies.

B. Operation and Maintenance Manuals: Submit operation and maintenance manuals for each of the following items of equipment or systems.
1. Pumps, Accessories, and Specialties
2. Plumbing Control Systems.

C. Include the following elements in each O & M manual:
1. Erection or installation instructions.
2. Start-up procedures.
3. Recommended and alternative operating procedures.
4. Schedule of preventive maintenance requirements.

5. Schedule of recommended spare parts to be stocked, complete with part number, inventory quantity, and ordering information.
6. Detailed maintenance procedures.
7. Schedule of lubrication requirements.
8. Corrected and approved control and wiring diagrams.
9. Data sheet listing pertinent equipment or system information, as well as the addresses and telephone numbers of the nearest sales and service representatives.

D. Submit Operation and Maintenance Manuals by complete system.

1.5 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Comply with construction requirements of State, County, and such other local political subdivision's specifications as may exceed the requirements of the codes, standards, and approving bodies referenced herein.
   1. Perform Work in accordance with New York State Building Code.

B. Maintain one copy of each document on site.

C. All equipment or apparatus of any one system must be the product of one manufacturer or equivalent products of a number of manufacturers which are suitable for use in a unified or assembled system.

D. Comply with requirements of the National Fire Protection Association (NFPA) Standards referenced in the various Specifications Sections, and as directly appropriate to the work and workmanship.

E. Comply with requirements for both the Underwriters' Laboratories, Inc. (UL) Listings, Labels, and Approvals and the National Electrical Manufacturers' Associations (NEMA) Stamps or Seals as applicable to electrical equipment or apparatus forming parts of the Mechanical Equipment.

F. Certificates and Permits: Upon completion of work, and prior to final payment, furnish to the A/E formal certification of final inspections from authorities having jurisdiction and secure required permits, if any, from such authorities. Additionally, prepare detailed diagrams and drawings, which may be required by those authorities having jurisdiction.

G. Source Quality Control: Products used throughout these specifications, and as indicated on the Drawings, are those of companies having established reputations in the manufacture of the particular materials, equipment, or apparatus specified. Such products may be of their own make, or products of others for which they assume full responsibility when used in said assemblies (which are not manufactured completely by them), and with replacement parts available.

1.6 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. Provide: Furnish and install.

G. Piping: Pipe, fittings, hangers and valves.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and equipment to the Project site in a clean condition with openings plugged or capped (or otherwise sealed by packaging) both during shipping and during temporary storage.

B. Delivered equipment crating and/or packaging shall clearly identify pick-points or lift- points. In the absence of crating or packaging, pick-points or lift-points must be identified on the equipment.

C. When unloading materials and equipment provide special lifting harness or apparatus as may be required by manufacturers. Handle materials and equipment in accordance with manufacturer's written instructions.

D. The Design Builder shall determine the required equipment needed for unloading operations and have such equipment on site to perform unloading work on the date of equipment delivery.

E. Store materials and equipment, both on and off site, in accordance with manufacturer's written instructions.

F. All equipment and materials shall be stored on palates or dunnage and kept out of contact with the floor or ground

1.8 DRAWING INTERPRETATION AND COORDINATION

A. Plumbing Drawings are diagrammatic and indicate the general arrangement of systems and equipment, unless indicated otherwise by dimensions or Detail Drawings.

B. Plans are intended to show size, capacity, approximate location, direction, and general relationship of one work phase to another, but not the exact detail or arrangement.

C. For locations of building elements, refer to dimensioned Architectural and Structural Drawings and perform field measurements to verify exact locations.

D. Equipment outlines shown on Detail Drawings, or dimensions indicated anywhere on the Drawings, are limiting dimensions. Equipment exceeding approximate dimensions indicated by equipment outlines on Detail Drawings and any equipment or arrangements that reduce indicated clearances or exceed specific equipment dimensions may not be used.

E. Electrical Service Devices:
1. Provide starters, fused disconnect switches or combination starter fusible disconnect switches required for motors and equipment of this Division of the Specifications.
2. Correct sizing of starters and disconnect switches is the joint responsibility of the Design Builder and the equipment or apparatus manufacturer.
3. Motor starters shall be minimum NEMA Size 1. Electrical enclosures to be NEMA 12 for indoor units and NEMA 4 for outdoor units unless otherwise indicated on the Drawings.
4. Starters shall be complete with two sets of auxiliary contacts; one set normally open; one set normally closed.
5. For motors 25 HP or greater, provide autotransformer type reduced voltage starters.
6. Motor starters and disconnect switches shall be located as indicated on the Drawings.

1.9 MATERIALS, EQUIPMENT AND WORKMANSHIP

A. Install equipment in strict accordance with manufacturer's instructions for type and capacity of each piece of equipment. Obtain these instructions from the manufacturer and such instructions shall be considered a part of these Specifications. Type, capacity and application of equipment shall be suitable and capable of satisfactory operation.

B. All equipment or apparatus of any one system must be the product of one manufacturer or equivalent products of a number of manufacturers which are suitable for use in a unified or assembled system.

1.10 WARRANTY

A. Extended Warranties: See individual Sections for extended Warranties.

B. Submit manufacturer’s warranty and verify that forms are completed in Owner’s name and registered with manufacturer.

C. Date warranties to date of Substantial Completion for Project.

D. Correct defective Work within a one- year period after Date of Substantial Completion.

1.11 MAINTENANCE

A. Maintenance Service: Maintenance service should be provided for all piping, fixtures, and equipment that is installed or provided under this contract.

B. Provide service and maintenance for one year from date of Substantial Completion, except where longer service is indicated in individual sections.

PART 2 - PRODUCTS

2.1 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

A. Plastic Nameplates: Laminated plastic with engraved letters.

B. Plastic Tags: Laminated plastic with engraved letters, minimum 1-1/2 inches diameter.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, for direct burial service.

2.2 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

2.3 MECHANICAL SLEEVE SEALS

A. Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.4 FORMED STEEL CHANNEL

A. Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

PART 3 - EXECUTION

3.1 INSTALLATION - PIPING AND EQUIPMENT IDENTIFICATION

A. Install plastic nameplates with adhesive.

B. Install plastic tags with corrosion resistant metal chain.

3.2 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel escutcheons at finished surfaces.

END OF SECTION

SECTION 22 05 03 - PIPES, FITTINGS AND VALVES FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Pipe and pipe fittings for the following systems:
   1. Storm water piping, within5 feet of building.
   2. Bedding and cover materials.

B. Related Sections:
   1. Section 220500 – Common Work Results for Plumbing.

1.2 REFERENCES

A. See Piping Schedule attached to this specification section for Testing Agency reference numbers.

B. American Society of Mechanical Engineers:
   1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
   2. ASME B16.3 - Malleable Iron Threaded Fittings.
   3. ASME B16.4 - Gray Iron Threaded Fittings.
   4. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   5. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   6. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
   7. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
   8. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

C. ASTM International:
   1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
   2. ASTM B32 - Standard Specification for Solder Metal.
   3. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
   4. ASTM B75 - Standard Specification for Seamless Copper Tube.
   5. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
   6. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
   7. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes.
   8. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).
   9. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
   10. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
   11. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

12. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.
13. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
14. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
15. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
16. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
17. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
18. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
19. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
20. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
21. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
22. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
23. ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
24. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
25. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
26. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

D. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

E. American Water Works Association:
1. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
2. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

F. Cast Iron Soil Pipe Institute:
1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings forStorm Drain Piping Applications.
2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Storm Drain Piping Applications.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, and sizes. Submit shop drawings sealed by registered professional engineer.

C. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

D. Design Data: Indicate pipe sizes. Indicate pipe sizing methods. Indicate calculations used. Submit sizing methods and calculations sealed by registered professional engineer.

E.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations and sizes of valves.

C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

B. Perform Work in accordance with the Plumbing Code of New York State.

C. Maintain one copy of document on site.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience approved by manufacturer.

C. Design piping systems under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of New York.

1.7 PRE-INSTALLATION MEETINGS

A. Division 01 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

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

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 COORDINATION

A. Division 01 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of buried piping with trenching.

1.12 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish five year manufacturer warranty for valves excluding packing.

1.13 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Requirements for extra materials.

B. Furnish two packing kits for each size valve.

PART 2 - PRODUCTS

2.1 PIPE, VALVES AND PIPE FITTINGS

A. Refer to individual pipe material schedules at the end of this section for pipe, valve and fitting materials and joining materials and methods.

2.2 MANUFACTURERS

A. Pipe and Fittings:
   1. Charlotte Pipe and Foundry Co.
   2. Mueller Industries.
   3. Nibco, Inc.
   4. Orion Fittings
   5. Tyler Pipe

B. Valves
   1. Conbraco Industries, Apollo Valve Division.
   2. Milwaukee Valve Company.
   3. NIBCO, Inc.
   4. Stockham Valves & Fittings.

2.3 BEDDING AND COVER MATERIALS

A. Bedding: See Division 31.

B. Cover: See Division 31.

C. Soil Backfill from Above Pipe to Finish Grade: See Division 31.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify excavations are to required grade, dry, and not over-excavated.

C. Verify trenches are ready to receive piping.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection to existing piping system size, location, and invert are as indicated on Drawings.

B. Establish elevations of buried piping with not less than 4 ft. of cover.

C. Establish minimum separation of 5' from sanitary sewer piping in accordance with plumbing code.

D. Excavate pipe trench in accordance with Section 31.

E. Install pipe to elevation as indicated on Drawings.

F. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density. The Design Builder is to retain a testing company to test soil & confirm compaction level.

G. Install pipe on prepared bedding.

H. Route pipe in straight line.

I. Install pipe to allow for expansion and contraction without stressing pipe or joints.

J. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.

K. Install trace wire continuous buried 6 inches below finish grade, above pipe line; coordinate with Division 31.

L. Pipe Cover and Backfilling:
   1. Backfill trench in accordance with Division 31.
   2. Maintain optimum moisture content of fill material to attain required compaction density.
   3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 6 inches minimum cover over top of jacket. Compact to 95 percent maximum density. The Design Builder is to retain a testing company to test the soil & confirm the compaction level.
   4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
   5. Do not use wheeled or tracked vehicles for tamping.

M. Install Work in accordance with plumbing code of New York State.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 22 05 00.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 05 00.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 05 00.

G. Provide access where valves and fittings are not accessible.

H. Install non-conducting dielectric connections wherever jointing dissimilar metals.

I. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. Maintain gradients.

J. Slope piping and arrange systems to drain at low points.

K. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

L. Install piping penetrating roofed areas to maintain integrity of roof assembly.

M. Install valves in accordance with Section 22 05 00.

N. Install piping specialties in accordance with Section 22 05 00.

O. Insulate piping. Refer to Section 22 05 00.

P. Install pipe identification in accordance with Section 22 05 00.

3.5 INSTALLATION - STORM DRAINAGE PIPING SYSTEMS

A. Install storm drainage piping systems in accordance with the Plumbing Code of New York State.

B. Install storm drainage piping systems in accordance with Section 22 05 00.

C. Install bell and spigot pipe with bell end upstream.

D. Support cast iron drainage piping at every joint.

3.6 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B.

C. Test storm drainage piping system in accordance with local authority having jurisdiction.

3.7 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

END OF SECTION

SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Sleeves.
   2. Stack-sleeve fittings.
   3. Sleeve-seal systems.
   4. Sleeve-seal fittings.
   5. Grout.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Manufacturers:
   1. Jay R. Smith Mfg. Co.
   2. Zurn Industries, LLC
   3. Watts; a Watts Water Technology, Company
   4. or engineer's approved equal

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers:
   1. Jay R. Smith Mfg. Co.
   2. Zurn Industries, LLC
   3. Watts; a Watts Water Technology, Company
   4. or engineer's approved equal

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
   1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   2. Pressure Plates: Stainless steel.
   3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Manufacturers:
   1. Advance Products & Systems, Inc.
   2. CALPICO, Inc.
   3. Proco Products, Inc.
   4. Or engineer's approved equal

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
   1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
   2. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
   3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.
   1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
   2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
   3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
   4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
   5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:
   1. Concrete Slabs above Grade:
      a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves PVC-pipe sleeves.
      b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.
   2. Interior Partitions:
      a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
      b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 220517

SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Brass ball valves.
   2. Bronze ball valves.
   3. Bronze swing check valves.
   4. Bronze gate valves.
   5. Iron gate valves.

B. Related Sections:
   1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
   2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. NRS: Nonrising stem.

~~C. OS&Y: Outside screw and yoke.~~

D. RS: Rising stem.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
   1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Block check valves in either closed or open position.

B. Use the following precautions during storage:
1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. .

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Sizes: Same as upstream piping unless otherwise indicated.

C. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

D. Valve-End Connections:
1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

2.2 BRASS BALL VALVES

A. One-Piece, Reduced-Port, Brass Ball Valves with 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. Kitz Corporation.
2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 400 psig.
c. Body Design: One piece.
d. Body Material: Forged brass.
e. Ends: Threaded.
f. Seats: PTFE or TFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Reduced.

B. Two-Piece, Full-Port, Brass Ball Valves with 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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Milwaukee Valve Company.
d. NIBCO INC.
2. Description:
a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Full.

C. Two-Piece, Regular-Port, Brass Ball Valves with 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. Hammond Valve.
b. Jamesbury; a subsidiary of Metso Automation.
c. Legend Valve.
d. Marwin Valve; a division of Richards Industries.
e. Milwaukee Valve Company.
2. Description:
a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Regular.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze 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. .
      b. Conbraco Industries, Inc.; Apollo Valves.
      c. Crane Co.; Crane Valve Group; Crane Valves.
      d. Milwaukee Valve Company.
      e. NIBCO INC.
      f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      a. Standard: MSS SP-110.
      b. SWP Rating: 150 psig.
      c. CWP Rating: 600 psig.
      d. Body Design: Two piece.
      e. Body Material: Bronze.
      f. Ends: Threaded.
      g. Seats: PTFE or TFE.
      h. Stem: Bronze.
      i. Ball: Chrome-plated brass.
      j. Port: Full.

E. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel 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. Conbraco Industries, Inc.; Apollo Valves.
      b. Crane Co.; Crane Valve Group; Crane Valves.
      c. Milwaukee Valve Company.
      d. NIBCO INC.
      e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      a. Standard: MSS SP-110.
      b. SWP Rating: 150 psig.
      c. CWP Rating: 600 psig.
      d. Body Design: Two piece.
      e. Body Material: Bronze.
      f. Ends: Threaded.
      g. Seats: PTFE or TFE.
      h. Stem: Stainless steel.
      i. Ball: Stainless steel, vented.
      j. Port: Full.

F. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze 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. Conbraco Industries, Inc.; Apollo Valves.
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. Crane Co.; Crane Valve Group; Stockham Division.
      d. Milwaukee Valve Company.

e. NIBCO INC.

2. Description:
   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig.
   c. CWP Rating: 600 psig.
   d. Body Design: Two piece.
   e. Body Material: Bronze.
   f. Ends: Threaded.
   g. Seats: PTFE or TFE.
   h. Stem: Bronze.
   i. Ball: Chrome-plated brass.
   j. Port: Regular.

2.3 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:
   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. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. Crane Co.; Crane Valve Group; Stockham Division.
      d. Milwaukee Valve Company.
      e. NIBCO INC.
      f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      a. Standard: MSS SP-80, Type 3.
      b. CWP Rating: 200 psig.
      c. Body Design: Horizontal flow.
      d. Body Material: ASTM B 62, bronze.
      e. Ends: Threaded.
      f. Disc: Bronze.

2.4 BRONZE GATE VALVES

A. Class 125, RS Bronze Gate Valves:
   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. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. Crane Co.; Crane Valve Group; Stockham Division.
      d. Hammond Valve.
      e. Milwaukee Valve Company.
      f. NIBCO INC.
      g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      a. Standard: MSS SP-80, Type 2.
      b. CWP Rating: 200 psig.

c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

2.5 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:
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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
a. Standard: MSS SP-70, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 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.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:
   1. Shutoff Service: Ballor gate valves.
   2. Pump-Discharge Check Valves:
      a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
      b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal or resilient-seat check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

END OF SECTION 220523

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Pipe positioning systems.
10. Equipment supports.

B. Related Sections:
1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
3. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.

4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:
1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
1. Manufacturers: Subject to compliance with requirements, provide products but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product or comparable product by one of the following:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.
   c. Flex-Strut Inc.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
3. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
4. Standard: MFMA-4.
5. Channels: Continuous slotted steel channel with inturned lips.
6. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
8. Metallic Coating: Hot-dipped galvanized.
9. Plastic Coating: Epoxy.

B. Non-MFMA Manufacturer Metal Framing Systems:
1. Manufacturers: Subject to compliance with requirements, provide products but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product or comparable product by one of the following:
   a. Anvil International; a subsidiary of Mueller Water Products Inc.

b. Empire Industries, Inc.
c. ERICO International Corporation.
d. Haydon Corporation; H-Strut Division.
e. NIBCO INC.

3. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
4. Standard: Comply with MFMA-4.
5. Channels: Continuous slotted steel channel with inturned lips.
6. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
8. Coating: Zinc.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, 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.

2.5 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:
1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:
1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.

5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.6 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.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 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

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

H. Pipe Stand Installation:
   1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
   2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

I. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

J. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

K. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

L. 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.

M. Install lateral bracing with pipe hangers and supports to prevent swaying.

N. 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.

O. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

P. 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.

Q. Insulated Piping:
   1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 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.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 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.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   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 099113 "Exterior Painting." Section 099123 "Interior Painting." Section 099600 "High-Performance Coatings."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 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 metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
   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. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
   5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
   6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   9. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
   10. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
   11. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
   12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
   13. 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.
   14. 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.
   15. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
   16. 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.
   17. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
   18. 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.
   19. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
   20. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. 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.

L. 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.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb
    b. Medium (MSS Type 32): 1500 lb
    c. Heavy (MSS Type 33): 3000 lb
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
   2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
   3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
   4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
   5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
   6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
   7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
   8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
      a. Horizontal (MSS Type 54): Mounted horizontally.
      b. Vertical (MSS Type 55): Mounted vertically.
      c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

S. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 22 05 33 - HEAT TRACING FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes plumbing piping heat tracing for freeze prevention, domestic hot-water-temperature maintenance, and snow and ice melting on roofs and in gutters and downspouts with the following electric heating cables:
   1. Plastic insulated, series resistance.
   2. Self-regulating, parallel resistance.
   3. Constant wattage.

B. Related Requirements:
   1. Section 210533 "Heat Tracing for Fire-Suppression Piping."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
   2. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.

B. Shop Drawings: For electric heating cable.
   1. Include plans, elevations, sections, and attachment details.
   2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

A. Manufacturers: Subject to compliance with requirements, provide products but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product or comparable product by one of the following:
   1. Chromalox.
   2. Delta-Therm Corporation.
   3. Nelson Heat Trace; a division of EGS Electrical Group LLC.
   4. Raychem; a brand of Tyco Thermal Controls LLC.
   5. Thermon Americas Inc.

C. Comply with IEEE 515.1.

D. Heating Element: Pair of parallel No. 18 AWG, nickel-coated, stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.

E. Electrical Insulating Jacket: Flame-retardant polyolefin.

F. Cable Cover: Stainless-steel braid and polyolefin outer jacket with ultraviolet inhibitor.

G. Maximum Operating Temperature (Power On): 150 deg F.

H. Maximum Exposure Temperature (Power Off): 185 deg F.

I. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 CONTROLS

A. Pipe-Mounted Thermostats for Freeze Protection:
   1. Remote bulb unit with adjustable temperature range from 30 to 50 deg F.
   2. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.
   3. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.
   4. Corrosion-resistant, waterproof control enclosure.

2.3 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Labels: Refer to Section 220553 "Identification for Plumbing Piping and Equipment."

C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.
   1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
   2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Install the following types of electric heating cable for the applications described:
   1. Snow and Ice Melting on Roofs and in Gutters and Downspouts: Constant-wattage heating cable
   2. Temperature Maintenance for Domestic Hot Water: Self-regulating, parallel-resistance heating cable.

3.3 INSTALLATION

A. Install electric heating cable across expansion, construction, and control joints according to manufacturer's written instructions; use cable-protection conduit and slack cable to allow movement without damage to cable.

B. Electric Heating-Cable Installation for Snow and Ice Melting on Roofs and in Gutters and Downspouts: Install on roof and in gutters and downspouts with clips furnished by manufacturer that are compatible with roof, gutters, and downspouts.

C. Electric Heating-Cable Installation for Freeze Protection for Piping:
   1. Install electric heating cables after piping has been tested and before insulation is installed.
   2. Install electric heating cables according to IEEE 515.1.

3. Install insulation over piping with electric cables according to Section 220719 "Plumbing Piping Insulation."
4. Install warning tape on piping insulation where piping is equipped with electric heating cables.

D. Electric Heating-Cable Installation for Temperature Maintenance for Domestic Hot Water:
1. Install electric heating cables after piping has been tested and before insulation is installed.
2. Install insulation over piping with electric heating cables according to Section 220719 "Plumbing Piping Insulation."
3. Install warning tape on piping insulation where piping is equipped with electric heating cables.

E. Set field-adjustable switches and circuit-breaker trip ranges.

3.4 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
2. Test cables for electrical continuity and insulation integrity before energizing.
3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

D. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.

E. Cables will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.6 PROTECTION

A. Protect installed heating cables, including nonheating leads, from damage during construction.

B. Remove and replace damaged heat-tracing cables.

END OF SECTION 220533

SECTION 22 05 48 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Pipe-riser resilient supports.
9. Resilient pipe guides.
10. Elastomeric hangers.
11. Spring hangers.
12. Snubbers.
13. Restraint channel bracings.
14. Restraint cables.
15. Seismic-restraint accessories.
16. Mechanical anchor bolts.
17. Adhesive anchor bolts.

B. Related Requirements:
1. Section 230548 "Vibration and Seismic Controls for HVAC" for devices for HVAC equipment and systems.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.
    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction.
    b. Annotate to indicate application of each product submitted and compliance with requirements.

B. Shop Drawings:
1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment.

C. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.
1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, due to seismic forces required to select vibration isolators, and due to seismic restraints.
3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.
4. Seismic-Restraint Details:
    a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
    d. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For professional engineer

C. Retain "Welding certificates" Paragraph below if retaining "Welding Qualifications" Paragraph in "Quality Assurance" Article.

D. Welding certificates.

E. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:
   1. Site Class as Defined in the IBC: D
   2. Assigned Seismic Use Group or Building Category as Defined in the IBC: II
      a. Component Importance Factor: 1.25
      b. Component Response Modification Factor: 3
      c. Component Amplification Factor: 3
   3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 0.134
   4. Design Spectral Response Acceleration at 1.0-Second Period: .005
   5. Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction.
      a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

2.2 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product or comparable product by one of the following:
    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Isolation Technology, Inc.
    d. Kinetics Noise Control, Inc.
    e. Mason Industries, Inc.
3. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
4. Size: Factory or field cut to match requirements of supported equipment.
5. Pad Material: Oil and water resistant with elastomeric properties.
6. Surface Pattern: Smooth, Ribbed or Waffle pattern.
7. Infused nonwoven cotton or synthetic fibers.
8. Load-bearing metal plates adhered to pads.
9. Sandwich-Core Material: Resilient and elastomeric
10. Retain "Surface Pattern" Subparagraph below if the sandwich-core material has a surface pattern.
    a. Surface Pattern: Smooth, Ribbed or Waffle pattern.
    b. Infused nonwoven cotton or synthetic fibers.

2.3 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts
1. Manufacturers: Subject to compliance with requirements, provide product but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product or comparable product by one of the following:
    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Isolation Technology, Inc.
    d. Kinetics Noise Control, Inc.
    e. Mason Industries, Inc.
3. Mounting Plates:
    a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded or with threaded studs or bolts.
    b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
4. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:
1. Manufacturers: Subject to compliance with requirements, provide products but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product or comparable product by one of the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.

3. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
   a. Housing: Cast-ductile iron or welded steel.
   b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.5 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators:
1. Manufacturers: Subject to compliance with requirements, provide products but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product or comparable product by one of the following:
   a. Ace Mountings Co., Inc.
   b. California Dynamics Corporation.
   c. Isolation Technology, Inc.
   d. Kinetics Noise Control, Inc.
   e. Mason Industries, Inc.
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. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
8. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.6 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:
1. Manufacturers: Subject to compliance with requirements, provide products but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product or comparable product by one of the following:
   a. Ace Mountings Co., Inc.
   b. California Dynamics Corporation.
   c. Isolation Technology, Inc.
   d. Kinetics Noise Control, Inc.
   e. Mason Industries, Inc.
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. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Top housing with threaded mounting holes and internal leveling device or elastomeric pad.

2.7 RESTRAINED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:
1. Manufacturers: Subject to compliance with requirements, provide products but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide **product** or comparable product by one of the following:
    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Isolation Technology, Inc.
    d. Kinetics Noise Control, Inc.
    e. Mason Industries, Inc.
3. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.
    a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Top plate with threaded mounting holes or elastomeric pad.
    c. Internal leveling bolt that acts as blocking during installation.
4. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
5. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
6. Minimum Additional Travel: 50 percent of the required deflection at rated load.
7. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
8. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.8 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:
1. Manufacturers: Subject to compliance with requirements, provide products but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product or comparable product by one of the following:
    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Isolation Technology, Inc.
    d. Kinetics Noise Control, Inc.

e. Mason Industries, Inc.

3. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
   a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
   b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.
4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
5. Minimum Additional Travel: 50 percent of the required deflection at rated load.
6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.9 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch thick neoprene
   1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
   2. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.10 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch thick neoprene
   1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.11 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
   1. Manufacturers: Subject to compliance with requirements, provide products but are not limited to, the following:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide **product** or comparable product by one of the following:
      a. Ace Mountings Co., Inc.
      b. California Dynamics Corporation.
      c. Isolation Technology, Inc.
      d. Kinetics Noise Control, Inc.
      e. Mason Industries, Inc.
   3. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.

4. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.12 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
   1. Manufacturers: Subject to compliance with requirements, provide products but are not limited to, the following:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide product or comparable product by one of the following:
      a. Ace Mountings Co., Inc.
      b. California Dynamics Corporation.
      c. Kinetics Noise Control, Inc.
      d. Mason Industries, Inc.
      e. Vibration Eliminator Co., Inc.
   3. 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.
   4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   5. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
   8. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
   9. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
   10. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.13 SNUBBERS

A. Manufacturers: Subject to compliance with requirements, provide products but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product or comparable product by one of the following:
   1. Kinetics Noise Control, Inc.
   2. Mason Industries, Inc.
   3. Vibration Mountings & Controls, Inc.

C. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
   1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
   2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.

3. Maximum 1/4-inch air gap, and minimum 1/4-inch thick resilient cushion.

2.14 RESTRAINT CHANNEL BRACINGS

A. Manufacturers: Subject to compliance with requirements, provide products but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product or comparable product by one of the following:
   1. Cooper B-Line, Inc.
   2. Hilti, Inc.
   3. Mason Industries, Inc.
   4. Unistrut.

C. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.15 RESTRAINT CABLES

A. Manufacturers: Subject to compliance with requirements, provide products but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product or comparable product by one of the following:
   1. Kinetics Noise Control, Inc.
   2. Loos & Co., Inc.
   3. Vibration Mountings & Controls, Inc.

C. Restraint Cables: ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.16 SEISMIC-RESTRAINT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product or comparable product by one of the following:
   1. Cooper B-Line, Inc.
   2. Kinetics Noise Control, Inc.
   3. Mason Industries, Inc.
   4. TOLCO

C. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.

D. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

E. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

F. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

G. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.17 MECHANICAL ANCHOR BOLTS

A. Manufacturers: Subject to compliance with requirements, provide \ but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product or comparable product by one of the following:
   1. Cooper B-Line, Inc.
   2. Hilti, Inc.
   3. Kinetics Noise Control, Inc.
   4. Mason Industries, Inc.

C. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.18 ADHESIVE ANCHOR BOLTS

A. Manufacturers: Subject to compliance with requirements, provide products but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product or comparable product by one of the following:
   1. Hilti, Inc.
   2. Kinetics Noise Control, Inc.
   3. Mason Industries, Inc.

C. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

B. Equipment Restraints:
   1. Install seismic snubbers on plumbing equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
   2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
   3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction] that provides required submittals for component.

C. Piping Restraints:
   1. Comply with requirements in MSS SP-127.
   2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
   3. Brace a change of direction longer than 12 feet.

D. Install cables so they do not bend across edges of adjacent equipment or building structure.

E. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction that provides required submittals for component.

F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

I. Drilled-in Anchors:
   1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
   2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
   3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
   4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
   5. Set anchors to manufacturer's recommended torque, using a torque wrench.
   6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:
   1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION 220548

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Pipe labels.
   4. Stencils.
   5. Valve tags.
   6. Warning tags.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:
   1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   4. Fasteners: Stainless-steel rivets.
   5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
   2. Letter Color: Black.
   3. Background Color: Yellow
   4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   7. Fasteners: Stainless-steel rivets .
   8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow .

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets .

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
   2. Lettering Size: At least 1-1/2 inches high.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
   1. Stencil Material: Brass
   2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
   3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
1. Size: 3 by 5-1/4 inches minimum
2. Fasteners: Brass grommet and wire
3. N," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles , on each piping system.
1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet 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.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

SECTION 22 07 00 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Insulation Materials:
      a. Cellular glass.
      b. Flexible elastomeric.
      c. Mineral fiber.
   2. Insulating cements.
   3. Adhesives.
   4. Mastics.
   5. Lagging adhesives.
   6. Sealants.
   7. Factory-applied jackets.
   8. Field-applied jackets.
   9. Tapes.
   10. Securements.
   11. Corner angles.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. LEED Submittal:
   1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.

C. Shop Drawings:
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail attachment and covering of heat tracing inside insulation.
   3. Detail insulation application at pipe expansion joints for each type of insulation.
   4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   5. Detail removable insulation at piping specialties, equipment connections, and access panels.
   6. Detail application of field-applied jackets.

7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

D. Qualification Data: For qualified Installer.

E. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

F. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Products: Subject to compliance with requirements, provide the following :
      a. Cell-U-Foam Corporation; Ultra-CUF.
      b. Pittsburgh Corning Corporation; Foamglas Super K.
   2. Block Insulation: ASTM C 552, Type I.
   3. Special-Shaped Insulation: ASTM C 552, Type III.
   4. Board Insulation: ASTM C 552, Type IV.
   5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
   6. Preformed Pipe Insulation with Factory-Applied ASJ ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
   7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

E. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
   1. Products: Subject to compliance with requirements, provide the following :
      a. Aeroflex USA Inc.; Aerocel.
      b. Armacell LLC; AP Armaflex.
      c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

F. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Products: Subject to compliance with requirements, provide the following :

a. CertainTeed Corp.; CrimpWrap.
b. Johns Manville; MicroFlex.
c. Knauf Insulation; Pipe and Tank Insulation.
d. Manson Insulation Inc.; AK Flex.
e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
1. Products: Subject to compliance with requirements, provide the following :
a. Insulco, Division of MFS, Inc.; Triple I.
b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.
1. Products: Subject to compliance with requirements, provide the following :
a. Childers Products, Division of ITW; CP-97.
b. Foster Products Corporation, H. B. Fuller Company; 81-27/81-93.
c. Marathon Industries, Inc.; 290.
d. Mon-Eco Industries, Inc.; 22-30.
e. Vimasco Corporation; 760.
2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, provide the following :
a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, provide the following :
a. Dow Chemical Company (The); 739, Dow Silicone.
b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Speedline Vinyl Adhesive.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
   1. For indoor applications, use mastics that have a VOC content of g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
   1. Products: Subject to compliance with requirements, provide the following :
      a. Childers Products, Division of ITW; CP-35.
      b. Foster Products Corporation, H. B. Fuller Company; 30-90.
      c. ITW TACC, Division of Illinois Tool Works; CB-50.
      d. Marathon Industries, Inc.; 590.
      e. Mon-Eco Industries, Inc.; 55-40.
      f. Vimasco Corporation; 749.
   2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
   3. Service Temperature Range: Minus 20 to plus 180 deg F.
   4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
   5. Color: White.

2.5 SEALANTS

A. Joint Sealants:
   1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, provide the following :
      a. Childers Products, Division of ITW; CP-76.
      b. Foster Products Corporation, H. B. Fuller Company; 30-45.
      c. Marathon Industries, Inc.; 405.
      d. Mon-Eco Industries, Inc.; 44-05.
      e. Pittsburgh Corning Corporation; Pittseal 444.
      f. Vimasco Corporation; 750.
   2. Joint Sealants for Polystyrene Products: Subject to compliance with requirements, provide the following :
      a. Childers Products, Division of ITW; CP-70.
      b. Foster Products Corporation, H. B. Fuller Company; 30-45/30-46.
      c. Marathon Industries, Inc.; 405.
      d. Mon-Eco Industries, Inc.; 44-05.
      e. Vimasco Corporation; 750.
   3. Materials shall be compatible with insulation materials, jackets, and substrates.
   4. Permanently flexible, elastomeric sealant.
   5. Service Temperature Range: Minus 100 to plus 300 deg F.
   6. Color: White or gray.
   7. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:
   1. Products: Subject to compliance with requirements, provide the following :
      a. Childers Products, Division of ITW; CP-76-8.

b. Foster Products Corporation, H. B. Fuller Company; 95-44.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
   a. Products: Subject to compliance with requirements, provide the following :
      1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
5. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
   a. Products: Subject to compliance with requirements, provide the following :
      1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
6. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
   a. Products: Subject to compliance with requirements, provide the following :
      1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide the following :

a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto PVC Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
   a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
5. Factory-fabricated tank heads and tank side panels.

C. Metal Jacket:
1. Products: Subject to compliance with requirements, provide the following :
   a. Childers Products, Division of ITW; Metal Jacketing Systems.
   b. PABCO Metals Corporation; Surefit.
   c. RPR Products, Inc.; Insul-Mate.
2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
   a. Factory cut and rolled to size.
   b. Finish and thickness are indicated in field-applied jacket schedules.
   c. Moisture Barrier for Indoor Applications: 1-mil- thick.
   d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper thick Polysurlyn.
   e. Factory-Fabricated Fitting Covers:
      1) Same material, finish, and thickness as jacket.
      2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      3) Tee covers.
      4) Flange and union covers.
      5) End caps.
      6) Beveled collars.
      7) Valve covers.
      8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.8 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
   1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
   2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches 4 inches o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.
   4. Manholes.
   5. Handholes.
   6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
   1. Comply with requirements in Division 07 Section "Penetration Firestopping"irestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
   2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
   3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
   4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets,

valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
   4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
   2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed sections of cellular-glass insulation to valve body.
   2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
   1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
   3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof

sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:
   1. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
   2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Drainage piping located in crawl spaces.
   2. Underground piping.
   3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

3.11 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 220700

SECTION 22 14 13 - FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following storm drainage piping inside the building:
   1. Pipe, tube, and fittings.
   2. Special pipe fittings.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:
   1. Storm Drainage Piping: 10-foot head of water .

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. LEED Submittal:
   1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.

C. Shop Drawings:
   1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.
   2. Controlled-Flow Storm Drainage System: Include calculations, plans, and details.

D. Field quality-control inspection and test reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service and Extra-Heavy class(es).

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
   1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
      a. Manufacturers:
         1) ANACO.
         2) Fernco, Inc.
         3) Ideal Div.; Stant Corp.
         4) Mission Rubber Co.
         5) Tyler Pipe; Soil Pipe Div.
   2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
      a. Manufacturers:
         1) ANACO.
         2) Clamp-All Corp.
         3) Ideal Div.; Stant Corp.
         4) Mission Rubber Co.
         5) Tyler Pipe; Soil Pipe Div.

3. Heavy-Duty, Shielded, Cast-Iron Couplings: ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.
   a. Manufacturers:
      1) MG Piping Products Co.

2.5 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.

B. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.

C. Pressure Fittings:
   1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
   2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
   3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
   4. Cast-Iron Flanges: ASME B16.1, Class 125.
   5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Storm sewer and drainage piping outside the building are specified in Division 33 Section "Storm Utility Drainage Piping."

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

D. Install wall-penetration fitting system at each service pipe penetration through foundation wall. Make installation watertight.

E. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
   1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
   2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.

F. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

G. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.2 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. Hub-and-Spigot, Cast-Iron Soil Piping Calked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

D. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

E. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.3 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

D. Connect force-main piping to the following:
   1. Storm Sewer: To exterior force main or storm manhole.
   2. Sump Pumps: To sump pump discharge.

3.4 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. 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 storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.5 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221413

DIVISION 23
HEATING, VENTILATION, AND AIR CONDITION (HVAC)

SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Related Documents
   1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
   2. All application specific requirements that appear in Divisions. 22, 23 & 26, which commonly require more demanding requirements, apply to this Section.

B. This Section includes the following materials and methods common to other Sections of this Division:
   1. Sleeves and Seals
   2. Grout
   3. Pipe and Pipe Fittings
   4. Joining Materials
   5. Piping Specialties
   6. Identification for Piping and Equipment
   7. Fire-stopping
   8. Flashing
   9. Painting
   10. Motors
   11. Cutting and Patching

1.2 REFERENCES

A. The publications listed below form a part of this section to the extent referenced. The publications are referred to within the text by the basic definition only. Use latest edition of publication.

B. American National Standards Institute (ANSI):
   1. ANSI/ASME B31; Code for Pressure Piping.
   2. A 13.1 Scheme for the Identification of Piping Systems.
   3. B 31 Code for Pressure Piping.

C. American Society of Mechanical Engineers (ASME):
   1. Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.

D. American Welding Society (AWS):
   1. Soldering Manual. 2nd ed. 1977.
   2. Brazing Manual. 4th ed. 1991.
   3. A 5.8 Specifications for Filler Metals for Brazing.
   4. D 1.1 Structural Welding Code for Steel.

E. National Electric Manufacturer's Association (NEMA) Standards as apply to specified products.

1. NEMA MG1; Motors and Generators.

F. Steel Structures Painting Council (SSPC):

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections. Submit in sufficient detail to show full compliance with Contract Documents.

B. Product Data:
1. Submit manufacturer's product data for each product and material
2. Indicate manufacturer, trade names, and model numbers, components, arrangement, and accessories being provided.
3. Include applicable literature, catalog material or technical brochures.
4. Include material and equipment specifications, sizes, types, dimensions, weights, rated capacities, and performance tables or performance curves.
5. Include utility requirements for wiring, piping, and service connection data, motor sizes complete with electrical characteristics.

C. Shop Drawings: Submit shop drawings where required under other individual Sections of this Division:
1. Include dimensional data for rough in and installation instructions.
2. Indicate typical layout including dimensions and utility connections.
3. Submit Fabrication Drawings for construction and connections to equipment.
4. Submit drawings showing field measured conditions.
5. Shop drawings detailing fabrication and installation for equipment pads, metal and wood supports and anchorage for materials and equipment.
6. Coordination drawings for access panel and door locations.
7. Submit for piping and equipment identification list of wording, symbols, letter size, and color coding for pipe identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
8. Requirements of this section do not relieve the Desgn Builder of requirement to address specific shop drawing requirements for each technical specification section under Division 23.

D. Samples:
1. Submit samples where required under other individual Sections of this Division.

1.4 CLOSEOUT SUBMITTALS:

A. Record Documents
1. Record installed locations and position of systems, components, and accessories.
2. Maintain and update documents on a daily basis.
3. Provide electronic files of Record Documents in addition to Printed copies.

B. Operation and Maintenance Manuals: Submit operation and maintenance manuals for each of the following items of equipment or systems.
1. Heating and Cooling Equipment Heat Pump.

C. Include the following elements in each O & M manual:
   1. Erection or installation instructions.
   2. Start-up procedures.
   3. Recommended and alternative operating procedures.
   4. Schedule of preventive maintenance requirements.
   5. Schedule of recommended spare parts to be stocked, complete with part number, inventory quantity, and ordering information.
   6. Detailed maintenance procedures.
   7. Schedule of lubrication requirements.
   8. Corrected and approved control and wiring diagrams.
   9. Data sheet listing pertinent equipment or system information, as well as the addresses and telephone numbers of the nearest sales and service representatives.

D. Submit Operation and Maintenance Manuals by complete system.

1.5 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Comply with construction requirements of State, County, and such other local political subdivision's specifications as may exceed the requirements of the codes, standards, and approving bodies referenced herein.
   1. Perform Work in accordance with the Uniform Construction Code.
   2. Perform Work in accordance with local Authorities having Jurisdiction

B. Maintain one copy of each document on site.

C. Qualify welding processes and operators for structural steel according to AWS D1.1.

D. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX.
   1. Comply with provisions of ASME B31 Series "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

E. All equipment or apparatus of any one system must be the product of one manufacturer or equivalent products of a number of manufacturers which are suitable for use in a unified or assembled system.

F. Comply with requirements of the National Fire Protection Association (NFPA) Standards referenced in the various Specifications Sections, and as directly appropriate to the work and workmanship.

G. Comply with requirements for both the Underwriters' Laboratories, Inc. (UL) Listings, Labels, and Approvals and the National Electrical Manufacturers' Associations (NEMA) Stamps or Seals as applicable to electrical equipment or apparatus forming parts of the Mechanical Equipment.

H. Certificates and Permits: Upon completion of work, and prior to final payment, furnish to the A/E formal certification of final inspections from authorities having jurisdiction and secure

required permits, if any, from such authorities. Additionally, prepare detailed diagrams and drawings, which may be required by those authorities having jurisdiction.

I. Source Quality Control: Products used throughout these specifications, and as indicated on the Drawings, are those of companies having established reputations in the manufacture of the particular materials, equipment, or apparatus specified. Such products may be of their own make, or products of others for which they assume full responsibility when used in said assemblies (which are not manufactured completely by them), and with replacement parts available.

1.6 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. Provide: Furnish and install.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and equipment to the Project site in a clean condition with openings plugged or capped (or otherwise sealed by packaging) both during shipping and during temporary storage.

B. Delivered equipment crating and/or packaging shall clearly identify pick-points or lift- points. In the absence of crating or packaging, pick-points or lift-points must be identified on the equipment.

C. When unloading materials and equipment provide special lifting harness or apparatus as may be required by manufacturers. Handle materials and equipment in accordance with manufacturer's written instructions.

D. The Design Builder shall determine the required equipment needed for unloading operations and have such equipment on site to perform unloading work on the date of equipment delivery.

E. Store materials and equipment, both on and off site, in accordance with manufacturer's written instructions.

1.8 DRAWING INTERPRETATION AND COORDINATION

A. Mechanical Drawings are diagrammatic and indicate the general arrangement of systems and equipment, unless indicated otherwise by dimensions or Detail Drawings.

B. Plans are intended to show size, capacity, approximate location, direction, and general relationship of one work phase to another, but not the exact detail or arrangement.

C. For locations of building elements, refer to dimensioned Architectural and Structural Drawings and perform field measurements to verify exact locations.

D. Equipment outlines shown on Detail Drawings, or dimensions indicated anywhere on the Drawings, are limiting dimensions. Equipment exceeding approximate dimensions indicated by equipment outlines on Detail Drawings and any equipment or arrangements that reduce indicated clearances or exceed specific equipment dimensions may not be used.

E. Electrical Service Devices:
   1. Provide starters, fused disconnect switches or combination starter fusible disconnect switches required for motors and equipment of this Division of the Specification, which are not specified elsewhere.
   2. Correct sizing of starters and disconnect switches is the joint responsibility of the Desgn Builder and the equipment or apparatus manufacturer.
   3. Motor starters shall be minimum NEMA Size 1. Electrical enclosures to be NEMA 12 for indoor units and NEMA 4 for outdoor units unless otherwise indicated on the Drawings.
   4. Starters shall be complete with two sets of auxiliary contacts; one set normally open; one set normally closed.
   5. Motor starters and disconnect switches shall be located as indicated on the Drawings.

1.9 MATERIALS, EQUIPMENT AND WORKMANSHIP

A. Install equipment in strict accordance with manufacturer's instructions for type and capacity of each piece of equipment. Obtain these instructions from the manufacturer and such instructions shall be considered a part of these Specifications. Type, capacity and application of equipment shall be suitable and capable of satisfactory operation.

B. All equipment or apparatus of any one system must be the product of one manufacturer or equivalent products of a number of manufacturers which are suitable for use in a unified or assembled system.

1.10 WARRANTY

A. Extended Warranties: See individual Sections for extended Warranties.

B. Submit manufacturer’s warranty and verify that forms are completed in Owner’s name and registered with manufacturer.

C. Date warranties to date of Substantial Completion for Project.

D. Correct defective Work within a one year period after Date of Substantial Completion.

1.11 MAINTENANCE

A. Maintenance Service:

B. Provide service and maintenance for one year from date of Substantial Completion, except where longer service is indicated in individual sections.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Use of Trade Names: The use of trade names on the drawings or other documents is to establish a basis of design, constructability, and level of quality. It is not intended to exclude other manufacturers whose products are equivalent to those named, subject to compliance with Contract requirements.

B. Alternates and Substitutions: In accordance with the Contract Documents, including General and Supplemental Conditions.

2.2 SLEEVES AND SEALS

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or gage thick galvanized steel.

C. Sleeves for Ductwork: Galvanized steel, gauge to match ductwork.

D. Pipe Sleeve Sizing:
   1. Un-insulated Pipes: Size sleeves two pipe sizes larger than pipe passing through, or size sleeves for a minimum of 1/2-inch clearance between inside of sleeve and outside diameter of pipe passing through.
   2. Wall Seal Sleeve: Size sleeves to accommodate the pipe plus the hydrostatic Wall Seal.
   3. Insulated Pipes: Size sleeves for a minimum of 1/2-inch clearance between inside of sleeve and outside diameter of insulation covering on pipes passing through.
   4. Sleeve Length:
      a. Wall and Partitions: Equal to total thickness of wall or partitions and terminated flush with finished surfaces.
      b. Floors: Equal to total depth of floor construction including finish and extending a minimum of one inch above floor level.

E. Sleeve Materials:
   1. Pipe Sleeves In Cast-In-Place Concrete: Fabricate from Schedule 10 black steel pipe and weld a 2-inch wide intermediate anchoring flange of 3/16-inch steel midway on pipe sleeve; or provide sleeve as furnished by wall seal manufacturer.
   2. Pipe Sleeves in Masonry: No. 18 gauge galvanized sheet steel.
   3. Pipe Sleeves in Wallboard Partitions: No. 18 gauge galvanized sheet steel with anchoring flanges or tabs.

F. Wall Pipe: Cast iron construction with an integral intermediate anchoring flange midway on the pipe exterior.
   1. Wall pipe ends of type indicated on Drawings, and where not indicated, pipe end shall match that of adjoining pipe.
   2. Provide wall pipes similar to those manufactured by Clow Corporation, American Cast Iron Pipe Co., U.S. Pipe and Foundry Co.

G. Seals:
   1. Manufacturers:
      a. Thunderline Link-Seal, Inc.
      b. NMP Corporation.
      c. Substitutions: Permitted and Subject to Approval
   2. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

H. Plates:
   1. Wall and Ceiling Plates: Cast metal with integral set screw or similar anchoring screw. Hinged or split design plates may be provided.
   2. Escutcheons: Provide chrome plated stamped steel hinged plates to close pipe penetrations through structure interior in finished areas. Provide plates designed to lock on pipes using setscrews.

I. Pre-Fabricated Roof Penetration Seal: Provide a factory pre-fabricated system of materials acceptable to or by the existing roofing system membrane manufacturer.
   1. The pre-fabricated system design shall accommodate multiple pipes and conduits in a single fabricated curb and EPDM pipe portal unit.

J. Sealant: Refer to Architectural Drawings for requirements

2.3 GROUT:

A. Non-shrink, Nonmetallic Grout: ASTM C 1107, Grade B.
   1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psi, 28-day compressive strength.
   3. Packaging: Premixed and factory-packaged.

2.4 PIPE AND PIPE FITTINGS:

A. Refer to individual piping system specification Sections for pipe and fitting materials and joining methods.

2.5 JOINING MATERIALS:

A. Refer to individual piping system specification Sections in Division 23 for special joining materials not listed below.

B. Brazing Filler Metals: AWS A5.8.
   1. BCuP Series: Copper-phosphorus alloys.
   2. BAg1: Silver alloy.

C. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.6 PIPING SPECIALTIES:

A. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type where required to conceal protruding fittings and sleeves.
   1. Inside Diameter: Closely fit around pipe, tube, and insulation.
   2. Outside Diameter: Completely cover opening.
   3. Cast Brass: Split casting, with concealed hinge and set-screw.
   4. Finish: Polished chrome plate.
   5. Stamped Steel: Split plate, with concealed hinge, set-screw, and chrome-plated finish.

2.7 IDENTIFICATION FOR PIPING AND EQUIPMENT

A. Refer to Section 23 05 53.

B. Plastic Nameplates: Laminated three-layer plastic with engraved black letters on light background color.

C. Plastic Tags: Laminated three-layer plastic with engraved black letters on light background color, minimum 1-1/2 inches diameter.

D. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener. Color and Lettering: Conform to ASME A13.1.

E. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Color and Lettering: Conform to ASME A13.1.

F. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 inches thick, manufactured for direct burial service.

2.8 FIRESTOPPING

A. Refer to Architectural Drawings for Fire-stopping requirements.

B. Provide fire-stopping against the spread of fire, smoke and gases where penetrations occur for piping and ductwork.

2.9 FLASHING

A. Flash and counter flash where mechanical equipment passes through exterior or waterproofed walls, floors and roofs.

B. Flash pipes projecting 12 inch minimum above finished roof surface with flashing worked 1 inch minimum into hub, 8 inch minimum clear on sides with minimum 24 x 24 inch sheet size. For pipes through outside walls turn flange back into wall and caulk.

C. Provide curbs for mechanical roof installations 12 inch minimum high. Flash and counter flash with galvanized steel, soldered and made waterproof.

D. Metal Flashing: 26 gage thick galvanized steel.

E. Metal Counter flashing: 22 thick galvanized steel.

F. Lead Flashing:
   1. Waterproofing: 5 lb./sq. ft sheet lead.
   2. Soundproofing: 1 lb./sq. ft sheet lead.

G. Flexible Flashing: 47 thick sheet compatible with roofing.

H. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.10 PAINTING

A. Shop Paint: For primer coats provide only those primers that are compatible with field coats specified on Architectural Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

B. Refer to equipment specifications in other Sections for roughing-in requirements.

3.2 INSTALLATION

A. General Requirements: Install equipment, components, and materials at locations indicated on the Drawings and in accordance with manufacturer’s instructions..

3.3 EQUIPMENT INSTALLATION--COMMON REQUIREMENTS:

A. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the CM.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

D. Perform required interconnection of mechanical systems to other mechanical and electrical equipment, devices, or apparatus, regardless of where such Products are specified, in order to ensure the completeness of such mechanical systems.

E. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

F. Install equipment giving right-of-way to piping systems installed at a required slope.

G. All equipment shall operate without objectionable noise or vibration as determined by the Owner. If such objectionable noise or vibration should be produced by apparatus, piping, ducts or other parts of this work, make necessary changes, as determined by the Owner without additional compensation.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual piping Sections specify unique piping installation requirements.

B. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

C. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome- plated finish. Use split-casting escutcheons if required, for existing piping.

D. Un-insulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.

E. Un-insulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.

F. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.

G. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

3.5 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 2 inches above finished floor level. Caulk sleeves full depth and provide floor plate.

E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire-stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install stainless steel escutcheons at finished surfaces.

G. Adjusting: Relocate identifying devices as necessary for unobstructed view in finished construction.

H. Provide foundation sleeves for those piping installations where piping is designed to pass through a foundation wall and does not form an integral part of the wall.

I. Provide the proper gland and gasket to make a watertight seal on piping passing through the foundation sleeve.

3.6 SEALS AND PLATES INSTALLATION

A. Following pipe installation through sleeves in exterior walls below grade, install Wall Seal to render installation leak free. Wall Seal not required in interior walls, partitions, floor and ceilings.

B. Install wall seal as close to outside surface of wall as possible to provide a watertight seal below grade. Apply a coating of coal tar paint or other type-approved coating on bolt heads and other metal parts on below grade wall seals prior to backfilling.

C. Install wall and ceiling plates to close pipe sleeve openings.

D. Install escutcheons to close pipe sleeve openings in finished areas.

3.7 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. Locate holes and provide sleeves, cutting and fitting required for mechanical work. Relocate improperly located holes and sleeves.

C. Repair cut surfaces to match adjacent surfaces.

D. Perform patching in finished construction of building under the sections of specifications covering these materials.

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGE:

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1 "Structural Welding Code--Steel."

3.9 GROUTING

A. Install nonmetallic, non-shrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

3.10 FIRESTOPPING

A. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire-stopping sealant material.

3.11 INSTALLATION - PIPING AND EQUIPMENT IDENTIFICATION

A. Refer to Section 23 05 53 – Identification for HVAC Piping and Equipment.

B. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

C. Install plastic tags with corrosion resistant metal chain.

D. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of mechanical equipment.

E. Install plastic nameplates with adhesive.

F. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows, showing duct system service and direction of flow.

G. Adjusting: Relocate identifying devices as necessary for unobstructed view in finished construction.

3.12 PAINTING AND FINISHING

A. Refer to Architectural drawings for Painting requirements.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.13 FIELD QUALITY CONTROL

A. General: Perform cleaning, testing, startup, adjusting, balancing, and commissioning operations as specified in other Sections included under Division 23 - Mechanical.

3.14 PROTECTION

A. Protect equipment and materials in storage on site, during and after installation until final acceptance. Leave factory covers in place and take special precautions to prevent entry of foreign material into working parts of piping and duct systems.

B. Protect equipment with polyethylene covers and crates.

C. Protect installed work from subsequent construction activities.

D. Operate, drain and flush bearings and refill with change of lubricant before final acceptance.

E. Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Provide extended nipples for lubrication.

F. Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not re-use existing materials and equipment unless specifically indicated.

END OF SECTION

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 23 05 17 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Grout.
3. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

A. From the selection please select three (3) manufacturers.

B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.

C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends and integral welded waterstop collar.

D. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

F. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

G. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 GROUT

A. Description: Nonshrink, recommended for interior and exterior sealing openings in nonfire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.3 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, use NT.

1. From the selection please select three (3) manufacturers.

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

1. From the selection please select three (3) manufacturers.

C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

1. From the selection please select three (3) manufacturers.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke-Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal-system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls Above Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.

END OF SECTION

SECTION 23 05 18 - ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. From the selection please select three (3) manufacturers.

2.2 ESCUTCHEONS

A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.

C. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

D. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.

E. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

F. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping and Relocated Existing Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
b. Chrome-Plated Piping: One-piece steel with polished, chrome-plated finish.
c. Insulated Piping: One-piece steel with polished, chrome-plated finish.
d. Insulated Piping: One-piece stainless steel with polished stainless-steel finish.
e. Insulated Piping: One-piece cast brass with polished, chrome-plated finish.
f. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
g. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
h. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stainless steel with polished stainless-steel finish.
i. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
j. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
k. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
l. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stainless steel with polished stainless-steel finish.
m. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
n. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
o. Bare Piping in Unfinished Service Spaces: One-piece steel with polished, chrome-plated finish.
p. Bare Piping in Unfinished Service Spaces: One-piece cast brass with polished, chrome-plated finish.
q. Bare Piping in Unfinished Service Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
r. Bare Piping in Equipment Rooms: One-piece steel with polished, chrome-plated finish.
s. Bare Piping in Equipment Rooms: One-piece cast brass with polished, chrome-plated] finish.
t. Bare Piping in Equipment Rooms: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

2. Escutcheons for Existing Piping to Remain:

a. Chrome-Plated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
b. Insulated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
f. Bare Piping in Equipment Rooms: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 230518

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Fastener systems.
3. Pipe stands.
4. Equipment supports.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 230516 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
3. Section 230548 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.
4. Section 233113 "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Pipe stands.
4. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
   1. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
   2. Standard: MFMA-4.
   3. Channels: Continuous slotted steel channel with inturned lips.
   4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
   5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
   6. Metallic Coating: Hot-dipped galvanized.
   7. Paint Coating: Acrylic.
   8. Plastic Coating: PVC.

B. Non-MFMA Manufacturer Metal Framing Systems:

   1. From the selection please select three (3) manufacturers.
   2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
   3. Standard: Comply with MFMA-4.
   4. Channels: Continuous slotted steel channel with inturned lips.
   5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
   6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
   7. Coating: PVC.

2.3 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.4 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.5 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, 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

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. 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.

D. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
b. NPS 4: 12 inches long and 0.06 inch thick.
c. NPS 5 and NPS 6.

3.2 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.

3.3 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
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. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. 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.

L. 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.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

END OF SECTION 230529

SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolatos.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Pipe-riser resilient supports.
9. Resilient pipe guides.
10. Air-spring isolators.
11. Elastomeric hangers.
12. Spring hangers.
13. Snubbers.
14. Restraint channel bracings.
15. Restraint cables.
16. Seismic-restraint accessories.
17. Mechanical anchor bolts.
18. Adhesive anchor bolts.
19. Vibration isolation equipment bases.

B. Related Requirements:

1. Section 220548 "Vibration and Seismic Controls for Plumbing" for devices for plumbing equipment and systems.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
    b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.

1. Include design calculations and details for selecting vibration isolators, seismic restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate static and dynamic loading due to equipment weight, operation, and seismic forces required to select vibration isolators and seismic restraints and for designing vibration isolation bases.

    a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.
4. Seismic-Restraint Details:

    a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and

spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

d. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For professional engineer.

C. Welding certificates.

D. Air-Mounting System Performance Certification: Include natural frequency, load, and damping test data performed by an independent agency.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-spring mounts to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are

preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:
   1. Building Classification Category: II.
   2. Minimum 10 lb/sq. ft. multiplied by maximum area of HVAC component projected on vertical plane normal to wind direction, and 45 degrees either side of normal.

B. Seismic-Restraint Loading:

   1. Site Class as Defined in the IBC: B.
   2. Assigned Seismic Use Group or Building Category as Defined in the IBC: I.

      a. Component Importance Factor: 1.0.
      b. Component Response Modification Factor: 2.5.
      c. Component Amplification Factor: 1.0.
   3. Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES.

      a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

2.2 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:
   1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
   2. Size: Factory or field cut to match requirements of supported equipment.
   3. Pad Material: Oil and water resistant with elastomeric properties.
   4. Surface Pattern: Smooth pattern.
   5. Infused nonwoven cotton or synthetic fibers.
   6. Load-bearing metal plates adhered to pads.
   7. Sandwich-Core Material: Resilient.

      a. Surface Pattern: Smooth pattern.
      b. Infused nonwoven cotton or synthetic fibers.

2.3 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:
   1. 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.

2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 SEISMIC-RESTRAINT ACCESSORIES

A. Hanger-Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to restraint cables.

C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.5 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

2.6 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

2.7 VIBRATION CONTROL AND SEISMIC-RESTRAINT 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 033053 "Miscellaneous Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

D. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.

E. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet, and longitudinal supports a maximum of 80 feet.
3. Brace a change of direction longer than 12 feet.

F. Install cables so they do not bend across edges of adjacent equipment or building structure.

G. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.

H. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

I. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

K. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

2.8 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 232113 "Hydronic Piping" for piping flexible connections.

2.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. Test and adjust restrained-air-spring isolator controls and safeties.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

2.10 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

2.11 VIBRATION ISOLATION EQUIPMENT BASES 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 033053, "Miscellaneous Cast-in-Place Concrete."

END OF SECTION 230548

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Valve tags.
5. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: Yellow.

4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. 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.
6. Fasteners: Stainless-steel rivets.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: Yellow.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch 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.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

G. Fasteners: Stainless-steel rivets.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; 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: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.4 VALVE TAGS

A. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety-yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. 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.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe Label Color Schedule:

1. Chilled-Water Piping: Black letters on a safety-orange background.
2. Condenser-Water Piping: Black letters on a safety-orange background.
3. Heating Water Piping: White letters on a safety-green background.
4. Refrigerant Piping: White letters on a safety-purple background.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:
   a. Refrigerant: 1-1/2 inches round.

2. Valve-Tag Colors:
   a. Defined by User: White letters on a safety-purple background, black letters on a safety-white background, white letters on a safety-gray background, and white letters on a safety-black background

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following HVAC piping systems:
   1. Refrigerant suction and hot-gas piping, indoors and outdoors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail attachment and covering of heat tracing inside insulation.
   3. Detail insulation application at pipe expansion joints for each type of insulation.
   4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   5. Detail removable insulation at piping specialties.
   6. Detail application of field-applied jackets.
   7. Detail application at linkages of control devices.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use.

   1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
   2. Sheet Form Insulation Materials: 12 inches square.
   3. Jacket Materials for Pipe: 12 inches long by NPS 2.
   4. Sheet Jacket Materials: 12 inches square.
   5. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Block Insulation: ASTM C 552, Type I.
   2. Special-Shaped Insulation: ASTM C 552, Type III.
   3. Board Insulation: ASTM C 552, Type IV.
   4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
   5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
   6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
   1. From the selection please select three (3) manufacturers.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I with factory-applied vinyl jacket with factory-applied FSK jacket with factory-applied FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. From the selection please select three (3) manufacturers.

I. Mineral-Fiber, Preformed Pipe Insulation:
   1. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, without factory-applied jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

J. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory-applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.

1. From the selection please select three (3) manufacturers.

K. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

L. Phenolic:

1. From the selection please select three (3) manufacturers.
2. Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.
3. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.
4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
5. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.

    a. Preformed Pipe Insulation: ASJ.

M. Polyisocyanurate: Unfaced, preformed, rigid cellular polyisocyanurate material intended for use as thermal insulation.

1. From the selection please select three (3) manufacturers.
2. Comply with ASTM C 591, Type I or Type IV, except thermal conductivity (k-value) shall not exceed 0.19 Btu x in./h x sq. ft. x deg F at 75 deg F after 180 days of aging.
3. Flame-spread index shall be 25 or less, and smoke-developed index shall be 50 or less for thickness up to 1 inch as tested by ASTM E 84.
4. Fabricate shapes according to ASTM C 450 and ASTM C 585.
5. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.

    a. Pipe Applications: ASJ

N. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

1. From the selection please select three (3) manufacturers.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. From the selection please select three (3) manufacturers.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. From the selection please select three (3) manufacturers.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.

1. From the selection please select three (3) manufacturers.

C. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

1. From the selection please select three (3) manufacturers.

D. Phenolic and Polyisocyanurate Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. From the selection please select three (3) manufacturers.

E. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. From the selection please select three (3) manufacturers.

F. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. From the selection please select three (3) manufacturers.

G. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. From the selection please select three (3) manufacturers.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. From the selection please select three (3) manufacturers.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.

1. From the selection please select three (3) manufacturers.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. From the selection please select three (3) manufacturers.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
2. Service Temperature Range: 0 to plus 180 deg F.
3. Color: White.

2.6 SEALANTS

A. Cellular-Glass, Phenolic, and Polyisocyanurate Joint Sealants:

1. From the selection please select three (3) manufacturers.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with Kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. From the selection please select three (3) manufacturers.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

1. From the selection please select three (3) manufacturers.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. From the selection please select three (3) manufacturers.
2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. From the selection please select three (3) manufacturers.
2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. From the selection please select three (3) manufacturers.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. From the selection please select three (3) manufacturers.
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. From the selection please select three (3) manufacturers.
2. Width: 3 inches.
3. Film Thickness: 4 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

2.9 SECUREMENTS

A. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

B. Wire: 0.062-inch soft-annealed, galvanized steel].

1. From the selection please select three (3) manufacturers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe

insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

E. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
4. Finish flange insulation same as pipe insulation.

F. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
3. Finish fittings insulation same as pipe insulation.

G. Insulation Installation on Valves and Pipe Specialties:

1. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
2. Install insulation to flanges as specified for flange insulation application.
3. Finish valve and specialty insulation same as pipe insulation.

3.6 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

B. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
d. Phenolic: 1 inch thick.
e. Polyisocyanurate: 1 inch thick.
f. Polyolefin: 1 inch thick.

C. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch thick.
b. Polyolefin: 1 inch thick.

3.7 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be one of the following:

    a. Cellular Glass: 2 inches thick.
    b. Flexible Elastomeric: 2 inches thick.
    c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
    d. Phenolic: 2 inches thick.
    e. Polyisocyanurate: 2 inches thick.
    f. Polyolefin: 2 inches thick.
    g. Polystyrene: 2 inches thick.

B. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be one of the following:

    a. Flexible Elastomeric: 2 inches thick.
    b. Polyolefin: 2 inches thick.

END OF SECTION 230719

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Refrigerant pipes and fittings.
2. Refrigerant piping valves and specialties.
3. Refrigerants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve, refrigerant piping, and piping specialty.

1. Include pressure drop, based on manufacturer's test data, for the following:

a. Thermostatic expansion valves.
b. Solenoid valves.
c. Hot-gas bypass valves.
d. Filter dryers.
e. Strainers.
f. Pressure-regulating valves.

B. Sustainable Design Submittals:

C. Shop Drawings:

1. Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes; flow capacities; valve arrangements and locations; slopes of horizontal runs; oil traps; double risers; wall and floor penetrations; and equipment connection details.
2. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
3. Show interface and spatial relationships between piping and equipment.
4. Shop Drawing Scale: 1/4 inch equals 1 foot.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to 2010 ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.7 PRODUCT STORAGE AND HANDLING

A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: L.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8/A5.8M.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Working Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:
1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:
1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.
4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

C. Check Valves:
1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
6. End Connections: Socket, union, threaded, or flanged.
7. Maximum Opening Pressure: 0.50 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 275 deg F.

D. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.

2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).
1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.

F. Safety Relief Valves: Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
2. Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Working Pressure Rating: 400 psig.
6. Maximum Operating Temperature: 240 deg F.

G. Thermostatic Expansion Valves: Comply with AHRI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: 40 deg F.
6. Superheat: Adjustable.
7. End Connections: Socket, flare, or threaded union.
8. Working Pressure Rating: 700 psig.

H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
5. Seat: Polytetrafluoroethylene.
6. Equalizer: Internal.
7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter and 24-V ac coil.
8. End Connections: Socket.
9. Throttling Range: Maximum 5 psig.
10. Working Pressure Rating: 500 psig.
11. Maximum Operating Temperature: 240 deg F.

I. Straight-Type Strainers:

1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig.
5. Maximum Operating Temperature: 275 deg F.

J. Angle-Type Strainers:

1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

K. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in parts per million (ppm).
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

L. Replaceable-Core Filter Dryers: Comply with AHRI 730.

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated **alumina**.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: **2 psig**.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

M. Permanent Filter Dryers: Comply with AHRI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated **alumina**.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: **2 psig**.

8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

N. Mufflers:

1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or flare.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

O. Receivers: Comply with AHRI 495.

1. Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
2. Comply with UL 207; listed and labeled by an NRTL.
3. Body: Welded steel with corrosion-resistant coating.
4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
5. End Connections: Socket or threaded.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

P. Liquid Accumulators: Comply with AHRI 495.

1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or threaded.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

2.4 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

B. Suction Lines NPS 3-1/2 and Smaller NPS 2 to NPS 3-1/2 for Conventional Air-Conditioning Applications: Copper Type L, drawn-temper tubing and wrought-copper fittings with brazed joints.

C. Suction Lines NPS 4 and Smaller for Conventional Air-Conditioning Applications: Copper, Type L, drawn-temper tubing and wrought-copper fittings with soldered joints.

D. Hot-Gas and Liquid Lines: Copper, Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

E. Hot-Gas and Liquid Lines: Copper, Type K , annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

F. Hot-Gas and Liquid Lines: Copper Type L, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.

G. Hot-Gas and Liquid Lines Type L, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

H. Hot-Gas and Liquid Lines NPS 2 to NPS 4 : Schedule 40, black-steel and wrought-steel fittings with welded joints.

I. Safety-Relief-Valve Discharge Piping: Copper, Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

J. Safety-Relief-Valve Discharge Piping: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

K. Safety-Relief-Valve Discharge Piping: Copper, Type L , drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.

L. Safety-Relief-Valve Discharge Piping: Copper, Type L, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

M. Safety-Relief-Valve Discharge Piping:

1. NPS 5/8 and Smaller: Copper, Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

N. Safety-Relief-Valve Discharge Piping NPS 2 to NPS 4: Schedule 40, black-steel and wrought-steel fittings with welded joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.

E. Install a full-size, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Hot-gas bypass valves.
4. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

L. Install receivers sized to accommodate pump-down charge.

M. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install refrigerant piping in protective conduit where installed belowground.

L. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

M. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

N. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

O. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:

1. Shot blast the interior of piping.
2. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.
3. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
4. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
5. Finally, draw a clean, dry, lintless cloth through the tube or pipe.
6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.

P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

Q. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

F. Threaded Joints: Thread steel 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 to restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Steel pipe can be threaded, but threaded joints must be seal brazed or seal welded.

H. Welded Joints: Construct joints according to AWS D10.12M/D10.12.

I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.5 HANGERS AND SUPPORTS

A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:

1. NPS 1/2: Maximum span, 60 inches; minimum rod, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod, 1/2 inch.

D. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2: Maximum span, 10 feet; minimum rod, 3/8 inch.
2. NPS 2-1/2: Maximum span, 11 feet; minimum rod, 3/8 inch.
3. NPS 3: Maximum span, 12 feet; minimum rod, 3/8 inch.
4. NPS 4: Maximum span, 14 feet; minimum rod, 1/2 inch.

E. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.

a. Fill system with nitrogen to the required test pressure.
b. System shall maintain test pressure at the manifold gage throughout duration of test.
c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 23 81 26 - SPLIT SYSTEM AIR CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. These specifications describe requirements for a mission critical environmental control system. The system shall be designed to control temperature and humidity conditions in rooms containing electronic equipment. The manufacturer shall design and furnish all equipment to be fully compatible with the heat dissipation requirements of the room. The equipment shall be provided with a high sensible cooling system, factory assembled, piped, wired, and run tested prior to shipment and designed down flow air delivery as detailed on the project plans and schedule.

1.2 RELATED DOCUMENTS

A. Project plans, schedules, drawings and general provisions of the Contract as they apply to this Section.

B. ASHRAE Std. 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particulate Size

C. Underwriters Laboratories (UL) standard UL1995, Heating and Refrigeration equipment

1.3 DEFINITION

A. DX: Direct Expansion
B. EEV: Electronic Expansion Valve
C. TXV: Thermal Expansion Valve

1.4 SUBMITTALS

A. Pre Delivery Submittals shall be provided with the proposal and shall include:
   1. Product Data: For each type of product indicated include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories
   2. Shop Drawings: Single-line diagrams; dimensional, capacity data; and piping.
   3. Wiring Diagrams: For power, signal, and control wiring.
   4. Each submittal shall be provide with documentation certifying that all materials, products, components and test reports are in compliance with the design requirements for this project.
   5. Specification Compliance with “C” Comply, “D” Deviation, or “N” Non-Compliant indicated for each paragraph, with appropriate notes and comments.

B. Post Delivery Submittal for record purposes shall include:
   1. Operation and Maintenance Data: To include operation, and maintenance.
   2. Warranty: Warranty statement for equipment provided.

1.5 DESIGN REQUIREMENTS

A. AIR COOLED WITH REMOTE OUTDOOR CONDENSING UNIT

1. The refrigeration system shall be a split system consisting of an indoor evaporator and remote air-cooled outdoor condensing unit.
2. Remote Outdoor Air-Cooled Condensing unit
   a. The remote outdoor condensing unit shall contain the hermetic scroll compressor with complete overload protection on all three power lines, internal thermostats, crankcase heater, sight-glass, and low pressure override timer for positive starting at low temperatures.
   b. The unit shall be a low profile with direct drive axial fans with electronically commutated (EC) synchronous DC motors; commonly referred to as EC fans. The EC motors have soft start capability.
   c. The housing shall be constructed of aluminum and contain a seamless rifled copper tube expanded into aluminum fin coil for maximum heat transfer.
   d. The air discharge shall be vertical to minimize the effects of wind blowing through the coil at low ambient temperatures.
   e. The condensing unit shall have the ability to control the fan speed via a pressure transducer feedback signal to modulate the speed of the fans and provide positive start-up and operation at ambient temperatures down to -20ºF (-29ºC).
   f. All controls including the fan speed control shall be factory mounted in the air cooled condensing unit in an integral factory wired and tested control panel.
   g. The air cooled condensing unit shall be manufactured by the manufacturer of the indoor evaporator unit.
   h. The evaporator and condensing unit shall be factory assembled and tested.
   i. Piping and wiring between the indoor evaporator and the remote outdoor air-cooled condensing unit shall be field provided by the installing contractor.

B. RETURN AIR TEMPERATURE AND HUMIDITY SENSOR

1. The environmental control units shall come standard with an all in one combination return air temperature and humidity sensor.
2. The return air temperature shall interface with the dap4™ microprocessor controller for precision temperature and humidity monitoring and control.
3. Discharge air temperature monitoring can be used by selecting the Discharge Air Temperature Sensor option.

C. ELECTRICAL

1. All electrical components, including contactors, relays and control transformers shall be pre-wired and contained in a unit-mounted electrical enclosure with piano-hinged door that shall swing out for easy access and servicing.
2. The control circuit voltage shall be 24 volts AC.
3. The input electrical power shall be as detailed on the project plans and schedule.

D. HIGH TEMPERATURE SENSOR

1. The high temperature sensor (Firestat) shall be factory-installed in the unit and shall be factory-set to 125ºF. It shall immediately shut down the environmental control system when activated. The sensor shall be mounted with the sensing element in the return air.

E. MICROPROCESSOR-CONTROL SYSTEM:

1. The environmental control system shall be furnished with a microprocessor based dap4™ panel. The panel shall include unit control functions and display normal functions and

service diagnostics on a backlit liquid crystal display (LCD). The panel shall allow recall and display of the high and low temperature for the last 24 hours, high and low humidity for the last 24 hours, current percent of capacity and average percent of capacity for the last hour of operation for chilled water valve (if applicable), compressor (if applicable), reheat, humidification, dehumidification, component runtimes (if applicable) for fan motor(s), reheat, humidification, dehumidification and chilled water valve. Programming shall have multilevel password access to prevent unauthorized access. Programming shall be accomplished entirely from the front of the unit without the need to access, set or program switches inside the unit (front door of the unit does not need to be opened). Programmable functions shall be entered on flash memory to ensure program retention should power fail. The historical database shall be maintained by battery backup. Multiple messages shall be displayed by automatically scrolling from each message to the next. Alarm conditions shall be displayed by automatically scrolling from each message to the next. Alarm conditions, in addition to being displayed, shall enunciate an audible alarm. Four programmable summary contacts shall be available for remote alarm monitoring. Additional test or service terminal shall not be required for any functions. The control shall include temperature anticipation, moisture level humidity control and automatic flush cycles.

2. An alarm condition shall continue to be displayed until the malfunction is corrected. Multiple alarms shall be displayed sequentially in order of occurrence and only those alarms which have not been acknowledged shall continue to sound an audible alarm. The dap4™ panel shall perform an automatic self-test on system start-up. A user accessible diagnostic program shall aid in system component trouble shooting by displaying on the unit LCD screen the name of the controlled item, output relay number, terminal plug and pin number for each controlled item.
3. The following automatic control functions shall be included (as applicable):

Selectable Water Under Floor Alarm	Start Time Delay
Temperature Anticipation	Automatic or Manual Restart
Dehumidification Lockout	Humidity Anticipation
Sequential Load Activation	Chilled Water Coil Flush Cycle
Latent Anticipation	Suction Pressure

4. The following conditions, data and normal functions shall be monitored and displayed (as applicable):

Current Date and Time	Unit Status
Temperature Setpoint	Humidity Setpoint
Current Temperature	Current Humidity
Cooling	Dehumidification
Reheat	Humidification
Current Percent of Capacity Utilized	Current Discharge Temperature*
Current Fan Speed	Current Chilled Water Valve Position
Current Rack Temperature 1, 2 and 3	Current Dewpoint*
Max Rack Temperature	

5. The following switching and control functions shall be included:

Alarm Silence Button	Select Buttons (Up and Down)
Menu Selection Button	Enter Button (Menu Exit/Program Set)
System On/Off/Esc Button	

Manual Override switches (as applicable): for:

Cooling	Reheat
Humidification	CW Valve
Fan ON/OFF and Speed	

6. The following alarm functions shall be monitored and displayed when they occur in addition to enunciating an audible alarm (as applicable):

High Temperature Warning	High Humidity Warning
Low Temperature Warning	Low Humidity Warning
Under Floor Water Detection	Dirty Filter
Power Failure Restart	Manual Override
Firestat Tripped	Humidifier Problem
Maintenance Required	Local Alarm
Humidity Sensor Error	Discharge Sensor Error
High Condensate Water Level*	
Fan Motor Overload*	Person to Contact on Alarm*
Rack Temperature Sensor Error 1, 2*, 3*	High Suction Pressure
Low Suction Pressure	High Pressure Alarm

7. The following historical data shall be available(as applicable):

High Humidity Last 24 Hours	Low Humidity Last 24 Hours
Alarm History (Last 100 Alarms)	Hourly Average of Duty
Rack Temperature Max last 24 Hours	Rack Temperature Min last 24 Hours
Rack Temperature Average Last 24 Hours	
Equipment Runtimes for:	
Fan(s)	Compressor
Reheat	Dehumidification

8. The following functions shall be programmable (as applicable):

Temperature Setpoint	Temperature Deadband
High Temperature Alarm Limit	Low Temperature Alarm Limit
Humidity Setpoint	Humidity Deadband
High Humidity Alarm Limit	Low Humidity Alarm Limit
Reset Equipment Runtimes	Audio Alarm Mode
Manual Diagnosis	Humidity Anticipation
Dehumidification Mode	Low Discharge Temp Alarm Limit
Power Problem or Restart Mode	System Start Delay
Message for Optional Alarm 1, 2, 3, 4*	Delay for Optional Alarm 1, 2, 3, 4*
Remote Alarm 1, 2, 3, 4 Selection*	Person to contact on Alarm
Define Password	Humidifier Autoflush Timer*
Firestat Temperature Alarm Limit	Scheduled Normal Maintenance
Temperature Scale	Calibrate Temperature Sensor
Calibrate Humidity	Humidifier
Water Valve Mode	Water Valve Voltage Range
Reverse Acting Water Valve	Network Protocol

Analog Module Sensor Setup*
Calibrate Chilled Water Temp Sensor*
Fan Speed Settings
High Dewpoint Deadband*
Low Dewpoint Deadband*
Fan temperature deadband*
High Suction Pressure Setpoint
Low Suction Pressure Setpoint
Fan Modulation Rate
Delta-T Setpoint
Latent Anticipation Setpoint*
Calibrate Discharge Air Sensor*
Fan Control Mode
High Dewpoint Setpoint*
Low Dewpoint Setpoint*
Fan temperature setpoint*
Superheat Setpoint
High Suction Pressure Deadband
Low Suction Pressure Deadband
Return Air Cooling Band
SCR Reheat Band*

* Some of the programmable selections, displays or alarms may require additional components or sensors

1.6 ADDITIONAL REQUIREMENTS

A. Energy Saver Coil: The environmental control unit shall be provided with an Energy Saver coil. The Energy Saver coil shall be an integral part of the unit and will be capable of providing the total cooling capacity. Whenever the incoming water/glycol temperature is below the setpoint of the water changeover thermostat, Energy Saver cooling shall be available. The Energy Saver shall operate providing there is a need for cooling. The Energy Saver coil shall include 3-way pressure control valves on the condenser circuits and 3-way valve on the economy coil. Common piping for the energy coil and condensers shall be provided.

B. Energy Saver Coil with Compressor Supplement: Units with Energy Saver coil shall be provided with compressor supplement if the Energy Saver is not sufficient as a stand-alone system. When the incoming water/glycol temperature is below the setpoint of the water changeover thermostat, the Energy Saver shall be enabled. When there is a call for cooling the Energy Saver coil will be used first until the cooling demand exceeds the Energy Saver coil capacity then the compressor shall come on and supplement the needed cooling capacity. A discharge air temperature sensor shall be included for field mounting.

C. Remote Temperature & Humidity Sensors: Units shall be provided with remote temperature and humidity sensor. The sensor shall be provided in a plastic case for remote mounting. Cable shall be provided for field wiring in 35 (10.7m) length.

D. Discharge Air Temperature Sensor: The environmental control unit shall be provided with a discharge air temperature sensor for field installation on the supply air side air temperature display via dap4™ controller.

E. Thru-Door Locking Disconnect Switch: The environmental control unit shall include a non-automatic disconnect switch mounted in the high voltage section of the electrical panel. The operating mechanism shall prevent access to the high voltage electrical components until switched to the "OFF" position. The operating mechanism shall protrude through the exterior door and be lockable in the OFF position.

F. Condensate Pump: Units shall be provided with dual float condensate pump. If condensate pump fails control panel shall enunciate an alarm and display. Pumps shall be factory mounted/wired and shall include sump, motor, and automatic control. A factory installed high condensate water level alarm switch will disable the unit prior to condensate pan overflow should the drain become plugged with debris. The audio alarm is activated and a “HIGH

CONDENSATE WATER LEVEL" message shall be displayed on the display module. The pumps shall be rated for 130 GPH at 20 foot of water.

G. Tandem Scroll Compressors: The environmental control unit shall be provided with tandem hermetic scroll compressors with two-step modulation for stage control. Each circuit shall contain two scroll compressors. Modulation shall allow one or both compressors (per circuit) to run depending upon the load of the system, resulting in part-load efficiency equal to full load efficiency.

H. Hot Gas Bypass - The environmental control unit shall be provided with hot gas bypass. The hot gas bypass valve shall be installed between the compressor discharge line and the leaving side of the expansion valve through a side outlet distributor.

I. Three-Way Water Regulating Valves - The environmental control unit shall be provided with a 3-way head pressure actuated regulating valve. The maximum water pressure shall be 150 psi.

J. High Efficiency Filters: Replace the standard MERV 8 filter with MERV 11 (based on ASHRAE Std. 52.2) disposable filters. The filters shall be 4-inch deep pleated design.

K. Vibration Isolation Pads: Vibrations isolation pads consisting of high density cork sandwiched between two layers of neoprene shall be supplied for field mounting.

PART 2 - EXECUTION

2.1 EXAMINATION

A. Contractor to examine the areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for hydronic piping systems to verify actual locations of piping connections before equipment installation.

C. Examine walls, floors, and roofs for suitable conditions where equipment will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

2.2 INSTALLATION

A. Install precision cooling units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Install in conjunction with server cabinets for integrated line up of equipment.

2.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Piping Connections: Connect equipment furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's piping connection diagram submittal to piping contractor. Install piping to allow proper service and maintenance.

C. Electrical Wiring: Install and connect electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's electrical connection diagram submittal to electrical contractor.

2.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, assist in testing, and adjust components, assemblies, and equipment installations, including connections.

END OF SECTION 238126

DIVISION 26
ELECTRICAL

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for basic electrical studies and reports, material handling, and other basic electrical materials and methods.

B. Related Sections:
   1. Section 01 33 00 - Submittal Procedures.
   2. Section 09 90 00 - Painting.
   3. Section 26 05 26 - Grounding and Bonding.
   4. Section 26 05 28 - Hangers and Supports for Electrical Systems.
   5. Section 26 05 53 - Identification for Electrical Systems.
   6. Section 26 05 63 - Acceptance Testing of Electrical Systems.
   7. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
   8. Section 26 05 33.13 – Conduit for Electrical Systems.
   9. Section 26 05 33.16 - Boxes for Electrical Systems
   10. Section 26 05 36 - Cable Trays for Electrical Systems
   11. Section 26 27 26 - Wiring Devices.

1.2 REFERENCES

A. America National Standards Institute (ANSI):
   1. ANSI Z535.4, Product Safety Signs and Labels.

B. American Society of Mechanical Engineers (ASME):
   1. ANSI/ASME Y14.2M, Line Conventions and Lettering.
   2. ANSI/ASME Y14.24M, Types and Applications of Engineering Drawings.
   3. ANSI/ASME Y14.34M, Associated Lists.
   4. ANSI/ASME Y14.35M, Revision of Engineering Drawings and Associated Documents.
   5. ANSI/ASME Y14.100, Engineering Drawing Practices.

C. Institute of Electrical and Electronic Engineers (IEEE):
   1. ANSI/IEEE 18, Standard for Shunt Power Capacitors.
   2. ANSI/IEEE 141, Recommended Practice for Electric Power Distribution for Industrial Plants - Red Book.
   3. ANSI/IEEE 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems - IEEE Buff Book.
   4. ANSI/IEEE 399, Recommended Practice for Power Systems Analysis - Brown Book.
   5. ANSI/IEEE 519, Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.
   6. IEEE 1036, Guide for Application of Shunt Power Capacitors.
   7. ANSI/IEEE 1584, Guide for Arc-Flash Hazard Calculations.

8. ANSI/IEEE C37.10, Guide for Diagnostics and Failure Investigation of Power Circuit Breakers.
9. ANSI/IEEE C37.13, Low-Voltage AC Power Circuit Breakers Used in Enclosures.
10. ANSI/IEEE C57.12.00, General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers.
11. ANSI/IEEE C57.12.59, Standard for Dry-Type Transformer Through-Fault Current Duration

D. InterNational Electrical Testing Association, Inc. (NETA):
1. ANSI/NETA ETT Standard for Certification of Electrical Testing Technicians.

E. National Electric Manufacturer's Association (NEMA).
1. ANSI/NEMA MG 1, Motors and Generators.
2. NEMA ICS 6, Industrial Control and Systems: Enclosures.

F. National Electrical Design Builders Association (NECA)
1. ANSI/NECA 100 Symbols for Electrical Construction Drawings.

G. National Fire Protection Association (NFPA):
1. NFPA 70, National Electrical Code (NEC).
2. NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces.

H. The Society for Protective Coatings (SSPC):
1. SSPC-SP 2, Hand Tool Cleaning.

I. Other Published References:
1. Electrical Safety Handbook, by John Cadick, McGraw Hill, Inc., Article on Safety Electrical One-Line Diagrams.

1.3 DEFINITIONS

A. PCC: Point-of-Common-Coupling, which occurs at terminals to which both harmonic producing loads, such as variable speed drives, and non-harmonic producing loads are connected.

B. THD: The Total Harmonic Distortion of the electrical system, including the effects of all harmonics.

C. UPS: Uninterrupted power supply, usually an independent electrical power supply designed to provide power when normal electrical service is interrupted.

1.4 DESIGN REQUIREMENTS

A. The contractor shall Prepare and submit a Short Circuit, Arc-Flash, and Protective Device Coordination Study and a Harmonic Distortion Study as specified in this Article.

B. The studies shall be performed under the supervision of a professional engineer using computer software by SKM Systems Analysis Power Tools, ETAP or equal.

1. Immediately after award of the Contract, collect all data needed to perform calculations for the studies.

a. Obtain, in writing, electrical utility source information and any other information required from the utility to perform the necessary studies directly from the serving utility.
b. The Owner and Engineer will provide, as available, information about the portions of the facility's existing electrical system affected by the work performed under this Contract.
1) The Owner will provide two copies of the latest revision of the existing facility record drawings and the facility equipment list to the Design Builder for use in defining existing equipment load requirements.
2) Base the contribution of motors on actual motor loads as indicated on the equipment list, system one-line diagrams, and panel schedules.
3) If the information provided is insufficient to perform the studies or represents unknown ratings of existing equipment, investigate and obtain the information required.
a) Employ qualified technicians to obtain the necessary data.
c. Obtain data for new equipment directly from suppliers and other Design Builders working on the project.

2. Once the data needed is obtained, perform a preliminary computerized Short Circuit, Arc-Flash, and Protective Device Coordination Study and a preliminary computerized Harmonic Distortion Study, both complete with calculations.
a. At least two full calendar weeks prior to submitting Shop Drawings for equipment included the respective studies, submit the preliminary studies and corresponding computer printouts and annotated one-line distribution diagram to the Engineer for review and comment.
b. After the Engineer provides his comments, submit four copies of the revised and corrected preliminary studies.

3. Include the following types of information common to each study:
a. Calculations and tabulations.
1) Ensure that the calculations in the Short Circuit, Arc-Flash, and Protective Device Coordination Study are sufficient to ascertain interrupting and/or withstand ratings of the equipment.
a) Identify items of distribution system equipment that are not rated for the available fault current, and provide corrective recommendations for consideration.
2) Ensure the calculations in the Harmonic Distortion Study are sufficient to ascertain the adequacy of harmonic filter performance.
b. Data on the computer programs used to perform calculations and tabulations.
c. An appendix to each report that includes the information obtained from outside entities, agencies, electrical manufacturers, the serving utility company, field inspections, and other field sources such as the following:
1) Copies of letters.
2) Photographic records.
3) Nameplate tracings.
4) Actual data sources from which the data and information was obtained.

C. Final Project Report:
1. After the Engineer accepts the revised and corrected preliminary studies, prepare a report summarizing the results of the individual studies; and submit this Final Project Report to the Engineer for acceptance and approval.
a. Include the following sections in the Final Project Report:
1) Description.

2) Purpose.
3) Basis and scope of the study.
a) A single line diagram of that portion of the power system that is included within the scope of the study.
b) Computerized time versus current coordination graphs and corresponding printouts for protective devices.
c) Include the feeder cable damage curves associated with the items being coordinated in these graphs.
d) Include the ANSI/NEMA MG 1 damage points for the motors in the system and the ANSI/IEEE C57.12.00 mechanical and electrical damage points on the curves.
4) Tabulations of the relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
5) Harmonic data at Points-of-Common-Coupling (PCC).

b. Submit ten bound copies of the Final Project Report for review and approval and two copies of record drawings showing the existing facility as it was before the work of this Contract was performed.

c. Once the Final Project Report has been approved, forward one additional bound final copy of the report to the Owner.

D. Short Circuit, Arc-Flash, and Protective Device Coordination Study:

1. Prepare the Short Circuit, Arc-Flash, and Protective Device Coordination Study under the supervision of a Professional Engineer licensed in the state of NY, or have a NETA certified electrical testing laboratory employing technicians certified according to ANSI/NETA ETT prepare it.

a. Perform the short circuit portion of the Study in accordance with ANSI/IEEE C37.10, ANSI/IEEE C37.13, ANSI/IEEE 141, ANSI/IEEE 242, and ANSI/IEEE 399.

1) Calculate short circuit momentary duty values and interrupting duty values on the basis of the following short circuit conditions at every distribution transformer, secondary and primary terminal at every bus in every switchboard, motor control center, distribution panelboard, branch circuit panelboard and at terminals of utilization equipment whether it be Electrical, Process, HVAC, Plumbing or Instrumentation that is either 480V or 208V, 3-phase and rated 15 Amps or higher. Include:
a) Single line to ground fault.
b) Bolted three-phase line to ground fault.
c) Double line (line to line) to ground fault.

b. Perform the arc flash portion of the Study for the electrical distribution equipment in accordance with NFPA 70E and ANSI/IEEE 1584.

1) Perform the analysis under worst-case arc-flash conditions; and if applicable, describe in the final report how these conditions differ from worst-case bolted fault conditions.
2) Perform separate analysis for operation from the normal utility source(s) and operation from the stand-by generator(s). Present results for both operating conditions in the reports.
3) Provide the following items for each circuit and arc location analyzed:
a) Printed hardcopy of calculations performed.
b) Arcing fault magnitude.
c) Device clearing time.
d) Duration of arc.
e) Arc flash boundary distances.

f) Working distance.
g) Arc flash incident energy.
h) Hazard risk category.
i) Personal-protective equipment classes.
j) Arc flash warning labels as specified in Section 26 05 53.
k) Provide separate labels for operation from the normal utility source(s) and operation from the stand-by generator(s).
l) Recommendations and potential options for arc flash energy reduction to reduce the Incident Energy levels where they are calculated to be over the 40 cal/cm2. Refer to and coordinate with AW Engineering Standards for conducting this work.
m) Maintenance procedures/guidelines in accordance with the requirements of NFPA 70E for the Owner.

c. Coordinate protective devices with systems and equipment by providing the necessary calculations and logic decisions required to select or to check the selection of power fuse ratings, ratios and characteristics of associated current transformers, and breaker trip characteristics and settings and distribution system fuses.
1) Provide coordination plots for phase and ground protective devices on a system basis.
a) Adhere to National Electrical Code restrictions, and maintain proper coordination.
b) Provide a sufficient number of separate curves to clearly indicate the coordination achieved.
2) Either computer-generate or hand-draw time-current characteristics of the specified protective devices on log-log scale plots.
a) Include complete titles, the respective one-line diagram and identifying legends, associated relays or fuse characteristics, significant motor starting characteristics, complete operating bands of low voltage circuit breaker trip curves and fuses.
b) Indicate the types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, transformer magnetizing inrush, through-fault current duration per ANSI/IEEE C57.12.59, dry-type transformers withstand, cable thermal overcurrent withstand limits, symmetrical fault currents and motor full load current, locked-rotor current, and magnetizing inrush in the coordination plots.
3) Provide the selection and settings of the protective devices separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios and connection, manufacturer and type, range of adjustment, and recommended settings.
a) Use the information from the Study to obtain optimum device protective and coordination performance.

2. In addition to the information common to the studies as listed in **Subparagraph 1.04.A.3**, include the following information specific to short circuit, arc-flash, and protective device coordination distortion only in the Short Circuit, Arc-Flash, and Protective Device Coordination Study:
a. Complete short circuit and protective device coordination studies, including coordination plots, for the following electrical distribution systems serving the entire facility:
1) Utility Voltage Service.
2) Not used
3) Utility low voltage service system.

4) Standby low voltage generator system.
5) Not used
6) Low voltage 208Y/120 volts, 3 phase, 4 wire distribution systems.
7) Downstream systems devices connected through isolation transformers.

b. Power company supply and network characteristics, including the following:
1) The base quantities selected.
2) Source impedance data and impedance diagrams.
3) One-line diagrams.
4) Calculation methods and tabulations.
a) Include short circuit tabulations of the fault impedance, X to R ratios, asymmetry factors, KVA, symmetrical and asymmetrical fault currents, and all multiplying factors.
5) Conclusions and recommendations.

c. Motor starting characteristics for motors 50 HP and above.
1) Study reduced voltage motor timer settings to determine the correct coordinated settings and the correct tap setting based on the motor torque curve, load torque curve, and motor WK2 and load WK2 to minimize undesirable influence on the distribution system.

d. Capacitor switching transient surge analysis.
1) Indicate effects the capacitor switching has on the electrical power distribution system.
2) If adverse effects on the power distribution system are indicated by the study, submit corrective recommendations with the short circuit and protective coordination study for review by the Engineer.

e. Provide sufficient information in the study to ensure adequate protection of the cables, transformers, and other equipment; to indicate proper coordination between fuses and circuit breakers; and to determine areas of the system in which additional coordination may be required.

3. Submit Short Circuit, Arc-Flash, and Protective Device Coordination Study information with the equipment submittals for review by the Engineer.

E. Harmonic Distortion Study:
1. Prepare the Harmonic Distortion Study under the supervision of a Professional Engineer licensed in the state of New York, or have it prepared by a NETA certified electrical testing laboratory employing technicians certified according to the NETA Standard for Certification of Electrical Testing Technicians.
a. Perform the harmonic distortion study in accordance with the requirements of ANSI/IEEE 519.
b. Ensure that the maximum permissible harmonic distortion of the electrical system complies with the limitations in ANSI/IEEE 519, ANSI/IEEE 18, ANSI/IEEE 399, and IEEE 1036; and at the Point-of-Common-Coupling (PCC) ensure that it meets or exceeds the following criteria:
1) Voltage Distortion:
a) Ensure that the maximum voltage distortion as a percentage of the fundamental harmonic does not exceed the values in Table 26 05 00-1.
b)

Table 26 05 00-1 Maximum Voltage Distortion - Percent of Fundamental

Harmonic	Percent Harmonic Voltage Distortion (THD)	
	Normal Power Source	Emergency Generator Source

Total	5	5
One Harmonic	3	3

2) Current Distortion:
   a) Ensure that the maximum current distortion as a percentage of the fundamental harmonic does not exceed the values in Table 26 05 00-2, where the following definitions apply:
      (1) I_{sc} is the maximum short circuit current at the Point-of-Common-Coupling (PCC).
      (2) I_L is the maximum load current (fundamental frequency at PCC).
      (3) THD_C is the total harmonic current distortion.

Table 26 05 00-2 Maximum Current Distortion as a Percent of the Fundamental Harmonic

I_{sc}/I_L	Harmonic Order (Odd Harmonics*)					
	2-10	**11-16**	**17-22**	**23-34**	**35 UP**	**THD_C**
<20**	4.0	2.0	1.5	0.6	0.3	5.0
20-50	7.0	3.5	2.5	**1.0**	0.5	8.0
50-100	10.0	4.5	4.0	1.5	0.7	12.0
100-1000	12.0	5.5	5.0	2.0	1.0	15.0
>1000	15.0	7.0	6.0	2.5	1.4	10.0
* Even harmonics are limited to 25 percent of the odd harmonic limits in Table 26 05 00-2.						
**All power generation equipment is limited to these values of current distortion, regardless of actual I_{sc}/I_L.						

3) Notch Area:
   a) Ensure that the maximum notch area as defined in Figure 10.1 of ANSI/IEEE 519 does not exceed the following values:
      (1) For a maximum voltage distortion of 3 percent on 480-volt systems: 16,400 volt-microseconds.
      (2) For a maximum voltage distortion of 5 percent on 480-volt systems: 22,800 volt-microseconds.
      (3) For other than 480-volt systems multiply the notch area by V/480, where V is the voltage of the system.
4) Notch Depth:
   a) Ensure that the maximum notch depth as defined in Figure 10.1 of ANSI/IEEE 519 does not exceed the following values:
      (1) For a Total Harmonic Distortion (THD) of 3 percent: 10 percent.
      (2) For a Total Harmonic Distortion (THD) of 5 percent: 20 percent.
5) Telephone Interference:
   a) Ensure that the telephone interference, expressed as the I·T product defined in ANSI/IEEE 519 and the following, does not exceed 10,000:
      (1) I is the rms magnitude of the current in amperes.
      (2) T is the Telephone Influence Factor, TIF, a dimensionless quantity indicative of the waveform.
6) Limits of Flicker:
   a) Ensure that flicker, the magnitude of the voltage variation, does not exceed the limits shown in Figure 10.3 of ANSI/IEEE 519.

2. In addition to the common information required for all specified studies as listed in Subparagraph 1.04.A.3, include the following information specific to harmonic distortion only in the Harmonic Distortion Study:

a. Total Harmonic Distortion (THD), each harmonic component up to and including the 35th harmonic, and the amount of each harmonic component at each of the following:
   1) Points-of-Common-Coupling between feeders to drives and feeders' distribution equipment buses,
   2) The main service.
   3) The generator terminals.
   4) The utility high voltage line at the plant boundary.
b. Telephone Influence Factor for telephone service to the plant.
c. The magnitude of the voltage distortion, current distortion, and telephone interference at each Point-of-Common-Coupling (PCC), including individual harmonics up to and including the 35th harmonic, the Total Harmonic Distortion (THD) on the system, and derating factors affecting equipment.
   1) Hardware contributions must include harmonics caused by any variable speed drives supplied under this Contract.
d. Predicted voltage distortion, current distortion, and telephone interference in the electrical distribution system at each Point-of-Common-Coupling (PCC), utility service point, uninterrupted power supply (UPS), and primary of transformers having a 120/208 volt secondary.
   1) Provide calculations for the cases when one or a combination of variable frequency drive units are in operation.
e. KVAC loadings, RMS current and peak voltage, the power factor correction capacitors within the plant, and the power factor correction capacitors located within 5 miles of the plant on power company lines feeding the plant.
   1) List KVAC loadings in percent.
f. An analysis of capacitor switching that indicates the effects such switching has on the voltage distortion, current distortion, and telephone interference in the electrical distribution system at each Point-of-Common-Coupling (PCC), utility service point, uninterrupted power supply (UPS), and primary of transformers having a 120/208 volt secondary.
   1) Include the effects of harmonics on capacitors.
   2) If adverse effects on the power distribution system are indicated by the study, submit corrective recommendations with the harmonic distortion study for review by the Engineer.
g. Heat loadings of equipment expressed as a percent of $V_{rms}2$ to rated V_L2 for equipment connected to motor control Center (MCC) buses.

F. Motor Overload Relay and Branch Circuit Overcurrent Protective Device Schedule
1. Prepare and submit a Motor Overload Relay and Branch Circuit Overcurrent Protective Device Schedule that provides all information needed to determine proper settings.
2. Obtain the actual horsepower, service factor, and full load running current for each motor on the project that is rated over one-eighth horsepower.

G. Electrical Safety Operating Diagrams:
1. Prepare and submit one-line Electrical Safety Operating Diagrams for the electrical system.
   a. Make the diagrams similar to the diagrams shown in the article on Safety Electrical One-Line Diagrams in the Electrical Safety Handbook, or in any other nationally recognized style.
      1) Show outlines of equipment using a line weight that contrasts with the line weight of wiring.
      2) Use heavier of line weights for buses; and use different line weights for each voltage level, increasing the line weight for increasing voltage.

3) Omit ratings, but include the voltage levels of all buses; and include equipment designations and their common names.
4) Use symbolism similar to that on the Contract Drawings or conforming to ANSI standards, such as ANSI/NECA 100, ASME Y14.2M, ASME Y14.24M, ASME Y14.34M, ASME Y14.35M, and ASME Y14.100.
5) Provide a legend on each sheet.

2. Create a separate diagram for each building or structure showing the following items:
   a. The electrical system for the building or structure, complete and showing all sources supplying power to the building or structure from the first disconnecting device upstream of the building or structure.
   b. Overcurrent protective devices, disconnecting devices, and all wiring between them and equipment buses for the following:
      1) Devices and buses within motor control centers.
      2) Devices and buses within switchboards.
      3) Main devices and devices disconnecting external power from each motor starter.
      4) Main devices and buses in each panelboard.
      5) Main devices on engine generator sets.
      6) Feeder overcurrent protective devices on engine generator sets.
   c. Include branch circuit overcurrent protective devices within panelboards that supply the following items:
      1) Feeders to other panelboards and to transformers.
      2) Motor starters.
      3) Control panels.
      4) Motor control centers.
      5) Transient voltage surge suppressors.
      6) Loads larger than 5 kVA or 5 horsepower, or rated over 300 Volts.
   d. Equipment:
      1) Transformers external to equipment.
      2) Motor starters for motors over 1 horsepower and their disconnecting devices.
      3) Utilization equipment that is rated larger than 5 kVA or 5 horsepower, or is rated over 300 Volts, and its disconnecting devices.
      4) Motors rated over 1 horsepower and their disconnecting devices.
   e. Interconnecting wiring between equipment.
   f. Sources of all power upstream of the building or structure, and devices that disconnect this power without ratings.
3. For each device in the building or structure show the first item downstream of that device whether or not the downstream item is in the same building or structure.
4. Submit the Electrical Safety Operating Diagrams for approval.
   a. After approval by Engineer, provide an electronic copy of all Electrical Safety Operating Diagrams on a CD ROM disc in AutoCAD (dwg) or Adobe (pdf) format.

1.5 SUBMITTALS

A. Submit the following information for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:
   1. Product Data:
      a. Submit Product Data, including catalog cuts, for all products provided for the electrical work of this Contract and as specified in other Sections.
         1) Clearly indicate the usage of each product on each submittal.

2. Shop Drawings:
   a. Submit Shop Drawings for the electrical work of this Contract as specified in other Sections.
3. Quality Assurance/Control Submittals:
   a. Design Data:
      1) Short Circuit, Arc Flash and Protective Device Coordination Study Reports:
         a) Preliminary Short Circuit, Arc Flash and Protective Device Coordination Study.
         b) Final Short Circuit, Arc Flash and Protective Device Coordination Study.
         c) CD ROM disc containing:
            (1) The complete computer program model(s) used in performing the Short Circuit, Arc Flash, and Protective Device Coordination Study. Provide with both the Preliminary and Final Study Reports.
            (2) Spreadsheet in MS Excel format that tabulates all analyzed scenarios with accompanying results. Provide with both the Preliminary and Final Study Reports.
      2) Harmonic Distortion Study Reports:
         a) Preliminary Harmonic Distortion Study.
         b) Final Harmonic Distortion Study.
         c) CD ROM disc containing:
            (1) The complete computer program model(s) used in performing the Harmonic Distortion Study. Provide with both the Preliminary and Final Study Reports.
            (2) Spreadsheet in MS Excel format that tabulates all analyzed scenarios with accompanying results. Provide with both the Preliminary and Final Study Reports.
      3) Final Project Report, with final Short Circuit, Arc Flash and Protective Device Coordination Study and Harmonic Distortion Study Reports.
      4) Motor Overload Relay and Branch Circuit Overcurrent Protective Device Schedule.
      5) Electrical Safety Operating Diagrams:
         a) Hard copies for approval.
         b) CD ROM disc in AutoCAD (dwg) or Adobe (pdf) format.
   b. Certificates:
      1) Testing agency quality verification that all products meet requirements or manufacturer disclaimer statements.
   c. Qualification Statements:
      1) Testing agency qualifications.
4. Closeout Submittals:
   a. Operation and Maintenance Manuals.
   b. CD ROM disc containing the complete computer program model(s) used in performing the Circuit, Arc Flash, Protective Device Coordination, and Harmonic Distortion Studies, updated to reflect the final as-built condition.

1.6 SUBSTITUTIONS, BASIS OF DESIGN, AND ACCEPTABLE MANUFACTURERS

A. All substitutions to identified materials or equipment shall comply with the applicable requirements of Division 1. In any case of conflict between such requirements of Division 1 and this paragraph, the more stringent requirements shall govern.

B. Whenever an item of material or equipment is identified by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function and quality required. Unless the identification or description contains or is followed by words reading that no like, equivalent or "or- equal" item or no substitution is permitted, material or equipment of other Suppliers may be proposed.

C. Where substitutions to identified items are permitted, any proposed substation or alternate must fully comply with the following in order to be considered by the Engineer:
   1. Be of a reputable manufacturer,
   2. Be fully compliant with the requirements of this Section and the Drawings,
   3. Be fully compatible with all interfacing items and work, and with the installation environment,
   4. Be appropriate (as determined by the Engineer) for the proposed application, and
   5. Be equivalent (as determined by the Engineer) in character, performance, and quality to any identified Basis of Design.

D. Where a specific manufacturer or product is identified as the Basis of Design or listed first in a list of acceptable manufacturers, the overall project design is based on the identified manufacturer or product. If the Design Builder elects to substitute a manufacturer or product which differs from the identified Basis of Design, the Design Builder shall bear all efforts and costs of any design changes necessary in order to achieve finished work which is equal in character, performance, and quality to the original design depicted in the Contract Documents. Such changes shall include, but not necessarily be limited to: changes to ratings and/or features of other equipment, changes to material sizes and/or types, new material and/or equipment, and changes to structural and/or architectural features (including room sizes). Approval by the Engineer of a proposed substitute item shall not relieve the Design Builder of this responsibility.

E. The listing of specific manufacturers is solely intended to identify reputable manufacturers who are known to provide quality products of the general type specified. Such listing is in no way intended to imply that the identified manufacturers product(s) have been verified to satisfy the specified requirements, or to be equivalent to any identified Basis of Design manufacturer. Nor does such a listing imply acceptance of products which do not meet the specified requirements, ratings, features, dimensions, and functions as indicated.

1.7 QUALITY ASSURANCE

A. Qualifications:
   1. Testing Agency Qualifications:
      a. Use a NETA accredited testing agency, or approved equal, that is accredited for the region in which the Contract work is performed.
      b. Submit the testing agency's qualifications to the Engineer for approval.

B. Regulatory Requirements:
   1. Perform all electrical work in conformance with the requirements of NFPA 70, the National Electrical Code.

C. Certifications:
   1. Submit evidence with all Product Data that the products represented meet testing agency quality verification requirements, including agency listing and labeling requirements.
      a. Such evidence may consist of either a printed mark on the data or a separate listing card.

b. Submit a written statement from those product manufacturers that do not provide evidence of the quality of their products that indicates why an item does not have quality assurance verification.
1) Such statements provided in lieu of quality assurance verification are subject to the acceptance of the Owner and the Engineer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and equipment to the work site in accordance with the requirements of Section 26 05 00.
1. Deliver materials and equipment in a clean condition.
a. Provide packaging that plugs, caps, or otherwise seals openings both during shipping and temporary storage.
2. Provide equipment needed for unloading operations, and have such equipment on the work site to perform unloading work when the material and equipment is delivered.
a. If possible, clearly identify pick-points or lift-points on electrical equipment crating and packaging.
b. In the absence pick-points or lift-points on equipment crating and packaging, identify pick-points or lift-points on the equipment itself.

B. Handle materials and equipment in accordance with the requirements of Section 26 05 00.
1. Handle materials and equipment in accordance with manufacturer's written instructions.
2. When unloading materials and equipment, provide special lifting harnesses or apparatus as required by manufacturers.

C. Store electrical materials and equipment, whether on-site or off-site, in accordance with Section 26 05 00 and the following:
1. Follow the manufacturer's written instructions for storing the items.
2. Store electrical equipment and products under cover.
a. Except for electrical conduit, store electrical equipment and products in heated warehouses or enclosed buildings with auxiliary heat and that provide protection from the weather on all sides.

1.9 SYSTEM STARTUP

A. Energize the following items in the presence of the Engineer:
1. Process instrumentation.
2. Equipment rated over 300 Volts.
3. Equipment rated over 1-horsepower.

B. Startup the following items in the presence of the Engineer:
1. Instrumentation.
2. Process equipment.

1.10 MAINTENANCE

A. Operation and Maintenance Manuals:
1. Prepare Operation and Maintenance Manuals in conformance with the requirements of Metro North, other Contract requirements, and as follows:

a. Organize Operation and Maintenance Manuals by Specification Section and equipment number as designated on the Contract Drawings.
b. Include suppliers, supplier addresses, and supplier telephone numbers for the equipment and products furnished.

2. 60 days prior to the request for final payment, prepare and submit two copies of the proposed Operation and Maintenance Manuals to the Engineer for approval.
3. Upon approval of the proposed Operation and Maintenance Manuals, submit six corrected copies as follows:
   a. Submit one set to the Engineer.
   b. Place one set in the spare parts and fuse cabinet in the new electrical service building
   c. Deliver the remaining four copies to the Owner.
4. Insert final record drawings in each set of Operation and Maintenance Manuals at Project Closeout.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Grounding and Bonding Materials:
1. Provide grounding and bonding materials in accordance with the requirements of Section 26 05 26.

B. Hangers and Supports:
1. Provide hangers and supports for electrical equipment in accordance with the requirements of Section 26 05 28.

C. Electrical Identification Materials:
1. Provide electrical identification materials in accordance with the requirements of Section 26 05 53.

D. Wire and Cable:
1. Provide medium-voltage electrical wire, cable, and accessories in accordance with the requirements of Section 26 05 13
2. Provide low-voltage electrical wire, cable, and accessories in accordance with the requirements of Section 26 05 19.

E. Conduit and Raceway:
1. Provide conduit and raceway as indicated, as appropriate for the application per NFPA 70, and in accordance with the following:
   a. Conduit and Tubing: Provide electrical conduit and tubing in accordance with the requirements of Section 26 05 33.13.
   b. Surface Raceway: Provide electrical surface raceway in accordance with the requirements of Section 26 05 33.16.
   c. Wireway and Fittings: Provide electrical wireway and fittings in accordance with the requirements of Section 26 05 36.
   d. Cable Trays and Fittings: Provide electrical cable trays and fittings in accordance with the requirements of Section 26 05 36.

F. Wiring Devices:
1. Provide electrical wiring devices in accordance with the requirements of Section 26 27 26.

2.2 SHOP FINISHING

A. For electrical equipment, factory-apply paint and coating systems that at a minimum meet the requirements of the NEMA ICS 6 corrosion-resistance test and the additional requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 POSTING OF ELECTRICAL SAFETY OPERATING DIAGRAMS

A. Post a 24" x 36" hard paper copy of the Electrical Safety Operating Diagram in each building or structure. Diagrams shall be posted on a wall in metal frame under 1/8" Lexan in clear view of the devices disconnecting all power from the building or structure.

3.2 INSTALLATION

A. Field-Applied Finishes:
   1. Except for factory-finished items that have been completely finished with factory- applied primer and final finish coatings, finish installed electrical materials, equipment, apparatus, and items in the field in accordance with the requirements of Section 09 90 00.
      a. Apply paint material matching the composition of the factory-applied products.
         1) Obtain factory-supplied paint for this work whenever available.
      b. Comply with the paint manufacturer's instructions for mixing, thinning, surface preparation, application, spreading rate, drying time, and environmental limitations concerning application of the paint.
      c. Apply paint in such a manner so that the finished appearance will match as nearly as possible the factory finish.
         1) Poorly applied paint may be required to be repaired and re-applied by the Design Builder in accordance with Article 3.02 at no additional cost to the Owner.
   2. Coordinate the painting of large areas with the Engineer to minimize the duration of exposure of other workers to toxic paint fumes.

3.3 REPAIR/RESTORATION

A. If the factory finish of factory-finished items is damaged for any reason, refinish the item.
   1. If an item that has several surfaces has damage on one surface, refinish the entire damaged surface.
      a. Surface Preparation:
         1) Outside the damaged area, lightly sand the entire surface and perform additional sanding to profile the damaged paint edge.
         2) Prepare the surfaces of damaged areas in accordance with SSPC-SP 2.

3.4 FIELD QUALITY CONTROL

A. Contractor shall perform electrical testing as detailed in Section 26 05 63 and in each Specification Section.

B. Contractor shall have electrical work inspected as required by the local Authority Having Jurisdiction (AHJ).
   1. Submit a copy of the certification of inspection with the final project closeout documents, and post the original in the electrical room on-site protected by a metal frame with a protective plate glass cover.

C. The quality of finishing and refinishing work is subject to approval by the Engineer.

3.5 MANUFACTURERS' FIELD SERVICES

A. Contractor shall provide the services of a qualified field engineer and necessary tools and equipment to test, calibrate, and adjust the protective relays and circuit breaker trip devices as recommended in the Final Project Report of the power system study.

END OF SECTION

SECTION 26 05 19 LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for furnishing, installing, connecting, energizing, testing, cleaning, and protecting low voltage cable, shielded cable, and accessories.

B. Related Sections:
   1. Section 01 33 00 - Submittal Procedures.
   2. Section 26 05 00 – Common Work Results for Electrical
   3. Section 26 05 26 - Grounding and Bonding.
   4. Section 26 05 53 – Identification for Electrical Systems.
   5. Section 26 05 63 – Acceptance Testing for Electrical Systems.
   6. Section 26 05 33.16 – Boxes for Electrical Systems

1.2 REFERENCES

A. American Society for Testing Materials (ASTM):
   1. ASTM B 8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

B. Institute of Electrical and Electronic Engineers (IEEE):
   1. IEEE 383 - Standard for Qualifying Class 1E Electric Cables and Field Splices for Nuclear Power Generating Stations.
   2. IEEE 1202 - Standard for Flame-Propagation Testing of Wire and Cables.

C. National Electrical Manufacturer's Association (NEMA):
   1. NEMA WC 26/EEMAC 201 - Binational Wire and Cable Packaging Standard.
   2. ANSI/NEMA WC 57 - Standard for Control, Thermocouple Extension, and Instrumentation Cables.

D. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC).

E. Underwriter's Laboratories, Inc. (UL):
   1. UL 13 - Standard for Power-Limited Circuit Cables.
   2. UL 1277 - Standard for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
   3. UL 1569 - Standard for Metal-Clad Cables.
   4. UL 1581 - Reference Standard for Electrical Wires, Cables, and Flexible Cords.
   5. UL 1685 - Standard for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables.
   6. UL 2250 - Standard for Instrumentation Tray Cable.

F. Insulated Cable Engineers Association (ICEA):
   1. ICEA T-29-520 - Vertical Cable Tray Flame Test @ 210,000 BTU.

1.3 DESIGN REQUIREMENTS

A. Conductors in Raceway and Conduit Systems:
   1. Provide conduit systems for installing the wiring that is outside of equipment.
   2. Except for raceway or conduit for control wires or where otherwise indicated on the Contract Drawings, design raceway and conduit systems so that the maximum number of low-voltage current carrying conductors (per NFPA 70, Article 310) in each raceway or conduit does not exceed three, plus a ground.

B. Cable Tension Design Requirements:
   1. Design conduit runs so that the tension limits set by the wire and cable manufacturers will not be exceeded.
      a. Provide additional pulling points as required to limit the tension to acceptable levels.
   2. Generate and submit tension cable pulling calculations for all underground power runs.
      a. Include pull loads, tension, and safety factors for all cables with the calculations.

C. Product Data and Catalog Cuts:
   1. Submit low-voltage ground, power, and control wiring product data as listed below for the products provided as the Work of this Section; and clearly indicate the usage of each product on the data submitted.
      a. Wires and cables.
      b. Lugs.
      c. Connectors.
      d. Tapes.
      e. Pulling lubricant.
      f. Tools used to crimp connectors.

D. Use of Trade Names:
   1. The use of trade names within the Contract Documents is intended to establish the basis of design and to illustrate the constructability and level of quality required.
      a. The use of trade names is not intended to exclude other manufacturers whose products are equivalent to those named, subject to compliance with Contract requirements.

1.4 SUBMITTALS

A. Submit the following information to the Engineer for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:
   1. Product Data:
      a. Wires and cables.
      b. Lugs
      c. Connectors.
      d. Tape.
      e. Pulling lubricant.
   2. Samples:
      a. Wire samples.
   3. Quality Assurance/Control Submittals:
      a. Design Data.

1) Tension cable pulling calculations for all underground power runs.

b. Certificates.
   1) Testing agency/quality verification.

c. Manufacturers Instructions.
   1) Cable manufacturer's recommendations.

d. Qualification Statements.
   1) Documented experience of the installing firm.
   2) Qualifications of the licensed electricians supervising the Work.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications:
      a. To install the Work of this Section, employ the services of a firm specializing in installing wire, cable, and accessories, and that has a minimum of 3 years experience doing so.
         1) Submit the documented experience of the firm installing the wire, cable, and accessories.
      b. To supervise installation of the Work of this Section, employ licensed electricians.
         1) Submit the qualifications of the licensed electricians supervising the Work of this Section.

B. Regulatory Requirements:
   1. Perform the Work of this Section in accordance with the requirements specified in NFPA 70, and to all other applicable state, local, and national governing codes and regulatory requirements.

C. Certifications:
   1. Provide products that are listed and labeled by Underwriters Laboratory, approved by Factory Mutual, or certified as meeting the standards of UL by the Electrical Testing Laboratory (ETL) for the location installed in, and the application intended, unless products meeting the requirements of these testing laboratories are not available or unless standards do not exist for the products.
      a. Provide copper conductors listed and labeled by UL for all wiring.
   2. Submit evidence of testing agency/quality verification, listing, and labeling for each product with the submitted product data either by providing a printed mark on the data or by attaching a separate listing card.
      a. For items without such evidence, submit a written statement from the product manufacturer that indicates why it does not have quality assurance verification.

D. Field Samples:
   1. Submit one 36-inch long sample of each type of wire to be used.

1.6 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
   1. Imprint insulated conductors with the date of manufacture, the wire type, and the manufacturer.
   2. Package wire and cable in conformance with the requirements of NEMA WC 26/EEMAC 201.

3. Protect items from damage during delivery, handling, and installation.
    a. Comply with the cable manufacturer's recommendations for inspection, handling, storage, temperature conditioning, bending and training limits, pulling limits, and calculation parameters for installing cable.
    b. Submit the cable manufacturer's recommendations for inspection, handling, storage, temperature conditioning, bending and training limits, pulling limits, and calculation parameters for installing cable.

B. Acceptance at Site:
1. Wire and cable manufactured more than 12 months before delivery to the Site is unacceptable for use under this Contract, and will be rejected.

C. Storage and Protection:
1. Store products indoors on blocking or pallets.
2. Protect items from damage during storage.

1.7 PROJECT ENVIRONMENTAL REQUIREMENTS

A. Install armored instrumentation cable only when the temperature is above -40 degrees Celsius.

1.8 MAINTENANCE

A. Operation and Maintenance Manuals:
1. Include product data for the products provided as the Work of this Section in the Operation and Maintenance Manuals submitted with the record drawings at project closeout in accordance with Metro North standards.

PART 2 - PRODUCTS

2.1 LOW VOLTAGE CONDUCTORS

A. Conductor Design Requirements:
1. Provide conductors of the proper size and ampacity ratings based on Article 310 of NFPA 70.
    a. Provide copper conductors that have 98 percent conductivity.
    b. Unless otherwise indicated on the Contract Drawings, at a minimum provide conductors of the following American Wire Gauge (AWG) sizes:
        1) For power and branch feeder circuits: 12 AWG.
            a) For power and branch feeders, provide solid or stranded copper low-voltage conductors for sizes up to and including 10 AWG, provide stranded copper low-voltage conductors for 8 AWG and larger sizes.
        2) For control circuits: 14 AWG.
        3) For alarm and status circuits: 14 AWG.
        4) For single conductor instrument wiring: 14 AWG.
        5) For multiple conductor instrument wiring: 16 AWG.

B. Insulation Design Requirements:
1. Provide low voltage ground, power, and control wiring having the proper insulation types as follows:

a. For exterior, wet, and damp locations, including NEMA 4X locations: Type XHHW-2.
b. For underground wiring:
1) For sizes 14 AWG through 10 AWG: Type XHHW-2.
2) For sizes 8 AWG and larger: Type RHW-2 or XHHW-2.
c. For wiring that is wholly in dry indoor locations: Type XHHW-2, or dual-rated Type THHN/THWN.
d. For ground wires: THW may be used at the Design Builder's option.

2. Color Coding of Wires
a. Insulation shall be factory colored per Tables 16122-1, 16122-2 and/or 16122-3 below. The use of tape for color coding is prohibited.

C. Manufacturers
1. Acceptable Manufacturers:
a. Continental Wire & Cable Company
b. SouthWire
c. General Cable
d. Okonite Co.
e. Or Approved Equal

2.2 MATERIALS

A. 600 Volt Rated Multi-Conductor Cable:
1. Provide multi-conductor cable that is suitable for use indoors or outdoors; exposed or concealed; as open wiring; in any raceway, underground duct, or cable tray; direct buried; or embedded in concrete.
a. Provide cable that is UL listed as Type MC in compliance with the requirements of UL 1569, and is UL listed for 90 degrees Celsius dry or wet, for direct burial, for cable tray use, and as sunlight resistant.
2. Assemble the cable with non-hygroscopic fillers and binder tape.
a. Insulated Conductors:
1) Provide uncoated stranded copper conductors, complying with the requirements of ASTM B 8 for Class B conductors.
2) Provide cross-linked polyethylene type XHHW-2 insulation rated for 600 volts.
b. Grounding Conductors:
1) Provide uninsulated copper conductors.
c. Cover the overall assembly with a single strip of interlocked aluminum tape, and then apply an outer final jacket of black flame-retardant PVC.
3. Manufacturers:
a. General Cable Technologies Corporation,
b. The Okonite Company,
c. Or Approved Equal.

B. Tray Cable:
1. Provide tray cable that is suitable for use indoors or outdoors; in any raceway, underground duct, or cable tray; or direct buried.
a. Provide cable that is UL listed as Type TC in compliance with the requirements of UL 1277, and is UL listed for 90 degrees Celsius dry or wet, for direct burial, for cable tray use, and as sunlight resistant.
2. Assemble the cable with non-hygroscopic fillers and binder tape.
a. Conductors:

1) Provide uncoated stranded copper conductors, complying with the requirements of ASTM B 8 for Class B conductors.
2) Provide the following number and size of conductors where indicated in the Contract Documents:
a) For power cables:
(1) 3-conductor, Number 12 AWG.
(2) 4-conductor, Number 12 AWG.
(3) 3-conductor, Number 10 AWG.
(4) 4-conductor, Number 10 AWG.
b) For status/control cables:
(1) 4-conductor, Number 16 AWG.
(2) 4-conductor, Number 14 AWG.

b. Insulation:
1) Provide type XHHW-2 insulation rated for 600 volts that is color coded according to ANSI/NEMA WC 57 Method 1.

c. Cover the overall assembly with a cable jacket constructed of flame- retardant chlorinated polyethylene (CPE).

3. Manufacturers:
a. General Cable Technologies Corporation, Flame-Retardant Ethylene Propylene (FREP®) XHHW-2 VW-1,
b. Or Approved Equal.

C. Metal Clad Cable:
1. Bare soft annealed copper conductors, solid or Class B stranded per ASTM B8. Conductors shall be solid copper in sizes up to and including No. 10 AWG. For sizes No. 8 AWG and larger, conductors to be stranded copper.
2. Type THHN insulation, 600 volts, color coded.
3. Insulated green copper grounding conductor. Meets or exceeds requirements of NEC Table 250-95.
4. Assembled per UL 1569 with non-hygroscopic fillers and binder tape.
5. Close fitting interlocked galvanized steel armor per UL 1569.
6. UL listed as type MC cable.
7. UL listed for cable tray use.
8. Cable shall be suitable for environmental air handling space installation.
9. Imprint insulated conductors with the date of manufacture, wire type, and manufacturer. Wire and cable manufactured more than 12 months before delivery to the job site shall not be used.
10. The only permitted use of Metal Clad cable is for final whip-connections to lighting fixtures above suspended ceilings. Length shall not exceed 72 inches.
11. Acceptable Manufacturers:
a. AFC Cable Systems.
b. Or Approved Equal.

D. Shielded Instrumentation Tray Cable (2/C Cable):
1. Provide 100 percent shielded, two-conductor, 16 AWG twisted pair instrumentation tray cable.
a. Provide cable that is UL listed as Type TC in compliance with the requirements of UL 1277, and having a 90 degree temperature rating.
b. Conductors:
1) Provide stranded tin-coated copper conductors.
c. Shielding:

1) Provide aluminum-polyester foil shielding that incorporates an 18 AWG stranded tinned copper drain wire.

d. Insulation:

1) Provide insulation rated for 600 volts and consisting of polyvinyl chloride (PVC) with a nylon overcoat all covered by an overall PVC jacket.

2. Manufacturers:

a. Belden, Inc., Part Number 9342,
b. Alpha Wire
c. West Penn
d. Or Approved Equal

E. Shielded Instrumentation Cable (2/C Cable):

1. Provide 100 percent shielded, two-conductor, 16 AWG twisted pair cable.

a. Provide NFPA 70 (NEC) Class CL2 cable that is UL (recognized) Style 20253, and has a 90 degree temperature rating.

b. Conductors:

1) Provide stranded (19 x 29 AWG) tin-coated copper conductors.

c. Shielding:

1) Provide aluminum-polyester foil shielding that incorporates an 18 AWG stranded tinned copper drain wire.

d. Insulation:

1) Provide color coded insulation rated for 600 volts and consisting of polyethylene covered by an overall PVC jacket.

2. Acceptable Manufacturers:

a. Belden, Inc., Part Number 8719
b. Alpha Wire
c. West Penn
d. Or Approved Equal

F. Armored Instrumentation Cable:

1. Provide armored instrumentation cable consisting of a single pair with left-hand lay and an overall shield suitable for use indoors or outdoors; in any raceway, underground duct, or cable tray; or direct buried.

a. Provide cable that is UL listed as Type PLTC (Power-Limited Tray Cable) and Power-Limited Circuit Cable for use in Class II or III circuits in accordance with Articles 725 and 727 of NFPA 70, and is UL listed for 90 degrees Celsius dry or wet, for direct burial, for cable tray use, and as sunlight resistant.

1) Provide cables complying with UL requirements for Types CL2 and CL3.

b. Conductors:

1) Provide 7-strand concentric 16 AWG bare soft annealed copper conductors complying with the requirements of ASTM B 8 for Class B conductors.

c. Cable Shielding:

1) Provide a shield consisting of a 1.35 mil blue double faced aluminum/synthetic polymer backed tape overlapped to provide 100 percent coverage, and a 7-strand tinned copper drain wire, two sizes smaller than the conductor

d. Insulation:

1) Provide high dielectric strength, chemically cross-linked, color coded polyethylene insulation rated for 300 volts and that complies with the requirements of UL 13 and UL 2250.

a) Inner Jacket: Black, flame-retardant polyvinyl chloride (PVC).

b) C-L-X Sheath: Close fitting, impervious, continuous, welded, corrugated aluminum sheath that exceeds the equipment grounding conductor requirements of Section 250.122 of NFPA 70 (NEC).
c) Outer Jacket: Black, flame-retardant polyvinyl chloride (PVC).
2) Color Code: Black and white.
3) Nominal Thickness: 25 mils.

2. Acceptable Manufacturers:
   a. The Okonite Company, C-L-X Type P-OS
   b. Or Approved Equal.

G. Shielded RTD Cable for Interior Applications (3/C):
1. Provide cable which meets the following:
   a. Cable fabricated using stranded (19 x 29 AWG) tin-coated copper conductors with polyethylene insulation, color coded conductor insulation and overall PVC jacket.
   b. Cable 100 percent shielded, utilizing aluminum-polyester, incorporating a
   c. #18 AWG tinned copper drain wire.
   d. Cable UL (recognized) Style 2107 having a 300 volt insulation and 60 degree C temperature rating, three-conductor, twisted triad, #16 AWG.
   e. NEC type CL3.
2. Acceptable Manufacturers:
   a. Belden, Inc., Part Number 8618,
   b. Alpha Wire
   c. West Penn
   d. Or Approved Equal

H. Shielded RTD Cable for Ductbanks (3/C):
1. Provide cable which meets the following:
   a. Cable fabricated using stranded (7-strand) bare copper conductors with modified Ethylene Tetrafluoroethylene insulation, color coded conductor insulation and overall modified Ethylene Tetrafluoroethylene jacket.
   b. Cable 100 percent shielded, utilizing aluminum-nylon-polyester tape, incorporating a #16 AWG tinned copper drain wire.
   c. Cable UL listed as ITC/PLTC, CL2 and CL3, having a 300 volt insulation and 150 degree C temperature rating, three-conductor, twisted triad, #16 AWG.
   d. Cable suitable for direct burial.
2. Acceptable Manufacturers:
   a. Okonite, catalog number 264-45-4401.

2.3 ACCESSORIES

A. Cable Lubricant:
1. Provide cable lubricant specifically recommended by the cable manufacturer for cable pulling operations.
   a. For rubber of plastic jacketed cables, provide soapstone, graphite, or talc cable lubricant.

B. Grounding Braid:
1. Provide conformable, all-metal (tinned copper wires), corrosion resistant, woven grounding braid having a high current-carrying capacity approximately that of 6 AWG wire, such as.
2. Manufacturers:

a. 3M, Scotch, Scotch® 25 Electrical Grounding Braid,
b. Plymouth
c. Permacel
d. Or Approved Equal.

C. Tapes:
1. Arc Proofing Tape:
a. Provide fire retardant arc proofing tape, such as Scotch® 77 Fire Retardant Electric Arc Proofing Tape, that is capable of protecting cables from fault arc generated heat and flames and of protecting adjacent wrapped cables and accessories exposed to fault arcs until limiting devices can interrupt the faulted circuit.
2. Vinyl Insulating Tape:
a. Provide UL-listed flexible polyvinyl chloride (PVC) backed insulating tape with a pressure sensitive adhesive, such as black Scotch® 33+ Vinyl Electrical Tape, that is resistant to abrasion, acids, alkalis, and copper corrosion; resistant to, hot, cold and wet weather; and resistant to damage from UV sunlight exposure.
3. Rubber Splicing Tape:
a. Provide highly conformable, linerless, self-bonding, ethylene rubber (EPR), high-voltage (through 69 kV) insulating tape formulated to provide excellent thermal dissipation of splice heat, and designed to insulate splices and terminate cables whose overload temperatures can reach 130 degrees Celsius, such as Scotch® 130C Linerless Rubber Splicing Tape.
4. Manufacturers:
a. 3M, Scotch
b. Plymouth
c. Permacel
d. Or Approved Equal.

D. Tubing:
1. Heat Shrinkable Tubing:
a. Provide flexible, flame retardant, polyolefin heat shrinkable thin wall tubing that has good resistance to common fluids and solvents, and has a high dielectric strength.
2. Waterproof Splice Kits:
a. Provide heat shrinkable thin wall polyolefin electrical cable splice kits.
3. Manufacturers:
a. Tyco Electronics, CGPT
b. Thomas & Betts Corp.
c. Or Approved Equal.

E. Wire and Cable Connections:
1. Grounding Connectors:
a. Provide grounding connectors conforming to the requirements of Section 26 05 26, Grounding and Bonding.
2. Connectors for Service Wires and Cables, and for Wires and Cables Larger Than Number 6:
a. Split Bolt Connectors or Compression Type Connectors:
1) Provide UL-listed split bolt connectors or compression type connectors for making parallel or butt splices of stranded copper wire.
2) Use companion preformed plastic insulating covers or tape insulation conforming to NFPA 70 (NEC) requirements.
b. Mechanical compression connectors:

1) Provide mechanical compression connectors that are capable of connecting single or multiple conductors, and of being installed with one wrench.
   a) Type: Compact, two-hole mechanical compression connectors having two clamping bolts.
      (1) Connector Body: Provide a high copper bronze or brass alloy body.
      (2) Bolts: Provide brass or bronze bolts; plated steel screws are unacceptable.
      (3) Fasteners: Provide silicon-bronze fasteners for bolting connectors to connections.

c. Crimped Compression Connectors:
   1) Provide two-hole crimped compression type connectors fabricated from high conductivity, seamless, electrolytic wrought copper, electrolytically tin-plated, and color coded to match the dies.
   2) Provide crimped compression type connectors with adequate area to conduct the electrical current.
   3) To crimp connectors, provide crimping tools from the same manufacturer that manufactured the connectors.

3. Control Wiring Connections:
   a. For control wiring connections at terminal boards, provide crimped nylon- insulated ring terminals.
   b. For control wiring splices, provide nylon insulated butt splices with insulation grips.
   c. For joining more than two control wires, provide junction boxes with terminal boards.
4. Instrumentation Cable Connectors:
   a. For connecting instrumentation cable and the equipment being furnished under this Contract, provide companion type connectors.
      1) For equipment controllers/enclosures that are furnished under other Sections of this Contract, furnish the connectors for connecting cable to the equipment with the equipment.
      2) Terminate the wiring as required for proper operation.
   b. Manufacturers:
      1) Thomas & Betts Corp.
      2) AMP Inc.
      3) Ilsco Corp.
      4) Ideal Industries, Inc.
5. Connectors for Other Conductors:
   a. Any of the applicable types listed for larger wire may be provided.
   b. Screw Terminal Connections:
      1) For making terminal connections of stranded copper wire to screw terminals, provide nylon insulated crimped compression terminals with copper barrel on the wire.
      2) For making terminal connections of solid copper wire to screw terminals, provide screw lock connectors.
   c. Wire Nuts:
      1) For making splices of copper wire, provide pre-insulated, UL-listed, solderless connectors of the spring-lock or compression type that can be installed by hand or using tools.
      2) For site lighting, wire nuts used in underground or below grade locations is prohibited. There only permitted use for site lighting is within a pole base.
   d. Manufacturers:
      1) Thomas & Betts Corp.

2) Tyco Electronics, AMP Inc.
3) Ilsco Corp.
4) FCI-Burndy® Products
5) Approved equal.

2.4 SOURCE QUALITY CONTROL

A. Tests:
1. 600 Volt Rated Multi-Conductor Cable:
   a. 70,000 BTU/hr Vertical Tray Flame Test:
      1) 600 Volt rated multi-conductor cable must pass the vertical tray flame test requirements of UL 1569, IEEE 383, and IEEE 1202.
   b. 210,000 BTU/hr Vertical Tray Flame Test:
      1) 600 Volt rated multi-conductor cable must pass the vertical tray flame test requirements of ICEA T-29-520.
2. Tray Cable:
   a. 70,000 BTU/hr Vertical Tray Flame Test:
      1) Tray cable must pass the vertical tray flame test requirements of UL 1277, IEEE 383, and IEEE 1202.
   b. 210,000 BTU/hr Vertical Tray Flame Test:
      1) Tray cable must pass the vertical tray flame test requirements of ICEA T-29-520.
   c. VW-1 test:
      1) Tray cable insulated conductors must pass the VW-1 test requirements of UL 1581.
3. Shielded Instrumentation Tray Cable (2/C Cable):
   a. Vertical Tray Flame Test:
      1) Shielded instrumentation tray cable must pass the vertical tray flame test requirements of UL 1581 to obtain a VW-1 rating.
4. Shielded Instrumentation Cable (2/C Cable):
   a. Vertical Tray Flame Test:
      1) Shielded instrumentation cable must pass the vertical tray flame test requirements of UL 1685 with UL loading.
5. Armored Instrumentation Cable:
   a. 70,000 BTU/hr Vertical Tray Flame Test:
      1) Armored instrumentation cable must pass the vertical tray flame test requirements of UL 1581, IEEE 383, and IEEE 1202.
   b. 210,000 BTU/hr Vertical Tray Flame Test:
      1) Armored instrumentation cable must pass the vertical tray flame test utilizing the corner configuration.
      2) Armored instrumentation cable must pass the vertical tray flame test requirements of ICEA T-29-520.
      3) Such statements are subject to the approval of the Engineer before the product may be used for this Contract.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Install the work of this Section only under the supervision of licensed electricians.

3.2 EXAMINATION

A. Inspect all conduits, junction boxes, electrical vaults, and handholes to verify that they are clean, that they do not have burrs, that conduits are properly aligned, and that they are complete.
   1. Ensure that on all conduits without threaded hubs, two locknuts are installed.
   2. Ensure that in all conduits with wires larger than No. 10, bushings are installed.
   3. Ensure that grounding bushings and fittings are installed at all places specified in Section 26 05 26, Grounding and Bonding.
   4. Verify that proper sized boxes are installed.

B. Verify that boxes and conduit fittings conform to the bending requirements specified in Article 314 of NFPA 70 (NEC).

3.3 PREPARATION

A. Verify that pulling calculations have been made and are available for long conduit runs and pulls as indicated in this Section.

B. Do not begin installing wiring until other work which might cause damage to the wires, cables, or conduits has been completed.
   1. Correct deficiencies in conduits, junction boxes, electrical vaults, and handholes that have been discovered by the inspection required in **Paragraph 3.02.A**.

C. Prepare conduits to receive wire and cable.
   1. Swab the conduits with a nylon brush and steel mandrel.
   2. Pre-lubricate the conduits for which the pulling tension calculations are based on a coefficient of friction less than that of a dry conduit.

D. Verify that a means of controlling the pulling tension on the wire or cable is installed on the mechanical assist devices furnished for pulling cable.

E. Take the necessary precautions to prevent water, dirt, or other foreign material from accumulating in the conduits during the execution of wiring work.

3.4 INSTALLATION

A. Low Voltage Ground, Power, and Control Wiring:
   1. Install Type CL2P, FPLP, or CMP cable as required by the application in accordance with the requirements of NFPA 70 (NEC).
      a. For exposed low voltage wiring, use plenum cable.
      b. For low voltage wiring concealed from view, only install wiring in the accessible locations permitted by the Contract Drawings.

2. Neutral Conductors:
    a. For each single-phase and each multi-phase feeder, provide separate neutrals.
    b. For branch circuits, except at three-phase wye-connected panelboards, provide separate neutral conductors.
        1) For the three-phase wye-connected panelboards, provide common neutrals from 3 adjacent single-pole circuit breakers or from the poles of the same multi-pole circuit breaker.
    c. Except for feeders with a small unbalanced and single-phase load, size each neutral the same as the largest phase conductor.
        1) For feeders with a small unbalanced and single-phase load, size the feeders to the largest of the following:
            a) The size of any three-phase load connected to the neutral, which contains lighting, computer power outlets, instrumentation, or other electric loads.
            b) The size required for 125 percent of the maximum unbalanced load.
3. Equipment Ground Conductors:
    a. Provide a green equipment ground conductor with all runs.
        1) Provide the equipment ground conductor wire type as specified in Section 26 05 26, Grounding and Bonding.

B. Special Cable Installation Requirements:
1. In addition to the other installation requirements specified within this Section, comply with the manufacturer's installation instructions for bending, pulling, connector types, and grounding when installing armored variable frequency drive cable.
    a. Submit the manufacturer's installation instructions for armored variable frequency drive cable.

C. Pulling Cable:
1. Establish a feed-in point at the manhole, handhole, or building located at the highest elevation of the run, and pull cables down grade using flexible cable feeds to convey the cables into the duct runs through the feed-in point opening.
    a. Furnish quadrant blocks located properly along the cable run.
    b. Limit cable pulling tensions to the maximum pulling tensions recommended by the cable manufacturer.
        1) Measure the cable pulling tension on all runs pulled with mechanical assistance and for all cable runs where calculations are required to be submitted by using a dynameter.
        2) Remove cables subjected to excessive bending and tension and that are cracked or have damaged or nicked outer jackets from the Site, and replace these cables with new undamaged cables.
            a) If pulling tension is exceeding during pulling, remove the affected cables and mark them as not to be reused.
    c. Lubricate cables with lubricants during pulling.

D. Installing Cables in Manholes:
1. Install cable along the manhole wall that provides the longest route and the maximum spare cable length.
2. Form cables so they closely parallel the walls, and do not interfere with duct entrances.
3. Support cable on brackets and insulators spaced at a maximum of 2 feet apart.
4. Use pulling lubricants approved by the cable manufacturer.

E. Terminating Cable:

1. Terminate cable using materials and methods indicated or specified herein, or in accordance with the written instructions of the cable manufacturer or termination kit manufacturer.
    a. For equipment connections, provide split bolt or compression type connectors, mechanical compression connectors, or crimped compression type connectors as specified and approved by the equipment manufacturer; for all other types of connections provide connectors of one of the types specified:
2. Protect insulated power and lighting cable terminations from accidental contact, deterioration of coverings, and moisture by using proper terminating devices and materials.

F. Splicing Wire and Cable:
1. Install all service and feeder conductors from end to end without splices.
2. Install all motor conductors from the starter to the motor without splices.
3. Only splice cables in accessible locations.
4. Below-Grade Splices:
    a. In underground systems, locate splices above the 100 year flood level.
    b. Make below-grade splices using a compression connector on the conductor.
    c. Insulate and waterproof below-grade splices by methods suitable for continuous submersion in water using either of the methods that follow:
        1) Gravity Pour Method:
            a) Provide an approved commercial waterproof splice kit with the necessary materials and equipment, including a mold suitable for the cables to be spliced.
                (1) When the mold is in place around the joined conductors, prepare and pour the resin mix into the mold.
        2) Cast-Type Splice Insulation:
            a) Provide an approved commercial waterproof splice kit with the necessary materials and equipment, including a thermosetting epoxy resin insulating material applied by a gravity pour method or by a pressure injection method.
            b) Fix cables in place until the splicing materials have completely set.
    d. Within outlet or junction boxes, make wire and cable splices that conform to the requirements of NFPA 70 (NEC).
    e. Install these outlet or junction boxes in accessible locations.

G. Wiring Identification:
1. Color code all feeder wires and cables as indicated in Table **26 05 19**-1, Table 26 05 19-2 and/or Table 26 05 19-3.

Table 26 05 19-1 Feeder Wire and Cable Color Coding

Phase	480Y/277 Volts	208Y/120 Volts
A	Brown	Black
B	Orange	Red
C	Yellow	Blue
Neutral	Gray or White with Yellow Tracer	White
Electrical Ground Conductor	Green	Green

Table 26 05 19-2 Feeder Wire and Cable Color Coding	
Phase	**120/240 Volts Single-Phase**
A	Black
B	Red
Neutral	White
Electrical Ground Conductor	Green

Table 26 05 19-3 Feeder Wire and Cable Color Coding	
Phase	**240/120 Volts Three-Phase High Leg**
A	Black
B	Red
C	Blue
Neutral	White
Electrical Ground Conductor	Green
High Leg	Add Orange tape to color indicated above

2. Identify all power wiring by circuit and panelboard, switchboard, and motor control center numbers.
3. Identify all control wiring with wire numbers.
4. Provide additional electrical identification of cabling and wiring as specified in Section 26 05 53, Electrical Identification.

3.5 FIELD QUALITY CONTROL

A. Site Tests:
   1. Prior to energizing wire and cable, field test the wire and cable as specified in Section 26 05 63, Electrical Testing.

B. Inspection:
   1. Record the actual installed elevations and locations of grounding cables and rods, both concealed and exposed, on the record drawings specified in Section 17 80 00, Closeout Submittals.
      a. Verify that the control wiring wire numbers correspond to the numbers indicated in the record drawings.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for connecting, energizing, testing, cleaning, and protecting grounding and bonding systems.

B. Related Sections:
   1. Section 01 33 00 – Submittal Procedures.
   2. Section 26 05 00 – Common Work Results for Electrical
   3. Section 26 05 63 – Acceptance Testing for Electrical Systems.
   4. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables
   5. Section 26 05 33.13 – Conduit for Electrical Systems

1.2 REFERENCES

A. American Public Works Association (APWA):
   1. APWA Public Works Management Practices Manual.

B. American Society for Testing Materials (ASTM):
   1. ASTM B 1; Standard Specification for Hard-Drawn Copper Wire.
   2. ASTM B 3; Standard Specification for Soft-Drawn Copper Wire.
   3. ASTM B 8; Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
   4. ASTM C 653; Standard Guide for Determination of the Thermal Resistance of Low-Density Blanket-Type Mineral Fiber Insulation.
   5. ASTM D 5; Standard Test Method for Penetration of Bituminous Materials.
   6. ASTM D 149; Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.
   7. ASTM D 257; Standard Test Methods for D-C Resistance or Conductance of Insulating Materials.
   8. ASTM D 570; Standard Test Method for Water Absorption of Plastics.

C. InterNational Electrical Testing Association, Inc. (NETA):
   1. ANSI/NETA ETT Standard for Certification of Electrical Testing Technicians.

D. National Fire Protection Association (NFPA):
   1. NFPA 70, National Electrical Code (NEC).

E. National Electrical Manufacturing Association (NEMA):
   1. NEMA TC-2; Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
   2. NEMA TC-3; Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
   3. NEMA TC-14; Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

4. NEMA WC-7; Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

F. Underwriter's Laboratories, Inc. (UL):
1. UL 467, Standard for Grounding and Bonding Equipment.
2. UL 486A-486B, Wire Connectors.
3. UL 486C, Standard for Splicing Wire Connections.
4. UL 486D, Standard for Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
5. UL 486E, Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.

1.3 DESIGN REQUIREMENTS

A. Design the electrical system installation to conform to Article 300 of NFPA 70, Wiring Methods, and to other applicable articles of NFPA 70 governing methods of wiring.

B. Ground the conduit systems, metal enclosures, equipment frames, motors, and receptacles in accordance with Article 250 of NFPA 70, Grounding.
1. Ground all metallic conduits, wiring channels, and armored cables continuously from outlet to outlet, and from outlets to cabinets, junction boxes, or pull boxes.
   a. Bond each run of raceways to form a continuous path for ground faults from end to end.
   b. When liquid tight flexible metal conduit sizes larger than 1-inch or flexible metal conduit are installed, provide external bond wires.
2. Grounding Bushings:
   a. Provide all 1-inch or larger metallic conduits with grounding bushings unless they enter metallic enclosures via integral threaded hubs.
   b. Provide grounding bushings for conduits entering the bottom of freestanding equipment.
   c. Bond wire from every grounding bushing to the equipment ground stud or ground bus in the enclosure.
   d. Bond the grounding bushings to ground studs or ground buses in the enclosures.
3. Provide insulated, internal equipment ground wire in all conduits.
   a. Bond the internal wire to all pullboxes, junction boxes, equipment enclosures, and other enclosures as required by NFPA 70.

C. Equipment Grounds:
1. Design all feeders and branch circuits to include an equipment grounding conductor consisting of a copper wire within a raceway or cable and sized as specified herein.
   a. Where conductors are run in parallel in multiple raceways, run the equipment grounding conductor in parallel to the related conductors.
   b. Size each of the parallel equipment grounding conductors on the basis of the ampere rating of the circuit overcurrent protecting device.
2. Ground enclosing cases, mounting frames, rack mounted components, rack struts, switches, breakers, control panels, motors, and other electrical or electrically operated equipment by providing an equipment grounding conductor with phase conductors from an established equipment ground source.

D. Ground Wire Sizes:

1. The minimum size for bonding jumpers, equipment ground conductors, grounding electrode conductors, and ground grid conductors is as follows:
    a. Under 600 volts:
        1) Provide #12 AWG, minimum.
        2) Control power circuits, Provide #14 AWG, minimum.
    b. Over 600 volts:
        1) For transformers, provide #2 AWG ground wire, minimum.
        2) For motors, provide #4 AWG ground wire, minimum.
2. When the ground wire size is not specified or indicated on the Contract Drawings, provide wire sized in accordance with the requirements of NFPA 70.

E. Within 60 days of the Contract award, submit the following:
1. The Submittals required by Section 26 05 00.
    a. Include Product Data and Catalog Cuts for all products provided and describe the usage of each product.
2. Shop Drawings for the ground well grid installation in unpaved areas.
3. Shop Drawings for the ground well grid installation in paved areas.
4. Shop Drawings for the ground bus installation.

F. Project Record Documents:
1. Prepare and submit record drawings showing the actual installed elevations and locations of grounding cables and rods for both concealed and exposed work provided under this Contract.

G. Project Closeout:
1. Submit Operation and Maintenance Manuals that include the record drawings and all Product Data in accordance with Metro North standards.

1.4 SUBMITTALS

A. Submit the following information for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:
1. Product Data:
    a. Manufacturer’s product data
2. Shop Drawings:
    a. Ground well grid installation in unpaved areas.
    b. Ground well grid installation in paved areas.
    c. Ground bus installation.
3. Quality Assurance/Quality Control Submittals:
    a. Certificates:
        1) Testing agency product certification
    b. Qualification Statements:
        1) System installers’ qualifications
        2) Installation supervisors’ resumes
4. Closeout Submittals:
    a. Operation and Maintenance Manuals

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications:
    a. Employ installers who specialize in the work of this Section, and who can demonstrate a minimum of three years documented experience.
    b. Submit the system installers' qualifications.
2. Supervisor's Qualifications:
    a. Employ supervisor to supervise the installation work who are skilled licensed electricians.
    b. Submit the installation supervisors' resumes.
3. All products are to be certified by Underwriters Laboratories, Inc. (UL),

B. Regulatory Requirements:
1. All grounding and bonding Work must comply with the requirements of NFPA 70, the National Electrical Code.

C. Certifications:
1. Testing Agency Product Certification:
    a. Verify product quality by certifying products as meeting the requirements of one of the following:
        1) Underwriters Laboratories, Inc. (UL).
            a) Provide products listed and labeled by UL.
    b. Testing agency product certification must include agency listing and labeling, either by a printed mark on the data or by a separate listing card.
        1) If an item does not have this quality assurance verification, provide a written statement from the product manufacturer indicating why not; such manufacturer's statements are subject to the approval of the Owner and the Engineer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
1. Transport materials, both on site and from Design Builder's storage to site, in accordance with the recommendations of the respective manufacturers.

B. Storage and Protection:
1. Store materials, both on and off site, in accordance with manufacturer's written instructions.
2. Store products indoors on blocking or pallets.

PART 2 - PRODUCTS

2.1 UNDERGROUND WARNING TAPE

A. Metal detectable polyester material, with minimum one-inch high lettering. Overcoated graphics to read, "CAUTION-BURIED ELECTRIC LINE BELOW" for electric lines and/or "CAUTION – TELECOMMUNICATION BELOW" for telephone lines. APWA color to be red for electric lines and orange for telecommunication or fiber-optic lines.

B. Acceptable Manufacturers:
1. Brady #91600 Series
2. Presco

3. Seton
4. Or Approved Equal

2.2 MATERIALS

A. Conduit and Conduit Fittings:
   1. For conduit and conduit fittings that enclose single ground wires without accompanying circuit conductors provide one of the following:
      a. Schedule 80, non-metallic conduit and fittings conforming to the requirements of Section 26 05 33.13 and the conduit additionally conforming to the requirements of NEMA TC-2, and the fittings additionally conforming to the requirements of NEMA TC-3.
      b. Fiberglass reinforced plastic (FRP) conduit and fittings conforming to the requirements of NEMA TC-14 and Section 26 05 33.13.
   2. For other conduit and conduit fittings, provide conduit of the types specified or indicated and that conform to the requirements of Section 26 05 33.13.

B. Wire:
   1. Bare Ground Wire:
      a. Soft drawn copper, Class A or Class B stranded, meeting the requirements of ASTM B3 for sizes #6 or larger.
      b. Soft drawn solid copper, meeting the requirements of ASTM B3 for sizes #8 or smaller.
   2. Insulated Ground Wire:
      a. Provide insulated Class B copper stranded wire rated for 600 volts that conforms to the requirements of NEMA WC-7, and is green in color. Insulation type shall be as specified in Section 26 05 19.
   3. Acceptable Manufacturers:
      a. Continental Wire & Cable Company www.continentalwire.com
      b. SouthWire www.southwire.com
      c. General Cable www.generalcable.com
      d. Okonite Co. www.okonite.com
      e. Or Approved Equal

C. Clamps and Non-Welded Connectors:
   1. Provide bronze or brass clamps and connectors that are UL listed for use below grade.
      a. All bolts and other material must be bronze or brass, plated steel screws are unacceptable.
      b. Fabricate multi-bolt, solderless compression clamps from high strength electrical bronze, and provide silicon bronze clamping bolts and hardware.
   2. Provide bolts, nuts, lock-washers, and similar hardware designed not to damage ground wire.
   3. Acceptable manufacturers:
      a. Ilsco.
      b. Framatone Connectors Inc. (FCI), Burndy.
      c. Or Approved Equal.

D. Exothermic Welding Kits:
   1. Provide molds, thermite packages, and other material for exothermic welds that are rated to carry 100 percent of the cable ratings, and which are letter-coded exothermic welded type.
   2. Provide all items such as tees, crosses, splices, and cable connections necessary for connecting ground and bonding cables to the following items:

a. Ground rods.
b. Reinforcing steel bars.
c. Ground-bus.
d. Structural steel.
e. Water pipe.
f. Bonding to the main-ground-grid.
g. Bonding to Copper Grounding Bus Bar

3. Provide all exothermic welding molds, thermite packages, and other material used throughout the Work from a single manufacturer.
4. Acceptable Manufacturers:
   a. Erico, Cadweld®.
   b. Continental Industries, Inc., Thermoweld®.
   c. Or Approved Equal.

E. Ground Rods:
1. Provide UL listed, sectional ground rods fabricated using a electrolytic plating process to copper clad a medium carbon steel core
2. Diameter: 3/4 inch.
3. Length: 10 feet.
   a. To obtain longer length rods, join rod sections using copper clad rod couplers.
4. Acceptable Manufacturers:
   a. Erico International Corp.
   b. Galvan Industries, Inc.
   c. South Atlantic, LLC
   d. A.B. Chance Co.
   e. Or Approved Equal

F. Concrete Protective Boxes (Ground Wells):
1. Provide precast concrete boxes with flush cast iron covers rated for heavy traffic H20 areas and having slots for conduit entrances.
   a. Minimum size: 10” diameter by 12” high with maximum depth up to 36”.
   b. Cover legend: Provide the cast-in legend “GROUND TEST WELL” in the cast iron covers provided.
2. Acceptable Manufacturers:
   a. National Lightning Protection Corporation
   b. East Coast Lightning Equipment
   c. Or Approved Equal

G. Coating Compound:
1. Provide permanently pliable, moldable, un-backed, black rubber based coating materials for covering or coating grounding clamps and connectors.
2. Coating Physical Properties:
   a. Solids/Density: 100 percent; 12 pounds per gallon.
   b. Penetration: Within 90 to130 when tested in accordance with ASTM D 5.
   c. Water Absorption: 0.10 percent, maximum, when tested in accordance with ASTM D 570.
   d. Dielectric Strength: 500 volts/mil when tested in accordance with ASTM D 149.
   e. Volume Resistivity: 2,000 megohm-inches, or 5,000 megohms-cm, when tested in accordance with ASTM D 257.

f. Service Temperature: Minus 40 degrees to 160 degrees Fahrenheit; and having no melting point; flammability, or slow burning when tested in accordance with ASTM C 653.
g. Chemical Resistance:
    1) Resistant to alcohol, water, aqueous hydrochloride, and sodium hydroxide.
    2) Dissolved by carbon tetrachloride, naphtha gasoline, mineral spirits, and benzene.
h. Cohesive/Adhesive: Adheres to metals, concrete, and itself.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions:
1. The Contract Drawings are generally indicative of the Work, but due to their small scale, it is not possible to indicate some offsets and fittings required nor the minor structural obstructions that may be encountered.
    a. Perform field measurements to discover offsets and fitting requirements not shown.
    b. Locate all on-site utilities and other obstructions in the area of construction, and verify that interferences will not occur.

3.2 PREPARATION

A. Layout electrical work to suit actual field conditions and in accordance with accepted standard practice.

3.3 INSTALLATION

A. Perform required earthwork including excavation, backfill, and compaction, as specified.

B. Construct each ground system and connection so it is mechanically secure and electrically continuous.
1. Secure grounds to boxes in such a manner that each system is electrically continuous from the point of service to each outlet.
2. Terminate conduits using double locknuts and bushings.
    a. Unless a conduit run enters a metallic enclosure via integral threaded hubs, provide the conduit run with two locknuts.
3. Clean paint, grease and such other insulating materials from the contact points of grounds.

C. Ground Grids:
1. Installing Ground Rods:
    a. Drive ground rods head to 6 inches below grade by using a ground rod cap to protect the head of the rod.
        1) If the top of the rod is damaged during driving operations, cut it off.
2. Installing Ground Wells:
    a. Install a concrete protective box for the ground well flush with the grade and 4 inches above the top of the ground rod designated on the Contract Drawings.
3. Installing Ground Wires:

a. Excavate the trenches for the ground grid cables, and lay the ground cable in the trenches from ground rod to ground rod without splice, and from one side of the grid to the other as shown on the Contract Drawings.
   1) Lay the ground grid cables cable allowing 10 percent slack.
   2) Form 12-inch minimum radius bends at changes in direction.
   3) At intersections, place cables so they diverge 60 degrees or more from other cables at the intersection.
   4) Connect service entrance grounds directly to the ground grids without splices in the cable.

b. Route connecting cables from the ground grid in the trenches to the building structure.
   1) Route exposed cables parallel to the building lines, except for bends; form all bends with a 12-inch minimum radius.
   2) Wherever the cable breaks grade, provide schedule 80 conduit from 2- feet below finished grade to 3-feet above finished grade for protection; and provide conduit at other points where the cable may be subject to damage.

c. Clamp the conduit to the building structure's wall at the ends and at intervals not to exceed 5 feet.
   1) Whenever cable exits from the conduit, clamp the cable to the wall at intervals not to exceed 5 feet and at each entrance to equipment.
   2) Allow a 1/4 inch space between ground cables, conduit, and the surface it is mounted on.

d. Remove any damaged or kinked cable.

4. Welding ground wires to the ground rods and equipment connections.
   a. Follow the procedures of the exothermic welding kits manufacturer.
   b. Prior to welding ground wires to the ground rods and equipment connections perform the following:
      1) Clean the proposed welding area of combustible and flammable materials; and block access to personnel to protect them from harm; and provide a shield to prevent damage to other materials.
      2) Clean insulation from ground wire for a distance of 12 inches, and clean the exposed wire to a bright finish.
      3) Clean paint, grease, and other similar insulating materials from contact points.
      4) Inspect the molds for damage; and discard any faulty mold or any molds used over 40 times.
   c. Exothermically weld the ground wires to the ground rods as shown on the Contract Drawings, including to ground rods at grid crossings, to ground rods at grid intersections on the sides of the ground grid, and at all equipment connections.
   d. After completing the welding, replace the insulation removed from insulated wires, and coat connections and the area around connections with coating compound.
      1) Coating Thickness: 1/8-inch, minimum.
      2) Make sure the coating is free from pin-holes and holidays.
5. Make all connections to electrical equipment and ground buses with compression, two-hole lugs and studs.
   a. Clean paint, grease, and other similar insulating materials from the contact points for the ground lugs and studs.
   b. Clean all wires to a bright finish prior to construction the connections.

D. Equipment Ground Buses:
   1. Whenever several pieces of equipment, other than service grounds, require external bond wires in an area, provide an equipment ground bus.
   2. Wherever 5 or more conduits enter a box or enclosure, provide an equipment ground bus.

a. Connect all equipment ground wires and conduit bond wires within the box or enclosure to a single ground stud or single common ground bus.

3. Size ground buses to carry 100 percent of the rating or setting of the largest over current device in the circuit(s) ahead of the equipment, conduit, or other item, and as indicated on the Contract Drawings.

E. Equipment Grounds:

1. Install equipment grounds in spaces accessible to authorized personnel only.
2. Equipment Grounding Connectors:
   a. Only use approved grounding connectors.
      1) Terminate grounds with closed lugs with star washers on both sides and a 1/4-20 bolt and nut, minimum; spade lugs are not allowed.
      2) For portable electrical equipment, provide electric cords having an equipment grounding conductor and a NEMA and UL approved cord cap.
   b. Do not install grounding lugs on flanges, mounting screws, or standoffs in switches, distribution boxes, or panels.
   c. Cover or coat grounding clamps and connectors with coating compound.
3. Equipment Grounding Conductors:
   a. Unless using multi-conductor cable, run equipment grounding conductors inside the same conduit or wiring channel enclosing the power conductors.
   b. In multi-conductor cable, locate grounding conductor inside the sheath or cable.
   c. Do not use a system neutral or a current carrying conductor as the equipment grounding conductor.
      1) Do not ground the electrical and electronic equipment neutral to chassis, racks, equipment ground conductor, or any non-current carrying conductor on the equipment.
4. Grounding Lighting Fixtures:
   a. Provide the housing of each lighting fixture with a separate, factory-installed grounding device and ground conductor.
   b. Use the factory-installed grounding device for connecting a separate grounding conductor meeting applicable grounding requirements of the NEC to the fixture.
      1) Provide a green covered grounding conductor of the same wire gauge as the two power feed wires.
      2) Provide a continuous ground for the fixture construction.
5. Grounding Motors:
   a. Install equipment grounding wire within conduit supplying power to motor.
   b. Install bonding connectors across the liquid tight flexible conduit supplying motors.
6. Grounding and Bonding Pumps:
   a. Provide a bond from each pump to its motor using a conductor equal in size to the motor circuit equipment grounding conductors.
7. Grounding Transformers:
   a. If a transformer is a separately derived system as defined in NFPA 70, provide a ground wire in both the primary and secondary conduits; and bond the ground wire and metallic conduits, if used, to the nearest effectively grounded metallic water pipe or nearest effectively grounded structural steel column.
   b. Provide an additional bond between cold or hot water pipes and structural steel located near a transformer bond connection.
8. Grounding Isolated Ground Receptacles:
   a. Ground the receptacle grounding terminal via an insulated equipment grounding conductor routed with the circuit conductors within the raceway.

1) This grounding conductor may pass through one or more panelboards without being connected to the panelboard grounding terminal in order to terminate directly at an equipment grounding conductor terminal of the applicable separately derived system or service within the same building or structure.

b. Use of isolated equipment grounding conductors does not remove the requirement for grounding the raceway system and outlet box.

9. Fences:
   a. Fences shall be bonded to dedicated ground rods in at least two locations in and at a maximum interval of 200 feet around fences longer than 400feet. Ground rods shall be equally spaced around the perimeter of the fence.
   b. Fences shall be bonded to dedicated ground rods at each side of a gate or other opening.
      1) A buried bonding jumper shall be used to bond across a gate or other opening.
   c. Gates and any barbed wire strands shall be bonded to the grounding conductor, jumper or fence.
   d. When fence posts are of conducting material, a grounding conductor shall be bonded to the fence post as required with a suitable connecting means. For non-conducting posts, suitable bonding connection shall be made to the fence mesh and barbed wire strands at each grounding conductor point.
   e. For fences located within 5 feet of electrical equipment (transformers, switchgear, etc.), each fence ground rods shall be bonded to the equipment ground bus.
   f. For outdoor substations where a station ground ring and/or mat is installed, each fence ground rod shall be bonded to the station ring and/or mat.
   g. Where an overhead power line crosses a fence, the fence shall be bonded to at least one additional dedicated ground rod installed directly under the line. This ground rod shall be bonded to the nearest pole ground.
   h. Bonding conductors shall be minimum 6 AWG copper unless otherwise indicated on the plans.
   i. Ground rods, bonding jumpers, and connections shall comply with Section 26 05 26.

3.4 REPAIR/RESTORATION

A. Replace any finished exothermic welded splice connections that inspections find to be defective.

B. After inspection by Engineer and Owner's representative, backfill the direct buried cables and around ground rod protectors.
   1. Begin backfilling with clean washed sand to 6 inches above the ground rods or to the depth shown on the Contract Drawings, whichever is greater.
   2. Backfill using select fill in accordance with the requirements of Section 02315.
   3. Slope the finish grade away from ground rods at a slope of 1 inch in 18 inches for a distance of 27 inches from the rods in all directions.

C. Install underground warning tape above all buried cables/conduits at a depth of 12" below finished grade.

3.5 FIELD QUALITY CONTROL

A. Site Testing:
   1. Prior to energizing any system, test the resistance to ground for the system in accordance with Section 26 05 63.

a. Perform a continuity test from all utilization and distribution equipment to the ground grid on a run-by-run basis.

B. Inspection:
1. Prior to completion of the Work of this Section, inspect the items provided for conformity to the Contract Drawings and Specifications.
a. Leave in-place "made grounds" open until they have been inspected and approved by the Engineer.
b. Clean the surfaces involved in "made grounds" before connecting the grounds, and finish the installation with touch up painting or another protective coating to prevent corrosion.
2. Inspect finished exothermic welded connections for the following defects:
a. Conductors appear within the splice area.
b. Top of splice risers are below conductors.
c. Surfaces exhibiting more than 20 percent slag material.
d. Surfaces with over slag material that has flowed into conductors.
e. Mold blowouts.
f. Excessive porosity.
1) Small pores less than 1/32 inch are permitted.

3.6 PROTECTION

A. Protect finished insulated wires from being painted.

B. Protect all ground grid wells from damage during paving and landscaping.

C. Protect all ground grid installations and ground wires from damage during the work of other Sections.

END OF SECTION

SECTION 26 05 28 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for furnishing, installing, cleaning, and protecting hanger and support systems for electrical wiring, conduit boxes, and equipment.

B. Related Section:
   1. Section 01 33 00 - Submittal Procedures.
   2. Section 26 05 00 – Common Work Results for Electrical

1.2 REFERENCES

A. American Iron and Steel Institute (AISI):
   1. AISI Standard Steels (Handbook).

B. American Society for Testing Materials (ASTM):
   1. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel.
   2. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot- Dipped, Zinc-Coated - Welded and Seamless.
   3. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   4. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   5. ASTM A 283/A 283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
   6. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi, Minimum Tensile Strength.
   7. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   8. ASTM A 563 - Standard Specification for Carbon and Alloy Steel Nuts.
   9. ASTM A 575 - Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
   10. ASTM A 576 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
   11. ASTM A 635/A 635M - Standard Specification for Steel, Sheet and Strip, Heavy- Thickness Coils, Carbon, Hot-Rolled.
   12. ASTM A 1011/A 1011M - Standard Specification for Steel, Sheet and Strip, Hot- Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   13. ASTM B 633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
   14. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. American Welding Society (AWS):
   1. AWS D1.1/D1.1M - Structural Welding Code - Steel.

D. National Electrical Manufacturers Association (NEMA):
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts maximum).

E. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC).
   2. NFPA 258 - Standard Research Test Method for Determining Smoke Generation of Solid Materials.

F. Society of Automotive Engineers International (SAE):
   1. SAE J 429 - Mechanical and Material Requirements for Externally Threaded Fasteners.

G. The Society for Protective Coatings (SSPC):
   1. SSPC Painting Manual.
      a. SSPC-SP 2 - Hand Tool Cleaning.
      b. SSPC-Paint 15 - Paint Specification No. 15, Steel Joist Shop Paint, Type I, Red Oxide Paint, Type II, Asphalt Coating.
      c. SSPC-Paint 20 - Paint Specification No. 20, Zinc-Rich Primers (Type I, "Inorganic," and type II, "Organic").

H. Underwriters Laboratory, Inc. (UL):
   1. UL 568 - Nonmetallic Cable Tray Systems.
   2. UL 635 - Standard for Insulating Bushings.
   3. UL 870 - Standard for Wireways, Auxilliary Gutters, and Associated Fittings.
   4. UL 884 - Standard for Underfloor Raceways and Fittings.
   5. UL 1479 - Standard for Fire Tests of Through-Penetration Firestops.
   6. UL 2239 - Hardware for the Support of Conduit, Tubing, and Cable.

I. U. S. General Services Administration (GSA)
   1. Federal Specifications:
      a. A-A-1922A - Shield, Expansion (Caulking Anchors, Single Lead).
      b. FF-S-107C(2) - Screws, Tapping and Drive.

1.3 SUBMITTALS

A. Submit the following information to the Engineer for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures, and Section 26 05 00, Basic Electrical Materials and Methods:
   1. Product Data:
      a. Provide product data and catalog cuts for the products provided under this Section.
   2. Shop Drawings:
      a. Provide Shop Drawings.
      b. Provide Shop Drawings of hanging supports for conduit.
   3. Quality Assurance/Control Submittals:
      a. Design Data:
         1) Provide structural calculations for the following items:
            a) Equipment backboards and support structures not directly fastened to the walls.
            b) Hanging supports for conduit.

2) Detailed drawings of proposed departures from the original design.

b. Certificates:

1) Testing Agency/Quality Verification:

a) With the product data for electrical hangers and supports, provide evidence of quality verification, listing, and labeling by the Electrical Testing Agency (ETA); either by a printed mark on the data, or by a separate listing card.

b) If an item does not have ETA quality assurance verification, provide a written quality assurance verification statement from the product manufacturer indicating why the item does not have the specified quality assurance verification.

(1) Such quality assurance verification statements are subject to approval by the Owner and the Engineer.

2) Manufacturers' Certificate of Compliance.

c. Qualification Statements:

1) Manufacturers' qualifications.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Electrical Testing Agency (ETA) Qualifications:
   a. Use the Electrical Testing Agency (ETA) qualified as specified in Section 26 05 00, Basic Electrical Materials and Methods.
2. Manufacturer's Qualifications:
   a. Provide electrical support framing made by manufacturers that have been manufacturing support framing for a minimum of 5 years, and who carefully controls their operations to ensure that excellent product engineering, quality, safety, and reliability are achieved.
   b. Submit the manufacturer's qualifications to the Engineer for approval.

B. Certifications:

1. Electrical Testing Laboratory (ETL) Certification:
   a. Provide products that are listed and labeled by Underwriters Laboratory, Inc. (UL) or certified as meeting the standards of UL by the Electrical Testing Laboratory (ETL) unless products meeting the requirements of these testing laboratories are not readily available or unless standards do not exist for the products.
2. Manufacturers Certificate of Compliance:
   a. Submit a manufacturer's Certificate of Compliance certifying that both the galvanizing and the products meet the requirements of the ASTM standards.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packaging, Shipping, Handling, and Unloading:

1. Deliver, store, and handle the hangers and supports in accordance with Section 26 05 00, Basic Electrical Materials and Methods, and as specified herein.
2. Deliver material to Site in the original factory packaging.

B. Storage and Protection:

1. Shelter and store the components under cover, and supported off the ground and floors on blocking.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Carbon Steel Shapes:
   1. Provide shapes of the sizes specified and as indicated on the Contract Drawings:
   2. Provide steel shapes complying with the following material specifications for the type of steel shape listed:
      a. Steel Sections: ASTM A36/A 36M.
      b. Steel Tubing: ASTM A 500, Grade B.
      c. Plates: ASTM A 283/A 283M.
      d. Sheets: ASTM A 1011/A 1011M.
      e. Pipe: ASTM A 53/A 53M, Grade B, Schedule 40, hot-dipped, zinc-coated.

B. Welding materials:
   1. Provide welding materials complying with the requirements of AWS D1.1/D1.1M for the type of material being welded.

2.2 MANUFACTURED UNITS

A. Metal U-Channel Electrical Support Framing Systems and Fittings:
   1. Carbon Steel U-Channel Support Framing Systems:
      a. Provide 1-5/8-inch nominal size U-channel supports fabricated from 12 gauge carbon steel electrolytically galvanized with a zinc-coating thickness commensurate with Service Condition SC 1 (mild) in conformance with the requirements of ASTM B 633.
         1) For Type II ASTM B 633 galvanized finishes, fabricate the framing from steel complying with the requirements for Grade 33 specified in
         2) ASTM A 1011/A 1011M.
         3) For Type III ASTM B 633 galvanized finishes, fabricate the framing from steel complying with the requirements of ASTM A 575, ASTM A 576, ASTM A 635/A 635M, or ASTM A 36/A 36M.
      b. Where combination members are required, spot-weld the members on 3- inch centers.
      c. Provide 1-3/8-inch or larger depths, except where supports are mounted directly to walls 13/16-inch or larger depths may be provided.
      d. Provide metal framing systems and fittings for metal framing systems from a single manufacturer.
      e. Manufacturers:
         1) Unistrut Corporation, Unistrut® Metal Framing System, www.unistrut.com.
         2) Thomas & Betts, Kindorf®, http://elec-cat.tnb.com.
         3) Cooper B-Line®, Inc., www.b-line.com.
   2. Stainless Steel U-Channel Support Framing Systems:
      a. Provide U-channel supports, fittings, threaded rod, and hardware fabricated from Type 316 stainless steel.
   3. PVC-Coated Steel U-Channel Support Framing Systems:
      a. Provide U-channel supports, fittings, threaded rod, and hardware fabricated from PVC-coated carbon steel.

B. Nonmetallic Electrical Support Framing Systems and Fittings:

1. Fiberglass Reinforced Polyester Angles, Channels, and Bars:
    a. Provide non-metallic angles, channels, and bars fabricated from a high impact strength, fiberglass reinforced polyester formulation having a glass to resin ratio of 45 to 55 percent by weight.
    b. Provide angles, channels, and bars that meet or exceed a Class 1 flame spread rating of less than 25 determined according to the requirements of ASTM E 84, and a smoke rating of 5 determined according to the requirements of the Smoke Chamber Test specified in NFPA 258.
    c. Manufacturers:
        1) Enduro Systems, Inc., www.endurocomposites.com.
        2) Robroy Industries, www.robroy.com.
        3) Or Approved Equal.
2. Pre-Engineered Glass-Fiber-Reinforced Supporting Systems:
    a. Pre-engineered, UL-listed supporting systems fabricated from glass-fiber- reinforced composites may be used in lieu of field-fabricated support systems.
    b. Manufacturers:
        1) Unistrut, www.unistrut.com.
        2) Allied Electrical Group, Aickinstrut Fiberglass Framing System, www.alliedtube.com.
        3) Enduro Systems, Inc., www.endurocomposites.com.

C. Conduit Supports:
1. Malleable Iron Conduit Supports:
    a. Provide one-hole style galvanized malleable iron fasteners with pipe straps similar to those as manufactured by Thomas & Betts.
    b. Provide support devices consisting of threaded rods, channel supports, and conduit straps/fasteners.
2. Stamped Steel Conduit Supports:
    a. Provide one-hole style galvanized stamped steel fasteners with pipe straps similar to those as manufactured by Thomas & Betts.
    b. Provide support devices consisting of threaded rods, channel supports, and conduit straps/fasteners.
3. Special Finishes:
    a. Where PVC-coated RGS conduits are to be installed, provide 40-mil PVC coated conduit supports including the threaded rods, channel supports, and conduit straps/fasteners.
4. Manufacturers:
    a. Thomas & Betts, http://www-public.tnb.com/Design Builder/docs/superstrut.pdf.
    b. Or Approved Equal.

D. Cable Supports:
1. Provide voltage rated cable supports fabricated from hot-dip galvanized malleable iron with a threaded collar.
2. Provide tapered wedging cable plugs fabricated from hard fiber, impregnated hardwood, or canvas bakelite for the cable supports.
3. Manufacturers:
    a. EGS Electrical Group, O-Z/Gedney, Inc., Type "M", http://www.o-zgedney.com/PDF/QA%201thru16.pdf.
    b. Or Approved Equal.

E. Bolts, Nuts, and Washers:

1. For bolts, nuts, and washers smaller than 1/4-inch trade size, provide 316 stainless steel fasteners complying with the requirements of ASTM A 325.
2. For fastening galvanized components, provide galvanized bolts, nuts, and washers galvanized in accordance with the requirements of ASTM A 325.

F. Anchors and Fasteners:
1. Drive (Deep-Pitch) Screws:
   a. Provide Type 316 stainless steel self-tapping type drive (deep-pitch) screws that comply with the requirements of FF-S-107C(2).
2. Drilled-In Anchors and Fasteners:
   a. Provide drilled-in anchors and fasteners that comply with the requirements of FF-S-107C(2).
   b. Masonry Anchors:
      1) Provide masonry anchors designed to accept both machine bolts and threaded rods as fasteners.
         a) Provide SAE J 429 Grade 2 machine bolt fasteners fabricated from AISI Type 316 stainless steel.
         b) Provide nuts and washers conforming to the requirements of ASTM A 563.
      2) Provide masonry anchors consisting of an expansion shield and expander nut contained inside the shield.
         a) Expander Nuts:
            (1) Fabricate square expander nuts with their sides tapered inward from the bottom to the top.
            (2) Design the expander nuts to simultaneously climb the bolt or rod thread and expand the shield as soon as the threaded expander nut reaches and bears against the shield bottom when being tightened.
         b) Expansion Shields:
            (1) Provide expansion shield bodies consisting of four legs, the inside of each tapered toward the shield bottom, or nut end.
            (2) The end of one leg shall be elongated and turned across shield bottom. Outer surface of shield body shall be ribbed for grip-action.
      3) Masonry Anchor Material:
         a) Provide die cast Zamac No. 3 zinc alloy having a 43,000 psi minimum tensile strength.
      4) Manufacturers:
         a) U.S.E. Diamond, Inc., FORWAY System, www.mktfastening.com.
   c. Concrete Anchors:
      1) Carbon Steel Anchor/Fastener:
         a) Provide UL listed one-piece studs (bolts) with integral expansion wedges, nuts, and washers.
         b) Provide carbon steel anchor/fasteners complying with the physical requirements specified in FF-S-325 for Group II, Type 4, Class 1.
      2) Stainless Steel Anchor/Fastener:
         a) Provide one-piece AISI Type 303 or 304 stainless steel studs (bolts) with integral expansion wedges, AISI Type 316 stainless steel nuts, and AISI Type 316 stainless steel washers.
         b) Provide stainless steel anchor/fasteners complying with the physical requirements of FF-S-325 for Group II, Type 4, Class 1.

3) Acceptable Manufacturers:
a) U.S.E. Diamond, Inc.; SUP-R-STUD, www.mktfastening.com.
b) Hilti Fastening Systems; KWIK-BOLT, hilti.com.
c) Molly Fastener Group; PARABOLT.
d) Phillips; RED HEAD Wedge-Anchor, www.phillipsfastener.com.

3. Hammer drive-type explosive charge drive-type anchors and fastener systems are unacceptable.
4. Lead shields, plastic-inserts, fiber-inserts, and drilled-in plastic sleeve/nail drive systems are unacceptable.

2.3 ACCESSORIES

A. Wall Seals:
1. Provide a hydrostatic seal to fill the annular space between conduit and through structure openings.
2. Manufacturer:
a. PSI-ThunderLine/Link-Seal Corp., Link-Seal®, www.linkseal.com.

B. Fire Seals:
1. Where conduit penetrates fire-rated walls, floors, partitions, and ceiling, provide approved fire seals to ensure that the fire rating is maintained.
2. Provide a fire seal system which is UL-listed for the application.
a. Provide fire seal compound or a mechanical seal for fire rating of 2 hours or less.
3. Manufacturers:
a. Compound Fire Seals:
1) Dow Corning Corporation, www.dowcorning.com.
2) 3M, http://solutions.3m.com/en_US/.
b. Mechanical Fire Seals:
1) PSI-ThunderLine/Link-Seal Corp., www.linkseal.com.
c. Through-Wall Barrier Fire Seals:
1) Cooper Crouse-Hinds, http://crouse-hinds.com.

2.4 FABRICATION

A. Fit and shop assemble items in the largest sections practical for delivery to the Site.

2.5 FINISHES

A. Prime paint non-galvanized steel items.
1. Prepare surfaces to be primed in accordance with the requirements of SSPC-SP 2.
a. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
2. Prime Painting: Apply one coat of primer.

B. Galvanizing items specified above as galvanized.
1. Galvanize the items after fabrication in accordance with the requirements of ASTM A 123/A 123M.
2. Provide a minimum galvanized coating of 1.25 ounces per square foot (380 grams per square meter).

C. Touch-Up Primer:
   1. For un-galvanized metal surfaces: Provide primer complying with the requirements of SSPC-Paint 15 for Type I, Red Iron Oxide.
   2. For galvanized surfaces: Provide primer complying with the requirements of SSPC-Paint 20 for Type I, Inorganic Zinc-Rich Primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field Measurement:
   1. Although the Contract Drawings are generally indicative of the Work, take field measurements to verify actual conditions.
      a. Due to the small scale of the Contract Drawings it is not possible to indicate all offsets, fittings, and apparatus required or the minor structural obstructions that may be encountered during the Work.
   2. Carefully investigate the structural and finish conditions, and other construction work, at the Site which may affect the work of this Section.

3.2 PREPARATION

A. After carefully investigating structural and finish conditions and other in-place construction work, produce detailed Shop Drawings showing proposed departures from the original design due to field conditions or other causes.
   1. Layout the electrical work according to accepted standard electrical trade practice to suit actual field measurements.
   2. Arrange the electrical work to consider existing conditions and to preserve access to other equipment, rooms, areas, and similar features of the construction.
   3. Provide plan and profile views of duct banks, and show equipment backboards and support structures not directly fastened to the walls on the Shop Drawings.
   4. Indicate the location and details of conflicting utility construction and slopes on the Shop Drawings.
   5. Submit the Shop Drawings to the Engineer for approval prior to performing the Work of this Section.

B. Obtain roughing-in dimensions of electrically operated equipment, including equipment being installed by both electrical and other construction trades.
   1. Set conduit and boxes only after receiving approved dimensions and checking such equipment locations.
   2. Arrange electrical Work accordingly and furnish such fittings and apparatus as required to accommodate such conditions and to preserve access to other equipment, rooms, areas, and similar spaces.

3.3 INSTALLATION

A. Install electrical Work in conformance to the requirements of NFPA 70 for wiring methods general requirements, and to other applicable Articles of the NEC governing methods of wiring.

B. Installing Anchors and Fasteners:
   1. For anchoring or fastening applications in masonry and hollow-core precast concrete structural elements, provide masonry anchors as specified herein.
   2. For anchoring or fastening applications in cast-in-place concrete and solid precast concrete structural elements, provide concrete anchors as specified herein.
   3. Threaded Bolts:
      a. Draw threaded bolted connections up tight using 316 stainless steel lock washers to prevent the bolt or nut from loosening.
   4. Drilled-In Expansion Anchors:
      a. Install expansion anchors in strict accordance with manufacturer's instructions and the following.
         1) Drill holes to the required diameter and depth in accordance with anchor manufacturer's instructions for the size of anchor being installed.
         2) Minimum Embedment:
            a) Embed expansion anchors to four and one-half bolt diameters minimum unless otherwise indicated on the Contract Drawings.

C. Installation of U-Channel Support Framing Systems in accordance with Table 26 05 28-1 below:

Table 26 05 28-1 U-Channel Support Framing Selection

Condition 1	Condition 2	Type
Aboveground	Outside vertical support within 6” of concrete	PVC Coated Steel or Stainless Steel
	Outside other locations	Stainless Steel or PVC Coated Steel
	Interior NEMA 1/12	Carbon steel, Stainless Steel, PVC Coated Steel or Glass-Fiber-Reinforced
	Interior NEMA 4X	Stainless Steel, PVC Coated Steel or Glass-Fiber-Reinforced

D. Installing Conduit Supports:
   1. For exterior locations provide malleable iron conduit supports.
   2. For interior locations, provide stamped steel conduit supports.

E. Panelboard/Enclosure Feed Risers:
   1. Furnish and install cable supports in feeder risers as required by the underwriters.

F. In areas designated as wet, NEMA 3, NEMA 3R, NEMA 4X, NEMA 12, or NEMA 13 as defined in NEMA 250; secure equipment and conduit to no fewer than two 7/8-inch minimum depth, non-metallic channels mounted vertically on the walls.

G. Field Fabrication:
   1. Fabricated Items:
      a. Fabricate backboards, backboard supports, equipment supports, conduit supports, and the other items as detailed on the Contract Drawings.

1) Hot-dip galvanize mild-steel fabrications in accordance with the requirements of ASTM A 153/A 153M.

b. Fabricate backboard posts as detailed on the Contract Drawings from concrete filled steel pipe with a crowned cap; and apply a prime paint finish.

c. Supply components required for the anchorage of fabrications.

1) Except where specifically noted otherwise, fabricate anchors and related components from the same material as the fabrication and apply the same finish.

2. Tightly fit and secure joints.

a. Make exposed joints butt tight, flush, and hairline.

b. Weld fabricated assemblies in accordance with AWS D1.1/D1.1M.

1) Continuously seal joined members using intermittent welds and plastic filler.

2) Dress welds smooth and free of sharp edges and corners.

c. Grind exposed joints flush and smooth with the adjacent finish surface.

3. Ease exposed edges to a small uniform radius.

a. Cut all backboard corners to a 1-inch radius.

4. For the attachment of work and for bolted connections, accurately drill or punch holes for the fasteners as required.

a. Burned holes are unacceptable.

b. Provide holes no more than 3/32-inch larger than the fasteners.

5. Exposed Mechanical Fastenings:

a. Except where specifically noted otherwise in the Contract Documents, provide flush countersunk screws or bolts; unobtrusively located, and consistent with the design of the component.

6. Fabrication Tolerances:

a. Squareness: 1/8 inch (3 mm), maximum difference in diagonal measurements.

b. Maximum offset between faces: 1/16 inch (1.5 mm).

c. Maximum misalignment of adjacent members: 1/16 inch (1.5 mm).

d. Maximum bow: 1/8 inch (3 mm) in 48 inches (1.2 m).

e. Maximum deviation from plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

3.4 REPAIR/RESTORATION

A. Coatings:

1. Repair damage to coatings.

a. Touch up damaged coating surfaces using the specified primer for primed steel surfaces, and using zinc-rich primer for galvanized steel surfaces.

3.5 FIELD QUALITY CONTROL

A. Inspection:

1. Verify the adequacy of coatings.

2. Inspect the items provided under this Section for adherence to the fabrication tolerances specified above, and correct any discrepancies:

3.6 PROTECTION

A. Protect the items provided under this Section from damage during the work of other trades.

END OF SECTION

SECTION 26 05 33.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for furnishing, installing, energizing, and testing conduit, tubing, and fittings for communication lines and electrical transmission, distribution, and service lines.

B. Related Section:
   1. Section 01 33 00 - Submittal Procedures.
   2. Section 07 84 00 - Firestopping.
   3. Section 26 05 00 - Common Work Results for Electrical
   4. Section 26 05 26 - Grounding and Bonding.
   5. Section 26 05 28 - Hangers and Supports for Electrical Systems.
   6. Section 26 05 63 – Acceptance Testing for Electrical Systems.

1.2 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI/ASME B1.20.1 - Pipe Threads, General Purpose (Inch).
   2. ANSI C80.1 - Rigid Steel Conduit - Zinc-Coated (GCR).
   3. ANSI C80.3 - Electrical Metallic Tubing - Zinc Coated (EMT).
   4. ANSI C80.6 - Intermediate Metal Conduit - Zinc Coated (IMC).

B. American Society for Testing and Materials (ASTM):
   1. ASTM A 568/A 568M - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold Rolled, General Requirements for.
   2. ASTM D 1784 - Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

C. National Electric Manufacturer's Association (NEMA):
   1. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   2. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit.

D. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC).

E. Underwriters Laboratory, Inc. (UL):
   1. ANSI/UL 6 - Standard for Rigid Metal Conduit.
   2. ANSI/UL 360 - Standard for Liquid-Tight Flexible Steel Conduit.
   3. ANSI/UL 498 - Standard for Safety for Attachment Plugs and Receptacles.
   4. ANSI/UL 514A - Metallic Outlet Boxes.
   5. ANSI/UL 797 - Electric Metallic Tubing - Steel.
   6. ANSI/UL 886 - Standard for Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

7. ANSI/UL 1242 - Standard for Electrical Intermediate Conduit - Steel

F. Institute of Electrical and Electronics Engineers (IEEE):
1. IEEE C2 - National Electrical Safety Code.

1.3 DEFINITIONS

A. Definitions for all items are as stated in NFPA 70, IEEE C2, and in other reference documents unless otherwise stated, specified, or noted.

1.4 DESIGN REQUIREMENTS

A. Conduit Systems:
1. Provide conduit of the type and material shown in **Table 26 05 33.13-1, 26 05 33.13-2, 26 05 33.13-3, 26 05 33.13-4 and 26 05 33.13-5** for the application indicated, or as indicated on the Contract Drawings.
2. Provide conduit fittings made of material identical to that of the conduit system with which they are used.

Table 26 05 33.13-1 Conduit System Selection

Location	Condition 1	Condition 2	Conduit Type	Size (Minimum) [1]
Under-Ground	Encased	Bends, over 10 degrees in length	Rigid Galvanized Steel or Intermediate Metal Conduit	1 Inch
		Conduit Risers	Rigid Galvanized Steel or Intermediate Metal Conduit	1 Inch
		Exposed conduit within 6-inches of exit from encasement	PVC Coated Rigid Galvanized Steel	1 Inch
		Straight Runs	PVC Schedule 40	1 Inch

1 No conduit smaller than 1-inch trade size is permitted unless indicated otherwise on the Contract Drawings.

Table 26 05 33.13-2 Conduit System Selection

Location	Condition 1	Condition 2	Conduit Type	Size (Minimum) [1]
Under-ground	Direct Burial	Classified (Hazardous Areas)	Rigid Galvanized Steel or Intermediate Metal Conduit	1 Inch
		Other	PVC Schedule 80	1 Inch

1 No conduit smaller than 1-inch trade size is permitted unless indicated otherwise on the Contract Drawings.

Table 26 05 33.13-3 Conduit System Selection				
Location	**Condition 1**	**Condition 2**	**Conduit Type**	**Size (Minimum) [1]**
Above-Ground	Outside	NEMA 3R/4/4X locations	PVC Coated Rigid Galvanized Steel	3/4 Inch
	Inside NEMA 1/12	Within 6-inches of floor when exposed	PVC Coated Rigid Galvanized Steel	3/4 Inch
		Within 6-inches of floor when within footprint of floor mounted equipment	PVC Schedule 40	3/4 Inch
		Above suspended ceilings	Electrical Metal Tubing or Rigid Galvanized Steel	3/4 Inch
		Concealed in Open-Cell Masonry Block Wall	Electrical Metal Tubing or PVC Schedule 40	3/4 Inch
		Concealed in Cast-in-Place Concrete Wall or Floor	Rigid Galvanized Steel	3/4 Inch
		Concealed behind Gypsum Board Wall or Ceiling	Electrical Metal Tubing or Rigid Galvanized Steel	3/4 Inch
		Recess Mounted Lighting Fixtures and Rotating or Vibrating Equipment	Flexible Metal Conduit or Liquid-Tight Flexible Metal Conduit	3/4 Inch
		Exposed within 10'-0" AFF	Rigid Galvanized Steel or Intermediate Metal Conduit	3/4 Inch
		Exposed above 10'-0" AFF	Electrical Metal Tubing or Rigid Galvanized Steel	3/4 Inch

Table 26 05 33.13-3 Conduit System Selection				
Location	**Condition 1**	**Condition 2**	**Conduit Type**	**Size (Minimum) [1]**
1 No conduit smaller than 3/4-inch trade size is permitted unless indicated otherwise on the Contract Drawings.				

Table 26 05 33.13-4 Conduit System Selection				
Location	**Condition 1**	**Condition 2**	**Conduit Type**	**Size (Minimum) [1]**
Above-Ground	Inside NEMA 3R/4/4X	Within 6-inches of floor	PVC Coated Rigid Galvanized Steel	3/4 Inch
		Concealed in Masonry Block Wall	Rigid Galvanized Steel, Intermediate Metal Conduit or PVC Schedule 40	
		Concealed in Cast-in-Place Concrete Wall or Floor	Rigid Galvanized Steel	3/4 Inch
		Recess Mounted Lighting Fixtures and Rotating or Vibrating Equipment	Liquid-Tight Flexible Metal Conduit	3/4 Inch
		Exposed	PVC Coated Rigid Galvanized Steel	3/4 Inch
		Recess Mounted Lighting Fixtures and Rotating or Vibrating Equipment	Liquid-Tight Flexible Metal Conduit	3/4 Inch
1 No conduit smaller than 3/4-inch trade size is permitted unless indicated otherwise on the Contract Drawings.				

Table 26 05 33.13-5 Conduit System Selection				
Location	**Condition 1**	**Condition 2**	**Conduit Type**	**Size (Minimum) [1]**
Above-Ground	Inside NEMA 7/9	Within 6-inches of floor	PVC Coated Rigid Galvanized Steel	3/4 Inch
		Concealed in Masonry Block Wall, Cast-in-Place Masonry or Floor above grade	Rigid Galvanized Steel or Intermediate Metal Conduit	3/4 Inch
		Exposed	PVC Coated Rigid Galvanized Steel	3/4 Inch

Table 26 05 33.13-5 Conduit System Selection				
Location	**Condition 1**	**Condition 2**	**Conduit Type**	**Size (Minimum) [1]**
1 No conduit smaller than 3/4-inch trade size is permitted unless indicated otherwise on the Contract Drawings.				

1.5 SUBMITTALS

A. Submit the following information to the Engineer for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:
   1. Product Data:
      a. To facilitate power utility approval of the items installed from the utility's service poles to the main service panels, submit 4 more copies of the conduit submittals than the number required by Section 01 33 00, Submittal Procedures.
      b. Rigid Polyvinyl Chloride (PVC) Conduit.
      c. Non-metallic conduit solvent.
      d. Electrical Metallic Tubing (EMT).
      e. Intermediate Metal Conduit (IMC).
      f. Plastic coated rigid galvanized steel conduit.
      g. Liquidtite flexible metal conduit.
      h. Rigid galvanized steel conduit (RGS).
      i. Fittings for non-metallic conduit systems.
      j. Fittings for metallic conduit systems.
      k. Conduit spacers.
      l. Heat shrink tubing.
      m. Wall and floor penetration seals.
      n. Cold galvanize coating.
   2. Shop Drawings:
      a. Proposed departures from the original design.
   3. Quality Assurance/Control Submittals:
      a. Qualification Statements:
         1) Qualifications of the installer.
         2) Qualifications of the Electrical Testing Laboratory (ETL).
      b. Certificates:
         1) Testing agency/quality verification, listing, and labeling.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications:
      a. Employ an installation firm with a minimum of three years documented experience installing conduit and tubing similar in type and scope to that required by this Contract to install the Work of this Section.
      b. Employ skilled licensed electricians to supervise the Work of this Section.
      c. Submit information verifying the installer's qualifications.
   2. Electrical Testing Laboratory (ETL) Qualifications:

a. Employ an independent testing agency, qualified as specified in Section 26 05 63, Acceptance Testing for Electrical Systems, to perform the testing required by this Section.
b. Submit information verifying the ETL's qualifications.

B. Regulatory Requirements:
1. Perform the Work of this Section in accordance with the requirements specified in NFPA 70 (NEC), and to other applicable state, local, and national governing codes and regulatory requirements.
2. All items installed from utility service poles to the main service panels must be approved by the serving utility, whether electrical service or telephone service, as listed in Section 26 05 00, Basic Electrical Materials and Methods.

C. Certifications:
1. Provide products that are listed and labeled by Underwriters Laboratory, approved by Factory Mutual, or certified as meeting the standards of UL by the Electrical Testing Laboratory (ETL) for the location the product is installed in, and the application intended, unless products meeting the requirements of these nationally recognized testing laboratories are not available or unless standards do not exist for the products.
a. Submit evidence with the Product Data that the products represented meet testing agency quality verification requirements, including agency listing and labeling requirements.
1) Such evidence may consist of either a printed mark on the data or a separate listing card.
b. Submit a written statement from those product manufacturers that do not provide evidence of the quality of their products that indicates why an item does not have a quality assurance verification.
1) Such statements provided in lieu of quality assurance verification are subject to the acceptance of the Owner and the Engineer.

1.7 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
1. Pack, ship, handle, and unload products in accordance with the requirements of Section 26 05 00, Basic Electrical Materials and Methods, and as detailed herein.

B. Acceptance at Site:
1. Acceptance products at the Site in accordance with the requirements of Section 26 05 00, Basic Electrical Materials and Methods, and as detailed herein.

C. Storage and Protection:
1. Store products in accordance with the requirements of Section 26 05 00, Basic Electrical Materials and Methods, and as detailed herein.
a. Store all products indoors on blocking or pallets.

PART 2 - PRODUCTS

2.1 NON-METALLIC CONDUIT

A. Electrical Plastic Tubing and Conduit:
   1. Rigid Polyvinyl Chloride (PVC) Conduit:
      a. Provide high impact PVC conduit conforming to the requirements of
      b. NEMA TC 2 at 90 degrees Celsius, and made from compounds conforming to the requirements of ASTM D 1784.
         1) Use material that at 78 degrees Fahrenheit has a tensile strength exceeding 5500 psi, a flexural strength exceeding 11,000 psi, and a compressive strength exceeding 800 psi,
      c. Provide PVC conduits that are UL listed, labeled, or approved for both underground and above ground use.
   2. Manufacturers:
      a. JM Eagle, www.jmeagle.com
      b. Queen City Plastics, Inc., www.queencityplastics.com.
      c. Or Approved Equal.

B. Non-Metallic Conduit Solvent:
   1. Provide solvent for non-metallic conduit joints from the same manufacturer as the conduit and conforming to the requirements of ASTM D 2564.

2.2 METALLIC CONDUIT

A. Electrical Metallic Tubing (EMT):
   1. Provide electrical metallic tubing (EMT) conforming to the requirements of Article 358 in NFPA 70 (NEC) for materials and uses, ANSI C80.3 and UL 797.
   2. Provide galvanized steel tubing conduit lengths bearing the manufacturer's trademark.
   3. Manufacturers:
      a. Tyco/Allied Tube and Conduit, www.alliedtube.com
      b. Wheatland Tube Company, Division of John Maneely Company, www.wheatland.com.
      c. Or Approved Equal.

B. Intermediate Metal Conduit (IMC):
   1. Provide intermediate metal conduit (IMC) conforming to the requirements of Article 342 in NFPA 70 (NEC) for materials and uses, ANSI C80.6 and UL 1242.
   2. Fabricate intermediate metal conduit (IMC) from high strength low alloy sheet steel meeting the requirements for ASTM A 568 piping, galvanized inside and outside, and protected against corrosion by a dichromate rinse or a zinc chromate coating.
   3. Provide conduit furnished in 10-foot minimum lengths with both ends threaded and one end fitted with a coupling.
   4. Manufacturers:
      a. Tyco/Allied Tube and Conduit, www.alliedtube.com.
      b. Wheatland Tube Company, Division of John Maneely Company, www.wheatland.com.
      c. Or Approved Equal.

C. Plastic Coated Rigid Galvanized Steel Conduit:

1. Provide plastic coated rigid galvanized steel conduit bearing the UL label.
2. Provide base conduit of rigid hot-dip galvanized steel conduit as specified in **Paragraph 2.02E**, and of the type indicated, specified, or scheduled to be coated.
3. Apply plastic coating in accordance with the following:
    a. Apply a 40-mil thick PVC coating on the outside and a 2-mil thick fusion- bonded blue, red, or green urethane coating on the inside, both coatings conforming to the requirements of NEMA RN 1.
    b. Have the same manufacturer who produces the hot dip galvanized base conduit factory-apply the plastic coating.
    c. Provide plastic coating of one uniform color on all plastic coated rigid galvanized steel conduit provided for the Contract.
4. Provide 40-mil thick plastic sleeves to protect internally threaded conduit openings.
    a. Provide sleeves with an inside diameter equal to the outside diameter of the conduit/pipe protected by it; and extending either one pipe diameter or 2- inches, whichever is less, beyond the opening.
5. Manufacturers:
    a. OCAL, http://www.tnb.com/Design Builder/docs/ocal.pdf.
    b. Robroy Industries/Perma-Cote, www.permacote.com.

D. Liquidtite Flexible Metal Conduit:
1. Provide PVC coated flexible metal conduit conforming to the requirements of Article 350 of NFPA 70 (NEC) for materials and uses and ANSI/UL 360.
2. Provide conduit with interlocking spiral strip construction capable of bending to a minimum radius of five times its diameter without deforming the spiral strips both inside and outside of the conduit.
    a. Provide conduit with a flexible, galvanized, interlocking spiral strip steel core jacketed with smooth, liquid-tight polyvinyl chloride designed to withstand temperatures from minus 40 degrees Celsius to plus 60 degrees Celsius.
3. Finish the interior and exterior of flexible conduit smooth and free from burrs, sharp edges, and other defects that may injure wires; and place the manufacturer's trademark on each length.
4. Furnish an integral continuous copper ground in 1/2-inch through 1-1/4-inch PVC coated flexible metal conduit.
5. Acceptable Manufacturers
    a. Electri-Flex Company, Liquatite®, Type LA, www.electriflex.com.
    b. ANAMET Electrical, Inc., Anaconda Sealtite®, www.anacondasealtite.com.
    c. Or Approved Equal.

E. Rigid Galvanized Steel Conduit (RGS):
1. Provide rigid galvanized steel conduit (RGS) conforming to the requirements of Article 344 of NFPA 70 (NEC) for materials and uses, ANSI C80.1, and UL 6.
2. Fabricate the RGS from mild steel piping, galvanized or sherardized inside and outside, and protected against corrosion by a dichromate rinse or a zinc chromate coating.
3. Provide defect free conduit bearing the UL label, and furnished in 10-foot minimum lengths with both ends threaded and one end fitted with a coupling.
    a. Provide tapered NTP 3/4 inch per foot threads complying with ANSI/ASME B1.20.1.
4. Acceptable Manufacturers:
    a. Tyco/Allied Tube and Conduit, www.alliedtube.com.
    b. Wheatland Tube Company, Division of John Maneely Company, www.wheatland.com.
    c. Approved equal.

F. Rigid Aluminum Conduit (RAC):
1. Provide rigid aluminum conduit (RAC) conforming to the requirements of NEC Article 344 for materials and uses, ANSI C80.5, and UL 6A.
2. Rigid aluminum conduit shall be manufactured from 6063 alloy in temper designation T-1.
3. Provide defect free conduit bearing the UL label, and furnished in 10-foot minimum lengths with both ends threaded and one end fitted with a coupling.
   a. Provide tapered NTP 3/4 inch per foot threads complying with ANSI/ASME B1.20.1.
   b. Provide threaded aluminum fittings and conduit bodies that meet the requirements of ANSI/UL 514B, ANSI/NEMA FB1, and ANSI/UL 886 for Use in Hazardous (Classified) Locations. Connectors shall have insulated throat. Associated fittings shall meet the requirements of UL and ANSI C80 standards for the applicable raceway system.
4. Acceptable Manufacturers:
   a. Tyco/Allied Tube and Conduit.
   b. Wheatland Tube Company, Division of John Maneely Company.
   c. Or approved Equal.

2.3 CONDUIT FITTINGS

A. Fittings for Non-Metallic Conduit Systems:
1. Provide high impact non-metallic fittings conforming to same requirements as for the non-metallic conduit as specified in **Article 2.01**.
2. Non-Metallic Conduit Expansion Fittings:
   a. Provide a two-piece nonmetallic, noncorrosive, nonconductive, UL listed expansion fitting.
3. Acceptable Manufacturers:
   a. Lamson & Sessions, Carlon®, www.carlon.com.
   b. Queen City Plastics, Inc., www.queencityplastics.com.
   c. Or Approved Equal.

B. Fittings for Metallic Conduit Systems:
1. Construct conduit bodies/fittings from cast malleable iron or cast steel.
2. For PVC coated raceway systems, provide PVC coated fittings of cast malleable iron or cast steel from the same manufacturer that provides the uncoated conduit bodies/fittings.
3. For RAC raceway systems, provide RAC fittings of aluminum from the same manufacturer that provides the uncoated conduit bodies/fittings. Provide hazardous Class 1, Division 1, Group C & D for NEMA 7 locations.
4. Conduit Outlet Bodies:
   a. Provide malleable iron threaded entry type conduit outlet bodies with neoprene gaskets and cast steel conduit.
   b. Acceptable Manufacturers:
      1) EGS/Appleton Electric, www.appletonelec.com.
      2) EGS/O-Z/Gedney, www.o-zgedney.com.
      3) Or Approved Equal.
5. Conduit Expansion Joints:
   a. Provide telescoping sleeve type galvanized, weatherproof, and vapor tight conduit expansion joints designed for 4-inch maximum expansion with an insulated bushing and lead-wool packing.
   b. Acceptable Manufacturers:
      1) EGS/Appleton Electric, www.appletonelec.com.

2) EGS/O-Z/Gedney, www.o-zgedney.com.
3) Or Approved Equal.

6. Conduit Unions:
   a. Provide conduit unions capable of completing a conduit run when neither conduit end can be turned.
   b. Acceptable Manufacturers:
      1) EGS/Appleton Electric, UNF and UNY Unions, www.appletonelec.com..
      2) Thomas and Betts Company, Erickson® Coupling., www.tnb.com/Design Builder/docs/tbhazardous.pdf
      3) Or Approved Equal.
7. Conduit Outlet Boxes:
   a. Provide malleable or cast iron conduit outlet boxes conforming to the requirements of UL 886, and having a cover with O-rings to keep out moisture.
   b. Acceptable Manufacturers:
      1) EGS/Appleton Electric, GRF outlets and covers, www.appletonelec.com.
      2) EGS/O-Z Gedney, www.o-zgedney.com.
      3) Or Approved Equal.
8. Conduit Device Boxes:
   a. Provide malleable iron conduit device boxes with internal grounding screws and conforming to the requirements of UL 498 and UL 514A.
   b. Acceptable Manufacturers:
      1) EGS/Appleton Electric, FD device boxes, www.appletonelec.com.
      2) EGS/O-Z Gedney, www.o-zgedney.com.
      3) Or Approved Equal.
9. Conduit Sealing Fittings:
   a. Provide, triple coated, malleable iron conduit sealing fittings.
      1) Coat the conduit sealing fittings with zinc electroplate, dichromate, and an epoxy powder coat.
   b. Provide drain fittings in conduit sealing fittings where required.
   c. Provide sealing covers for junction boxes where required.
   d. Acceptable Manufacturers:
      1) EGS/Appleton Electric, www.appletonelec.com.
         a) Sealing hubs: ES.
         b) Sealing fittings: EYSEF, EYSDEF, and EYD.
      2) EGS/O-Z Gedney, www.o-zgedney.com.
      3) Or Approved Equal.

2.4 CONDUIT SPACERS

A. Provide non-metallic, interlocking type conduit spacers which snap together to join any combination of intermediate and base units together, both vertically and horizontally.

B. Manufacturers:
   1. Underground Devices Inc., www.udevices.com.
   2. The George-Ingraham Corp.
   3. Or Approved Equal.

2.5 HEAT SHRINK TUBING

A. Provide all-weather corrosion resistant vinyl plastic heat shrink tubing designed for application on the exterior of metallic conduit to protect against galvanic action, moisture or other deteriorating contaminants.

B. Manufacturers:
   1. Tycho Electronics, Raychem, www.raychem.com.
   2. Thomas & Betts
   3. Or Approved Equal.

2.6 WALL AND FLOOR PENETRATION SEALS

A. Provide watertight mechanical seals capable of holding up to 20 psig, and sealing against water, soil, and backfill material.

B. Acceptable Manufacturers:
   1. Pipeline Seal & Insulator, Inc., Thunderline/Link-Seal, www.linkseal.com.
   2. Flexicraft Industries, PipeSeal, lhttp://flexicraft.com.
   3. Or Approved Equal.

2.7 FINISHES

A. Cold Galvanize Coating:
   1. Provide a cold galvanize coating to provide protection against corrosion by forming an insoluble zinc salt barrier from a cathodic reaction when the coating is damaged by abrasion and exposed to weather.
      a. Provide a single component pre-mixed liquid organic zinc compound producing 95 percent zinc in the dry film.
      b. Provide a coating that bonds to clean iron, steel, or aluminum through electrochemical action.
   2. Acceptable Manufacturers:
      a. ZRC. Worldwide, www.zrcworldwide.com.
      b. Clearco
      c. Krylon
      d. Rustoleum
      e. Or Approved Equal

PART 3 - EXECUTION

3.1 EXAMINATION

A. Although the Contract Drawings are generally indicative of the Work, take field measurements to verify actual conditions.
   1. Due to the small scale of the Contract Drawings it is not possible to indicate all offsets, fittings, and apparatus required or the minor structural obstructions that may be encountered during the Work.

B. Inspect the condition of existing conduit that is required for the Work of this Section.

3.2 PREPARATION

A. After carefully investigating structural and finish conditions and other in-place construction work, prepare and submit detailed Shop Drawings showing proposed departures from the original design due to field conditions or other causes.
   1. Layout the electrical work according to accepted standard electrical trade practice to suit actual field measurements.
   2. Arrange the electrical work to consider existing conditions and to preserve access to other equipment, rooms, areas, and similar features of the construction.
   3. Include plan and profile views of duct banks.
   4. Indicate the location and details of conflicting utility construction and slopes.
   5. Submit these Shop Drawings to the Engineer for approval prior to performing the Work of this Section.

B. Submit Product Data and catalog cuts for all products provided under this Section.
   1. Clearly indicate the usage of each product on the submittal.
   2. Include Product Data for the conduit and tubing provided under this Section with the Operation and Maintenance Manuals.

C. Obtain roughing-in dimensions of electrically operated equipment, including equipment being installed by both electrical and other construction trades.
   1. Set conduit and boxes only after receiving approved dimensions and checking such equipment locations.

D. Remove dirt, debris, and other obstructions from existing conduit required for the Work of this Section by blowing out and mandreling the conduits as applicable.

3.3 INSTALLATION

A. Perform the Work of this Section as specified in Section 26 05 00, Basic Electrical Materials and Methods.

B. Fabricate and install conduit and wireway systems in accordance with accepted electrical trade standard practice.
   1. Layout the electrical work of this Section to suit actual field measurements.
      a. Record the actual installed elevations and locations of duct banks and the as-found locations of conflicting utility lines on the record drawings as specified by Metro North, and submit the record drawings.
   2. Install the electrical Work of this Section in conformance to the wiring methods general requirements of Article 300 in NFPA 70 (NEC), and to all other applicable Articles of NFPA 70 governing wiring methods.
   3. Cut conduit and wireway square, and ream the cut ends according to the requirements of NFPA 70 (NEC) to deburr the openings so that they are not restricted more than cuts made by the material manufacturer.
   4. Avoid bending conduits as much as possible and practical; but if bends are made, use an approved conduit bending tool or machine to make the bends.
   5. Do not install crushed or deformed conduit, and remove crushed or deformed conduit from the Site.

6. On conduit that is installed outside, provide a second equipment ground conductor and use fittings with a built-in ground lug for bonding.
7. Provide flexible conduit only to the extent permitted by NFPA 70 (NEC).
    a. In flexible conduits that do not have an integral ground wire, install a green insulated wire in addition to the neutral wire for grounding purposes.
        1) Form a ‘J’ or ‘S’ hook with a drip loop to allow flexibility.
        2) Provide a second equipment grounding conductor on outside conduit and provide fittings with built-in ground lug for bonding.
    b. In exposed areas, use PVC coated flexible metal conduit and fittings.
    c. Use flexible metal conduit or liquid tight flexible metal conduit for final connection to recessed lighting fixtures and rotating and vibrating equipment.
        1) Flexible Metal Conduit is only permitted for final connections to lighting fixtures in dry, environmentally conditioned spaces.
        2) Liquid tight flexible metal conduit, as herein specified, for final connection to recess mounted lighting fixtures in unconditioned spaces and to all rotating and vibrating equipment including transformers, motors, solenoid valves, pressure switches, limit switches, generators, engine-mounted devices and pipe-mounted devices.
        3) Flexible conduit not to exceed 18 inches in length for motor connections, 36 inches in length for equipment connections or 72-inches for lighting fixture connections.
8. Provide fittings and apparatus as required to construct the approved electrical design.
    a. Running threads on conduit are not permitted.
        1) Where couplings and connectors are required for metal conduits, use approved threaded couplings and connectors.
    b. Provide conduit unions where necessary to complete a conduit run when neither conduit end can be turned.
    c. Where conduit and raceway runs cross building expansion joints, make provision for expansion in the conduit and raceway runs.
    d. Provide sealing fittings with drain fittings in all lower runs and vertical runs.
    e. Provide sealing covers for junction boxes where required.
    f. Provide weatherproof conduit hubs on all conduit connections exterior to the building, and on instruments, process equipment, and pump motors.
9. Installing RGS and PVC Coated Conduit:
    a. Install RGS and PVC coated conduit using methods and techniques recommended by the conduit manufacturer.
    b. Threading Conduit:
        1) Field thread the conduits per the manufacturers instructions.
            a) For PVC coated conduit, first use a cylindrical guide, oversized to fit over the plastic coating, to neatly cut the coating off at the proposed end of the threads.
            b) Do not damage or remove the coating beyond the proposed end of the threads.
        2) Once the threading operation is complete, protect the newly cut threads against corrosion by applying a "sealing" compound as recommended by the manufacturer.
    c. Assembling RGS and PVC Coated Conduit Fittings:
        1) Use PVC coated conduit bodies, clamps, supports, accessories, and fittings with coated conduit systems.

2) Just prior to assembling each conduit joint, apply the conduit manufacturer's touch-up compound to the end of the conduit in the area normally covered by the fitting sleeve.
3) Use cloth or other material over strap type wrenches to protect the coating while tightening conduits.

10. Breathers and drains shall be provided at the low point(s) of all conduit runs in NEMA 3R, 4, 4X and 7 areas, and where otherwise subject to the accumulation of condensation. Conduits shall be arranged to drain away from dry areas toward damp or wet areas, and away from equipment and enclosures.

C. Exposed Work:
1. In exposed work, run conduit and raceway parallel to centerlines and structure surfaces; or perpendicular to centerlines where required, with right angle turns consisting of symmetrical bends or fittings.
2. Maintain at least 6 inches clearance between conduit and raceway runs and pipes, ducts, and flues of mechanical systems.
3. If a portion of a metallic conduit run, whether plastic-coated or not, extends above grade or is otherwise exposed to personnel, ensure that the conduit is properly bonded to an equipment grounding conductor at both ends.
4. Install the equipment grounding conductor either inside or outside the box.

D. Concealed Work:
1. When performing electrical work in concealed spaces, provide the same quality workmanship as in exposed work.
2. Conceal conduits and raceways in the structure's construction where practicable unless otherwise indicated on the Contract Drawings or required by the Engineer.
   a. Group conduit and raceway runs in concealed work as much as practical to avoid congesting the concealed spaces.
   b. Do not weaken the structure by excessive or unnecessary cutting.
      1) Only make cuts into the structure's construction in conformance to the applicable building codes.
3. Conduits and Raceways Embedded in Concrete Slabs:
   a. Separate multiple conduits encased together by not less than two inches of concrete.
   b. Locate conduit installed in floor slabs within the reinforced area of the slab.
   c. Where conduit crosses expansion joints, provide weather tight expansion and defection fittings and bonding jumpers.
4. Install below grade conduit in conformance with the requirements of Section 33 71 19, Underground Ducts and Manholes.
   a. For conduits that pass under building support walls, provide a minimum of 3 inches of concrete encasement all around.
   b. For underground and concrete encased duct banks, provide non-metallic conduit spacers.
      1) Provide sufficient space to allow pouring the concrete envelope without displacing or shifting the individual conduits.
      2) Install conduit spacers at intervals not exceeding five feet.

E. Hangers and Supports:
1. Install auxiliary support structures, anchors, and fasteners as specified in Section 26 05 28, Hangers and Supports.
   a. Mount or suspend conduit and wireway systems directly on structural members of the structures and walls.

b. Do not attach conduit or raceway systems to suspended ceiling members or to the suspending mediums.
c. Securely attach anchors into walls.

2. At all conduit attachments, allow space between the mounting surfaces and the conduit by providing U-channel supports, clamp-backs, or spacers.
   a. Attach wall-mounted conduit runs close to the walls following the contour of the walls, parallel to the walls and other building lines except at bends.

F. Structure Penetrations:
1. Make penetrations in existing concrete structures by core-drilling.
   a. Drill the penetrations true, clean, and free from spalling.
2. At penetrations through fire rated floors, walls, and similar assemblies, provide firestopping as specified in Section 07 84 00, Firestopping.
3. Make floor penetrations as detailed on the Contract Drawings.
   a. Seal all conduit penetrations through floor slabs on grade in buildings with a floor penetration seal.
4. Install a wall penetration seal at all wall penetrations.
   a. Size wall penetrations to accommodate the conduit outside diameter plus either 1/4 inch or a hole allowance to allow the installation of the wall penetration seal.
5. For conduits that enter rooms from concrete floors or masonry, provide corrosion protection by using an RGS or PVC coated conduit that extends from 12 inches inside the concrete or masonry to at least 6 inches into the room.

G. Hazardous Locations
1. Within the areas labeled as “hazardous” on the Contract Drawings, only provide equipment, fittings, and wiring as indicated which are approved for Class 1, Division 1, Group D or Class II, Division 1, Group F locations as required by NFPA 70 (NEC) for the type of area in question and as specifically designed for this type of hazardous use.
2. In hazardous locations, engage at least five full threads on conduit connections to couplings and fitting hubs.
   a. Coat the threads with a sealing compound that makes the connections gas tight
3. Properly install sealing fittings at all required locations in accordance with code regulations.

H. Wiring:
1. Install wiring in conduit as indicated.
2. Prior to the installation of any wire, verify that the conduit is clean and free of debris.
3. Install a separate ground conductor within every conduit.

3.4 FIELD QUALITY CONTROL

A. Inspection:
1. Inspect installed conduit runs for obstructions, proper support, proper grounding, and completeness.
2. Record the actual installed elevations and locations of conduit and tubing on record drawings specified by Metro North.

END OF SECTION

SECTION 26 05 33.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for furnishing, installing, connecting, cleaning, and protecting electrical pull and junction boxes.

B. Related Section:
   1. Section 01 33 00 - Submittal Procedures.
   2. Section 26 05 00 - Common Work Results for Electrical.
   3. Section 26 05 26 - Grounding and Bonding.
   4. Section 26 05 28 - Hangers and Supports for Electrical Systems.
   5. Section 26 05 63 – Acceptance Testing for Electrical Systems.
   6. Section 26 05 19 - Low Voltage Electrical Power Conductors and Cables.
   7. Section 26 05 33.13 - Conduit for Electrical Systems.

1.2 REFERENCES

A. National Electric Manufacturer's Association (NEMA):
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable.
   3. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

B. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC).

C. American National Standards Institute (ANSI):
   1. ANSI Z55.1 - Gray Finishes for Industrial Apparatus & Equipment (*withdrawn 1990, no replacement*).

D. Underwriters Laboratories, Inc. (UL):
   1. UL 886 - Standard for Outlet Boxes and Fittings for Use In hazardous (Classified) Locations.

1.3 DESIGN REQUIREMENTS

A. Product Data:
   1. Submit a list of the materials proposed to satisfy the requirements of this Section.
   2. Submit the manufacturer's comprehensive calculations used to determine size requirements for the boxes.
   3. Submit Product Data and catalog cuts of the materials and equipment proposed to be used to satisfy the requirements of this Section.

4. Include Product Data for the equipment and material provided under this Section with the Operation and Maintenance Manuals submitted in accordance with the requirements of Metro North, at project closeout.

1.4 SUBMITTALS

A. Submit the following information to the Engineer for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:
   1. Product Data:
      a. List of the proposed materials.
      b. Catalog cuts of cast outlet boxes for general purpose applications used with steel conduit systems.
      c. Catalog cuts of cast outlet boxes for general purpose applications used with coated conduit systems.
      d. Catalog cuts of sheet metal boxes for general purpose applications in dry locations.
      e. Catalog cuts of outlet boxes for hazardous locations.
      f. Catalog cuts of pull boxes for hazardous locations.
      g. Catalog cuts of equipment and control device enclosures for all areas except outdoor and corrosive locations.
      h. Catalog cuts of equipment and control device enclosures for outdoor locations.
      i. Catalog cuts of equipment and control device enclosures for corrosive locations.
   2. Quality Assurance/Control Submittals:
      a. Design Data.
         1) Manufacturer's comprehensive calculations.
      b. Test Reports.
         1) Factory test reports.
      c. Certificates.
         1) Testing agency/quality verification, listing, and labeling.
      d. Qualification Statements.
         1) Qualifications of the licensed electricians.
         2) Qualifications of the Electrical Testing Laboratory (ETL).

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications:
      a. To supervise installation of the Work of this Section, employ licensed electricians.
         1) Submit the qualifications of the licensed electricians supervising the Work of this Section.
   2. Electrical Testing Laboratory (ETL) Qualifications:
      a. Employ an independent testing agency, qualified as specified in Section 26 05 63, Electrical Testing, to perform testing required by this Section.
      b. Submit information verifying the ETL's qualifications.

B. Regulatory Requirements:
   1. Perform the Work of this Section in accordance with the requirements specified in Articles 250, 300, and 370 of NFPA 70 (NEC), and to all other applicable state, local, and national governing codes and regulatory requirements.

C. Certifications:
1. Provide products that are listed and labeled by Underwriters Laboratory, approved by Factory Mutual, or certified as meeting the standards of UL by the Electrical Testing Laboratory (ETL) for the location installed in, and listed and labeled or approved for the application intended as indicated or specified, unless products meeting the requirements of these testing laboratories are not readily available or unless standards do not exist for the products.
a. Provide products that are approved, listed, and labeled for the short circuit currents, voltages, and currents indicated or specified to be applied.
b. Provide service entrance labeled products for all service entrance equipment.
2. Submit evidence of testing agency/quality verification, listing, and labeling for each product with the submitted product data, either by providing a printed mark on the data or by attaching a separate listing card.
a. For items without such evidence, submit a written statement from the product manufacturer that indicates why it does not have quality assurance verification.

1.6 MATERIAL DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
1. Pack, ship, handle, and unload products in accordance with the requirements of Section 26 05 00, Basic Electrical Materials and Methods.

B. Acceptance at Site:
1. Accept products at the Site in accordance with the requirements of Section 26 05 00, Basic Electrical Materials and Methods.

C. Storage and Protection:
1. Store products in accordance with the requirements of Section 26 05 00, Basic Electrical Materials and Methods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Use of Trade Names:
1. The use of trade names within the Contract Documents is intended to establish the basis of design and to illustrate the constructability and level of quality required.
2. The use of trade names is not intended to exclude other manufacturers whose products are equivalent to those named, subject to compliance with Contract requirements.

2.2 MANUFACTURED UNITS

A. Steel Outlet and Device Boxes for General Purpose Applications:
1. For general purpose applications in dry, flush (in-wall) locations only, provide UL Listed galvanized steel outlet and device boxes conforming to NEMA OS 1.
a. Boxes shall be fabricated from steel not less than 0.062" thickness.
b. Boxes shall have standard trade size knockouts to facilitate conduit and cable connector attachments.

c. Boxes shall be equipped with one 10-32 tapped hole for ground wire attachment.

2. Ceiling fan and light fixture bar hangers shall be UL Listed for 35 pound fan and 50 pound fixture.

3. Manufacturers:
   a. Appleton Electric
   b. O-Z/Gedney
   c. Crouse Hinds
   d. Thomas & Betts
   e. Or Approved Equal

B. Cast Outlet Boxes for General Purpose Applications:

1. For Use with Steel Conduit Systems:
   a. For use with steel conduit systems, provide UL Listed small cast steel or cast malleable iron outlet boxes with threaded hubs that meet the NEMA 250 requirements for Type 12 enclosures.
   b. If covers are indicated or specified, provide cast steel or cast malleable iron covers with neoprene gaskets.
      1) Provide captive Type 316 stainless steel mounting screws for the covers.
   c. If fixture hangers are indicated or specified, provide ball type cast steel or cast malleable iron fixture hangers with neoprene gaskets.
      1) Provide captive Type 316 stainless steel mounting screws for the fixture hangers.
   d. Finish:
      1) Provide outlet boxes, covers, and hangers with an electroplated zinc coating, followed first by a dichromatic prime, and then by an aluminum polymer finish coating conforming to NEMA FB 1.
   e. Manufacturers:
      1) Appleton Electric
      2) O-Z/Gedney
      3) Crouse Hinds
      4) Thomas & Betts
      5) Killark
      6) Or Approved Equal.

2. For Use with Coated Conduit Systems:
   a. When boxes for use with coated conduit systems are indicated or specified, provide cast outlet boxes as specified for steel conduit systems, but having coatings as specified in Section 26 05 33.13, Conduit and Tubing, for the system.
      1) Provide a 40 mils thick PVC coating conforming to the requirements of NEMA RN 1 outside, and a 2 mils thick fusion-bonded blue, red, or green urethane coating inside.
         a) Insure that the color of the PVC coating is uniform throughout the Work of this Contract.
      2) For internally threaded openings in the box, provide a 40 mil thick plastic sleeve extending one pipe diameter or 2 inches, whichever is less, beyond the openings with an inside sleeve diameter equal to the outside diameter of the conduit or pipe used.
   b. Manufacturers:
      1) Thomas & Betts, Ocal
      2) Robroy Industries
      3) Or Approved Equal

C. Sheet Metal Junction and Pull Boxes for General Purpose Applications:
   1. For general purpose applications in dry locations, provide small sheet steel pull and terminal boxes and covers that meet the NEMA 250 requirements for Type 12 enclosures with continuously welded and ground smooth seams, and having no holes or knockouts.
      a. Cover:
         1) Provide overlapping sheet steel screw covers with captivated screws for each box.
         2) Provide a means of bonding on the cover.
      b. Gasket: Provide an oil resistant cover gasket for each box.
      c. Mounting Brackets:
         1) Provide 12 gauge steel wall-mounting brackets.
      d. Finish:
         1) Provide polyester powder coating applied over phosphatized surfaces.
         2) Color: ANSI Z55.1 Number 61 gray.
   2. Manufacturers:
      a. Hoffman, Screw Cover SC Junction Boxes
      b. Rittal Corp
      c. Milbank Manufacturing
      d. Or Approved Equal

D. Outlet Boxes for Hazardous Locations:
   1. For hazardous locations, provide junction boxes and covers that comply with the requirements of UL 886, and are sized according to the installation and NFPA 70 (NEC) requirements.
   2. For suspended type or surface mounted conduit runs in hazardous locations, provide outlet boxes having a threaded cover and the proper size and number of tapped conduit hub openings.
      a. Outlet Box Body:
         1) Fabricate outlet box bodies from iron alloy, electrogalvanized and coated with aluminum acrylic paint.
         2) Provide threaded access openings that can either accommodate threaded covers that create a seal against the hazard, or that allow the outlet box depth to be increased by using threaded extensions.
         3) Provide taper-threaded hubs in the box capable of accommodating threaded rigid or IMC conduit, and having smooth integral hub bushings to protect conductor insulation during wire pulling.
         4) Provide an internal ground screw.
      b. Outlet Box Covers:
         1) Provide copper-free aluminum threaded covers with cast “ears”, recesses, or other means to facilitate tightening and removing the cover.
            a) Provide a neoprene O-ring with the cover.
         2) If required, in lieu of providing standard covers provide threaded sealing covers having a removable threaded plug to allow the enclosure to be filled with sealing compound.
         3) If required, in lieu of providing standard covers provide threaded covers or canopies capable of mounting pendant type lighting fixtures.
   3. Manufacturers:
      a. Cooper Crouse Hinds Company, GUA and GUR Series Outlet Boxes
      b. Appleton Electric
      c. O-Z/Gedney
      d. Thomas & Betts

e. Or Approved Equal.

E. Pull Boxes for Hazardous Locations:
1. For hazardous locations, provide pull boxes and covers that comply with the requirements of UL 886, and are sized according to installation and NFPA 70 (NEC) requirements.
a. Pull Box Body:
1) Provide copper-free aluminum or iron alloy bodies capable of being factory or field drilled and tapped for conduit entries of the proper size and number.
2) Machine enclosures to accommodate field installed mounting plates.
3) Provide an internal ground lug.
b. Pull Box Cover:
1) Provide threaded, bolted, or hinged and bolted covers, fabricated from copper-free aluminum or iron alloy, as required.
a) Provide bolts for attaching bolted covers.
b) Provide hinges for hinged covers.
2) Provide a neoprene gasket with each cover.
c. Manufacturers:
1) Cooper Crouse Hinds Company, GUB and EJB Series Junction Boxes
2) Appleton Electric
3) O-Z/Gedney
4) Thomas & Betts
5) Or Approved Equal.

F. Equipment and Control Device Enclosures:
1. For all areas except outdoor and corrosive locations, provide enclosures with hinged doors that meet the NEMA 250 requirements for Type 4 or 12 enclosures, depending on Contract requirements.
a. Enclosure Cabinet:
1) Provide sheet steel boxes having continuously welded seams, ground smooth.
2) Provide enclosures having no holes or knockouts.
b. Enclosure Door:
1) Provide overlapping sheet steel hinged doors, having a continuous hinge with a removable heavy gauge hinge pin and door clamps with screws to provide a watertight seal or to exclude liquids and contaminants.
2) Provide a means of bonding on the door.
c. Door Gasket:
1) Provide an oil resistant door gasket for each box.
d. Security:
1) Provide a mechanism for padlocking the enclosure.
e. Finish:
1) Provide polyester powder coating applied over phosphatized surfaces.
2) Color: ANSI Z55.1 Number 61 gray.
f. Manufacturers:
1) Hoffman, Single-Door Type 4 Enclosures or Type 12 and Type 13 Enclosures
2) Rittal Corp
3) Milbank Manufacturing
4) Or Approved Equal
2. For outdoor locations, provide galvanized steel enclosures with covers that meet the NEMA 250 requirements for Type 3R enclosures, and as follows.
a. Enclosure Body:

1) Fabricate enclosures from galvanized steel or aluminum sheets; and provide a drip shield on the top, and seam-free sides, fronts, and backs.

b. Covers:
1) Provide a removable slip-on cover with plated steel captivated screws along the bottom edge for each enclosure.

c. Security:
1) Provide a mechanism for padlocking the enclosure.

d. Finish:
1) Provide polyester powder coating applied over phosphatized surfaces.
2) Color: ANSI Z55.1 Number 61 gray.

e. Manufacturers:
1) Hoffman, Screw Cover Type 3R Enclosures
2) Rittal Corp
3) Milbank Manufacturing
4) Or Approved Equal

3. For corrosive locations, provide enclosures that meet the NEMA 250 requirements for Type 4X enclosures, and as follows:

a. Enclosure Cabinet:
1) For wall mounted enclosures, fabricate enclosure bodies from 14 gauge Type 304 or Type 316L stainless steel sheets; and having continuously welded seams, ground smooth.
2) For floor mounted enclosures, fabricate enclosure bodies from 12 gauge Type 304 stainless steel sheets and enclosure backs from 10 gauge Type 304 stainless steel sheets; and having continuously welded seams, ground smooth.
a) Provide stainless steel floor stands, if required.
b) Provide stainless steel lifting eyes.
3) Provide a grounding stud on the enclosure body.
4) Provide enclosures having no holes or knockouts.

b. Enclosure Doors:
1) For wall mounted enclosures, provide a removable hinged door fabricated from 14 gauge Type 304 or Type 316L stainless steel sheets; and having a rolled lip on three sides and a continuous stainless steel hinge with a removable hinge pin on the fourth side.
a) Provide a stainless steel door clamp assembly that assures a watertight seal.
2) For floor mounted enclosures, provide either doors similar to those specified for wall mounted enclosures, or 14 gauge Type 304 or Type 316L stainless steel sheets hinged doors with concealed die-cast hinges that allow 180 degree door opening and easy door removal.
3) Provide a means of bonding on the door.

c. Door Gasket:
1) Provide a seamless, foam-in-place, oil-resistant door gasket for each enclosure.

d. Security:
1) Provide a mechanism for padlocking the enclosure.

e. Finish:
1) Provide enclosures with unpainted, Number 4 brushed finish surfaces.

f. Manufacturers:
1) Hoffman, Type 4X Enclosures and General Purpose Two-Door Floor- Mount Type 4X Enclosures
2) Rittal Corp
3) Milbank Manufacturing

4) Or Approved Equal

G. Ground Lug/Bus Bar:
1. Provide a copper ground lug or a 1/4-inch by 2-inch copper bus bar in large pull and junction boxes.

2.3 SOURCE QUALITY CONTROL

A. Tests:
1. Submit factory test reports to the Engineer as specified for the products in this Section.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Install the work of this Section only under the supervision of licensed electricians.

3.2 EXAMINATION

A. Verify that conduit stub-ups to be mated with electrical boxes and enclosures are the correct type and size, and are at the proper location.

3.3 INSTALLATION

A. Junction Boxes and Pull Boxes for General Purpose Applications:
1. For general purpose applications in dry locations, provide small sheet steel pull and terminal boxes that meet the NEMA 250 requirements for Type 12.
2. Provide boxes that are fabricated from the same type of material as the conduit with which the boxes are used.

B. Junction Boxes and Pull Boxes for Hazardous Locations:
1. Provide junction boxes rated for the hazard classification of the area where they are installed, whether explosionproof, dust-ignitionproof, raintight, wet locations, watertight, or other classification.

C. Equipment and Control Device Enclosures:
1. For all areas except outdoor and corrosive locations, provide enclosures that meet the NEMA 250 requirements for Type 4 or 12 enclosures, depending on Contract requirements.
2. For outdoor locations, provide enclosures with covers that meet the NEMA 250 requirements for Type 3R enclosures.
3. For corrosive locations, provide enclosures that meet the NEMA 250 requirements for Type 4X enclosures.

D. Installing Boxes for Electrical Outlets and Devices:
1. Install boxes level and plumb within 1/16-inch of vertical or horizontal over the length of the box.
2. Install device boxes at a uniform height as indicated on the Contract Drawings.

a. Mount all adjacent boxes in alignment at the same mounting height.
b. Mount outlet boxes for equipment within 18-inches of the equipment power connection.

3. Do not install flush mounting boxes back-to-back in walls.
   a. Provide a minimum separation of 6 inches (150 mm).
   b. Provide a minimum separation of 24inches (600 mm) s in acoustic rated walls.
4. When installing boxes outside or to exposed conduit in unfinished areas, provide cast boxes.
   a. Mount these boxes on spacers to be 1/8-inch from wall unless box has built- in raised pads to perform the same function.
5. When installing boxes for single devices, two devices, or wall outlets, install 4- inch square boxes with appropriate plaster rings.
   a. Space boxes on opposite sides of the wall 6 inches apart.
   b. Set plaster rings flush or to protrude less than 1/16-inch from the wall.
   c. Openings for boxes in finished walls must be within 1/16-inch of the box.
      1) Correct all oversize openings in accordance with the specifications for the wall material.
6. Outlet boxes must be of the one-piece type, the use of expandable sheet metal boxes is prohibited.
7. Support cast boxes for outlet and device using one of the following methods:
   a. Mount the boxes directly to the structure using 4 or more anchors.
      1) Attach mounting screws to feet located outside of the box interior.
      2) Provide 1/4-inch spacers behind the boxes unless the box has raised pads.
   b. Attach the box to two 1-inch or larger conduits which are supported within 12-inches of the box.
   c. Attach the box to two 1-inch or larger conduits which exit from a poured concrete floor no further than 18-inches from the box.

E. Installing Boxes for Other than Electrical Outlets and Devices:
1. Accurately punch holes for conduit openings using a hydraulic punch and punches sized for the conduit to be installed.
2. Install a conduit breather in the top of the box and a conduit drain fitting in the bottom of all boxes not located in bone-dry areas that are at least 100 feet from a hose-bib.
3. Support boxes for other than electrical outlets and devices using one of the following methods:
   a. Mount the boxes directly to the structure using 4 or more anchors.
      1) Attach mounting screws to feet located outside of the box interior or seal the screw holes to prevent water penetration.
      2) Provide 1/4-inch spacers behind the boxes unless the box has raised pads.
   b. Attach the box to two 1-inch or larger conduits which are supported within 12-inches of the box.
   c. Attach the box to two 1-inch or larger conduits which exit from a poured concrete floor no further than 18-inches from the box.
   d. Mount the box on U-channel and structural supports conforming to Section 26 05 28, Hangers and Supports.

F. Make up all conduit connections to boxes in accordance with the requirements of Section 26 05 33.13, Conduit and Tubing.

G. Install wiring in boxes in accordance with the requirements of Section 26 05 19, Low- Voltage Wire, Cable, and Accessories.

H. Ground boxes in conformance with Section 26 05 26, Grounding and Bonding.

3.4 REPAIR/RESTORATION

A. Touch up damaged coatings on electrical boxes and enclosures.

3.5 FIELD QUALITY CONTROL

A. Site Tests:
   1. Test all boxes to verify that they are properly connected to the grounding system.

B. Inspection:
   1. Inspect flush boxes to verify that the opening between the box and the wall finish is less than 1/16-inch.
   2. Inspect flush boxes to verify that each box is flush with the wall, or protrudes less than 1/16-inch, and is not set behind the wall surface.
   3. Inspect surface mounted boxes to verify that they are level and plumb within 1/16-inch as specified.
   4. Record the actual installed elevations and locations of pull and junction boxes on record drawings specified by Metro North.

3.6 CLEANING

A. Waste Management and Disposal:
   1. Clear and dispose of waste materials in accordance with the requirements of Section 26 05 00, Basic Electrical Materials and Methods.

3.7 PROTECTION

A. Except for surfaces to be painted, mask electrical boxes to protect them from paint overspray or over-brushing during painting operations.

B. Protect boxes against damage from other work.

END OF SECTION

SECTION 26 05 48 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This dual-purpose section provides for vibration isolation as well as seismic control for the "equipment" as listed below. This specification is part of the general conditions for the Electrical contract.

1.2 REFERENCES

A. International Building Code (IBC)
   1. IBC 2012

1.3 DESCRIPTION

A. Intent:
   1. All equipment listed below and conduit shall be seismically braced. Vibration control shall apply as described herein.
   2. Seismic bracing and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer.
   3. It is the intent of the seismic portion of this specification to keep all electrical building system components in place during a seismic event and operational.
   4. All such systems must be installed in strict accordance with seismic codes, component manufacturer's and building construction standards. Whenever a conflict occurs between the manufacturers or construction standards, the most stringent shall apply.
   5. This specification is considered to be minimum requirements for seismic consideration.
   6. Any variance or non-compliance with these specification requirements shall be corrected by the Design Builder in an approved manner.

B. The work in this section includes, but is not limited to the following:
   1. Vibration isolation for equipment.
   2. Seismic restraints.
   3. Certification of seismic restraint designs and installation supervision.
   4. Certification of seismic attachment of housekeeping pads.
   5. All equipment, (components) requiring IBC certification.
   6. All inspection and test procedures for equipment, (components) requiring IBC certification.
   7. All electrical equipment and systems within or on the building. Equipment buried underground is excluded but entry of services through the foundation wall is included. Equipment referred to below is typical. (Equipment not listed is still included in this specification).
   8. For IBC projects, all systems listed in or part of this paragraph are referred to as components.

Battery Chargers	Light Fixtures
Battery Racks	Motor Control Centers
Bus Ducts	Supports
Cable Trays	Switchboards

Conduit
Electrical Panels
Equipment Supports
Generators
Transformers
Variable Frequency Controllers

C. Definitions (all codes):
   1. Life Safety Systems:
      a. All systems involved with fire protection including sprinkler piping, fire pumps, jockey pumps, fire pump control panels, service water supply piping, water tanks, fire dampers and smoke exhaust systems.
      b. All mechanical, electrical, plumbing or fire protection systems that support the operation of or are connected to emergency power equipment including all lighting, generators, transfer switches and transformers.
      c. Automated supply, exhaust, fresh air and relief air systems on emergency control sequence including air handlers, duct, dampers, etc.
   2. Positive Attachment:
      a. Positive attachment is defined as a cast-in anchor, a drill-in wedge anchor, a double-sided beam clamp loaded perpendicular to a beam, or a welded or bolted connection to structure. Single sided "C" type beam clamps for support rods of overhead piping, duct work, fire protection or any other equipment are not acceptable on this project as seismic bracing points.
   3. Transverse Bracing:
      a. Restraint(s) applied to limit motion perpendicular to the centerline of the pipe or duct.
   4. Longitudinal Bracing:
      a. Restraint(s) applied to limit motion parallel to the centerline of the pipe or duct.
   5. Refer to Chapter 16 of the IBC 2009 for additional definitions.

1.4 QUALITY ASSURANCE

A. Substitution of internally or externally isolated and restrained equipment supplied by the equipment vendor, in lieu of the isolation and restraints specified in this section, is acceptable provided all conditions of this section are met. The Equipment manufacturer shall provide a letter of guarantee from their Engineering Department P.E. stamped and certified per the section on Seismic Restraint Design (paragraph 1.05) stating that the seismic restraints are in full compliance with these specifications.

B. Letters from field offices or representatives are unacceptable. All costs for converting to the specified vibration isolation and/or restraints shall be borne by the equipment vendor in the even of non-compliance with the preceding.

C. Letters from representatives are unacceptable.

1.5 SUBMITTAL DATA REQUIREMENTS

A. Refer to Section 26 05 00.

B. The manufacturer of vibration isolation and seismic restraints shall provide submittals for products as follows:
   1. Descriptive Data:

a. Catalog cuts or data sheets on vibration isolators and specific restraints detailing compliance with the specification.
b. Detailed schedules of flexible and rigidly mounted equipment, showing vibration isolators and seismic restraints by referencing numbered descriptive drawings.

2. Shop Drawings:
   a. Submit fabrication details for equipment bases including dimensions, structural member sizes and support point locations.
   b. Provide all details of suspension and support for ceiling hung equipment.
   c. Where walls, floors, slabs or supplementary steel work are used for seismic restraint locations, details or acceptable attachment methods for ducts and pipe must be included and approved before the condition is accepted for installation. Restraint manufacturers' submittals must include spacing, static loads and seismic loads at all attachment and support points.
   d. Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.
3. Seismic Certification and Analysis:
   a. Calculations by the Manufacturer's qualified licensed Engineer substantiating the mounting system, seismic restraints and recommended anchor bolts shall e submitted for approval along with the shop drawings. Calculations shall be based on the loads as established in the table at the end of this section. All analysis shall be stamped by a registered professional having a P.E. from the same state as the project.
   b. Unless otherwise specified, all equipment and conduit shall be restrained to resist seismic forces. Restraints shall maintain equipment or conduit in a captive position. Restraint devices shall be designed and selected to meet seismic requirements as defined in the latest issue of:
      1) Applicable state and local codes
      2) IBC International Building Code
4. International Building Code Additions: In addition to all of the above provisions, Design Builder shall comply with sections 16 and 17 of the International Building Code using only vendors that comply with the provisions stated herein and submitting the special inspections listed within these specifications. Where compliance is not possible, each Design Builder shall submit a vendor report clearly indicating that none of the specified, listed or other vendors known to the Design Builders meet the compliance, testing and certification portions of the IBC spec section 16 and 17. Special inspections shall still be conducted even if no vendors meet the enclosed requirements. All non-isolated and isolated equipment, (components) shall be secured to the structure in accordance with that code.
   a. All component manufacturers shall submit for approval the following as required below:
      1) All life safety system components noted in this specification will have the manufacturer of that component submit the Approved Agencies Certificate of Compliance for the specific equipment on this project when the Seismic Design Category is "C – F". Analytical or shaker test certification thru the component's load path including structure at its center of gravity shall include anchorage, structural and online capability.
      2) All components noted in this specification will have the manufacturer of that component submit the Approved Agencies Certificate of Compliance for their equipment when used on a Seismic Design Category is "C-F". This requirement also pertains to projects that combine an emergency preparedness center within a structure of another Occupancy Category where that component is needed for continued operation of the building or whose failure could impair the continued operation of the building. Note: the definition of the above refers to any

component which does not allow or hampers the use or capability of the intended purpose of that structure Analytical or shaker test certification thru the total component's load path to structure at its center of gravity shall include anchorage, structural and on line capability.

3) All components containing hazardous or flammable materials will have the manufacturer of that component submit the Approved Agencies Certificate of Compliance for their equipment when used on any project having a minimum Seismic Design Category of "C-F". Analytical or Shaker Test Certification thru the total component's load path to structure at its center of gravity shall include anchorage and structural capability to insure against loss of hazardous or flammable, (explosive) material.

4) All components that are not listed in the above categories shall have the manufacturers of each component submit a PE stamped calculation package that their project specific equipment will accept anchorage through the component's load path to structure at its center of gravity at the designated anchorage locations. This requirement is for all projects having a Seismic Design Category of (C-F).

b. The following systems shall require Special Inspection and Periodic Special Inspection for anchorage during the course of construction as defined earlier in this section for all buildings in Seismic Design Categories C-F.

1) All electrical components for standby or emergency power systems require Periodic Special inspection.
2) All flammable, combustible and highly toxic piping and their associated mechanical systems.
3) All equipment using combustible or toxic energy sources.
4) All electric motors, transformers, switchgear unit substations and motor control centers.
5) Reciprocating and rotting type machinery.
6) Conduit, 3" and larger.
7) Isolator units for seismic isolation system.

C. Design Builder Responsibilities and Approvals:

1. Each Design Builder responsible for the installation of the components above shall be responsible for submitting to the design team for their approval a written Design Builder's statement of responsibility as outlined below.
   a. Identify the components that are part of the Quality Assurance Plan.
   b. Identify all Special Inspection and Testing.
   c. List control procedures within the Design Builder's organization including methods and frequency of reporting and their distribution.
   d. List personnel and their qualifications exercising control over the seismic aspects of the project.

D. Design Loads:

1. Projects will have a maximum design load of .4g for statically mounted components and .9g for resiliently mounted components.
2. The minimum horizontal restraint capability shall be 0.4 g horizontal and .27 vertical. Life safety equipment defined above shall be designed to survive a horizontal load of .9g and a vertical load of .6g.
3. Testing or calculations (including the combining of tensile and shear loadings) to support seismic restraint designs must be stamped by a registered Professional Engineer with at least five years of seismic design experience and licensed in the state of the job location. Testing

and calculations must include shear and tensile loads as well as one test or analysis at 45° to the weakest mode. IBC Component testing must be by an Approved Agency.

4. Analysis for anchorage must indicate calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces detailed in Section 4 acting through the equipment center of gravity. Overturning moments may exceed forces at ground level.
5. Vertical load shall be calculated at 2/3 the horizontal load.
6. Internally isolated equipment in lieu of specified isolation and restraint systems must meet the specified isolation and system restraint criteria.
7. A seismic design Errors and Omissions insurance certificate MUST accompany the equipment manufacturer's certification. Product liability insurance certificates are not acceptable.
8. In the event that the equipment is internally isolated and restrained, the entire unit assembly must be seismically attached to the structure. Curb or roof rail mounted equipment must not only have seismic attachment of the equipment to the roof but also to the curb or rails. The attachment and certification thereof shall be by this section.

1.6 RELATED WORK

A. Housekeeping pad design shall be as indicated on the drawings. Attachment shall be designed and certified according to this section by the seismic/isolation supplier. Material and labor required for attachment and construction shall be by the Design Builder. Housekeeping pads shall be sized to accommodate a minimum of six (6) inches of clearance all around the equipment or 12 times the anchor bolt diameter, whichever is greater and its mounting package. Structural support and connections for all equipment, including roof-mounted equipment, specified in other sections shall comply with all IBC requirements indicating load path to the structure. .

B. Lay-in ceilings in compliance with seismic zone requirements may use earthquake clips or other approved means of positive attachment to brace fixtures such as lights and diffusers less than 75 pounds to T-bar structures. Local codes dictate support requirements.

1.7 CODE AND STANDARDS REQUIREMENTS

A. Applicable Codes and Standards:
   1. All City, State and Local Codes.
   2. American Society For Testing and Materials (ASTM) Standard.
   3. International Building Code (IBC).

B. In cases where requirements vary, the guideline for the most stringent shall be utilized.

C. Use IBC-2009 as reference code standard unless otherwise designated.

1.8 MANUFACTURER'S RESPONSIBILITY

A. Manufacturer of vibration isolation and seismic control equipment shall have the following responsibilities:
   1. Determine vibration isolation and seismic restraint sizes and locations.

2. Provide vibration isolation and seismic restraints as scheduled or specified.
3. Provide calculations and materials if required for restraint of unisolated equipment.
4. Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.
5. Certify correctness of installation upon completion.
6. All provisions of section 1.05.B.3. Seismic Certification & Analysis.

B. All manufacturers providing equipment and/or vibration/seismic control systems must provide a Seismic Design Error and Omissions Insurance Certificate for their firm or their design consultant to certify their ability to provide engineering and design as required by this Section.

C. All manufacturers' including Original Equipment Manufacturers (OEM) are responsible for Section 1.01 through 1.06, including 1.05.B.3. Seismic Certification & Analysis.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. All vibration isolation and seismic devices described in this section shall be the product of a single manufacturer.

B. Design of hardware and devices such as beam clamps, anchor bolts, cable and cast- in-place plates must be by this section's supplier to ensure seismic compliance and certification. The Design Builder has the option to utilize alternate fastening devices (anchor bolts) so long as the sizing and dimensions on seismic submittals are followed.

C. Unless otherwise specified, all isolator hardware shall be zinc plated. Springs with a deflection of up to 2 inches shall be coated with a polyester epoxy powder. Springs and rubber isolators shall be color coded for proper identification of rated load capacity. Zinc plating shall conform at ASTM B633, Class 2 SC2, minimum. All other metal parts used outdoors shall be hot spray or hot dipped galvanized.

2.2 VIBRATION ISOLATION AND SEISMIC RESTRAINT TYPES

A. Double Deflection Neoprene:
1. Double deflection neoprene mountings shall have a minimum rated static deflection of 0.40 inches. Steel top plate and base plate shall be completely bonded and embedded in oil-resistant elastomer. Mountings shall be molded in color for ease of identification of load capacity, and shall have ribbed neoprene surfaces on top and bottom to provide friction pads for those applications, which do not need to be bolted to the floor or to equipment. Bolt holes shall be provided on the bottom plate, and a tapped hole on the top, for applications requiring positive tie down.
2. Acceptable Manufacturers:
   a. Vibration Mountings and Controls, Inc.
   b. Mason Industries.
   c. Vibration Eliminator.

B. Floor Mounted Spring Isolators:

1. Free standing spring-type isolators, shall be laterally stable without housing, snubbers, or guides, and shall include a steel reinforced, ribbed neoprene cup (¼ inch minimum thickness) between the baseplate and the support. Mountings shall have leveling bolts on the top, consisting of an adjusting bolt, cap screw and washer. Mountings shall include a bolt hole in the bottom cup or a two hole rectangular steel baseplate for bolting to the structure.
2. Springs shall not be welded to the baseplate or cup. Spring diameters shall be no less than 0.8 times the compressed height of the spring at rated load. Springs shall also have a minimum additional travel to solid equal to 50% of the rated deflection.
3. Acceptable Manufacturers:
    a. Vibration Mountings and Controls, Inc.
    b. Mason Industries.
    c. Vibration Eliminator.

C. Housed Springs With Limit Stops:
1. Free standing, laterally stable spring type isolators. Isolator is the same as described in Specification 2.02.B, except that it includes a housing to provide vertical limit stops to prevent spring extension during weight changes, or when equipment is exposed to uplift loads such as wind loading. The housing serves as blocking during erection, and shall be located between the equipment and supporting structure. There shall be a minimum clearance of ¼" between the restraining bolts and the housing and spring to prevent interference with spring performance. Limit stops shall be out of contact during normal operation. Mountings shall have an adjusting bolt on the top of the spring compression plate. For non-seismic applications, neoprene acoustical non-skid pads (¼ inch minimum thickness) shall be attached to the bottom plate. When used in seismic applications, neoprene bushings shall be incorporated in the limit stop plate. Spring diameters shall be no less than 0.8 times the compressed height of the spring at rated load. Springs shall also have a minimum additional travel to solid equal to 50% of the rated deflection. Springs shall not be welded to the cups or housings.
2. Acceptable Manufacturers:
    a. Vibration Mountings and Controls, Inc.
    b. Mason Industries.
    c. Vibration Eliminator.

D. Combination Spring/Rubber Isolation Hangers:
1. Spring-Flex hangers shall consist of a steel spring in series with a .2 inch (minimum) deflection neoprene element. Springs shall be color coded, and elastomer element molded in specific colors for proper identification of rated load capacity. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Pipe isolators shall have spring diameters and hanger box lower hole sizes of sufficient size to permit the hanger rod to swing approximately 30° before contacting the box. Hangers which are to be used with flat iron duct straps will be provided with eye bolts on both ends.
2. Acceptable Manufacturers:
    a. Vibration Mountings and Controls, Inc.
    b. Mason Industries.
    c. Vibration Eliminator.

E. Spring/Rubber Pre-Positioning Hangers:
1. Spring-Flex hangers shall consist of color-coded steel spring in series with a neoprene element molded in specific colors for proper identification of rated load capacity. Hanger design shall incorporate a means for supporting the suspended equipment or piping at a fixed

elevation during installation regardless of load changes as well as a means for transferring the load to the spring.

2. Acceptable Manufacturers:
   a. Vibration Mountings and Controls, Inc.
   b. Mason Industries.
   c. Vibration Eliminator.

F. Pre-Compressed Hangers:
1. Spring-Flex hangers shall consist of a color-coded steel spring in series with a neoprene element molded in specific colors for proper identification of rated load capacity. Springs shall be pre-compressed to the rated deflection so as to support the suspended equipment or piping at a fixed elevation during installation regardless of load changes. For 30° misalignment capability, spring diameters and hanger box lower hole sizes shall be of sufficient size to permit the hanger rod to swing approximately 30° before contacting the box.
2. Acceptable Manufacturers:
   a. Vibration Mountings and Controls, Inc.
   b. Mason Industries.
   c. Vibration Eliminator.

G. Spring Hangers:
1. Spring-Flex hangers shall consist of a color-coded steel spring with a neoprene and steel washer, which will properly distribute the load on the spring. For 30° misalignment capability, spring diameters and hanger box lower hole sizes shall be of sufficient size to permit the hanger rod to swing approximately 30° before contacting the box. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Hangers, which are to be used with flat iron duct straps will be provided with eye bolts on both ends.
2. Acceptable Manufacturers:
   a. Vibration Mountings and Controls, Inc.
   b. Mason Industries.
   c. Vibration Eliminator.

H. Self-Aligning Spring Hanger:
1. Spring-Flex hangers shall consist of a color-coded steel spring seated in a neoprene spring cup with integral bushing to insulate the lower support rod from the hanger box. The steel hanger box shall be hinged to allow for a minimum of 30° misalignment between the rod attachment to structure and the connection to the supported equipment. Hanger boxes shall withstand three times the rated load without failure.
2. Acceptable Manufacturers:
   a. Vibration Mountings and Controls, Inc.
   b. Mason Industries.
   c. Vibration Eliminator.

I. Floor, Wall, And Ceiling Sleeves:
1. Where piping passes through walls, floors, or ceilings, a vibration control sleeve shall be provided to reduce the transmission of vibration. The sleeve shall consist of two pipe halves with neoprene sponge material bonded to the inside and a bolting arrangement for secure fit around piping. Where temperature exceeds 240°F, an appropriate density fiberglass shall be used in place of neoprene material.
2. Acceptable Manufacturers:
   a. Vibration Mountings and Controls, Inc.

b. Mason Industries.
c. Vibration Eliminator.

J. Seismic Spring Mountings:
1. Steel spring isolator incorporating elastomeric snubbing in all directions. The snubber shall be adjustable in the vertical direction and allow a maximum of ¼" travel in all directions before contacting the elastomer cushion. Spring diameters shall be no less than 0.8 times the compressed height of the spring at rated load. Springs shall also have a minimum additional travel to solid equal to 50% of the rated deflection. Housing shall have provision to adjust the rebound plate and to inspect the spring. Housing shall be of cast ductile iron, malleable cast iron or of welded steel construction. Gray iron castings are not permitted. Springs shall be color coded for proper identification of rated load capacity. Springs shall be coated with a polyester epoxy powder. Hardware shall be stainless steel, or zinc plated.
2. Acceptable Manufacturers:
a. Vibration Mountings and Controls, Inc.
b. Mason Industries.
c. Vibration Eliminator.

K. Seismic Snubbers/Restraints:
1. All-directional seismic snubbers shall include all directional elastomer elements, having a minimum elastomer thickness of ¾" in all directions. Elastomers shall be easy to inspect and shall consist of replaceable elastomer inserts. Elastomer shall be neoprene or a high quality rubber including anti-ozone and anti-oxidant materials and conform to ASTM D2000 Grade 2BC or Bridge Bearing Neoprene. Snubbers shall be manufactured with an air gap between steel and elastomer of 1/8 inch to ¼ inch. Snubbers shall be installed with factory set clearances.
2. Snubber must have at least two anchor bolt holes and shall have an ultimate load capacity of at least four times the rated static load capacity.
3. Acceptable Manufacturers:
a. Vibration Mountings and Controls, Inc.
b. Mason Industries.
c. Vibration Eliminator.

L. Cable Restraints/Single Arm Brace:
1. Steel aircraft cable restraints are designed and installed to limit motion on suspended isolated equipment, piping or ducting. Cable are installed with enough slack to engage only when ¼ inch movement occurs. On suspended equipment, cables are installed in sets of four, located at 45° angles to all three axes. Where required at pipe hangers, cables are placed two at each location, alternating orientation at successive locations. Cable shall be 7x19 galvanized or stainless steel aircraft cable conforming to FED-STD-RR-W-410D.
2. Non-isolated equipment, pipe, and duct shall be seismically restrained with the use of a rigid brace consisting of two steel brackets designed to accept a steel angle or unistrut. Brackets shall provide easy installation by allowing full range of motion in horizontal and vertical directions. Rigid braces with slotted holes or hinges are not acceptable.
3. Acceptable Manufacturers:
a. Vibration Mountings and Controls, Inc.
b. Mason Industries.
c. Vibration Eliminator.

M. Captive Elastomer Mountings:

1. Consist of a captive elastomeric mount molded from neoprene or EPDM compound conforming to the requirements of ASTM D2000. Load bearing elastomer element shall be housed in a cast ductile iron housing. Mount shall incorporate a fail-safe captive design, and shall provide a vertical natural frequency of approximately 8 Hz at rated static load. Mount shall be capable of providing dynamic deflections of up to .5 inches.
2. Acceptable Manufacturers:
    a. Vibration Mountings and Controls, Inc.
    b. Mason Industries.
    c. Vibration Eliminator.

N. Structural Bases:
1. Integral structural steel bases shall be rectangular in shape. All structural members shall be of wide flange, angle or channel steel with depth equal to a minimum of 1/10 of the longest span of equipment, but not less than 6 inches. Built-in adjustable motor slide rails and height saving brackets shall be supplied as in integral part of the base.
2. Acceptable Manufacturers:
    a. Vibration Mountings and Controls, Inc.
    b. Mason Industries.
    c. Vibration Eliminator.

O. Structural Rails:
1. Rails for indoor applications or outdoor applications where equipment supports are mounted on isolation systems shall be of wide flange, angle or channel steel with depth equal to a minimum of 1/10 of the longest span of equipment, but not less than 6 inches. Height saving brackets shall be supplied as an integral part of the rails. For seismic applications rails must be structurally attached to one another.
2. Rails for outdoor applications where weatherproofed isolated equipment supports are required, shall be a continuous structural support rail that combines equipment support and isolation mounting into one unitized assembly. Rails shall incorporate roof-enclosed springs, which are adjustable, removable and interchangeable, after equipment has been installed. The system shall maintain the same installed and operating height with or without the equipment load and shall be capable of being utilized as a blocking device. The entire assembly shall be an integral part of the roof's membrane waterproofing. Unit to be supplied with continuous upper and lower galvanized flashing. Rails shall be cross-braced at support and equipment attachment points when used in seismic zones. Rails shall be bolted or welded to the building steel or anchored to the concrete deck to attain specified acceleration criteria.
3. Acceptable Manufacturers:
    a. Vibration Mountings and Controls, Inc.
    b. Mason Industries.
    c. Vibration Eliminator.

PART 3 - EXECUTION

3.1 GENERAL

A. All vibration isolators and seismic restraint systems must be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.

B. Installation of vibration isolators and seismic restraints must not cause any change of position of equipment or conduit resulting in stresses or misalignment.

C. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.

D. The Design Builder shall not install any isolated equipment, which makes rigid connections with the building unless isolation is not specified. "Building" includes, but is not limited to, slabs, beams, columns, studs and walls.

E. Coordinate work with other trades to avoid rigid contact with the building.

F. Overstressing of the building structure must not occur because of overhead support of equipment. Design Builder must submit loads to the structural engineer of record for approval. General bracing may occur from flanges to structural beams, upper truss cords in bar joist construction and cast in place inserts or wedge type drill-in concrete anchors.

G. Seismic cable restraints shall be installed slightly slack to avoid short circuiting the isolated suspended equipment.

H. Seismic cable assemblies are installed taut on non-isolated systems. Seismic solid braces may be used in place of cables on rigidly attached systems except where single arm braces incorporate resilient bushings.

I. At locations, where seismic cable restraints or seismic solid braces are located, the support rods must be braced when necessary to accept compressive loads.

J. At all locations where seismic cable braces and seismic cable restraints are attached to pipe clevises, the clevis bolt must be reinforced with pipe clevis cross bolt braces or double inside nuts if required by seismic acceleration levels.

K. Vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not permitted.

L. Where piping passes through walls, floors or ceilings, the Design Builder shall provide wall seals or resilient packed pipe sleeves.

M. Special & Periodic Inspections for items listed in Section 1.03 (Article #4) shall be conducted and submitted on a timely basis.

3.2 EQUIPMENT INSTALLATION

A. Equipment shall be isolated and restrained as follows:
   1. The following equipment shall be vibration isolated:
      a. Engine-generator sets.
      b. Transformers.
      c. Uninterruptible power supplies.
   2. All floor-supported equipment shall be seismically braced.
   3. All ceiling suspended equipment shall be seismically braced.
   4. All wall-mounted equipment shall be seismically mounted.
   5. All conduit, cable tray, bus duct and wireway shall be seismically braced.

6. Exhaust piping for engine-generator sets shall be seismically braced.

B. Place floor mounted equipment on 4" high concrete housekeeping pads properly doweled or expansion shielded to the deck to meet acceleration criteria (see Section 1.06). Anchor isolators and/or bases to housekeeping pads. Concrete work is specified under Division 2.

C. Additional Requirements:
1. The minimum operating clearance under bases shall be 2".
2. All bases shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the equipment, isolators and restraints.
3. The equipment shall be installed on blocks to the operative height of the isolators. After the entire installation is complete, and under full operational load, the isolators shall be adjusted so that the load is transferred from the blocks to the isolators. Remove all debris from beneath the equipment and verify that there are no short circuits of the isolation. The equipment shall be free in all directions.
4. Ceilings containing diffusers must meet seismic zone requirements by using earthquake clips or other approved means of positive attachment to secure diffuser to T-bar structure.
5. All floor or wall mounted equipment shall be restrained.

3.3 SEISMIC RESTRAINT OF PIPING, CONDUIT, BUS DUCT AND CABLE TRAY

A. All high hazard and life safety pipe regardless of size such as fuel oil piping shall be seismically restrained. Seismic cable restraints or seismic solid braces may be used. There are no exclusions for size or distance for this category.

B. Seismically restrain all conduit seismic cable restraints or seismic solid braces may be used on unisolated conduit.

C. See the below Table for maximum seismic bracing distances.

TABLE A
SEISMIC BRACING TABLE
ON CENTER SPACING

Equip	Transverse	Longitudinal	Within Each Change Of Direction (Larger of)
Conduit	40 Feet	80 Feet	10 Ft or 15 Diameters
Bus Duct	20 Feet	40 Feet	4 Feet
Cable Tray	40 Feet	80 Feet	10 Feet

D. Multiple runs of conduit on the same support shall have distance determined by calculation.

E. Rod braces shall be used for all rod lengths greater than 3'.

F. Clevis hangers shall have spacer placed inside of hanger at seismic brace locations.

G. Transverse restraint for one conduit section may also act as a longitudinal restraint for a conduit section of the same size connected perpendicular to it if the restraint is installed within 24" of the elbow or TEE or combined stresses are within allowable limits at longer distances.

H. Hold down clamps must be used to attach conduit to all trapeze members before applying restraints.

I. Branch lines may not be used to restrain main lines.

3.4 INSPECTION

A. All independent Special and Periodic Inspections must be performed and submitted on as outlined in Section 1.05.

B. Upon completion of installation of all vibration isolation devices, the local representative shall inspect the completed project and certify in writing to the Design Builder that all systems are installed properly, or require correction. The Design Builder shall submit a report to the Architect, including the representative's report. Certifying correctness of the installation or detailing corrective work to be done.

END OF SECTION

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for furnishing, installing, and protecting identification signs and labels for electrical systems.

B. Related Section:
   1. Section 26 05 00 – Common Work Results for Electrical.
   2. Section 26 05 19 - Low Voltage Electrical Power Conductors and Cables.
   3. Section 26 32 13.13 - Diesel Engine Driven Generators.
   4. Section 26 43 13 - Surge Protective Devices (SPD).
   5. Section 26 28 16.13 - Low-Voltage Enclosed Switches.
   6. Section 26 28 16.19 - Low-Voltage Enclosed Circuit Breakers.
   7. Section 26 29 13 - Enclosed Controllers.
   8. Section 26 24 13 - Paralleling Low Voltage Switchgear.
   9. Section 26 24 16 - Panelboards.

1.2 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI Z535.4, Product Safety Signs and Labels.

B. National Electrical Manufacturer's Association (NEMA):
   1. NEMA 250, Enclosures for Electrical Equipment.

C. National Fire Protection Association (NFPA):
   1. NFPA 70, National Electrical Code (NEC).
   2. NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces.

D. U. S. Government:
   1. Code of Federal Regulations (CFR)
      a. 29 CFR 1910 Occupational Safety and Health Standards.

1.3 DEFINITIONS

A. Mimic bus refers to a graphical representation of the devices and bus work within an item of electric equipment.

1.4 SUBMITTALS

A. Submit the following information for approval in accordance with the requirements of Section 01 33 00 and Section 26 05 00:

1. Product Data:
    a. Provide catalog cuts for the actual products provided, and indicate clearly the usage of each product.
2. Shop Drawings:
    a. Provide a schedule depicting all nametag legends.
    b. Provide drawings of typical nametags.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
    1. Comply with the all applicable requirements of OSHA, but particularly those stated in 29 CFR 1910.144 and 29 CFR 1910.145.
    2. Comply with the requirements of NFPA 70E that are applicable to electrical identification items as listed below in this Specification Section.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protect items from damage during delivery, storage, and handling in accordance with Section 26 05 00 and as detailed below.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide products meeting the specified requirements from one of the following manufacturers, unless otherwise indicated:
    1. Brady Worldwide, Inc., P. O. Box 2131, Milwaukee, WI 53201-2131, Telephone (414) 358-6600.
    2. Seton Identification Products, 20 Thompson Road, P. O. Box 819, Branford, CT 06405-0819, Telephone (800) 243-6624..
    3. LEM Products, Inc.; P. O. Box 190, 4089 Landisville Road, Doylestown, PA 18901, Telephone (800) 220-2400 or (215) 348-9900.

B. To serve as examples of the quality required of the specified products, several Brady Worldwide, Inc. Product Numbers are listed for informational purposes only.

2.2 MATERIALS

A. Laminated Phenolic or Plastic:
    1. Provide rigid, thermosetting resin or polymer material that is heat- and fire- resistant, abrasion resistant, electronically non-conductive, and non-corroding.
    2. Extrude the thermosetting resin or polymer into sheets, and laminate the sheets together so that colored top and bottom layers sandwich a contrasting color core in the middle.

B. Mounting Hardware:
    1. Provide number 10 hex-head machine screws and lock-washers, or hex-head bolts, lock-washers, and nuts for mounting identification nameplates onto electrical equipment.

2. Provide either type 316 stainless steel or brass fasteners; however, all fasteners used on the same nameplate must be of the same material.

2.3 EQUIPMENT IDENTIFICATION NAMEPLATES

A. Provide laminated phenolic or plastic equipment identification nameplates having beveled edges and engraved lettering.
   1. Drill holes for mounting hardware in the equipment identification nameplates as follows:
      a. For nameplates that are more than 2 inches wide, drill four holes.
      b. For nameplates that are more than 1-1/2 inches high, drill four mounting holes.
      c. For smaller nameplates, drill holes for two fasteners.
   2. Provide equipment identification nameplates long enough to ensure that the heads of fastening hardware do not extend beyond the nameplate material, and come no closer than 1/16-inch to the nearest letter of the nameplate legend and no closer than 1/16-inch to the nearest edge.

B. Engrave the following information on each equipment identification nameplate, similar to that shown in Examples 1 and 2 below except appropriate for the specific equipment being identified:
   1. In the first line, indicate the equipment type and identification number.
   2. In the second line, indicate the equipment Voltage, the equipment current if known, the phase, and the number of wires.
      a. If the current is listed, provide a description that further identifies the current, such as "overload protection current", full load amps (FLA), or other information identifying the current indicated.
   3. In the third line, indicate the words "SERVED FROM" followed by the serving equipment and the branch circuit.
      a. If multiple sources serve the equipment, list all sources on succeeding lines.

EXAMPLE 1:

POWER PANELBOARD PPB-2
208/120 VOLTS, 10.8 FLA, 3-PHASE, 4-WIRE
SERVED FROM
PPB-1, CIRCUITS F1 THROUGH T1

      b. If the equipment is supplied through automatic transfer switches and transformers or other items without disconnects, include data on all upstream disconnects; and beneath the sources add the word "THROUGH" followed by the name of the equipment that the sources are connected through.

EXAMPLE 2:

POWER PANELBOARD PPB-2
480/277 VOLTS, 3-PHASE, 4-WIRE
SERVED FROM
BOTH EGS-2 AND MCC-1
THROUGH ATS-1

4. For motor starters, circuit breakers, transformers, and disconnect switches, provide an additional line with the word “SERVES” and the equipment served.

C. Engrave the following information on identification plate for any distribution equipment (i.e. switchboard, panelboard, motor control center, switchgear, etc.).
1. The conductor insulation color coding for feeder and branch circuit wiring originating from each piece of distribution equipment per NFPA 70. Refer to Specification Section 26 05 19 for wire and cable color coding requirements.

EXAMPLE for 208Y/120 volt equipment:

PHASE	COLOR
A	BLACK
B	RED
C	BLUE
GROUNDED CONDUCTOR (NEUTRAL)	WHITE
EQUIPMENT GROUNDING CONDUCTOR	GREEN

D. Engrave equipment identification nameplates with all capital, Helvetica Medium font, or equal, lettering.
1. Provide white letters on a black background, except for warning nameplates provide white lettering centered on red backgrounds.
2. Provide a minimum 1/8-inch border between the nameplate lettering and the tops and bottoms of the nameplates.
3. Use 3/8-inch high letters for the first line, and 1/4-inch letters for succeeding lines; except, in cases where the tag will not fit because the equipment is too small, use 3/16-inch letters for the first line and 1/8-inch letters for succeeding lines.

2.4 CONDUIT AND RACEWAY LABELS

A. Conduit Voltage Markers:
1. Provide conduit markers consisting of polymer-coated cloth tape with a printable top coat and a rubber based pressure sensitive adhesive on the back to provide oil and water resistance, good print durability, and the flexibility to allow it to be wrapped around curved surfaces.
2. Clearly mark the voltages in black lettering on orange colored tape backgrounds.

B. Conduit Wiring System Identification:
1. Provide companion type labeling markers to indicate the wiring system in each raceway and consisting of a vinyl film substrate with a pressure sensitive acrylic adhesive backing.
2. Clearly mark the wiring systems in black lettering on orange colored tape backgrounds.
3. To properly identify each electrical system in the raceway, provide the following, or similar, wording on the labeling markers corresponding to the systems:
   a. For electrical power systems, word the labels "POWER".
   b. For control systems, word the labels "CONTROL".
   c. For instrumentation systems, word the labels "INSTR."
   d. For telephone systems, word the labels "TELEPHONE"
   e. For supervisory control and data acquisition systems, word the labels "SCADA",

f. For local area networks, word the labels "LAN".

C. Conduit Feeder Identification:
1. Provide conduit feeder identification markers consisting of polymer-coated cloth tape with a printable top coat and a rubber based pressure sensitive adhesive on the back to provide oil and water resistance, good print durability, and the flexibility to allow it to be wrapped around curved surfaces.
2. Provide conduit feeder identification labels that identify the feeder circuit with 3/4- inch high black lettering on yellow backgrounds.

D. Conduit and Raceway Label Dimensions:
1. Provide label color field lengths and lettering height as indicated in Table 26 05 53-1:

Table 26 05 53 -1 Conduit and Raceway Label Sizes

Raceway Outside Diameter (Inches)	Background Length (Inches)	Lettering Height (Inches)
3/4 to 2	7	1
1-1/2 to 2	7	1
2-1/2 to 6	14	1-1/4

E. Product Examples:
1. Conduit Voltage Markers: Brady Worldwide, Inc., B-946 custom self-sticking pipe markers or color code tape.
2. Conduit Wiring System: Brady Worldwide, Inc., B-946 custom self-sticking pipe markers or color code tape.
3. Conduit Feeder Identification: Brady Worldwide, Inc., Product Number 31964.

2.5 ARC-FLASH WARNING LABELS

A. Arc Flash Warning Labels shall be prepared in accordance with NFPA 70, NFPA 70E, IEEE-1584 latest editions and ANSI Z535.
1. Minimum label size shall be 4" x 6" as provided by Duralabel or Brady with applicable header information identifying both warning and danger based upon the findings.
2. Minimum information to be included on the Arc Flash label shall consist of the following:
a. Prefaced electrical warning including universal symbol identification, approved safety color, and preface description noting that arc and shock hazard are present. Note where dual labeling is provided/required with the use of arc flash reduction maintenance settings within the equipment, such labels shall be uniquely identified by a different label safety color l, as approved by the Owner. Consult the Owner for acceptable color schemes to be used for the equipment.
b. Statement noting that personnel protective equipment (PPE) requirements are required. Also clearly identify all equipment as “Dangerous” where work on energized equipment is otherwise prohibited and/or where no safe PPE protection so exists.
c. Calculated arc flash hazard boundary, in inches.
d. Calculated arc flash hazard at 18 inches, in calories/cm^2.
e. Arc flash hazard risk category, including descriptive summary of required PPE items necessary for entry into energized equipment.
f. Voltage classification and description of conditions present for shock hazard.

g. Insulated glove classification rating, as required for contact conditions and measurements.
h. Limited approach boundary, in inches.
i. Restricted approach boundary, in inches.
j. Prohibited approach boundary, in inches.
k. Available short circuit current
l. Unique equipment locator identification, corresponding to applicable one-line diagram and ESOD as specified in Section 26 05 00 device abbreviation identifiers.
m. Name, address & phone number of the responsible engineer, engineering company or agency contracted to perform the analysis. Also include the preparer's name, where prepared by a subcontract to the named company or agency contracted to perform the analysis report.
n. Respective contract (job) number for the analysis report.
o. Preparation date of the issued/approved Arc Flash Study (analysis) supporting the equipment labeling, as installed.
p. Suffix cautionary warning that "Changes in equipment settings or system configuration will invalidate the calculated values and PPE requirements."

2.6 DANGER WARNING LABELS:

A. Provide danger signage in accordance with the requirements of 29 CFR 1910.145 and NFPA 70E.
1. For enclosures, provide signs with the caption "DANGER HIGH VOLTAGE KEEP OUT"
2. For fences, provide signs similar to the signs for enclosures, except provide dual language sign captions in both Spanish and English and add Mister Ouch symbols.
3. For poles, provide dual language signs similar to the signs for fences, except add the words "KEEP OFF".

B. Product Examples:
1. Enclosure danger signs: Brady Worldwide, Inc. Product Number 84083.
2. Fence Danger signs: Brady Worldwide, Inc. Product Number 69737.
3. Pole danger signs: Brady Worldwide, Inc. Custom markers.

2.7 MULTIPLE SERVICES WARNING LABELS:

A. Provide a nameplate with black letters on a red background that indicates equipment is fed by two or more sources.

2.8 MIMIC BUS:

A. Provide plastic mimic buses in accordance with the electrical equipment manufacturer's standard practice for the respective equipment.
1. Provide a plastic or plastic tape mimic that is resistive to acids, alkalis, alcohol, chemicals, water, and weathering; and that does not come off after application without the use of a process designed specifically for the purpose.
a. If using plastic tape, provide a type that has a selective sheathing, cloth backing, and a pressure sensitive adhesive with paper backing, similar to Scotchlite Marking Film manufactured by 3M United States.
2. To indicate the various items of electrical equipment, use symbols that are similar to those used in an electrical one-line diagram.

3. Use the following standard colors for the buses indicated:
    a. For normal bus: Blue.
    b. For emergency bus: Red.
    c. For neutral bus: Yellow.
    d. For ground bus: Green.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to installing electrical identification items, verify with the Engineer that the data on each is correct.

3.2 INSTALLATION

A. Wiring Identification:
    1. Identify wiring in conformance with the requirements of Section 26 05 19.

B. Conduit and Raceway Identification:
    1. Identify the wiring systems in conduit and raceway by providing companion type labeling markers to indicate the systems in each.
    2. Identify the Voltages carried in conduit and raceway by providing voltage labeling markers on all accessible raceways.
    3. Identify feeders by providing identification labels.

C. Electrical Box Identification:
    1. For each pull box and junction box, if it is not otherwise indicated, install a laminated phenolic identification nameplate with 1/8-inch letters on a black background above or next to the box identifying its source of power; for example, indicate the panelboard and circuit number supplying power to a box with an identification nameplate.
    2. For each device and outlet box used as a branch circuit junction or pull box provide a legible hand written panel designation and circuit number on exterior of box cover. Utilize a permanent black marker.
    3. For above ground pull boxes and junction boxes, install nameplates adjacent to or above the item in a visible location.
        a. For NEMA 1 and 12 enclosures constructed as specified in NEMA 250, fasten the nameplate to the enclosure using 316 stainless steel screws or an approved equal.
        b. For other than NEMA 1 and 12 enclosures, fasten the nameplate to the enclosure using Seton number15660 adhesive or an approved equal.
    4. For in-ground pull boxes and junction boxes, install nameplates adjacent to or above the item in a visible location and inside the box immediately below the cover.
        a. For NEMA 1 and 12 enclosures constructed as specified in NEMA 250, fasten the nameplate to the enclosure using 316 stainless steel screws or an approved equal.
        b. For other than NEMA 1 and 12 enclosures, fasten the nameplate to the enclosure using Seton number15660 adhesive or an approved equal.

D. Wiring Device Faceplate Labeling:
    1. Outside of faceplate:

a. On receptacle faceplates, provide a label indicating panel designation and circuit number. Utilize a thermal label maker device with clear label tape, font color shall be black and type shall be Arial.

2. Inside of faceplate:
   a. On receptacle and lighting control device faceplates, provide a legible hand written panel designation and circuit number tag. Utilize a permanent black marker.

E. Electrical Equipment Identification:
   1. Provide identification nameplates and an approved mimic bus on the front of the following electrical equipment:
      a. Diesel electric generators, as specified in Section 26 32 13.13.
      b. Surge Protective Devices (SPD), as specified in Section 26 43 13.
      c. Enclosed circuit breakers as specified in Section 26 28 16.19.
      d. Low-voltage enclosed switches as specified in Section 26 28 16.13.
      e. Automatic transfer switches as specified in Section 26 36 23.
      f. Enclosed controllers as specified in Section 26 29 13.
      g. Switchboards as specified in Section 26 23 13.
      h. Panelboards as specified in Section 26 24 16.
   2. Install nameplates in the top center of the front face of the electrical equipment in a visible location.
      a. For NEMA 1 and NEMA 12 enclosures constructed as specified in NEMA 250, fasten the nameplate to the enclosure using 316 stainless steel screws or an approved equal.
      b. For other than NEMA 1 and 12 enclosures, fasten the nameplate to the enclosure using Seton number15660 adhesive or an approved equal.
   3. Provide a manufacturer installed mimic bus; field installed mimic buses are not acceptable.

F. Arc-Flash Warning Signage:
   1. For each arc location or circuit analyzed as part of the Arc Flash Study in Section 26 05 00, provide Arc Flash Warning labels.

G. High Voltage Warning Signage:
   1. Install high voltage warning signage on all personnel entry points to electrical rooms or fenced electrical areas, and on all equipment enclosures within those spaces.
      a. Install high voltage warning signage on all fence gates and every 10 feet on the perimeter fence around electrical areas.
      b. Install high voltage warning signage on both sides of all electrical poles.

H. Multiple Services Warning Signage:
   1. Within existing switchgear and on the tie circuit-breaker compartment of new switchgear and transfer devices, mark each panelboard with a nameplate indicating that this equipment is fed by two sources.

END OF SECTION

SECTION 26 05 63 - ACCEPTANCE TESTING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: The work specified in this Section consists of materials to performance test electrical systems and equipment.
   1. Items Supplied Under This Section:
      a. Daylight Dimming Controls
      b. Occupancy Sensor Controls
      c. Electrical System Testing
      d. Thermographic Testing
      e. Ground System Testing
      f. Insulation Testing
      g. Equipment Testing
      h. Performance Test
      i. Test Procedure
      j. Test Report

B. Related Sections:
   1. Division 1 – General Requirements
   2. Division 26 Sections, As Applicable

1.2 REFERENCES

A. Applicable Documents and Testing Requirements of:
   1. America National Standards Institute (ANSI): as applicable, including:
      a. ANSI C2, National Electrical Safety Code.
      b. ANSI Z244.1 American National Standards for Personnel Protection.
   2. National Electrical Manufacturer's Association (NEMA): as applicable, including:
      a. NEMA ICS 2.3 - Instructions for the Handling, Installation, Operation and Maintenance of Motor Control Centers.
      b. NEMA ICS 7.1 - Safety Standards for Construction and Guide for selection, Installation, and Operation of Adjustable Speed Drive Systems.
      c. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
      d. NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.
   3. American Society for Testing and Materials (ASTM), as applicable.
   4. Institute of Electrical and Electronics Engineers (IEEE), as applicable, including:
      a. IEEE C.57.13, IEEE Standard Requirements for Instrument Transformers.
   5. National Fire Protection Association (NFPA), as applicable, including:
      a. NFPA 70 - National Electrical Code (NEC).
      b. NFPA 70E - Electrical Safety Requirements for Employee Workplaces.
      c. NFPA 72 - National Fire Alarm Code (NFAC).
   6. International Electrical Testing Association (IETA) as applicable, including:

a. Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems.

7. Insulated Cable Engineer's Association (ICEA), as applicable.
8. State and Local Codes and Ordinances as applicable
9. Occupational Safety and Health Administration (OSHA), as applicable, including: Title 29, Parts 1907, 1910 and 1936.
10. International Electrical Testing Association (IETA) as applicable, including:
    a. ATS-2009: Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems.
    b. MTS-2007: Maintenance Testing Specifications for Electric Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. Submit documentation as required by this Section of the Contract to the Design Engineer in strict accordance with the provisions of Section 26 05 00 for review, comments and subsequent approval.

B. Submission to include the following:
1. Field inspection report as required for each item of material and/or equipment outlined herein.
2. Manufacturer's directions for use of ground megger with proposed method indicated.

C. Test Reports:
1. Each test report prepared by the respective testing firm(s) comply, where applicable, to all stipulations specified in Section 26 05 00 for Operation, Maintenance and Installation Manuals with reference to preparation, paper requirements, indexing and binders. Include in each test report the following:
    a. Summary of project.
    b. Description of equipment tested.
    c. Description of test.
    d. Test results.
    e. Conclusions and recommendations.
    f. Appendix, including appropriate test forms.
    g. Identification of test equipment used.
    h. Signature of responsible test organization authority.
    i. Furnish five copies of each completed report to the Design Electrical Engineer no later than 30 days after completion of each test. Assemble and certify the testing firm each final test report, which must be submitted to the Design Engineer for review, comments and subsequent approval.

1.4 QUALITY ASSURANCE

A. Qualifications of Testing Laboratory: Select an independent nationally recognized testing laboratory that is independent from electrical Design Builder that either is a member of The International Electrical Testing Association or meets the following qualifications:
1. Is nationally recognized as an electrical testing laboratory.
2. Has been regularly engaged in the testing of electrical systems and equipment for at least 5 years.
3. Is independent from the electrical Design Builder, the Owner, the Engineer and all other Design Builders on the job.

4. Has at least one Professional Engineer on staff that is licensed in the State where the project site is located.
5. Derives more than 80 percent of its income from electrical testing.
6. Owns or leases sufficient calibrated equipment to do the testing required.
7. Has a means to trace all test instrument calibration to The National Institute of Standards and Technology.

B. Membership in the International Electrical Testing Association (NETA) shall be considered evidence of meeting items A. 1. through and including A. 5.

C. Testing shall be done under the supervision of a technician certified by International Electrical Testing Association or by technicians that are both certified by the National Society of Professional Engineers and experienced in electrical testing with 5 years of testing experience.

D. The testing laboratory shall supervise or perform all testing of equipment and oversee setting of all circuit breakers and calibration of all instruments.

E. The testing firm used must be approved by the Engineer.

F. Include the cost of such tests in the Design Builders Bid Price for the applicable bid item.

1.5 GENERAL REQUIREMENTS

A. Field Inspection:
1. This Design Builder is responsible for a complete inspection of all equipment, prior to testing and energizing to ascertain that it is free from any damage, scratches, or missing components and that all power connections are correct, and that they are tight in conformance with recommended standard practice. The inspection is to also include a check of control wiring, terminal connections and all bolts and nuts.
2. Perform field inspection by this Design Builder during a time when the Field Engineer and the Design Engineer are present to witness each inspection and its performance.
3. Correct any deficiencies found during the inspection by this Design Builder prior to the energizing and testing of the equipment.

1.6 SCHEDULING

A. Schedule all testing with work of other Design Builders to ensure an orderly sequence of startup and completion of work.

1.7 UNDERGROUND CONDUIT SYSTEM INSPECTION

A. General Requirements: Perform inspection of the underground conduit systems installation by a representative of the Engineer as the work progresses. Inspect each of the following prior to proceeding to the next phase of the installation.
1. Trench bed.
2. Lower sand bed.
3. Lower concrete protection slab, where indicated or required.
4. Upper sand bed for conduits.
5. Each layer of conduits.

6. Soil backfill.
7. Warning Tape.
8. Soil backfill.

B. Failure to comply with any of the above, indicated sequential inspection requirements is just cause for the Engineer to request removal of the work and reinstall as per these specifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 ELECTRICAL INSPECTIONS AND TESTS

A. Perform, supervise, and furnish all test equipment needed to perform tests and provide safety measures, procedures and equipment required for each test.

B. Schedule all testing with the Engineer. Perform testing in the presence of the Engineer except when the Engineer approves in writing conducting a specific test without the Engineer's presence.

C. Notify all involved parties including the Engineer prior to tests, advising them of the test to be performed and the scheduled date and time.

D. Coordinate the tests with others involved.

E. Prepare written test procedures and forms used in the test reports and submit for approval prior to commencement of testing.

F. Include in each test report the following information:
1. Job title.
2. Date of test.
3. Equipment, system or cable identification.
4. Type of test.
5. Description of test instrument and date of latest calibration.
6. Section of specification defining test along with description of test and evaluations as reported by the testing company.
7. Test results (correct all readings at 20 degrees C).
8. Signature of person supervising test.
9. Signature of Design Builder.
10. Space for Engineer's signature.

G. Refer to individual tests and inspections hereinafter specified for any additional or specified requirements.

H. Test Instrument Calibration:
1. The testing firm is to have a calibration program, which assures that all applicable test instrumentation are maintained within rated accuracy.
2. The accuracy is to be directly traceable to The National Institute of Standards and Technology.
3. Instruments are to be calibrated in accordance with the following frequency schedule.

a. Field Instruments: Analog - 6 months maximum Digital - 12 months maximum
b. Laboratory Instruments: 12 months
c. Leased specialty equipment: 12 months

4. Make dated calibration labels visible on all test equipment.
5. Keep records up-to-date, which show date and results of instruments calibrated or tested.
6. Maintain an up-to-date instrument calibration instruction and procedure for each test instrument.
7. Calibrating standard is to be of higher accuracy than that of the instrument tested.

I. Safety and Precautions:
1. Safety practices are to include, but are not limited to, the following requirements:
a. Occupational Safety and Health Act of 1970-OSHA.
b. Accident Prevention Manual for Industrial Operations, National Safety Council, Chapter 4.
c. Applicable State and Local safety operating procedures.
d. IETA Safety/Accident Prevention Program.
e. Owner's safety practices.
f. National Fire Protection Association - NFPA 70E.
g. ANSI Z244.1 American National Standards for Personnel Protection.
2. Perform all tests with apparatus de-energized except where otherwise specifically required.
3. The testing firm is to have a designated safety representative on the project to supervise operations with respect to safety.

3.2 TESTING TO BE PERFORMED BY THE DESIGN BUILDER

A. Daylight Dimming Controls
1. Parties responsible to execute functional test:
a. Controls Design Builder: operate the controls
b. Electrical Design Builder: assist in testing sequences
c. Commissioning authority: to witness, direct and document testing.
2. Functions / modes required to be tested and test methods: The following testing requirements are an addition to and do not replace any testing requirements elsewhere in this Division.

Function / Mode	Test Method Manual (demonstration)
MISCELLANEOUS FUNCTIONS	
1. All specified functions and features are set up, debugged and fully operable.	Verbal discussion of features
2. Power failure and battery backup and power-up restart functions.	Demonstration
3. Occupant over-ride functions and duration setting.	Demonstration
4. Scheduling features fully functional and setup, including holidays.	Observation in terminal screens or printouts
5. Date and time setting in central computer.	Demonstration
DIMMING FUNCTIONS	
6. Test the sequence of operation for all features and modes.	Manual

7.	Test the dimming controls during "live" conditions verifying that amperage changes in light fixtures are proportional to external light changes, and that the light levels at the specified datum points remain within specified limits. Verify this over a broad area for all areas affected. Verify that all, and only, specified light fixtures are dimming.	Demonstration
8.	Verify that delays and ramp times are set and functioning so that the speed of change of light fixture output is slow enough to be judged non-bothersome to occupants.	Manual/ Demonstration
9.	Verify that dimming does not cause lower than specified light levels in adjacent "non-dimmed" spaces.	Manual
10.	Verify that the controls and sensors are not easily overridden or disabled by occupants.	Visual inspection
11.	Verify that the photo sensor is in an adequate location and is not being affected by direct sunlight or obstructions.	Visual inspection

3. Acceptance Criteria:
   a. For the conditions, sequences and modes tested, the dimming controls, integral components and related equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.
4. Sampling Strategy for Identical Units:
   a. Each photosensor and its controlled zone must be tested (no sampling).

B. Occupancy Sensor Controls
1. Parties responsible to execute functional test:
   a. Controls Design Builder: operate the controls
   b. Electrical Design Builder: assist in testing sequences
   c. Commissioning authority: to witness, direct and document testing.
2. Functions / modes required to be tested and test methods: The following testing requirements are an addition to and do not replace any testing requirements elsewhere in this Division.

Function / Mode	Test Method Manual (demonstration)
MISCELLANEOUS FUNCTIONS	
1. All specified functions and features are set up, debugged and fully operable.	Verbal discussion of features
2. Power failure and battery backup and power-up restart functions.	Demonstration
3. Occupant over-ride functions and duration setting.	Demonstration
4. Scheduling features fully functional and setup, including holidays.	Observation in terminal screens or printouts
5. Date and time setting in central computer.	Demonstration
OCCUPANCY SENSOR FUNCTIONS	
6. Verify 100% of occupancy sensors cover the entire space at its mounting location and adjusted angle.	Manual/Demonstration
7. Verify 100% of passive infra-red sensor types have their lens adjusted for the space geometry and size of space. Verify their sensitivity is adjusted for coverage of entire space.	Manual

8.	Verify 100% of ultrasonic sensor types have their sensitivity adjusted for coverage of entire space.	Manual
9.	Verify sensitivity adjustment for both types of sensors does not trigger nuisance trips from air diffusers close to the sensor.	Manual/Demonstration
10.	Verify sensitivity adjustments for both types of sensors eliminates trips from movement in adjacent space.	Manual/Demonstration
11.	After room lighting circuit is triggered on from an occupancy sensor, confirm programmed delay off time is functional. Temporarily reprogram the delay off time to expedite testing. If reprogrammed, verify final programmed delay off time matches specifications.	Manual/Demonstration

3. Acceptance Criteria:
   a. For the conditions, sequences and modes tested, the occupancy controls, integral components and all related equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.
4. Sampling Strategy for Identical Units:
   a. Of the total controlled room lighting circuits, 10% should be tested to confirm occupancy sensor controls. If 10% of the first group fails the test, select another 10% of the total room lighting circuits. If the 10% of these rooms fail, test all remaining rooms fully at the Design Builder's expense.

C. Continuity Test: Make test for continuity and correctness of wiring and identification on all conductors installed.

D. Wire and Cable:
1. Test all wires and cables sized No. 2 and larger in accordance with NETA ATS- 2009.
2. Perform visual, mechanical, and electrical tests on all No. 4 and No. 6 power cables that operate at voltages exceeding 150 volts to ground in accordance with NETA ATS-2009.
3. Perform visual, mechanical, and electrical tests on all other wires and cables in accordance with NETA ATS-2009.
4. Replace any wires which have been damaged.
5. Correct causes of all readings which do not meet the acceptable minimum insulation readings are as stated in NETA ATS-2009. Exceed the nominal expected temperatures for the actual load.
6. Retest items requiring correction.

E. Surge Protective Device (SPD):
1. Visually and mechanically inspect the SPD unit and connections.
2. Use an AC voltmeter to check all voltages and ensure that normal operating voltages of the power system match the voltage rating on the SPD nameplate.
3. Check LED status indicators on the display panels and suppression modules to confirm normal status.
4. Press the alarm test button to confirm the audible alarm and LED.
5. Operate the alarm silence switch to confirm proper operation.

F. Ground Fault Circuit Interrupter (GFCI) Receptacles:
1. Test all GFCI receptacles as specified in Section 26 27 26.

G. Initial Mechanical Performance Test

1. Provide on-site electricians and support to the general Design Builder during the mechanical performance test.
2. With the personnel of the Owner observing, demonstrate to the satisfaction of the Engineer the mechanical performance of each item of equipment when operated in accordance with the design intent indicated by the Drawings and described in the applicable sections of the Specifications.
3. Correct all deficiencies and demonstrate that they have been corrected.
4. Without reliance on Owner's personnel, operate and maintain the equipment in continuous, day to day, 24 hour operation until commencement of the Final Mechanical Performance Test.
5. During this interim, instruct and train the Owner's personnel in their duties.
6. Final Mechanical Performance Test: During a 48-hour period.
    a. With equipment in continuous normal operation, under supervision turn operation of the plant over to the personnel of the Owner beginning with the final tests.
    b. Demonstrate that equipment is coordinated and that installation complies with the applicable Drawings and Specifications.
    c. Measure all major feeders, the total power, total power factor, current on all lines, and voltage, phase and phase to ground, and on all phases.
    d. Measure all motors over 5 horsepower, power, power factor and voltage under load.
    e. Correct all deficiencies and demonstrate that they have been corrected.
    f. Owner will pay operating costs for the Final Mechanical Performance Tests.
    g. Test will be considered complete after a continuous 48-hours of satisfactory operation without any failure of equipment.

H. Test Interim:
1. Design Builder's Personnel, without reliance of Owner's Personnel, are to operate and maintain the equipment in continuous, day to day, 24 hour operation except as otherwise approved by the Engineer until commencement of the Final Mechanical Performance Test.
2. During this interim the Design Builder's Personnel are to instruct and train the Owner's Personnel in their duties.

I. Final Mechanical Performance Test: Final Mechanical Performance Test is to cover a 48 hour period while the plant is in continuous, normal operation.
1. With equipment in continuous, normal operation, the Personnel of the Owner are to assume day to day operation of the equipment under the direct supervision of the Design Builder's Personnel beginning with the Final Tests.
2. Design Builder's Personnel are to demonstrate to the satisfaction of the Engineer that equipment is coordinated and that installation complies with the applicable Drawings and Specifications.
3. Performance Tests are to be considered concluded at the end of the forty-eight hour period designated for the tests if the Engineer is satisfied with the test results or should deficiencies be found as a result of said test, then when the deficiencies have been corrected to the satisfaction of the Engineer.

J. Operating Costs: Costs for Final Mechanical Performance Tests: The Owner will pay operating costs for the Final Mechanical Performance Tests except those costs for chemicals required to complete Process Performance Tests and Acceptance Tests, if required on equipment.

3.3 TESTING TO BE PERFORMED BY THE TESTING LABORATORY

A. Select, hire and pay an independent nationally recognized electrical testing laboratory to perform all testing specified in this article. Obtain Owner's approval of the testing laboratory and the testing laboratory proposed test procedure prior to commencement of any tests.

B. Set all adjustments for all overcurrent protection devices in accordance with the protection and coordination study of Section 26 05 00.

C. Visually and mechanically inspect and electrically test items as scheduled in attached schedule for equipment in attached schedule equipment as listed in attached schedule in using the procedures of NETA ATS-2009. When a test for a particular item is not called out in ATS, test using the procedures in NETA MTS-2007.

D. Thermographic Inspection:

1. Perform thermographic inspection of the electrical equipment and installations as listed below in accordance with NETA ATS-2009, and as detailed below. The following equipment is to be scanned:

a.	Switchboards	all ratings
b.	Switchgear	all ratings
c.	Service Entrance Panelboards	all ratings
d.	Distribution Panelboards	50-Ampere and larger
e.	Lighting Panelboards	50-Ampere and larger
f.	Power Panelboards	50-Ampere and larger
g.	Motor Control Centers	all ratings
h.	Dry Type Transformers	10 kVA and Larger
i.	Individually Mounted Circuit Breakers	100 amp and larger
j.	Disconnect Switches	100 amp and larger
k.	Individually Mounted Motor Starters	Size 1 and larger
l.	Motors	30 HP and larger

2. Provide report including the following items:
   a. Items scanned
   b. Whether item passed or failed
   c. All items in NETA ATS-2009
   d. The probable cause
   e. Severity of defect
   f. Recommended corrective measures
   g. Video recording of test.
3. Scan using an infrared camera with video scanner output to a display screen with a range of at least 1 degree C to 75 degrees C with an accuracy of 0.1 degree C and with the following equipment:
   a. One 7 degree telephoto lens
   b. One 20 degree wide angle lens
   c. One 40 degree extra-wide angle lens
4. Record output of camera during testing onto a DVD or store digital images of each piece of equipment inspected onto a CD as a record of the temperature variations. Record either by order or by digital imprinting the actual equipment being scanned. Turn off recordings during inactive periods or edit DVD to eliminate dead periods.
5. Display data on a monitor capable of providing both a gray step mode and color monitor. These capabilities allow distinct temperature levels to be shown in black and white and color on the thermogram.

6. Submit three copies of report and two copies of the DVD or CD.
7. Include DVD or CD of thermographs of the defective equipment and installations. Also include in report.
8. Submit both copies of the report to the Engineer who will make the determination of corrective measurements.

E. Lighting Tests
1. Emergency, standby, equipment and lighting test-trip all incoming utility power and ascertain that all standby and emergency equipment operates. Additionally measure lighting levels on all egress paths, at each stair landing at middle of stairs, at changes in direction at doorways and every 25' along path. Replace and correct defective equipment. However report lighting levels to engineer. Correction of low lighting levels will be by change order as needed. Operate battery systems for emergency lighting without power for 90 minutes and correct all defects and retest.

F. Medium Voltage Switchgear Tests:
1. Visually and mechanically inspect and electrically test all medium voltage switchgear, in accordance with NETA ATS-2009.
2. Acceptable values are as stated in NETA ATS-2009.
3. Test all components as specified in this Section.

G. Medium Voltage Motor Controller Tests:
1. Visually and mechanically inspect and electrically test all medium voltage switchgear, in accordance with NETA ATS-2009.
2. Acceptable values are as stated in NETA ATS-2009.
3. Test all components as specified in this Section.

H. Liquid Filled Transformers Tests:
1. Visually and mechanically inspect and electrically test liquid filled transformers in accordance with NETA ATS-2009.
2. Acceptable values are as stated in NETA ATS-2009.

I. Metal Enclosed Medium Voltage Air Switch Tests:
1. Visually and mechanically inspect and electrically test all medium voltage air switches rated over 600 volts in accordance with NETA ATS-2009.
2. Acceptable values are as stated in NETA ATS-2009.

J. Low Voltage Molded Case Circuit Breaker Tests:
1. Visually and mechanically inspect and electrically test all low voltage circuit breakers in frame sizes rated 100-amperes or more in accordance with NETA ATS-2009.
2. Acceptable values are as stated in NETA ATS-2009.

K. Instrument Transformer Tests:
1. Visually and mechanically inspect and electrically test all instrument transformers in accordance with NETA ATS-2009.
2. Acceptable values are as stated in NETA ATS-2009.

L. Metering Tests:
1. Visually and mechanically inspect and electrically test all meters using standards traceable to The National Institute of Standards and Technology in accordance with NETA ATS-2009.
2. Meters should be accurate to within their stated calibration.

M. Grounding Electrode System Tests:
1. Visually and mechanically inspect and electrically test all made grounding electrode systems in accordance with NETA ATS-2009. For the point-to-point tests of NETA ATS-2009, measurements are only required for equipment conductors run with services, and feeders and branch circuits rated over 400 amperes.
2. Determine acceptable values as follows:
   a. Main service entrance ground: 5 ohms.
   b. Emergency/standby generator ground grid: 5 ohms.
   c. Panelboards ground bus: 10 ohms.
   d. Manhole ground rod electrodes: 25 ohms
   e. Prior to the electric service being energized and prior to the installed products being covered, measure the ground system resistance to earth in the presence of the Engineer.
   f. Grounds not otherwise covered in this Specification with a maximum of 25 ohms.
   g. For continuity tests, determine the acceptable value for the equipment grounding conductor by the following formula:

$$R_{EquipGndCond} \leq 0.1x\frac{V_{LineToGnd}}{I_{OverCurrentProtection}}$$

Where the following definitions apply:

$R_{equipGndCond}$ = The measured resistance of the Equipment Grounding Conductor.

$V_{linetoGnd}$ = The Nominal Line to Ground Voltage of the circuit or feeder.

$I_{overcurrentprotection}$= The Trip, or Melting Current of the overcurrent protective device for the circuit.

N. Medium Voltage Surge Arrectors Tests:
1. Visually and mechanically inspect and electrically test all medium voltage surge arrectors in accordance with NETA ATS-2009.
2. Acceptable values are as stated in NETA ATS-2009.

O. Low Voltage Switchboard Tests:
1. Visually and mechanically inspect and electrically test all low voltage switchboards in accordance with NETA ATS-2009.
2. Acceptable values are as stated in NETA ATS-2009.
3. Test all components as specified in this Section.

P. Motor Control Centers
1. Visually and mechanically inspect and electrically test all low voltage motor control centers in accordance with NETA ATS-2009.
2. Acceptable values are as stated in NETA ATS-2009.
3. Test all components as specified in this Section.

Q. Dry-Type Transformers Tests:

1. Visually and mechanically inspect and electrically test low voltage dry-type transformers in sizes rated over 7.5 kVA, 3-phase and rated less than 500 kVA, 3-phase in accordance with NETA ATS-2009.
2. Acceptable test values are as stated in NETA ATS-2009.

R. Ground Fault Protection Testing:
1. Visually and mechanically inspect and electrically test all ground fault protection systems in accordance with NETA ATS-2009.
2. Acceptable test values are as stated in NETA ATS-2009.

S. AC Motor Testing:
1. Visually and mechanically inspect and electrically test all AC motors rated 10- horsepower or more in accordance with NETA ATS-2009.
2. Acceptable test values are as stated in NETA ATS-2009.
3. Immediately report all motors, which fail inspection to the Engineer for correction.

T. Low Voltage Motor Starter Tests:
1. Visually and mechanically inspect and electrically test all low voltage motor starters rated 10-horsepower or more in accordance with NETA ATS-2009.
2. Acceptable values are as stated in NETA ATS-2009.

U. Voltage Adjustment:
1. Measure the plant voltage with the plant operated at both no load and at nominal load at the following locations.
    a. Main Distribution Switchboard.
    b. Each panelboard bus.
2. Adjust all transformer taps to bring the no-load voltage above nominal, but in no case, higher than 105.8% of nominal. Adjust the operated loaded voltage to a value above 91.7%, (ANSI Range A), with only momentary excursions to a maximum of 105.8% and a minimum of 88.3% for all loads and 86.7% for motor loads. (ANSI Range B).
3. After all adjustments have been made, re-measure all voltages.
4. For record purposes measure and record on all 3-phases, actual plant load at all switchboard and panelboard buses.
5. With a minimum/maximum recording voltmeter measure starting voltage dip for the largest motor at:
    a. Starter terminals.
    b. Panelboard.
    c. Main Distribution Switchboard.
6. Measure minimum/maximum/average voltage at Main Distribution Switchboard over a 24 hour period with the plant running on at least one phase with recording voltmeter.

V. Harmonic Testing
1. Conduct harmonic testing at:
    a. Main Distribution Switchboard.
    b. Points of Common Coupling (PCC). PCC defined as nearest switchboard or panelboard which directly serves each variable frequency drive.
    c. Generator terminals.
    d. Transformer primary terminals.
2. Measure and record the following data at each location where harmonic testing is required:
    a. Current Distortion: Total harmonic distortion (THD) and individual harmonic components up to and including the 35^{th} harmonic.

b. Voltage Distortion: Total harmonic distortion (THD) and individual harmonic components up to and including the 35th harmonic.
c. Voltage Notching: Notch area (volt-microseconds) and depth (volts).
d. For record purposes measure and record on all 3-phases, actual plant load at all switchboard and panelboard buses.

3. Conduct harmonic testing with harmonic producing loads in operation. Record the following information for variable frequency drives, taken at the time harmonic distortion measurements are made:
   a. Output frequency.
   b. Output current.
   c. Output voltage.
   d. Output power factor when motor metering includes this capability.
4. Conduct harmonic testing with variable frequency drives operating at full load and half load.
5. Test report shall include the following calculated values at each location where harmonic testing is required:
   a. Total demand distortion (TDD).
   b. Individual harmonic current distortion in percent of the maximum demand load current up to and including the 35th harmonic.

W. Power Conditioning Units Testing:
1. Visually and mechanically inspect the power conditioning unit and connections.
2. Tests and measurements shall be made at the panelboard immediately downstream from the power conditioning unit. Voltages shall be measured and recorded for all three phases.
3. Tests:
   a. Steady state voltage regulation for steady state loads varying from no load to full load. Acceptable test result: +/- 1.0%.
   b. Step voltage regulation for 25% step load, 50% step load and 100% step load. Acceptable test result: +/- 5.0%, +/- 8.0% and +10/-8%, respectively.
   c. Step load recovery time to +/- 1.0% voltage with up to 100% step. Acceptable test result: Within 1 cycle.
   d. Voltage distortion: Total harmonic distortion (THD) and individual harmonic components up to and including the 35th harmonic. Acceptable test result: 5.0% total harmonic distortion, 3% any single frequency.
   e. Phase angle with up to 30% unbalanced load. Acceptable test result: +/- 3.0%.
4. For record purposes measure and record on all 3-phases, actual voltage and voltage distortion (total harmonic distortion and individual harmonic components up to and including the 35th harmonic) at the input to the power conditioning unit.

3.4 TESTING TO BE PERFORMED BY MANUFACTURER'S REPRESENTATIVE

A. Emergency Generator Tests:
1. On completion of the installation, the initial start-up shall be performed by a factory-trained representative of the generator supplier. Two copies of operating and maintenance instruction books shall be supplied for the test of the generator set and such auxiliary equipment as may require same.
2. Provide equipment manufacturer's certification that the power generation equipment is installed, inspected, tested, adjusted and approved satisfactory by equipment manufacturer's service engineer.
3. Provide lubricating oils, lubrication, coolant water treatment and anti-freeze solution, Prestone or as approved, to -30 degrees F. (1 degree C.) fuel, electrical instruments, portable

load bank, etc., as required for tests. Load bank shall be similar to those manufactured by Avtron Manufacturing Inc., Cleveland, Ohio.

4. With Owner's operating personnel observing, demonstrate to the satisfaction of the Engineer the mechanical performance of power generation equipment, when operated in accordance with design intent of the Drawings and Specifications, and when tested with a portable load bank as follows:
   a. Start and idle for ten minutes.
   b. Operate generator set at 25 percent rated load for 10 minutes.
   c. Operate generator set at 50 percent rated load for 30 minutes.
   d. Operate generator set at 75 percent rated load for 30 minutes.
   e. Operate generator set at 100 percent rated load for three hours.
5. Record voltage, frequency, load current, oil pressure and coolant temperature at periodic intervals during test.
6. Prior to acceptance, any defects, which become evident during this test shall be corrected by this Design Builder at no additional cost to the Owner.
7. After acceptance of performance test:
   a. Change oil, oil filters and fuel filters.
   b. Fill fuel tanks.
   c. Provide one complete spare set of filters and related gaskets as specified hereinbefore.
   d. Instruct Owner's personnel regarding equipment operation and maintenance procedures.
8. Furnish copies of complete lists of spare parts and special tools recommended for 2 years of normal operation of the complete system including the manufacturer's name, addresses, catalog numbers and prices.

B. Automatic Transfer Switch Tests:
1. On completion of the installation, the initial start-up shall be performed by a factory-trained representative of the generator supplier. Two copies of operating and maintenance instruction books shall be supplied for the test of the automatic transfer switches.
2. Provide equipment manufacturer's certification that the automatic transfer switch equipment is installed, inspected, tested, adjusted and approved satisfactory by equipment manufacturer's service engineer.
3. Visually and mechanically inspect and electrically test automatic transfer switches in accordance with NETA ATS-2009.
4. Acceptable values are as stated in NETA ATS-2009.
5. Instruct Owner's personnel regarding equipment operation and maintenance procedures.
6. Furnish copies of complete lists of spare parts and special tools recommended for 2 years of normal operation of the complete system including the manufacturer's name, addresses, catalog numbers and prices.

C. AC Variable Frequency Drive (VFD) Tests:
1. On completion of the installation, the initial start-up shall be performed by a factory-trained representative of the AC drive manufacturer. Two copies of operating and maintenance instruction books shall be supplied for the test of the AC drives.
2. Provide equipment manufacturer's certification that the AC drives are installed, inspected, tested, adjusted and approved satisfactory by equipment manufacturer's service engineer.
3. Instruct Owner's personnel regarding equipment operation and maintenance procedures.
4. Furnish copies of complete lists of spare parts and special tools recommended for 2 years of normal operation of the complete system including the manufacturer's name, addresses, catalog numbers and prices.

D. Active Harmonic Filters Tests:
   1. On completion of the installation, the initial start-up shall be performed by a factory-trained representative of the Active Harmonic Filters manufacturer. Two copies of operating and maintenance instruction books shall be supplied for the test of the Active Harmonic Filters.
   2. Provide equipment manufacturer's certification that the Active Harmonic Filters are installed, inspected, tested, adjusted and approved satisfactory by equipment manufacturer's service engineer.
   3. Instruct Owner's personnel regarding equipment operation and maintenance procedures.

E. Furnish copies of complete lists of spare parts and special tools recommended for 2 years of normal operation of the complete system including the manufacturer's name, addresses, catalog numbers and prices.

3.5 CORRECTION OF DEFICIENCIES

A. Report all unacceptable values immediately. Correct all deficiencies found in work of this contract and separately report deficiencies in work of items of other contracts.
   1. Retest items requiring correction. Correct or have corrected any remaining deficiencies and retest until work is acceptable.

3.6 RETESTING

A. After equipment has been in service for a period of nine months repeat the following tests:
   1. Thermographic testing. Correct all causes of readings above the nominal expected reading for the load encountered.
   2. Insulation tests of all motors over 100 horsepower, switchgear, switchboards, and transformers over 50 kVA.

END OF SECTION

[This Page Left Intentionally Blank]

SECTION 26 24 13 - SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Surge protection devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.

1.2 ACTION SUBMITTALS

A. Product Data: For each switchboard, overcurrent protective device, surge protection device, ground-fault protector, accessory, and component.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Detail utility company's metering provisions with indication of approval by utility company.
6. Include evidence of NRTL listing for series rating of installed devices.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
9. Include schematic and wiring diagrams for power, signal, and control wiring.

C. Delegated Design Submittal:

1. For arc-flash hazard analysis.
2. For arc-flash labels.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Seismic Qualification Data: Certificates, for switchboards, overcurrent protective devices, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.4 Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. Testing Agency Qualifications: Member company of NETA or an NRTL.

1.7 FIELD CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 104 deg F.

b. Altitude: Not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.

3. Do not proceed with interruption of electric service without Owner's written permission.
4. Comply with NFPA 70E.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

B. Manufacturer's Warranty: Manufacturer's agrees to repair or replace surge protection devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Shake-table testing shall comply with ICC-ES AC156.
2. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 SWITCHBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton
2. General Electric Company
3. Siemens Industry, Inc.
4. Square-D by Schneider Electric

B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Comply with NEMA PB 2.

E. Comply with NFPA 70.

F. Comply with UL 891.

G. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted..
2. Sections front and rear aligned.

H. Nominal System Voltage: 208Y/120 V.

I. Main-Bus Continuous: Ampere rating as indicated on Contract drawings.

J. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Shake-table testing shall comply with ICC-ES AC156.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

K. Indoor Enclosures: Steel, NEMA 250, Type 1.

L. Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.

1. Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point.
2. Space-Heater Power Source: Transformer, factory installed in switchboard.

M. Service Entrance Rating: Switchboards intended for use as service entrance equipment shall contain from one to six service disconnecting means with overcurrent protection, a neutral bus with disconnecting link, a grounding electrode conductor terminal, and a main bonding jumper.

N. Utility Metering Compartment: Barrier compartment and section complying with utility company's requirements; hinged sealable door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.

O. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

P. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

Q. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from the front of the switchboard.
2. Phase- and Neutral-Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy with tin-plated aluminum circuit-breaker line connections.
3. Tin-plated aluminum feeder circuit-breaker line connections.
4. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with compression connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
5. Ground Bus: Minimum-size required by UL 891**,** hard-drawn copper of 98 percent conductivity, equipped with compression connectors for ground conductors.
6. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
7. Disconnect Links:

    a. Isolate neutral bus from incoming neutral conductors.
    b. Bond neutral bus to equipment-ground bus for switchboards utilized as service equipment or separately derived systems.

8. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with compression connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.

R. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

2.3 SURGE PROTECTION DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advanced protection Technologies
2. Eaton
3. General Electric Company
4. Siemens Industry, Inc.
5. Square-D by Schneider Electric

B. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 1.

C. Features and Accessories:

1. Integral disconnect switch.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Indicator light display for protection status.
4. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
5. Surge counter.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 320 kA per phase. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V for 208Y/120 V.
2. Line to Ground: 1200 V for 208Y/120 V.
3. Line to Line: 1000 V for 208Y/120 V.

F. SCCR: Equal or exceed 200 kA.

G. Nominal Rating: 20 kA.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long and short time adjustments.
    d. Ground-fault pickup level, time delay, and I squared t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
7. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
8. MCCB Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor material.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
e. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
f. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
g. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

B. Bolted-Pressure Contact Switch: Operating mechanism uses rotary-mechanical-bolting action to produce and maintain high clamping pressure on the switch blade after it engages the stationary contacts.
1. Main-Contact Interrupting Capability: Minimum of 12 times the switch current rating.
2. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.

a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
b. Mechanical Trip: Operation of mechanical lever, push button, or other device causes switch to open.

3. Auxiliary Switches: Factory installed, SPDT, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
4. Service-Rated Switches: Labeled for use as service equipment.
5. Ground-Fault Relay: Comply with UL 1053; self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.

a. Configuration: Integrally mounted **r**elay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

6. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens..

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

D. Fuses are specified in Section 262813 "Fuses."

2.5 INSTRUMENTATION

A. Instrument Transformers: NEMA EI 21.1, and the following:

1. Potential Transformers: NEMA EI 21.1; 120 V, 60 Hz, single secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
2. Current Transformers: NEMA EI 21.1; 5 A, 60 Hz, secondary; bar or window type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.

4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.

B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:

a. Phase Currents, Each Phase: Plus or minus 0.5 percent.
b. Phase-to-Phase Voltages, Three Phase: Plus or minus 0.5 percent.
c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 0.5 percent.
d. Megawatts: Plus or minus 1 percent.
e. Megavars: Plus or minus 1 percent.
f. Power Factor: Plus or minus 1 percent.
g. Frequency: Plus or minus 0.1 percent.
h. Accumulated Energy, Megawatt Hours: Plus or minus 1 percent; accumulated values unaffected by power outages up to 72 hours.
i. Megawatt Demand: Plus or minus 1 percent; demand interval programmable from five to 60 minutes.
j. Contact devices to operate remote impulse-totalizing demand meter.

2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

2.6 CONTROL POWER

A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

B. Electrically Interlocked Main and Tie Circuit Breakers: Two control-power transformers in separate compartments, with interlocking relays, connected to the primary side of each control-power transformer at the line side of the associated main circuit breaker. 120-V secondaries connected through automatic transfer relays to ensure a fail-safe automatic transfer scheme.

C. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

D. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.7 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

B. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.

C. Mounting Accessories: For anchors, mounting channels, bolts, washers, and other mounting accessories, comply with requirements in Section 260548.16 "Seismic Controls for Electrical Systems" or manufacturer's instructions.

2.8 IDENTIFICATION

A. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.

B. Install switchboards and accessories according to NEMA PB 2.

C. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness.

1. Install conduits entering underneath the switchboard, entering under the vertical section where the conductors will terminate. Install with couplings flush with the concrete base. Extend 2 inches above concrete base after switchboard is anchored in place.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to switchboards.
6. Anchor switchboard to building structure at the top of the switchboard if required or recommended by the manufacturer.

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.

E. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

F. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

G. Install filler plates in unused spaces of panel-mounted sections.

H. Install overcurrent protective devices, surge protection devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

I. Install spare-fuse cabinet.

J. Comply with NECA 1.

K. Comply with requirements for terminating feeder bus specified in Section 262500 "Enclosed Bus Assemblies." Drawings indicate general arrangement of bus, fittings, and specialties.

L. Comply with requirements for terminating cable trays specified in Section 260536 "Cable Trays for Electrical Systems." Drawings indicate general arrangement of cable trays, fittings, and specialties.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Acceptance Testing:

    a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within the switchboard, and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.
    b. Test continuity of each circuit.

2. Test ground-fault protection of equipment for service equipment per NFPA 70.
3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
4. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

B. Switchboard will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories.

END OF SECTION 262413

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: The work specified in this Section consists of all materials for furnishing, installing connecting, energizing, testing, cleaning and protecting wall- mounted panelboards.

B. Related Section:
1. Section 26 05 00 – Common Work Results for Electrical
2. Section 26 05 28 - Hangers and Supports for Electrical Systems
3. Section 26 05 53 - Identification for Electrical Systems
4. Section 26 05 63 - Acceptance Testing for Electrical Systems
5. Section 26 05 19 - Low Voltage Electrical Power Conductors and Cables
6. Section 26 43 13 - Surge Protective Devices (SPD)

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM B164 Nickel-Copper Alloy, Bar and Wire.
2. ASTM B187 Standard Specifications for Copper Bus, Bus Bar, Rod and Shapes

B. National Electrical Manufacturers Association (NEMA):
1. NEMA 250 Electrical Enclosures.
2. NEMA AB 1 Molded Case Circuit Breakers and Molded Case Switches.
3. NEMA AB 2 Molded Case Circuit Breakers and their Application.
4. NEMA PB 1 Panelboards.
5. NEMA PB 1.1 General Instructions for Proper installation, Operation, and Maintenance of Panelboards.

C. National Fire Protection Association (NFPA):
1. NFPA 70 National Electrical Code (NEC).

D. Underwriters Laboratories (UL):
1. UL 489 Molded Case Circuit Breakers and Circuit Breaker Enclosures
2. UL 50 Cabinets and Boxes
3. UL 67 Panelboards

1.3 SYSTEM DESCRIPTION

A. Panelboards are connected to system voltages as follows:
1. Not used.
2. 208Y/120 Volt, 3-phase, 4-wire.
3. 120/240 Volt, 1-phase, 2-wire.

1.4 SUBMITTALS

A. Testing Agency/Quality Verification: Provide with all product data evidence of testing agency/quality verification, listing, and labeling either by printed mark on the data or by a separate listing card. Provide from product manufacturers a written statement indicating why an item does not have a quality assurance verification. Such statements are subject to the approval of the Engineer.

B. Product Data and Catalog Cuts: Provide product data for all products provided. Indicate clearly the usage and designation of each product.

C. Shop Drawings: Submit shop drawings for all panelboards.

D. Provide manufacturer's instructions for all panelboards.

1.5 SHORT CIRCUIT, ARC-FLASH, PROTECTIVE DEVICE COORDINATION AND HARMONIC DISTORTION STUDY

A. The computerized short-circuit, arc-flash, protective coordination and harmonic study will be performed and submitted as outlined in Section 26 05 00 of these specifications.

B. The Design Builder is responsible for supplying the necessary and required information in order that this study may be completed and submitted at least two full calendar weeks prior to submitting Shop Drawings for equipment included the respective studies, submit the preliminary studies and corresponding computer printouts and annotated one-line distribution diagram to the Engineer for review and comment.

1.6 QUALITY ASSURANCE

A. Provide panelboards, which have been design tested in accordance with NEMA PB 1.

B. Provide panelboards which have been production tested in accordance with NEMA PB 1.

C. Conform all work to NFPA 70, National Electrical Code.

D. Install work under supervision of licensed electricians

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Basic Electrical Materials: Those products such as conduit, wireways, wire and connectors, cable, support devices, fasteners, and similar devices as required for work of this Section are as specified in other Sections of these Specifications.

2.2 PANELBOARDS

A. Provide dead-front panelboards as follows:
   1. Accommodate bolt-on molded case circuit breakers as specified below.
   2. Conform to NEMA PB 1 and NFPA 70, Article 384.
   3. Consist of interiors, matching enclosures and covers of a single manufacturer as specified below.
   4. Have circuit breakers of frame sizes, trip ratings, number of poles, and types as scheduled, indicated and noted.
   5. Provide branch circuits phased in sequence vertically and numbered uniformly left to right, top to bottom.

B. Provide panelboards that are fully rated for a short circuit capacity as scheduled, indicated and noted on the Drawings.

C. Interiors: Provide interiors, as follows:
   1. Provide tin plated main, ground and neutral copper buses conforming to ASTM B187 having not less than 98 percent conductivity.
   2. Mount interiors on galvanized steel backplate.
   3. Make provisions for future breakers and for circuit breakers in all future spaces as indicated, scheduled or noted and so that additional breakers can be mounted without additional connectors or extension of busses.

D. Provide solderless type main, sub-feed, and through feed lugs rated for copper and aluminum conductors of size, number and type, as indicated, scheduled and noted on the Drawings.

E. Enclosures:
   1. Provide enclosures conforming to NEMA 250 for the types as indicated, scheduled, noted, and specified. Provide NEMA 1 enclosures unless otherwise indicated on the Drawings.
   2. Fabricate from galvanized steel without knockouts.
   3. Provide side, bottom, and top gutters of minimum 4-inch (10cm) width, of minimum 5-1/2 inch (14cm) depth, and sized as indicated, scheduled, and noted and as required by NFPA 70 Article 373 for the actual entry point.
   4. Provide circuit directory of sufficient size to allow 40-characters per circuit; indicate the source of service (i.e. upstream panelboard, switchboard, motor control center, etc.) to the panelboard. Mount the directory in a transparent protective covering.

F. Doors: Provide doors as follows:
   1. Provide concealed hinges and trim clamps.
   2. Provide combination catch and master keyed, flat key lock with two keys for each lock and common keying throughout each building of the facility.

G. Finishes:
   1. Factory finish enclosure cover completely using an electro-deposition process that deposits a complete finish coat of paint on all interior and exterior surfaces as well as bolted joints.
   2. Include in the paint process cleaning, rinsing, phosphatizing, prepaint and post paint rinses, bake-cure and cool down steps.
   3. Finish switchboards with rust inhibiting primers and electro-disposition acrylic baked enamel top coating of No. 49 medium light grey conforming to ANSI Z55.1.
   4. Provide overall finish capable of passing a 300-hour salt spray per ASTM B117 with less than 1/8 loss of paint from a scribed line.

H. Molded case circuit breakers:
   1. Provide inverse time and instantaneous tripping characteristics.
   2. Provide trip ratings, frame sizes, and number of poles as indicated, scheduled, and noted on the Drawings.
   3. Provide full rated circuit breakers with short circuit ratings equal to the panelboard installed as scheduled on the Drawings.
   4. Provide molded case circuit breakers conforming to NEMA AB 1, and UL 489.
   5. Provide circuit breakers of the same manufacture and type as the panelboard installed.
   6. New circuit breakers for existing panelboards or loadcenters shall match the existing circuit breaker type, manufacturer, and AIC rating. Circuit breakers that are added into existing equipment shall be new, unless noted on the drawings as existing to be relocated and/or reused; and shall be purchased from an authorized manufacturer's distributor. Purchase of used, reconditioned, or brokered circuit breakers is prohibited unless approved by the Engineer.

I. Surge Protective Devices (SPD): Provide a Surge Protective Device as specified in Section 26 43 13. Factory install and wire SPD within the panelboard prior to shipment to the job site. Mount SPD audible alarm, alarm silence and test switches, and failure indicators (LEDs) on front of panelboard. Provide terminal blocks for external circuit connections.

J. Panelboard Types:
   1. Distribution - Square D I-Line.
   2. Branch Power and Lighting (208Y/120V) - Square D NQOD.
   3. Not used
   4. Not used

K. Acceptable Manufacturers:
   1. Square D Company
   2. Eaton Electric
   3. General Electric
   4. Siemens Industry for LV Power Distribution
   5. Or Approved Equal

PART 3 - EXECUTION

3.1 PREPARATION

A. Painted surfaces, which will be covered by items of this Section have a prime and finish coat of paint.

B. Ensure that all indoor areas are enclosed from the weather.

3.2 INSTALLATION

A. Space enclosures out from surfaces mounted on 1/4-inch (6mm) spacers or U- channel supports. Provide supports as specified in Section 26 05 28.

B. Install all panelboards and circuit-breakers in accordance with the manufacturer's instructions and NEMA PB 1.1.

C. Set enclosure top 6-feet 6-inches above finished floor or grade unless otherwise indicated or specified.

D. Punch holes for conduit entries in the enclosures.

E. In all areas except dry areas, install conduit drain fitting in punched hole in bottom of enclosure, conduit breather fitting in top of enclosure.

F. Interface with other work:
   1. Connect conduits to enclosure with watertight hubs, except in damp locations on the bottom of enclosures a sealing locknut may be used in place of watertight hubs, and in dry locations two locknuts and bushings may be used.
   2. Connect wiring to line and load terminals with lugs provided or approved by manufacturer in conformance with Section 26 05 19. Remove interior or protect interior components during wire pulling.
   3. Identify in accordance with Section 26 05 53.

G. At the end of the project update the circuit directories to reflect as-built conditions. Circuit directions shall be typed.

3.3 CLEANING

A. After wiring, vacuum out interior and wipe clean of all foreign material.

B. After painting in areas, remove all over paint, drips and splashes.

3.4 FIELD QUALITY CONTROL

A. Site Testing:
   1. Prior to Energizing:
      a. Have insulation testing and setting of overcurrent protective device adjustments made in conformance of Section 26 05 63.
      b. Ensure that all load side wiring is clear of shorts and has received and passed the insulation tests of Section 26 05 63.
      c. Open all downstream disconnects and open circuit breaker.
   2. Final testing after energizing:
      a. Perform thermographic test and record circuit parameters in conformity with Section 26 05 63.

3.5 PROTECTION

A. During painting, mask all nameplates, all plastic parts, and all items not to be painted.

B. Protect all items during work of other trades including welding and cutting.

C. Protect panelboards against overloads, short circuits, and improper operation, padlock off when work is being done on downstream circuits.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for furnishing, installing, connecting, energizing, testing, cleaning, and protecting wiring devices and cover plates.

B. Related Sections:
   1. Section 01 33 00 - Submittal Procedures.
   2. Section 26 05 00 - Common Work Results for Electrical.
   3. Section 26 05 26 - Grounding and Bonding.
   4. Section 26 05 28 - Hangers and Supports for Electrical Systems.
   5. Section 26 05 63 - Acceptance Testing for Electrical Systems.
   6. Section 26 05 53 - Identification for Electrical Systems.
   7. Section 26 05 33.13 - Conduit for Electrical Systems
   8. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables.
   9. Section 26 05 33.16 - Boxes for Electrical Systems

1.2 REFERENCES

A. National Electric Manufacturer's Association (NEMA):
   1. NEMA WD 1 - General Color Requirements for Wiring Devices.
   2. NEMA WD 6 - Wiring Devices - Dimensional Requirements.

B. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC).

C. Underwriter’s Laboratories, Inc. (UL):
   1. UL 20 - Standard for Safety for General-Use Snap Switches.
   2. UL 231 - Standard for Power Outlets.
   3. UL 498 - Standard for Safety for Attachment Plugs and Receptacles.
   4. UL 943 - Standard for Safety for Ground-Fault Circuit-Interrupters.
   5. UL 1449 - Standard for Transient Voltage Surge Suppressors.
   6. UL 1472 - Solid-State Dimming Controls.
   7. UL 1681 - Standard for Safety for Wiring Device Configurations.

D. U. S. General Services Administration (GSA):
   1. Federal Specifications:
      a. W-C-596/40D - Connector, Receptacle, Electrical, General Purpose, Duplex, General Grade and Hospital Grade, Grounding, 2 Pole, 3 Wire, 20 Amperes, 125 Volts, 50/60 Hertz, Box Mount and Snap-In Mount.
      b. W-C-596/41D - Connector, Receptacle, Electrical, General Purpose, Single, Hospital Grade, Grounding, 2 Pole, 3 Wire, 20 Amperes, 125 Volts, 50/60 Hertz.
      c. W-C-596/107A - Connectors, Receptacle, Electrical, Special Purpose, Single, Grounding, 2 Pole, 3 Wire, 20 Amperes, 277 Volts, 50/60 Hertz.

d. W-S-896F - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification).

1.3 DEFINITIONS

A. Definitions for all items are as stated in NFPA 70 and the other references listed unless otherwise stated, specified, or noted.

B. SPDT: An acronym for single pole, double throw type electrical switches.

C. Wiring Devices: Yoke mounted switches and receptacles with indicated line ratings of 300 Volts and 30 Amperes or less.

1.4 DESIGN REQUIREMENTS

A. Provide electrical power outlets designed in accordance with the requirements of UL 231 and UL 1681.

B. Product Data:
1. Submit a list of the products and accessories proposed to satisfy the requirements of this Section.
2. Submit Product Data and catalog cuts of the materials and equipment proposed to be used to satisfy the requirements of this Section.
   a. Clearly indicate the usage of each product on the submittal.
3. Include Product Data for the equipment and material provided under this Section with the Operation and Maintenance Manuals at project closeout.

1.5 SUBMITTALS

A. Submit the following information to the Engineer for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:
1. Product Data:
   a. List of the proposed materials.
   b. Catalog cuts of toggle handle snap switches.
   c. Catalog cuts of control switches.
   d. Catalog cuts of dimmer switches.
   e. Catalog cuts of emergency power shut-off switches.
   f. Catalog cuts of self contained occupancy sensor switches.
   g. Catalog cuts of heavy duty specification grade receptacles.
   h. Catalog cuts of commercial specification grade receptacles.
   i. Catalog cuts of heavy duty specification grade GFCI receptacles.
   j. Catalog cuts of commercial specification grade GFCI receptacles.
   k. Catalog cuts of standard grade surge suppression receptacles.
   l. Catalog cuts of power outlet receptacles.
   m. Catalog cuts of device plates and covers.
2. Quality Assurance/Control Submittals:
   a. Test Reports.
      1) Test reports for Site tests.
   b. Certificates.

1) Testing agency/quality verification, listing, and labeling.

c. Manufacturers Instructions.
   1) Manufacturer's printed installation instructions.

d. Qualification Statements.
   1) Qualifications of the Electrical Testing Laboratory (ETL).

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Electrical Testing Laboratory (ETL) Qualifications:
      a. Employ an independent testing agency, qualified as specified in Section 26 05 63, Acceptance Testing for Electrical Systems, to perform testing required by this Section.
      b. Submit information verifying the ETL's qualifications.

B. Regulatory Requirements:
   1. Perform the Work of this Section in accordance with the requirements specified in NFPA 70, and to all other applicable state, local, and national governing codes and regulatory requirements.

C. Certifications:
   1. Provide products that are listed and labeled by Underwriters Laboratory, approved by Factory Mutual, or certified as meeting the standards of UL by the Electrical Testing Laboratory (ETL) for the location installed in, and the application intended, unless products meeting the requirements of these testing laboratories are not available or unless standards do not exist for the products. Provide copper conductors listed and labeled by UL for all wiring.
   2. Submit evidence of testing agency/quality verification, listing, and labeling for each product with the submitted product data either by providing a printed mark on the data or by attaching a separate listing card.
      a. For items without such evidence, submit a written statement from the product manufacturer that indicates why it does not have quality assurance verification.

1.7 MATERIAL DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
   1. Pack, ship, handle, and unload products in accordance with the requirements of Section 26 05 00, Basic Common Work Results for Electrical.

B. Acceptance at Site:
   1. Accept products at the Site in accordance with the requirements of Section 26 05 00, Basic Common Work Results for Electrical.

C. Storage and Protection:
   1. Store products in accordance with the requirements of Section 26 05 00, Basic Common Work Results for Electrical.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Use of Trade Names:
   1. The use of trade names within the Contract Documents is intended to establish the basis of design and to illustrate the constructability and level of quality required.
   2. The use of trade names is not intended to exclude other manufacturers whose products are equivalent to those named, subject to compliance with Contract requirements.

B. Provide the switches and receptacles of the same kind provided under this Contract from the same manufacturer; a mixture of manufacturers' products is unacceptable.

2.2 MANUFACTURED UNITS

A. Switches:
   1. Provide UL listed specification grade switches meeting the requirements of W-S-896F, NEMA WD 1, and NEMA WD 6 for the voltage and current indicated, and having screw terminals.
   2. Toggle Handle Snap Switches:
      a. Provide quiet design, 20 Amp rated, single pole, 3-way or 4-way, toggle handle snap switches as indicated in the Contract Documents.
      b. Control Switches:
         1) For control switches, provide SPDT switches with center OFF and maintained contacts, or SPDT with center OFF and momentary contacts, of the same basic type, construction, and rating as specified for other toggle handle snap switches.
         2) Provide switch with terminals rated for both solid and stranded wire.
         3) See the Contract Drawings for additional information.
      c. Manufacturers:
         1) Hubbell, www.hubbell-wiring.com.
            a) Heavy Duty Specification Grade Switches: HBL1220 Series.
            b) Construction Series Heavy Duty Specification Grade Switches: CS120 Series.
         2) Pass & Seymour, www.passandseymour.com.
         3) Leviton Manufacturing Co., www.leviton.com.
         4) Approved equal.
   3. Dimmer Switches:
      a. Provide slide type, solid-state, positive off dimmer switches that comply with the requirements of UL 20 and UL 1472.
         1) Provide fully rated dimmer switches rated for a minimum of 1500 Watts, provide a larger size if necessary to accommodate the loads indicated on the Contract Drawings.
         2) Provide dimmer switches rated for incandescent or fluorescent lighting as shown on the Contract Drawings, and capable of being gang mounted without breaking off their cooling fins.
         3) Provide switch with terminals rated for both solid and stranded wire.
      b. Manufacturers:
         1) Lutron, "Nova" Series, www.lutron.com.
         2) Pass & Seymour, www.passandseymour.com.
         3) Leviton Manufacturing Co., www.leviton.com.

4) Or Approved Equal.

4. Emergency Power Shut-Off Switches:
   a. Provide a heavy duty, momentary contact pushbutton shut-off switch rated for 600 Volts AC.
   b. Provide flush mounted switches furnished with a 1-3/8-inch diameter red mushroom type stop button and a stainless steel cover plate.
   c. Provide switch with terminals rated for both solid and stranded wire.
   d. Manufacturers:
      1) Square D Company
      2) General Electric
      3) Eaton/Cutler-Hammer
      4) Siemens Industry for LV Power Distribution
      5) Approved equal.
5. Self Contained Occupancy Sensor Switches:
   a. Provide self-contained, single gang, occupancy and vacancy sensor switches designed to fit behind a standard decorator switch plate and to replace existing wall switches.
      1) Provide occupancy and vacancy sensor switches rated for dual 120/277 Volt operation.
      2) Provide occupancy and vacancy sensor switches having a passive infrared detector mounted behind a Fresnel lens.
      3) Provide switch with terminals rated for both solid and stranded wire.
   b. Sensitivity:
      1) Provide occupancy and vacancy sensor switches capable of detecting motion in 10 to 150 foot-candles, and capable of detecting both vertical and horizontal motion.
   c. Coverage:
      1) Sensing Field: 180 degrees.
      2) Sensing Distance: Up to 35 feet.
      3) Sensing Area: Up to 900 square feet.
   d. Time Delay:
      1) Provide occupancy and vacancy sensor switches having a time delay adjustable from 30 seconds to 30 minutes.
   e. Acceptable Manufacturers for interior dry/conditioned locations:
      1) Pass & Seymour, WSP200, www.passandseymour.com.
      2) Sensorswitch – LWS PDT
      3) Or Approved Equal
   f. Acceptable Manufacturers for interior unconditioned locations with low temperature and/or high humidity:
      1) Sensorswitch - LWS PDT LT.
      2) Or Approved Equal

B. Receptacles:
   1. Provide UL listed specification grade receptacles complying with the requirements of W-C-596/40D, W-C-596/41D, W-C-596/107A, NEMA WD 1, and NEMA WD 6 for the voltage and current indicated, and having screw terminals.
      a. Provide receptacles complying with the terminal identification requirements of UL 498.
   2. Standard Face Design Receptacles:
      a. Heavy Duty Specification Grade Receptacles:
         1) Provide 2-pole, 3-wire, grounding type duplex receptacles rated for 125 Volts AC and 20 Amperes.

2) Provide receptacles with terminals rated for both solid and stranded wire.
3) Manufacturers:
a) Hubbell, HBL5352 Series, www.hubbell-wiring.com.
b) Pass & Seymour, www.passandseymour.com.
c) Leviton Manufacturing Co., www.leviton.com.
d) Or Approved Equal.

b. Construction Series Heavy Duty Specification Grade Receptacles:
1) Provide 2-pole, 3-wire, grounding type duplex receptacles rated for 125 Volts AC and 20 Amperes, and having a finder groove nylon face.
2) Provide receptacles with terminals rated for both solid and stranded wire.
3) Manufacturers:
a) Hubbell, 5362 Series, www.hubbell-wiring.com.
b) Pass & Seymour, www.passandseymour.com.
c) Leviton Manufacturing Co., www.leviton.com.
d) Or Approved equal.

3. Ground Fault Circuit Interrupter (GFCI) Receptacles:
a. Heavy Duty Specification Grade GFCI Receptacles:
1) Provide 2-pole, 3-wire, grounding type duplex GFCI receptacles rated for 125 Volts AC and 20 Amperes; having solid state circuitry; and that comply with the requirements of UL 498 and UL 943.
2) Provide receptacles with terminals rated for both solid and stranded wire.
3) Manufacturers:
a) Hubbell, GFR5362TR Series, www.hubbell-wiring.com.
b) Pass & Seymour, www.passandseymour.com.
c) Leviton Manufacturing Co., www.leviton.com.
d) Or Approved Equal.

b. Commercial Specification Grade GFCI Receptacles:
1) Provide 2-pole, 3-wire, grounding type duplex GFCI receptacles rated for 125 Volts AC and 20 Amperes; having solid state circuitry; and that comply with the requirements of UL 498 and UL 943.
2) Provide receptacles with terminals rated for both solid and stranded wire.
3) Manufacturers:
a) Hubbell, GFTR20 Series, www.hubbell-wiring.com.
b) Pass & Seymour, www.passandseymour.com.
c) Leviton Manufacturing Co., www.leviton.com.
d) Or Approved Equal.

4. Specification Grade Surge Suppression Receptacles:
a. Provide receptacles rated for 125 Volts AC and 20 Amperes, and complying with the requirements of UL 1449 and UL 498.
b. Provide receptacles with terminals rated for both solid and stranded wire.
c. Manufacturers:
1) Hubbell, HBL5362SA Series, www.hubbell-wiring.com.
2) Pass & Seymour, www.passandseymour.com.
3) Leviton Manufacturing Co., www.leviton.com.
4) Or Approved Equal.

5. Specification Grade Isolated Ground Surge Suppression Receptacles:
a. Provide receptacles rated for 125 Volts AC and 20 Amperes, and complying with the requirements of UL 1449 and UL 498.
b. Provide receptacles with terminals rated for both solid and stranded wire.
c. Manufacturers:
1) Hubbell, IG5362SA Series, www.hubbell-wiring.com.

2) Pass & Seymour, www.passandseymour.com.
3) Leviton Manufacturing Co., www.leviton.com.
4) Or Approved Equal.

6. Isolated Ground Receptacles:
   a. Provide receptacles rated for 125 Volts AC and 20 Amperes.
   b. Provide receptacles with terminals rated for both solid and stranded wire.
   c. Manufacturers:
      1) Hubbell, www.hubbell-wiring.com.
         a) Isolated Ground Receptacles: IG5362 Series.
         b) Construction Series Isolated Ground Receptacles: CR5352IG Series.
      2) Pass & Seymour, www.passandseymour.com.
      3) Leviton Manufacturing Co., www.leviton.com.
      4) Or Approved Equal.
7. Power Outlet Receptacles:
   a. Provide heavy-duty, polarized, grounding type power outlet receptacles rated for the voltage and amperage indicated in the Contract Documents.
   b. Provide receptacles with terminals rated for both solid and stranded wire.
   c. Manufacturers:
      1) Hubbell, Twist-Lock and straight blade, www.hubbell-wiring.com.
      2) Pass & Seymour, www.passandseymour.com.
      3) Leviton Manufacturing Co., www.leviton.com.
      4) Or Approved Equal.

2.3 ACCESSORIES

A. Wall Plates:
   1. Unless otherwise indicated in the Contract Documents, provide AISI Type 302/304 stainless steel wall plates.
      a. For use with exposed stamped steel boxes and cast type boxes, provide heavy cadmium-plated steel wall plates whose edges are flush with the edges of the associated boxes.
      b. For pushbutton or buzzer outlet boxes, provide wall plates having openings to suit the pushbuttons or buzzers.
      c. For locations subject to wet or rain conditions, provide wet location wall plates marked with the words “Suitable for Wet Locations While in Use”.
   2. Thickness (Minimum): 0.040 inches thick (1mm).
   3. Finish:
      a. For finished areas, provide wall plates having a satin finish.
      b. For emergency circuits, provide either a red or Type 302/304 stainless steel wall plate engraved with the word “EMERGENCY” and with the panel designation and circuit number.
   4. Fasteners:
      a. For installing wiring devices and wall plates, provide the following of fastener types:
         1) For affixing plastic wall plates, provide nylon screws.
         2) For affixing metal wall plates, provide plated screws except as follows:
            a) For other than dry locations, provide stainless steel hardware.
   5. Manufacturers:
      a. Hubbell, www.hubbell-wiring.com.
      b. Pass & Seymour, www.passandseymour.com.
      c. Appleton, www.appletonelec.com.

d. Cooper Crouse-Hinds, http://crouse-hinds.com.
e. Or Approved Equal.

B. Weatherproof Cast Covers:
1. Provide with vertical cast construction, baked-on electrostatic polyester and powder paint for scratch/corrosion resistance.
2. Provide covers with stainless steel springs such that it closes automatically when plugs are removed.
3. Provide with heavy duty gasket that provides weatherproofing between cover plate and box.
4. Manufacturers:
a. Hubbell, www.hubbell-wiring.com.
b. Pass & Seymour, www.passandseymour.com.
c. Leviton Manufacturing Co., www.leviton.com.
d. Or Approved Equal.

C. Weatherproof While-In-Use Covers:
1. Body, cover and plates shall be made of polycarbonate and be non-conductive and non-corrosive.
2. A gasket shall be pre-applied that is constructed of closed-cell foam, neoprene blend regular density and UL rated HBF.
3. Cover shall provide a water channel, which keeps water moving outside while cord flap keeps the inside dry.
4. Cover shall be able to mount either vertically or horizontally.
5. Must provide a NEMA 3R protection level.
6. Manufacturers:
a. Hubbell, www.hubbell-wiring.com.
b. Pass & Seymour, www.passandseymour.com.
c. Leviton Manufacturing Co., www.leviton.com.
d. Or Approved Equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect the surfaces of concrete foundations where wiring devices will be mounted to verify that the surface is level and complete.
1. Verify that the required number of anchors of the correct type and size have been placed in the proper locations.
2. Verify that there are no concrete spalls, honeycomb areas, or other concrete defects.

B. Verify that the pull and junction boxes installed are the correct type and size, and are at the correct location.
1. Verify that flush boxes are plumb and level to within 1/8-inches of vertical and horizontal; and are either flush with the finish surface or protrude no more than 1/16 inch.
2. Verify that surface mounted boxes are plumb and level to within 1/16-inch of vertical and horizontal.
3. Verify that the size of each box conforms to the requirements of Article 370 of NFPA 70.

C. Verify that wiring pigtails within installed boxes are sufficiently long to re-terminate the wiring twice and still allow 6 inches of slack.

D. Verify that ground wires are the correct type and size, and are at the correct location.

3.2 PREPARATION

A. Correct defects discovered during the examination
   1. Remove any extraneous paint from the interior of boxes and from wiring.
   2. Clean the interior of boxes to remove dirt and debris.

B. Provide outlet boxes and supports for wiring devices in accordance with the requirements of Section 26 05 33.16, Boxes for Electrical Systems, and Section 26 05 28, Hangers and Supports for Electrical Systems.
   1. Mounting Locations and Heights:
      a. Unless otherwise specified or shown on the Contract Drawings, locate wiring devices by measuring the mounting heights from the finished floor to the centerline of the wiring device.
         1) Emergency Power Shut-Off Switches:
            a) Locate emergency power shut-off switches 5’- 0” above the finished floor on the hinge side of the exit door, or where shown on the Contract Drawings.
         2) Lighting Control Switches:
            a) Locate lighting control switches on the strike side of doors, and at 48-inches above the finished floor to the centerline of the switch, unless indicated otherwise on the Contract Drawings.
            b) Where it is not possible to mount lighting control switches side-by- side with a common device plate, mount them in tandem.
         3) Electrical Duplex Convenience Outlets:
            a) In Finished Areas:
               (1) Locate electrical duplex convenience outlets 18 inches above the finished floor to the centerline of the outlet, unless indicated otherwise on the Contract Drawings.
               (2) In concrete block walls, locate convenience outlets so they fall at the top of the second course, and at the top center of the respective block in which they are placed.
               (3) Locate electrical duplex convenience outlets that are above counters or backsplashes horizontally 6 inches above the counter or backsplash.
            b) In Unfinished Areas:
               (1) Locate electrical duplex convenience outlets 36 inches above the finished floor, unless this interferes with equipment or another obstacle.
               (2) If locating electrical duplex convenience outlets 36 inches above the finished floor interferes with equipment or another obstacle; then install the outlet above or below the obstruction as directed by the Engineer.
            c) For Water Coolers Receptacles:
               (1) Locate electrical outlets for water coolers directly behind the water cooler in order to hide the cord and attachment plug.
               (2) Prior to installing the box for the outlet, coordinate the mounting height of the wiring device with the height of the cooler to be

installed to insure that the cord and attachment plug will be hidden.

4) Wiring Devices in Mill Work:
   a) Mount wiring devices in mill work where shown in details or elevations, or as directed by the Engineer.

3.3 INSTALLATION

A. Install wiring devices and accessories in accordance with the manufacturer's printed installation instructions.
   1. Submit the manufacturer's printed installation instructions to the Engineer for information.
   2. Make connections to the devices in accordance with the requirements of Sections 26 05 19, Low Voltage Electrical Power Conductors and Cables, and Section 26 05 33.13, Conduit for Electrical Systems.
   3. Ground the devices in accordance with the requirements of Section 26 05 26, Grounding and Bonding.
   4. Emergency Circuits:
      a. Emergency Power Shut-Off Switches:
         1) Generators:
            a) Connect the emergency power shut-off switch for each emergency generator into the shunt-trip device of the main circuit breaker serving the respective generator.
         2) Boilers:
            a) Connect the emergency power shut-off switch for each boiler into the main run contact serving the respective boiler control panel.
      b. Provide red receptacles for emergency circuits.

B. Provide a wall plate for each switch, receptacle, and special purpose outlet.
   1. If the Contract Drawings show two or more switches or receptacles at the same location, gang these devices together and cover them with a single wall or cover plate.
   2. For multi-gang boxes, provide multi-gang outlet plates; sectional gang plates are unacceptable.

C. Identify the wiring devices in accordance with the requirements of Section 26 05 63, Acceptance Testing for Electrical Systems.
   1. Label emergency power shut-off switches appropriately.

3.4 REPAIR/RESTORATION

A. Correct the defects that are found in wiring devices during the specified inspections and tests, and retest the devices after correcting the defects.

3.5 FIELD QUALITY CONTROL

A. Site Tests:
   1. Test each receptacle with a plug-in tester that checks for reversed line and neutral wiring, reversed ground and neutral wiring, open ground wiring, and open neutral wiring.
   2. Verify that the GFCI receptacles work by using both the built-in integral tester and a plug-in tester which simulates a ground fault to test all receptacles.

3. Test the last receptacle in each branch circuit to ensure that the neutral and ground wiring resistance does not exceed 1 ohm between the receptacle and its panelboard.
4. Record and submit the results of the tests to the Engineer for approval.

B. Inspection:
1. Inspect boxes to verify proper operation, for visual appearance, and to verify correct mounting height.

3.6 ADJUSTING

A. Adjust the final position of switches and devices to be plumb and level, and set the final position of the wall plates for flush boxes flush to the wall.

3.7 CLEANING

A. Waste Management and Disposal:
1. Clear and dispose of waste materials in accordance with the requirements of Section 26 05 00, Common Work Results for Electrical.

3.8 PROTECTION

A. Mask electrical devices to protect them from paint overspray or over-brushing during painting operations.

B. Protect electrical devices against damage from other work.

3.9 SCHEDULES

END OF SECTION

SECTION 26 28 16.13 - LOW VOLTAGE ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for furnishing, installing, connecting, energizing, testing, cleaning, and protecting enclosed disconnect switches, hazardous location switches, and fuses.

B. Related Sections:
   1. Section 26 05 28 - Hangers and Supports for Electrical Systems.
   2. Section 26 05 53 - Identification for Electrical Systems.
   3. Section 26 05 63 - Acceptance Testing for Electrical Systems.
   4. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables.

1.2 REFERENCES

A. InterNational Electrical Testing Association, Inc. (NETA):
   1. ANSI/NETA ETT Standard for Certification of Electrical Testing Technicians.

B. National Electrical Manufacturers Association (NEMA):
   1. NEMA 250; Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. NEMA KS 1; Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

C. National Fire Protection Association (NFPA):
   1. NFPA 70; National Electrical Code (NEC).

D. Underwriter’s Laboratories, Inc. (UL):
   1. UL 98; Standard for Enclosed and Dead-Front Switches.

1.3 SUBMITTALS

A. Submit the following information for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:
   1. Product Data:
      a. Enclosed disconnect switches
      b. Enclosed hazardous location switches
      c. Fuses
   2. Shop Drawings:
      a. Enclosed disconnect switches
      b. Enclosed hazardous location switches
   3. Quality Assurance/Control Submittals:
      a. Certificates:
         1) Testing agency/quality verification listing cards, if required

2) Manufacturers written statement indicating why items do not have quality assurance verification, if required

b. Manufacturer's instructions:
   1) Enclosed disconnect switches

c. Qualification Statements:
   1) Electrical testing laboratory's qualifications

1.4 SHORT CIRCUIT, ARC-FLASH, PROTECTIVE DEVICE COORDINATION AND HARMONIC DISTORTION STUDY

A. The computerized short-circuit, arc-flash, protective coordination and harmonic study will be performed and submitted as outlined in Section 26 05 00 of these specifications.

B. The Design Builder is responsible for supplying the necessary and required information in order that this study may be completed and submitted at least two full calendar weeks prior to submitting Shop Drawings for equipment included the respective studies, submit the preliminary studies and corresponding computer printouts and annotated one-line distribution diagram to the Engineer for review and comment.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications:
      a. Employ licensed electricians to supervise installation of the work of this Section.
   2. Electrical Testing Laboratory (ETL) Qualifications:
      a. Use a NETA accredited electrical testing laboratory, or approved equal, that is accredited according to ANSI/NETA ETT for the region in which the Contract work is performed.
      b. Submit the electrical testing laboratory's qualifications to the Engineer for approval.

B. Regulatory Requirements:
   1. Conform all work to NFPA 70, the National Electrical Code.

C. Certifications:
   1. Provide products that are either listed and labeled by Underwriters Laboratory, approved by Factory Mutual, or certified as meeting the standards of UL by the Electrical Testing Laboratory (ETL) for the location installed in, and the application intended, unless products meeting the requirements of these testing laboratories are not available or unless standards do not exist for the products.

1.6 MAINTENANCE

A. Extra Materials:
   1. Provide one set of spare fuses for each point of use including all of the ampere sizes indicated for the location.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Use of Trade Names:
1. The use of trade names within the Contract Documents is intended to establish the basis of design and to illustrate the constructability and level of quality required.
2. The use of trade names is not intended to exclude other manufacturers whose products are equivalent to those named, subject to compliance with Contract requirements.

2.2 MANUFACTURED UNITS

A. Enclosed Disconnect Switches:
1. Provide enclosed disconnect switches that meet the requirements of NEMA KS l and UL 98, and that are as shown on the Contract Drawings.
a. Types:
1) Heavy duty fusible type.
a) Provide positive pressure fuse clips.
b) Provide fuses as specified
2) Heavy duty non-fusible type.
b. Provide enclosed disconnect switches rated for the horsepower, voltage, and amperage as indicated on the Contract Drawings.
c. Provide enclosed disconnect switches with the number of poles and of the type indicated on the Contract Drawings.
2. Enclosure:
a. Provide enclosures consisting of a box and cover conforming to the requirements of NEMA 250 and of the type indicated or scheduled on the Contract Drawings.
1) If not otherwise specified, provide enclosures conforming to the requirements of NEMA 250, type 1.
b. Material:
1) Construct enclosures of code gauge sheet steel per the requirements of UL 98.
c. Finish:
1) Apply a rust-inhibiting phosphate coating to the enclosure’s sheet steel, and then finish the enclosure in gray baked enamel.
d. Provide a permanent label with the manufacturer's switch type, catalog number, and horsepower rating on the enclosure.
3. Switch Mechanism:
a. Provide a quick-make, quick-break operating handle and switch mechanism integral to the box or body, not the cover.
1) Provide dead front construction with permanent arc suppressors and dual cover interlocks to prevent an unauthorized opening of the switch enclosure when the switch is in the ON position.
2) Provide the means to positively padlock the switch in the OFF position.
b. Provide a switch designed so that the switch blades are visible in the OFF position when door is open.
c. Provide UL-listed switch lugs for front removable copper cables.
d. Electroplate the switch’s current carrying parts to provide resistance to corrosion.
4. Acceptable Manufacturers:
a. Square D Company
b. Eaton Electric

c. General Electric
d. Siemens Industry for LV Power Distribution
e. Or Approved Equal

B. Hazardous Location Switches:
1. For hazardous areas having explosive vapors and/or gases present, provide UL- listed, heavy-duty safety switches rated for Class 1, Division 1 environments as defined in NFPA 70.
2. Enclosure:
a. Provide enclosures that conform to the NFPA 70 requirements for equipment to be used in Class 1, Division 1 locations.
1) Provide the type of enclosure indicated or scheduled on the Contract Drawings in accordance with the requirements of NEMA 250.
2) Provide threaded covers at each end of the enclosure set at an angle to facilitate wiring.
a) Provide enclosures designed so that the interior of the enclosure is readily accessible through the threaded cover openings.
3) Provide mounting lugs to mount the switch.
4) Provide taper tapped hubs with integral bushings for attaching conduit in a through feed arrangement.
b. Materials:
1) Body: Copper free aluminum.
2) Cover: Copper free aluminum.
3) Interior Parts: Sheet steel.
c. Provide a permanent label with the manufacturer's switch type, catalog number, and horsepower rating on the enclosure.
3. Switch Mechanism:
a. For motor circuit switches, provide un-fused, visible blade switches.
b. For disconnect switches, provide switches that at a minimum meet the requirements specified.
c. Provide a stainless steel threaded type operating shaft and stainless steel shaft bushings for each switch.
d. Provide an operating handle with the capability to be padlocked in the “ON” and the “OFF” positions.
4. Finish:
a. Electrodeposit a powered epoxy paint coating onto copper free aluminum items, and then bake this finish sufficiently to fuse the powder coating.
5. Acceptable Manufacturers:
a. Cooper Crouse Hinds; FLS Series.
b. Russell Stoll.
c. Appleton Electric Company.
d. Or Approved Equal.

C. Fuses:
1. Provide current limiting type fuses rated for the voltage and amperage as indicated on the Contract Drawings for those low-voltage switches requiring fuses.
a. For non-motor loads, provide UL Class RK1 single element, fast-acting type fuses.
b. For motor, welder, and transformer loads, provide UL Class RK5 dual element, time-delay type fuses.
2. Acceptable Manufacturers:
a. Cooper Bussman
1) UL Class RK1: Limitron®.

2) UL Class RK5: Fusetron®.

b. Gould-Shawmut.

c. Or Approved Equal.

2.3 SOURCE QUALITY CONTROL

A. Testing Agency/Quality Verification:

1. Perform the standard low-voltage enclosed switch factory tests specified in NEMA KS l and UL 98.
2. Submit evidence of testing agency/quality verification, listing, and labeling for each product with the submitted product data either by providing a printed mark on the data or by attaching a separate listing card.
   a. For items without such evidence, provide a written statement from the product manufacturer that indicates why it does not have quality assurance verification.
   b. Such statements are subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Install the work of this Section only under the supervision of licensed electricians.

3.2 PREPARATION

A. Provide a prime and finish coat of paint for painted surfaces that will be covered by items provided under this Section.

B. Prior to painting operations, mask all nameplates, plastic parts, push buttons, operating shafts, and other items not to be painted.

C. Ensure that all indoor areas to receive the items provided under this Section are enclosed from the weather.

3.3 INSTALLATION

A. Install disconnect switches and hazardous location switches in accordance with the switch manufacturer's instructions.

1. Mount enclosures on 1/4-inch (6mm) spacers or U-channel supports to provide a space between enclosures and mounting surfaces.
   a. Provide supports as specified in Section 26 05 28, Hangers and Supports for Electrical Systems.
2. Set the top of enclosures 6'-6" above the finished floor or grade unless otherwise indicated or specified.

B. Install the switch's conduit and wiring:

1. Punch holes in the disconnect switch enclosures for conduit entries, except use the pre-tapped hubs and integral bushings for attaching conduit to hazardous location switch enclosures.

a. Connect conduit to disconnect switch enclosures with water-tight hubs except as follows:
   1) In dry locations, either the watertight hubs or two locknuts and bushings may be used to connect conduits to the disconnect switch enclosure.
   2) In damp locations, either the watertight hubs or a sealing locknut, interior locknut, and grounding bushing may be used on the bottom of the enclosures.
b. In wet and/or hazardous areas, install a conduit drain-fitting in a hole punched in the bottom of the enclosure, and install a conduit breather fitting in a hole punched in the top of the enclosure.

2. Remove or protect components installed in the interior of enclosures during wire pulling.
3. Use lugs provided by or approved by the disconnect switch manufacturer to connect wiring to the disconnect switch's line and load terminals in conformance with Section 26 05 19, Low Voltage Electrical Power Conductors and Cables.

C. Identify low-voltage enclosed switches in accordance with Section 26 05 53, Identification for Electrical Systems.

3.4 FIELD QUALITY CONTROL

A. Site Testing:
1. Prior to energizing the low-voltage enclosed switches:
   a. Perform insulation testing and ensure that all load-side wiring is clear of shorts in accordance with the requirements of Section 26 05 53, Acceptance Testing for Electrical Systems.
2. Final testing after energizing the circuit breakers:
   a. Perform the thermographic test in conformity with Section 26 05 53, Acceptance Testing for Electrical Systems, and record the circuit parameters.

3.5 PROTECTION

A. Protect the items provided under this Section during the performance of work provided under other Sections, especially during welding and cutting operations.

B. Protect the low-voltage enclosed switches against overloads, short-circuits, and improper operation.
1. Pad-lock the low-voltage enclosed switches in the off position when work is being done on downstream circuits.

END OF SECTION

SECTION 26 28 16.19 - LOW VOLTAGE ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for furnishing, installing, connecting, energizing, testing, cleaning, and protecting enclosed, low-voltage, individually mounted molded-case circuit breakers.

B. Related Sections:
   1. Section 26 05 28 - Hangers and Supports for Electrical Systems.
   2. Section 26 05 53 - Identification for Electrical Systems.
   3. Section 26 05 63 - Acceptance Testing for Electrical Systems.
   4. Section 26 05 19 - Low Voltage Electrical Power Conductors and Cables.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM B 258, Standard Specification for Standard Nominal Diameters and Cross- Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors.

B. National Electrical Manufacturers Association (NEMA):
   1. NEMA 250; Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. NEMA AB 1; Molded-Case Circuit Breakers, Molded Case Switches, and Circuit- Breaker Enclosures.

C. National Fire Protection Association (NFPA):
   1. NFPA 70; National Electrical Code (NEC).

D. Underwriter’s Laboratories, Inc. (UL):
   1. UL 489; Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit- Breaker Enclosures.

1.3 DEFINITIONS

A. AIC: An acronym for ampere interrupting capacity.

B. AWG: An acronym for American Wire Gage, which is a standard system of designating electrical wire sizes specified in ASTM B 258.

1.4 DESIGN REQUIREMENTS

A. Design molded-case circuit breakers in conformance with the requirements of both NEMA AB 1 and UL 489.

1.5 SUBMITTALS

A. Submit the following information for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:
   1. Product Data:
      a. Enclosed molded-case circuit breakers
      b. Circuit breaker enclosures
   2. Shop Drawings:
      a. Enclosed molded-case circuit breakers
   3. Quality Assurance/Control Submittals:
      a. Certificates:
         1) Testing agency/quality verification listing cards, if required
         2) Manufacturers written statement indicating why items do not have quality assurance verification, if required
      b. Manufacturer's instructions:
         1) Enclosed circuit breakers

1.6 SHORT CIRCUIT, ARC-FLASH, PROTECTIVE DEVICE COORDINATION AND HARMONIC DISTORTION STUDY

A. The computerized short-circuit, arc-flash, protective coordination and harmonic study will be performed and submitted as outlined in Section 26 05 00 of these specifications.

B. The Design Builder is responsible for supplying the necessary and required information in order that this study may be completed and submitted at least two full calendar weeks prior to submitting Shop Drawings for equipment included the respective studies, submit the preliminary studies and corresponding computer printouts and annotated one-line distribution diagram to the Engineer for review and comment.

1.7 QUALITY ASSURANCE

A. Qualifications:
   1. Employ licensed electricians to supervise installation of the work of this Section.

B. Regulatory Requirements:
   1. Conform all work to NFPA 70, the National Electrical Code.

C. Certifications:
   1. Provide products that are either listed and labeled by Underwriters Laboratory, approved by factory mutual, or certified as meeting the standards of UL by the Electrical Testing Laboratory (ETL) for the location installed in, and the application intended, unless products meeting the requirements of these testing laboratories are not available or unless standards do not exist for the products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Use of Trade Names:
   1. The use of trade names within the Contract Documents is intended to establish the basis of design and to illustrate the constructability and level of quality required.
   2. The use of trade names is not intended to exclude other manufacturers whose products are equivalent to those named, subject to compliance with Contract requirements.

B. Provide circuit-breaker enclosures from the same manufacturer as the circuit-breaker.

C. Acceptable Manufacturers:
   1. Manufacturers offering products which can meet the requirements of this Section include, but are not limited to, the following:
      a. Square D Company
      b. Eaton Electric
      c. General Electric
      d. Siemens Industry for LV Power Distribution
      e. Or Approved Equal

2.2 MANUFACTURED UNITS

A. Enclosed Molded-Case Circuit-Breakers:
   1. Provide quick make-quick break, unit type molded-case circuit breakers with a thermal magnetic overload trip and lugs on both ends.
      a. Equip the circuit breakers with mechanically trip-free toggle handles.
      b. Equip multiple pole breakers with an internal common trip.
      c. Provide 15 and 20 ampere circuit breakers with lugs capable of accommodating one wire between 14 AWG and 10 AWG.
   2. Provide circuit breakers with the Voltage rating, poles, trip setting, and UL listed AIC rating as indicated on the Contract Drawings.
   3. Provide factory-installed accessories as indicated and specified.

B. Enclosures:
   1. Provide enclosures conforming to the requirements of NEMA 250, type 1.
      a. Provide enclosures of the type indicated or scheduled on the Contract Drawings.
      b. Unless otherwise indicated or scheduled, provide surface-mounted enclosures.
   2. Provide enclosures sized to contain the circuit breaker and all other required items.
      a. Provide an interlock that prevents opening the enclosure door when the circuit breaker is in the “ON” position.
         1) Provide an interlock defeater, which requires a common hand-tool to operate.
      b. Provide a copper ground-bus or ground-stud rated for 100 percent of the circuit breaker’s capacity.
   3. Provide each enclosure with an external operator that positively indicates the “ON”, “OFF”, and “TRIPPED” positions of the enclosed circuit breaker.
   4. Provide the capability to pad-lock the circuit breaker in the “ON” and the “OFF” positions by using three padlocks.

5. If the circuit-breaker is connected to a system with a grounded neutral, provide a copper solid-neutral bus or terminal-lug with a 100 percent rating, and suitable lugs for all incoming and outgoing cables.

2.3 SOURCE QUALITY CONTROL

A. Testing Agency/Quality Verification:
   1. Perform the standard circuit breaker factory tests specified in NEMA AB 1 and UL 489.
   2. Submit evidence of testing agency/quality verification, listing, and labeling for each product with the submitted product data either by providing a printed mark on the data or by attaching a separate listing card.
      a. For items without such evidence, provide a written statement from the product manufacturer that indicates why it does not have quality assurance verification.
      b. Such statements are subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Install the work of this Section only under the supervision of licensed electricians.

3.2 PREPARATION

A. Provide a prime and finish coat of paint for painted surfaces that will be covered by items provided under this Section.

B. Prior to painting operations, mask all nameplates, plastic parts, operating shafts, and other items not to be painted.

C. Ensure that all indoor areas to receive the items provided under this Section are enclosed from the weather.

3.3 INSTALLATION

A. Install circuit breakers in accordance with the circuit breaker manufacturer's instructions.
   1. Mount enclosures on 1/4-inch (6mm) spacers or U-channel supports to provide a space between enclosures and mounting surfaces.
      a. Provide supports as specified in Section 26 05 28, Hangers and Supports.
   2. Set the top of enclosures 6'-6" above the finished floor or grade unless otherwise indicated or specified.

B. Install circuit breaker conduit and wiring:
   1. Punch holes in the enclosures for conduit entries.
   2. In dry locations, two locknuts and bushings may be used to connect conduits to the circuit breaker enclosure.
   3. In damp locations and on the bottom of enclosures, connect conduits to the circuit breaker enclosure with watertight hubs or a sealing locknut.

4. Except in dry areas, install a conduit drain-fitting in a hole punched in the bottom of the enclosure, and install a conduit breather fitting in the top of the enclosure.
5. Remove or protect components installed in the interior of enclosures during wire pulling.
6. Use lugs provided or approved by the circuit breaker manufacturer to connect wiring to the circuit breaker's line and load terminals in conformance with Section 26 05 19, Low Voltage Electrical Power Conductors and Cables.

C. Identify circuit breakers in accordance with Section 26 05 63, Acceptance Testing for Electrical Systems.

3.4 FIELD QUALITY CONTROL

A. Site Testing:
1. Prior to energizing the circuit breakers:
   a. Perform insulation testing and ensure that all load-side wiring is clear of shorts in accordance with the requirements of Section 26 05 63, Acceptance Testing for Electrical Systems.
   b. Set and adjust overcurrent protective devices in conformance with the requirements of Section 26 05 63, Acceptance Testing for Electrical Systems.
   c. Open all downstream disconnects and the circuit breaker.
2. Final testing after energizing the circuit breakers:
   a. Perform the thermographic test in conformity with Section 26 05 63, Acceptance Testing for Electrical Systems, and record the circuit parameters.

3.5 PROTECTION

A. Protect the items provided under this Section during the performance of work provided under other Sections, especially during welding and cutting operations.

B. Protect circuit breakers against overloads, short-circuits, and improper operation.
1. Pad-lock the circuit breakers in the off position when work is being done on downstream circuits.

END OF SECTION

SECTION 26 43 13 - SURGE PROTECTIVE DEVICES (SPD)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: The work specified in this Section consists of materials for furnishing, installing, connecting, energizing, testing, cleaning and protecting enclosed surge protective devices.

B. Related Sections:
1. Section 26 05 00 – Common Work Results for Electrical
2. Section 26 05 26 - Grounding and Bonding
3. Section 26 05 28 - Hangers and Supports for Electrical Systems
4. Section 26 05 63 - Acceptance Testing for Electrical Systems
5. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables
6. Section 26 05 33.13 - Conduit for Electrical Systems

1.2 REFERENCES

A. American National Standards Institute/Underwriters Laboratories (ANSI/UL):
1. ANSI/UL 1449 Surge Protective Devices (Third Edition)
2. UL 1283 Electromagnetic Interference Filters

B. National Fire Protection Association (NFPA):
1. NFPA 70 National Electrical Code (NEC) Article 285.

C. Institute of Electrical and Electronic Engineers/American National Standards Institute (IEEE/ANSI):
1. ANSI/IEEE C62.41.1-2002 IEEE Guide on the Surge Environment in Low Voltage (1000 V and Less) AC Power Circuits
2. ANSI/IEEE C62.41.2-2002 IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits.
3. ANSI/IEEE C62.41.2-2002 IEEE Recommended Practice on Surge Testing Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.

1.3 SUBMITTALS

A. Make all submittals in accordance with Section 26 05 00.

B. Testing Agency/Quality Verification: Provide with all product data evidence of testing agency/quality verification, listing, and labeling either by printed mark on the data or by a separate listing card. Provide from product manufacturers a written statement indicating why an item does not have a quality assurance verification. Such statements are subject to the approval of the Owner and the Engineer.

C. Product Data and Catalog Cuts: Provide product data within 60 days of contract award for all products provided.

D. Shop Drawings: Submit shop drawings for all Surge Protective Devices.

E. Provide manufacturer's instructions for all Surge Protective Devices.

F. Project Record Documents: Record actual installed elevation and locations of equipment and wiring on record contract and shop drawings as specified in Section 26 05 00.

G. Project Closeout: Include record drawings, shop drawings and product data with Installation and Maintenance Manuals and submit at project closeout in accordance with Section 26 05 00.

1.4 SHORT CIRCUIT, ARC-FLASH, PROTECTIVE DEVICE COORDINATION AND HARMONIC DISTORTION STUDY

A. The computerized short-circuit, arc-flash, protective coordination and harmonic study will be performed and submitted as outlined in Section 26 05 00 of these specifications.

B. The Design Builder is responsible for supplying the necessary and required information in order that this study may be completed and submitted at least two full calendar weeks prior to submitting Shop Drawings for equipment included the respective studies, submit the preliminary studies and corresponding computer printouts and annotated one-line distribution diagram to the Engineer for review and comment.

1.5 QUALITY ASSURANCE

A. Conform all quality control work to Section 26 05 00.

B. Provide products that are listed and labeled by Underwriters Laboratory, approved by Factory Mutual or certified as meeting the standards of United Laboratories by the Electrical Testing Laboratory for the location installed in and the application intended unless products meeting the requirements of these testing laboratories are not available or unless standards do not exist for the products.

C. Unless products meeting the requirements of nationally recognized testing laboratories are not readily available for a category of products, provide products that are:
   1. Listed and labeled by Underwriters Laboratory.
   2. Approved by Factory Mutual.
   3. Certified as meeting the standards of Underwriters Laboratory by the Electrical Testing Laboratory.

D. Conform all work to regulatory requirements of all state, local, and national governing codes and requirements, NFPA 70, National Electrical Code, and the requirements of Section 26 05 00.

E. Installer Qualifications: Firm specializing in installing work of this Section with minimum three years documented experience.

F. Install work by or under supervision of licensed electricians.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protect items from damage during delivery, storage and handling in accordance with Section 26 05 00 and as detailed below.

B. Store all products indoors in heated warehouses on blocking or pallets.

1.7 WARRANTY

A. SPD shall have a ten-year warranty. Warranty shall be the responsibility of the electrical distribution equipment manufacturer and shall be supported by their respective field service division.

PART 2 - PRODUCTS

2.1 SURGE PROTECTIVE DEVICES EQUIPMENT

A. General Requirements:
1. Provide only products satisfying the applicable requirements for testing and reporting as established herein. Devices proposed for use on this project shall be tested in accordance with ANSI/UL 1449 Third Edition, as prescribed by ANSI/IEEE C62.45 - 2002. The voltage protection rating (VPR) or "clamping" voltages shall be recorded for all applicable mode of operation and for each of the test standard waveforms referenced. The results of these tests shall be submitted to the Engineer with the product data sheets as outlined under in this Section.
2. Products furnished for use on this project are to incorporate protective elements in all applicable modes, unless specifically indicated otherwise.
3. Install SPD equipment where so indicated on the Drawings. Voltage class and type of unit to be compatible with distribution voltage being protected.

2.2 Integral Surge Protective Devices:
1. SPD shall be Listed in accordance with ANSI/UL 1449 Third Edition, Standard for Safety, Surge Protective Devices.
2. All SPDs installed on the line side of the service entrance disconnect shall be a Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be a Type 1 or 2 SPD.
3. SPD shall be modular in design. Each protection element shall be a user replaceable surge current diversion Thermally Protected unimodule (MOV based). Each surge current diversion module shall have a short circuit current rating (SCCR) of 200 kA.. Each surge current diversion module shall include solid state status indicator lights.
4. SPD shall provide redundant surge current diversion modules for each mode of Protection. Modes of Protection shall be L-N, L-G, N-G in WYE systems, and L- L, L-G in DELTA systems.
5. SPD shall incorporate copper bus bars for the surge current path. Small gauge round wiring or plug-in connections shall not be used in the path for surge current diversion. Surge current diversion modules shall use bolted connections to the bus bars for reliable low impedance connections.

6. Nominal Discharge Current (In) – SPD applied to the distribution system shall have a minimum 20kA.
7. 320kA and 250 kA SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41.2 - 2002 Category C (Type 1) environments.
8. SPD shall meet or exceed the following criteria:
    a. Minimum surge current rating per mode shall be:
        1) L-N 120 kA
        2) L-G 120 kA
        3) N-G 120 kA
        4) Per phase 250 kA
9. Not used.
10. Not used.
11. SPD shall be equipped with onboard visual LED lights and audible diagnostic monitoring. Red and green LED indicator lights shall provide full time visual diagnostic monitoring of the operational status of each phase as well as each surge current diversion module. Audible diagnostic monitoring shall be by way of audible alarm. This alarm shall activate upon a fault condition. An alarm on/off switch shall be provided to silence the alarm. An alarm push to test switch shall be provided. The diagnostic monitoring circuits shall continually monitor the operational status of the surge current diversion modules. No other test equipment shall be required for SPD monitoring or testing before or after installation.
12. SPD shall be connected to the power bus through a dedicated circuit breaker or disconnect.
13. SPD shall include Form C dry contacts to monitor the performance of each phase and provide a summary alarm.
14. SPD shall include an event surge counter. The counter shall be equipped with a manual reset and a battery or flash memory to retain memory upon loss of AC power. The surge counter display and reset switch shall be mounted on the front of the SPD enclosure.
15. Acceptable Manufacturers:
    a. Eaton Electric
    b. Square D Company.
    c. General Electric.
    d. Siemens Industry for LV Power Distribution.
    e. Advanced Protection Technologies Inc.
    f. LEA International
    g. Or Approved Equal.

2.3 MATERIALS

A. Grounding Materials: Conform to Section 26 05 26

B. Steel Supports and Anchors: Conform to Section 26 05 28

C. Wiring, External to Equipment and Connectors: Conform to Section 26 05 19

D. Conduit Materials: Conform to Section 26 05 33.13

PART 3 - EXECUTION

3.1 PREPARATION

A. Painted surfaces, which will be covered by items of this Section, shall have a prime and finish coat of paint.

B. Ensure that all indoor areas are enclosed from the weather.

3.2 INSTALLATION

A. Space enclosures out from surfaces mounted on 1/4-inch spacers or u-channel supports. Provide supports as specified in Section 26 05 28.

B. Install all Surge Protective Devices in accordance with the manufacturer's instructions.

C. Ground all Surge Protective Devices in accordance with Section 26 05 26, and the manufacturer's instructions using wire as specified in Section 26 05 19, of size No. 6 AWG or larger if otherwise indicated, recommended, or specified.

D. Connect all Surge Protective Devices in accordance with Section 26 05 19 and the manufacturer's instructions. For service, Surge Protective Devices use No. 4 AWG or larger if otherwise indicated or recommended. For branch circuit Surge Protective Devices use No. 6 AWG or larger if otherwise indicated on the drawings, recommended, or specified. For instrument, communication, and data and telephone unit protectors use wire sized the same as the circuit, data-line that the Surge Protective Devices is connected to or larger if otherwise indicated, recommended, or specified.

E. Install all SPD's with the straightest & shortest practical lead length, less than 24 inches.

F. Interface with other work:
   1. Connect conduits to enclosure with watertight hubs except in damp locations on the bottom of enclosures. A sealing locknut may be used in place of watertight hubs and in dry locations two locknuts and bushings may be used.
   2. Connect wiring to line and load terminals with lugs provided or approved by manufacturer in conformance with Section 26 05 19. Remove interior or protect interior components during wire pulling.
   3. Connect to conduit systems in conformance with Section 26 05 33.13.
   4. Connect to wiring systems in conformance with Section 26 05 19.

3.3 FIELD QUALITY CONTROL

A. Site Testing:
   1. Prior to energizing:
      a. Have insulation testing and setting made in conformance of Section 26 05 63.
      b. Ensure that all load-side wiring is clear of shorts and has received and passed the insulation tests of Section 26 05 63.
      c. Energize in presence of Owner and close circuit breaker for first time in presence of Owner.

d. Final testing after energizing:
   1) Perform thermographic test and record circuit parameters in conformity with Section 26 05 63.

3.4 PROTECTION

A. During painting mask all nameplates, all plastic parts, pushbuttons, operating shafts and all items not to be painted.

B. Protect all items during work of other trades including welding and cutting.

C. Protect Surge Protective Devices against short circuits and improper operation.

END OF SECTION

SECTION 26 50 00 - LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for general and emergency egress lighting equipment, components, and related installation.

B. Related Sections:
   1. Division 1 Sections
   2. Section 26 05 26 - Grounding and Bonding.
   3. Section 26 05 28 - Hangers and Supports for Electrical Systems.
   4. Section 26 05 63 - Acceptance Testing for Electrical Systems.
   5. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables.
   6. Section 26 05 33.13 - Conduit for Electrical Systems.
   7. Section 26 05 36 - Cable Trays for Electrical Systems.
   8. Section 26 27 26 - Wiring Devices.

1.2 REFERENCES

A. The Aluminum Association, Inc. (AA):
   1. DAF-45, Designation System for Aluminum Finishes.

B. American National Standards Institute (ANSI).
   1. ANSI C81.64, Guidelines and General Information for Electrical Lamp Bases, Lampholders and Gauges.
   2. ANSI C81.64a, Electric Lamp Bases and Holders - Guidelines and General Information for Electrical Lamp Bases, Lampholders and Gauges.
   3. ANSI C82.1, Specifications for Fluorescent Lamp Ballasts.
   4. ANSI C82.1d, Electric Lamps – Paragraphs 5.3.3 and 5.5.3: Compact Fluorescent Lamp Ballasts.
   5. ANSI C82.1e, Fluorescent Lamps – Specifications for Fluorescent Lamp Ballasts.
   6. ANSI C82.2, Fluorescent Lamp Ballasts, Methods of Measurement of.
   7. ANSI C82.2a, Fluorescent Lamps - Methods of Measurement.
   8. ANSI C82.3, Fluorescent Lamp Reference Ballasts, Specifications for.
   9. ANSI C82.4, Ballasts - for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).
   10. ANSI C82.5, Reference Ballasts - High-Intensity-Discharge and Low-Pressure Sodium Lamps.
   11. ANSI C82.6, Reference Ballasts for High-Intensity-Discharge Lamps – Methods of Measurement.
   12. ANSI C82.6a, Reference Ballasts for High-Intensity-Discharge Lamps – Methods of Measurement.
   13. ANSI C82.8, Lamp Transformers – Incandescent Filament Lamp Transformers - Constant Current (Series) Supply Type.

14. ANSI C82.9, High-Intensity-Discharge and Low-Pressure Sodium Lamps, Ballasts and Transformers - Definitions.
15. ANSI C82.9b, Electric Lamp Ballasts - High-Intensity-Discharge and Low- Pressure Sodium Lamps, Ballasts and Transformers - Definitions.
16. ANSI C82.11, High-Frequency Fluorescent Lamp Ballasts.
17. ANSI C82.11a, Lamp Ballasts - Specifications for High-Frequency Fluorescent Lamp Ballasts - Distance to Grounded Starting Aid.
18. ANSI C82.11b, Lamp Ballasts - Specifications for High-Frequency Fluorescent Lamp Ballasts - Line Transient Requirements.
19. ANSI C82.11c, Normative Annex A: Specifications for Low Voltage Control Interface for Controllable Ballasts and Informative Index B: Specification for Nomenclature for Controllable Ballasts.
20. ANSI C82.12, Lamp Ballasts - Ballasted Adaptors.
21. ANSI C82.13, Fluorescent Lamps and Ballasts - Definitions.
22. ANSI C82.77, Lamp Ballasts - Harmonic Emission Limits - Related Power Quality Requirements for Lighting Equipment.

C. Federal Communications Commission (FCC)
1. FCC 47 CFR Part 15, Federal Code of Regulation (CFR) Testing Standard for Electronic Equipment

D. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
1. IEEE C62.41; Recommended Practice on Characterization of Surges in Low- Voltage (1000 V and Less) AC Power Circuits.

E. Illuminating Society of North America (IESNA)
1. IESNA LM-79, Electrical and Photometric Measurements of Solid-State Lighting Products
2. IESNA LM-80, Approved Method for Measuring Lumen Maintenance of LED Lighting Sources
3. IESNA TM-15, Luminaire Classification System for Outdoor Luminaires.

F. National Electrical Manufacturers Association (NEMA):
1. NEMA 250, Enclosures for Electrical Equipment.
2. NEMA SSL 3, High Power White LED Binning for General Illumination

G. National Fire Protection Association (NFPA):
1. NFPA 70, National Electrical Code (NEC).

H. Underwriter's Laboratories, Inc. (UL):
1. UL 496, Standard for Safety of Edison-Base Lampholders.
2. UL 542, Standard for Safety of Lampholders, Starters, and Starter Holders for Fluorescent Lamps
3. UL 924, Standard for Safety of Emergency Lighting and Power Equipment.
4. UL 935, Standard for Safety of Fluorescent Lamp Ballasts.
5. UL 1029, Standard for Safety of High-Intensity-Discharge Lamp Ballasts.
6. UL 1574, Standard for Safety of Track Lighting Systems.
7. UL 1598, Standard for Safety of Luminaires.
8. UL 1598B, Standard for Luminaire Reflector Kits for Installation on Previously Installed Fluorescent Luminaires.
9. UL 1993, Standard for Safety of Self-Ballasted Lamps and Lamp Adapters.
10. UL 1994, Standard for Safety of Low Level Path marking and Lighting Systems
11. UL 2108, Standard of Safety of Low Voltage Lighting Systems.

I. U. S. Government:
   1. Occupational Safety and Health Administration (OSHA):
      a. 29 CFR 1910 Occupational Health and Safety Standards.
      b. 29 CFR 1926 Safety and Health Regulations for Construction.
   2. Federal Communications Commission (FCC):
      a. 47 CFR 18 Industrial, Scientific, and Medical Equipment.
   3. Department of Energy (DOE):
      a. The Energy Policy of 2005, Public Law 109-58.

1.3 DEFINITIONS

A. LED – An acronym for "Light-Emitting Diode" used to indicate a semiconductor light source.

1.4 DESIGN REQUIREMENTS

A. Design Criteria:
   1. The Lighting Fixture Schedule on the Contract Drawings constitutes the basis of the lighting design for this Contract, but may not indicate the special design details required.
      a. The Lighting Fixture Schedule includes the lighting fixture descriptions, fixture manufacturers, and corresponding model numbers.
      b. The lighting fixtures as scheduled meet the requirements of the lighting design for this Contract with respect to the visible style, number of lamps, and lenses desired.
   2. Provide lighting fixtures meeting the requirements of the basis of the lighting design for this Contract, and which have the special details specified in this Section.
      a. Submit Shop Drawings and manufacturer's installation instructions to show details of assemblies and sub-assemblies, and specially-fabricated supporting and fastening devices.
      b. Submit bills of material for the fixtures and their appurtenances.
         1) Reference the bills of material to the Shop Drawings.
         2) Provide bills of material consisting of itemized lists of the parts required (i.e. ballast capacitor igniter, and other similar item descriptions).
         3) Identify each part with a part number and/or manufacturer number.
      c. Provide fixtures for exterior installation that are designed to be completely waterproof.
      d. Provide luminaire brackets designed to be compatible with configuration of the luminaire.

B. Prior to providing light fixtures substituted for the fixtures identified in the Lighting Fixture Schedule on the Contract Drawings, submit the following information to obtain the Engineer's approval to substitute the fixtures:
   1. The manufacturer's catalog cuts indicating the type, design, dimensions, mounting arrangement, and other industry standard lighting fixture information.
      a. Describe the lighting fixtures, exit signs, emergency battery units, and appurtenances.
   2. Manufacturer's photometric data, distribution curves, isolux charts, glare factor data, and coefficient of utilization.
   3. Complete photometric data for the fixture, including optical performance, completed by an independent testing laboratory developed according to the standards of the Illuminating Engineering Society of North America as follows:
      a. For direct, direct/indirect and indirect lights used for general illumination:
         1) Coefficients of utilization.

2) Candlepower data, presented graphically and numerically, in 5 degree increments (5 degree, 10 degree, 15 degree, etc.). Data developed for up and down quadrants of normal, parallel, and at 22-1/2 degree, 45 degree, 67-1/2 degree planes to lamp(s). If light output is asymmetric, provide additional planes as required to complete report.
3) Zonal lumens stated numerically in 10 degree increments (5 degree, 15 degree, etc.) as above.
4) Average luminaire luminance calculated in the lengthwise, crosswise, and 45 degree vertical planes.

b. For exterior roadway, area, or floodlighting luminaires, photometric data shall include isocandela charts, coefficient of utilization, IES roadway distribution classification (where applicable), and isofootcandle plots for the specific mounting heights, lamps, and conditions of the project.

4. Point-by-point lighting calculations showing the uniformity of light on the horizontal work plane in areas where substitutions are proposed. The substituted fixture shall be equivalent to the named fixture, including lighting level, Visual Comfort Performance (VCP), glare, Equivalent Sphere Illumination, energy usage and aesthetics.
   a. Prior to executing the point-by-point lighting calculations, request individual light loss factors, as defined in Chapter 9 of the IESNA lighting handbook, from the Engineer for input into the point-by-point lighting calculation.
   b. For each substituted light fixture provide photometric data and related information in IESNA standard file format for electronic transfer on a CD ROM.

C. Submit a complete lamp inventory for approval, including specific lamp type, manufacturer, and all appropriate lamp criteria including but not limited to: life, initial and mean lumens, beam spread, candlepower, lamp envelope, base type, color temperature, and color rendering index.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
1. The execution of work of this Section must satisfy the applicable requirements of the latest edition of NFPA 70 (NEC), the National Occupational Safety and Health Act as embodied in 29 CFR 1910 and 29 CFR 1926, and regulations of local jurisdictional authorities.
2. Comply with the requirements of the Energy Policy Act (EPACT) of 2005 and the applicable version of the International Energy Conservation Code.

B. Certifications:
1. All products must be Underwriters' Laboratories (UL) listed; and each fixture, Emergency Battery Unit, and exit sign must bear the UL label.
   a. The UL standards appropriate for the products specified are listed in Paragraph 1.02.E.
2. Fixtures that are to be installed in areas subject to the weather must be UL listed as "Enclosed and gasketed suitable for wet locations".
3. Provide lighting fixture ballasts certified by the Certified Ballast Manufacturers Association (CBM) or its successor organization to be in accordance with standard ballast specifications established by ANSI as listed in Paragraph 1.02.A.

1.6 SUBMITTALS

A. Submit the following information for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:
   1. Product Data:
      a. Manufacturer's catalog cuts.
         1) Lighting fixtures catalog cuts
         2) Ballast catalog cuts that include specific ballast information with sufficient information to show compliance with Contract Documents.
         3) Lamp catalog sheets of each lamp type for approval, including specific lamp type, manufacturer, and all appropriate lamp criteria including but not limited to: life, initial and mean lumens, beam spread, candlepower, lamp envelope, base type, color temperature, and color rendering index
      b. Manufacturer's photometric data, distribution curves, isolux charts, glare factor data, and coefficients of utilization for each lighting fixture type.
   2. Shop Drawings:
      a. Shop Drawings.
      b. Bills of material.
   3. Quality Assurance/Quality Control Submittals:
      a. Design Data:
         1) Calculations demonstrating that substituted fixtures are equivalent to the named fixtures.
      b. Certificates:
         1) Proof that equipment furnished has the required Underwriters' Laboratories (UL) listing.
         2) Ballast certifications.
      c. Manufacturer's Instructions:
         1) Manufacturer's installation instructions.

1.7 EXTRA MATERIALS

A. Lamps:
   1. For the lighting fixtures furnished, provide an additional 10 percent of each lamp type specified over the quantity required to initially lamp the fixtures furnished.

B. Maintenance Tools:
   1. Provide two each of the special maintenance tools as may be necessary for re- lamping fixtures and for fixture maintenance.

C. As the equipment for which the extra materials can be used is substantially completed, turn the extra materials for that equipment over to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Conduit and Raceway:
   1. Provide electrical conduit and raceway in accordance with the requirements of Section 26 05 33.13, or as indicated and as appropriate for the application per NFPA 70.

B. Control Devices:
   1. Provide electrical lighting control devices in accordance with the requirements of Section 26 27 26.

C. Fixture Support Devices and Fasteners:
   1. In addition to the supporting devices and fasteners specified in Section 26 05 28, provide suspension accessories, canopies, casing, sockets, holders, reflectors, plaster frames, recessing boxes, and similar items required to support the lighting equipment and luminaries as specified or indicated.

D. Wire and Cable:
   1. Provide electrical wire and cable in accordance with the requirements of Section 26 05 19.

2.2 MANUFACTURED UNITS

A. Light Fixtures:
   1. Provide those fixtures indicated on the Lighting Fixture Schedule on the Contract Drawings or approved substitutions.
      a. The manufacturers' fixture descriptions and corresponding fixture model numbers are also listed in the Lighting Fixture Schedule on drawing E-001.
      b. Additional manufacturers who can provide products comparable to those provided by the manufacturers listed and whose products the Design Builder proposes to use for this Contract must first be submitted to and receive the approval of the Engineer prior to being substituted for the listed manufacturers.
   2. Fixture Grounding Device and Conductor:
      a. Provide the housing of each fixture with a separate, factory-installed grounding device and ground conductor.
   3. Exterior Fixtures:
      a. Factory-equip fixtures intended for exterior installation with waterproof gaskets and anodized aluminum frames unless indicated otherwise on the Contract Drawings.
         1) Provide outlet boxes, neoprene gaskets, and stainless steel hardware to render the exterior fixture installation waterproof.
      b. Finish:
         1) Provide fixtures for exterior installation with a finish free of scratches and other surface blemishes.
      c. Brackets:
         1) Provide brackets of the type and style indicated or scheduled on the Contract Drawings and color matched to the light fixture.

B. LED Lighting Fixtures (excluding LED exit signs)
   1. Color temperature of any substituted fixture shall be within 10% of the specified value shown on the drawings.
   2. Power consumption of any substituted fixture shall not exceed the specified value shown on the drawings by more than 10%. If a substituted fixture is submitted and approved at an increased wattage 9within 10% of the specified wattage), any power system modifications necessary to accommodate the fixtures will be the responsibility of the Design Builder (i.e. increased wire sizes, increased circuit breaker size, additional circuits/breakers, etc.)
   3. LED Lumen Efficacy (Lumens/Watt) of a substituted fixture shall not be less than the specified fixture by more than 10%.

4. Characteristics of substituted fixtures shall have the same features as the specified LED fixtures (i.e. redundant drivers, driver protection, etc.) whether specifically noted on the lighting fixture schedule or not.
5. Drivers shall not exceed 350mA unless specifically noted otherwise on the lighting fixture schedule. Drivers shall have a Class A sound rating.
6. LED Light fixtures shall have a minimum expected life of 50,000 hours. The aforementioned life rating must be conducted with a 40 degrees calcium ambient temperature.
7. Power Factor: The LED fixture shall have a power factor of 0.90 or greater.
8. Total Harmonic Distortion induced into the AC power line by the luminaire shall not exceed 20 percent.
9. Surge Suppression: The LED fixture on-board circuitry shall include surge protective devices to withstand high repetition noise transients as a result of utility line switching, nearby lightning strikes, and other interference. The SPD shall protect the luminaire from damage and failure for common mode transient peak voltages up to 10 kV (minimum) and transient peak currents up to 5 kA (minimum). SPD shall conform to UL 1449 depending of the components used in the design. SPD performance shall be tested per the procedures in ANSI/IEEE C62.41-1992 (or current edition) for category A (standard). The SPD shall fail in such a way as the Luminaire will no longer operate. The SPD shall be field replaceable.
10. Operational Performance: the LED circuitry shall prevent visible flicker.
11. Thermal Management: The thermal management (of the heat generated by the LED's) shall be of sufficient capacity to assure the proper operation of the luminaire over the expected useful life. Thermal management shall be by passive design – the use of fans or other mechanical devised is not allowed.

C. Lighting Contactors:
1. Provide the type of contactor scheduled on the Contract Drawings, with the number of poles per contactor and the amperage and load voltage ratings indicated.
    a. For all types of lamp loads, provide single or multiple contact, continuous duty, electrically or mechanically held type contactors suited for non- inductive loads.
    b. Provide contactors of the flush dead back design with arc shields and barriers to prevent pole-to-pole flashover.
    c. Provide contactors with all parts accessible for inspection and maintenance.
        1) Provide contacts that are readily replaceable from the front of their panels.
2. Interrupting Capacity:
    a. Provide contactors with an interrupting capacity of 150 percent of their rating with no derating for high inrush loads.
3. Enclosure:
    a. Provide a contactor enclosure designed to meet the requirements for NEMA 12 surface type enclosures as specified in NEMA 250 unless indicated otherwise on the Contract Drawings.
    b. Provide enclosures complete, and with provisions for padlocking.
4. Acceptable Manufactures
    a. Square D www.schneider-electric.com
    b. Eaton Electric www.eatonelectric.com
    c. Siemens www.siemens.com
    d. General Electric www.geindustrial.com
    e. Allen-Bradley www.ab.com
    f. Or Approved equal.

D. Photocontrols:

1. Provide cadmium sulphide, hermetically sealed photocells suitable for remote mounting.
    a. For individual luminaries, provide plug-in, twist-to-lock-type photoelectric controls with voltage characteristics compatible with the luminaire.
    b. For a group of luminaires and/or lighting fixtures, provide conduit mounted type photoelectric controls with the voltage characteristics indicated on the Contract Drawings.
2. Provide fully temperature compensated photo controls designed with a 15 second time delay to prevent false switching.
3. Acceptable Manufacturers:
    a. Tork www.torkusa.com
    b. Tyco Electronics www.te.com
    c. Paragon Electrical Products www.paragontimecontrols.com
    d. Or Approved equal.

E. Luminaire Brackets:
1. Provide luminaire brackets of the type and style as indicated or scheduled on the Contract Drawings and color matched to light fixture.
2. Provide luminaire brackets fabricated to be compatible with the configuration of the luminaire.

F. Luminaire Poles
1. Comply with AASHTO LTS-3 for pole or other support structures, brackets, arms, appurtenances, base, and anchorage and foundation.
2. Wind-Load Strength of Total Support Assembly: Adequate to carry support assembly plus luminaires at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of 70 mph with a gust factor of 1.3. Support assembly includes pole or other support structures, brackets, arms, appurtenances, base, and anchorage and foundation.
3. Strength Analysis: For each pole type and luminaire combination, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
4. Aluminum Poles: Fabricated from seamless, extruded structural tube complying with ASTM B 429, 6063-T6 alloy with access handhole in pole wall.
5. Metal Pole Brackets: Match pole metal. Provide cantilever brackets without underbrace, in sizes and styles indicated, with straight tubular end section to accommodate luminaire.
6. Finish: Match finish of pole/support structure for arm, bracket, and tenon mount materials.

G. Luminaire Pole Foundations
1. Pole/Support Structure Bases: Anchor type with hold-down or anchor bolts, leveling nuts, and bolt covers.
2. Embedded type with underground conduit/cable entry.
3. Comply with Specification Section 03 30 00- Cast-in-Place Concrete.
4. Design Strength: 4000-psig (20.7-MPa), 28-day compressive strength.

H. Boxes, Gaskets, Hardware, and Support Devices:
1. Provide outlet boxes, neoprene gaskets, and stainless steel hardware to render the installation of the lighting waterproof.
    a. Provide waterproof splice kits where required as specified in Section 26 05 19.
2. Supply pendant stems, special mounting supports and hardware, and miscellaneous materials and incidentals required to install the lighting and emergency battery unit products in place.

3. Provide neoprene spacers for maintaining clearance between lighting and emergency battery unit products and concrete, mortar, and other masonry surfaces.

2.3 CEILING MOUNT OCCUPANCY SENSORS

A. One Way Directional Occupancy Sensor:
   1. Occupancy sensor shall combine both ultrasonic and passive infrared sensing.
   2. Occupancy sensor shall operate on 24VDC.
   3. Occupancy shall have automatic timer and sensitivity features to prevent "false- offs" and "false ons".
   4. Occupancy sensor shall cover 1,000 square foot.
   5. Occupancy sensor shall be provided with a mask to eliminate the coverage area for applications not requiring the full field of view of 360 degrees.

B. Multi-Directional Occupancy Sensor:
   1. Occupancy sensor shall combine both ultrasonic and passive infrared sensing.
   2. Occupancy sensor shall operate on 24VDC.
   3. Occupancy shall have automatic timer and sensitivity features to prevent "false- offs" and "false ons".
   4. Occupancy sensor shall cover 2,000 square foot.
   5. Occupancy sensor shall be provided with a mask to eliminate the coverage area for applications not requiring the full field of view of 360 degrees.

C. Power Pack for Occupancy Sensors:
   1. Power Pack shall have a high impact, UL rated 94 – 5 V plastic construction case.
   2. Power Pack shall be plenum rated.
   3. Power Pack shall have a 277V primary input and a 24 VDC, 100 mA nominal, full-wave rectified and filtered output.
   4. Power Pack shall have two isolated relays for the control of two circuits. Contact ratings shall be 20A for fluorescent ballasts and 1 HP for motor load.

2.4 ENTRANCE DIRECTIONAL LIGHTS

A. Provide directional lights above each traffic lane.

B. The directional lights shall be red and green, LED, 300 mm by 300 mm signal modules.

C. The material requirements, manufacturing, performance tests and electrical components shall be in accordance with NYS DOT Engineering Instructions EL 04-041.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to ordering flush mounted or lay-in type lighting fixtures, verify their locations and clearances, and coordinate with other construction work to verify that the fixtures will fit without interferences.

1. The Engineer assumes no responsibility for clearance, dimensions, tolerances, or exact hanging frame dimensions.

B. Prior to beginning installation of the lighting fixtures and accessories, verify that all other work affecting the installation of the lighting fixtures and accessories is complete to the extent that the light fixtures may be installed over substrates or incorporated into integrated systems without adversely affecting the lighting or other construction.

3.2 INSTALLATION

A. Assemble lighting fixtures if required; and install and wire the lighting fixtures, supports, brackets, and accessories at the locations and mounting heights indicated on the Contract Drawings.
   1. Wire the lighting fixtures and accessories as specified in Section 26 05 19.
   2. Ground the lighting fixtures in accordance with the requirements of Article 410 of NFPA 70 (NEC) and Section 26 05 26.
      a. Use the fixture grounding device to connect a separate grounding conductor in compliance with requirements specified in Section 26 05 26.
   3. Install all photoelectric controls facing north for proper operation.

B. Recessed Fixture Installation:
   1. Support recessed fixtures on the ceiling system's structural elements rather than its surface materials such as tiles, plaster, drywall, or similar surfaces.
      a. Use the mounting yokes furnished with the fixtures and, where required, the supports specified in Section 26 05 28.
   2. If the fixture is to be installed in modular tile ceilings, locate the fixture in the center of the ceiling panel unless indicated otherwise.
      a. Refer to the Architectural Reflected Ceiling Plan included in the Contract Drawings for modular tile ceiling layouts.
   3. If light leaks through gaps between the recessed fixture trim and the adjacent surface, install suitable sealing gaskets.

C. Exposed Fixture Installation:
   1. Install surface mounted and exposed fixtures as indicated on the Contract Drawings.
      a. Hang suspended fixtures plumb, with continuous rows of fixtures in alignment.
      b. Mount suspended fixtures in each room or area at the same height regardless of varying clear height conditions unless otherwise indicated on the Contract Drawings.
      c. Install surface mounted fixtures tight up against the substrate to eliminate gaps except where NFPA 70 (NEC) or local code restrictions require a separation between the fixtures and substrate.
   2. Exit Fixture Installation:
      a. Install exit fixtures for doors directly over the doorways as indicated on the Contract Drawings
      b. Center the fixtures over the doorways, and install the fixtures to clear the door and associated hardware.

D. Poles
   1. Use web fabric slings (not chain or cable) to raise and set poles.
   2. Mount pole to foundation with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
   3. Secure poles level, plumb, and square.

4. Grout void between pole base and foundation. Use nonshrinking or expanding concrete grout firmly packed in entire void space.
5. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

3.3 INTERFACE WITH OTHER WORK

A. Verify the locations and clearances of other installed or proposed work, and coordinate lighting fixture installations accordingly.

B. Coordinate the installation of lighting fixtures with all building systems and components to avoid any installation conflicts.

3.4 FIELD QUALITY CONTROL

A. Inspect, test, and certify lighting and the associated electrical distribution system and equipment in accordance with the requirements of Section 26 05 63.

3.5 CLEANING

A. Clean new lighting fixtures by following the cleaning procedures as recommended by the fixture manufacturer:
1. Use only those products for cleaning as recommended in the fixture manufacturer's literature.

3.6 AIMING AND FOCUSING

A. Design Builder shall notify the owner one week in advance and establish schedule for a night when final aiming will be done.

B. Lock the aiming adjustments, set during final aiming, in position. Position must hold during relamping and normal maintenance.

END OF SECTION

[This Page Left Intentionally Blank]

DIVISION 27
COMMUNICATIONS

SECTION 27 00 00 COMMUNICATIONS SYSTEM

PART 1 - GENERAL

1.1 OVERVIEW:

A. The Communications System Work under this Contract consists of, but not necessarily be limited to, furnishing and installing fiber optic and copper communications network interfaces and equipment with associated power supplies, cabinets, wiring and cabling, housing, mounts, brackets, conduits, fitting and connectors at designated network access sites to support communication needs of the systems required under this Contract. Please see Contract Drawings for specific locations requiring work. Locations shall include all field locations under Contract, and all remote and central locations to interface with this Contract for Metro-North Railroad (MNR) station platforms and customer areas.

B. The Communications systems provided shall be fully integrated with the existing MNR Communications Systems.

C. The contractor is responsible for all installations, configurations to final integrations into the MNR Communications Systems.

D. Contractor shall be responsible to ensure that all equipment (to be furnished and installed under Contract) and cabling have the correct connector types and are configured with the correct configuration options.

E. The Contractor shall bear full responsibility for all the designs of layouts for furnishing, removals and installations required under this Contract. All design drawings submitted for approval shall be checked, approved and countersigned by a Professional Engineer licensed by the State of New York. Submit drawings showing all cabling and wiring necessary for a functional system such as communications wiring between new equipment and existing equipment / patch panels / termination blocks both inside and outside the cabinet, and wiring for powering of new equipment, the proposed method of installation of chases, rack layouts, brackets, conduit, equipment layouts, and other field requirements. The contractor shall not proceed with such work until approval has been received. Such approval is for the sole responsibility of minimizing delays and rework in the field due to late identification of unacceptable practices and shall not relieve the Contractor of the responsibility for the accuracy, constructability and operational integrity of the Work.

F. Equipment shall be capable of interfacing with, and transporting the following applications:
   1. Digital (IP-based) CCTV;
   2. Fire alarm system;
   3. MEP SCADA system;
   4. Wireless data access system (such as IEEE 802.11 and 802.16);
   5. Enterprise data system, including employee workstations;
   6. Automated fare collection system;
   7. Emergency alarm system;

G. Fiber optic and copper connections shall be used for network connections between remote sites and networking equipment in communications rooms. Where applicable and noted under this

Contract, furnish and install media converters to support the connectivity to the communications rooms.

H. All copper and fiber cabling shall be armored or installed in conduits to protect from rodent damage.

I. The Contractor shall follow the guidelines below:
   1. Complete all site surveys and network design prior to furnishing any network equipment.
   2. Acceptance Testing of the network system shall be performed.
   3. Configuration and provisioning of network equipment with appropriate addresses shall be completed prior to installation of equipment in the field.
   4. Test all MNR provisioned circuits to ensure circuit parameters meet the need of the Contract.

J. Coordination with Other On-going Contracts
   1. Coordinate the work under this Contract with other contracts that are in construction at the sites indicated in Contract Drawings as they have impacts on schedule and successful completion of this Contract.

K. Section Includes:
   1. Telecommunications network interfaces.
   2. Telecommunications mounting elements.
   3. Backboards.
   4. Communications equipment racks and cabinets.
   5. Power Strips.
   6. Grounding.
   7. Unshielded twisted pair cabling.
   8. Fiber optic cabling.
   9. Data and voice outlets.

1.2 DEFINITIONS

A. CCTV: Closed Circuit Television

B. AWG: American Wire Gauge

C. AMP: Ampere

D. ASCE: American Society of Civil Engineering

E. mAMP: Millie Ampere

F. AC: Alternative Current

G. DC: Direct Current

H. V: Voltage

I. EMF: Electromagnetic Frequency

J. COM: Communication

K. CPU: Central Processing Unit

L. FOC: Fiber Optic Cable

M. FOV: Field of View

N. IEEE: Institute of Electrical and Electronic Engineering

O. IP: Internet Protocol

P. RU: Rack Unit

Q. NVR: Network Video Recorder

R. MTA: Metropolitan Transpiration Authority

S. MNR: Metro North Rail-Road

T. NEC: National Electrical Code

U. NFPA: National Fire Protection Association

V. UL: Underwriter Laboratory

W. UTP: Unshielded twisted pair

X. LAN: Local Area Network

Y. VMS: Video Management System

Z. PA: Public Address

AA. PoE: Power over Ethernet

BB. PoE+: Power over Ethernet (Plus)

CC. PB: Pull Box

DD. PDU: Power Distribution Unit

EE. JB: Junction Box

FF. SIA: Security Industry Association

GG. TCP/IP: Transmission Control Protocol/Internet Protocol

HH. TIA: Telecommunications Industry Association

II. UL: Underwriters Laboratory

JJ. NEMA: National Electrical Manufacturer's Association

KK. ANSI: American National Standards Institute

LL. ASTM: American Society for Testing and Materials

MM. ADA: Americans with Disabilities Act

NN. UTP: Unshielded Twisted Pair

OO. WAN: Wide Area Network

PP. IEC: International Electro Technical Commission

QQ. PC: Personal Computer

RR. UPS: Uninterruptible Power Supply

SS. BICSI: Building Industry Consulting Service International

TT. RCDD: Registered Communications Distribution Designer

1.3 CODES AND STANDARDS

A. All items furnished and installed under this Specification shall comply with the latest edition of applicable codes, provisions and all applicable standards issued by the organizations referenced below. The following publications are incorporated herein by reference to the extent applicable:

1. National Fire Protection Association (NFPA):
   a. NFPA 70 National Electrical Code.
2. Underwriters Laboratories, Inc. (UL) Standards
3. National Electrical Manufacturers Association (NEMA) Standards
4. American National Standards Institute (ANSI) Standards
5. Telecommunications Industries Association/ Electronic Industries Alliance (TIA/EIA) standards
6. Leadership in Energy and Environmental Design (LEED)
7. U.S. Green Building Council (USGBC)
8. International Organization for Standardization (ISO)
9. Americans with Disabilities Act (ADA)
10. Building Code of New York State
11. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
12. New York State Electrical Code (NYSEC)
13. Institute of Electrical and Electronics Engineers (IEEE) Standards
14. Advanced Television System Committee (ATSC)
15. Audi Engineering Society (AES)
16. Institute of Electrical and Electronics Engineers (IEEE) Standards
17. Telecommunications Industries Association/ Electronic Industries Association (EIA/TIA) standards.

B. Equipment shall meet all FCC rules and regulations including but not limited to the rules governing lightning and surge protection, electromagnetic interference and electromagnetic compatibility.

1.4 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Manufacturer's certification as required: signed by the manufacturer certifying that they comply with the specification's requirements. Upon request, submit evidence of experience.
4. Product certification as required: signed by the Contractor, certifying that the installers comply with the specified requirements.
5. Submit catalog cuts for wires and cables. Do not issue purchase orders or order the cable to be manufactured until approval of the catalog cuts.
6. For Public Address System: For the following equipment as may be required under this contract:
   a. Preamplifiers.
   b. Power amplifiers.
   c. Transfer to standby amplifier.
   d. Volume limiter/compressor.
   e. Tone generator.
   f. Equipment cabinet and rack.
   g. Loudspeakers.
   h. Volume Attenuator Station
   i. Battery backup power unit.
7. For CCTV System:
   a. Manufacturer's product data and installation instructions for each control device furnished, indicating dimensions, capacities, performance characteristics, electrical characteristics, finishes of materials, and including startup instructions. Provide samples as required. Product data shall be clearly labeled providing the reviewer with all relevant information required. These devices, products and materials shall have a product data sheet either previously submitted and approved or be part of the current Submittal.

B. Shop Drawings:

1. For Communications Equipment: Include plans, elevations, sections, details, and attachments to other work.
   a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   b. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.

      1) Provide detailed cabinet layouts indicating equipment and mounting location within the rack.

2) Provide detailed wiring diagram and schematic for the all equipment.
3) Communication Room Drawings indicating:

i. Architectural plan of the room with dimensions, including elevations.
ii. Location of equipment cabinets, racks, cables, cable ladders and conduits with sizes and types.
iii. A.C. and D.C. feeds to equipment cabinets with references to the source locations (electric panels, transfer panels, etc.).
iv. Location of equipment proposed for future installation, as directed.

c. Submit schematic cable connections, wire, conduit and trough schedules, duct assignment, cable entrance details, cable tray, conduit and trough layouts, cable layout and detailed construction drawings for approval before the start of any work. Submit junction box(s) and pull box(s) development drawings indicating existing and new cables before the start of work. The drawings shall also indicate existing and new cable arms and racks.

2. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.
3. Tagging/labeling nomenclature and related product data.
4. For CCTV System:
   a. Submit schematic cable connections, wire, conduit and trough schedules, duct assignment, cable entrance details, cable tray, conduit and trough layouts, cable layout and detailed construction drawings for approval before the start of any work. Submit junction box(s) and pull box(s) development drawings indicating existing and new cables before the start of work. The drawings shall also indicate existing and new cable arms and racks.
   b. Plans indicating location of cameras along with mounting types and FOV. Plans shall clearly label all devices, products and materials that are to be installed. Plans shall also provide a detailed layers layout of the platform, lighting and canopy indicating camera locations indicating wiring and conduits being utilized to interconnect all portions of the VMS system. Layers shall be in PDF and AutoCAD formats allowing the ability of the reviewer to enable and disable layers.
5. For Public Address System: Signed and sealed by a qualified professional engineer.
   a. Equipment Details: Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location of each field connection.
   b. Product data for each product specified; samples as required.
   c. Plans furnished by the manufacturer.
   d. Rack arrangements.
   e. Wiring Diagrams: Power, signal, and control wiring. Include the following:
      1) Identify terminals to facilitate installation, operation, and maintenance.
      2) Single-line diagram showing interconnection of components.
      3) Cabling diagram showing cable routing.

C. As-built Drawings:

1. Final installation drawings of communications System, drawn to scale based on all contractual approved changes from original contract.
2. Show cabling administration-point labeling. Identify labeling convention and show labels for equipment cabinets, power cables, copper communication cables, fiber cables, terminal hardware and positions, and equipment grounding conductors.

3. Furnish (6) six hard copies and an electronic record of all drawings, in software and format selected by the MNR.

D. Cable Schedule:

1. List incoming and outgoing cables and their origins and destinations.
2. Furnish an electronic copy of final comprehensive schedules.

E. Operation and Maintenance Data manuals.

F. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

G. Submittal log.

H. Test procedures and test reports for all testing and product data for test equipment; forms to be used for test data; test schedule; certified copies of test results; notification of testing four weeks in advance.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.
2. Bidder must submit their Manufacturing Quality Program Manual (MQPM) and a sample of the proposed product with their bid.
3. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall always be present when Work of this Section is performed at Project site.
4. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection

B. CCTV System:
1. Manufacturer shall be a firm regularly engaged in a manufacture of enterprise grade CCTV System, of types and sizes required, whose products have been a satisfactory use similar service for not less than five years. Products should be compatible with the existing MNR and MTA PD deployed products.
2. Installer is required to document that all technicians are currently certified by the CCTV System manufacturer and shall have a minimum five years successful experience in CCTV System installations.
3. Testing Agency Qualifications: Qualified agency, with the experience and capability to conduct testing indicated. Testing Agency's Field Supervisor: Currently certified by manufacturers to supervise onsite testing.
4. Source Limitations: Obtain CCTV System and/or CCTV System components from a single source and/or a single manufacturer, where applicable.
5. 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.
6. Comply with NFPA 70
7. All components and materials shall be UL listed.

1.6 SYSTEM DESIGN:

A. The design of the system shall be based on the current Communications System Design Guidelines and MNR Standards. The system infrastructure shall be designed to provide connected Communications Panels with a Gigabit connection at all times.

B. The system shall contain the latest security methods utilizing industry-standard technologies. The system shall be upgradeable by way of firmware, software, or ROM upgrades as new security technologies are standardized.

C. The system shall be complete with all required hardware and licenses for an ISP to connect and install equipment in the communication cabinet.

PART 2 - PRODUCTS

2.1 COMMUNICATIONS ROOM (WHERE REQUIRED):

A. The room's square footage shall accommodate all required communications and IT equipment, but at a minimum, shall have at least 64 square feet of usable floor space.

B. Four (4) dedicated 20-amp, 120-volt circuits with isolated grounds.

C. Sufficient insulation to prevent wide temperature swings in the conditioned space.

D. Smoke detector wired to station Fire Alarm System if station is occupied with such system.

E. The room shall be equipped with a secured door that can be accessed by IT department staff.

2.2 NETWORK EQUIPMENT (WHERE REQUIRED):

A. The network equipment shall support redundant communications with management system.

B. The network equipment shall be mounted to allow ease of access to front of cabinet.

C. The network equipment shall be mounted to minimize vibration effects on equipment.

D. The network equipment shall be mounted to maximize contiguous free panel space for future use.

E. The network equipment shall support 10GBASE-X LAN PHY and 10GBASE-X WAN PHY modules, with small form pluggable modules of appropriate type for single mode and multi-mode fiber optic cables.

F. The network equipment shall be configured with a power supply. The most appropriate PS shall be provided for this project.

G. Equipment shall be configured for 120VAC power supply.

H. Equipment shall support -48VDC power supply.

I. The network equipment shall support 10/100/1000BASE-T.

J. The network equipment shall support all IEEE 802.XX related protocols, not necessarily limited to 802.3ah, 802.1D, and 802.1ah.

K. The network equipment shall support, not necessarily limited to, IGMP Snooping, DHCP, BOOTP, DHCP relay, NTP, SNTP, STP and RSTP.

L. All communications equipment shall be capable of supporting both local and remote security mechanisms for access. Local security mechanisms shall include any security mechanism to prevent unauthorized access via the craft terminal interface. Remote security mechanisms shall include any security mechanism to prevent unauthorized access via the remote interface.

M. Equipment shall support SR (short reach), IR (intermediate reach), LR (long reach) and VLR (very long reach) optical interfaces.

N. Furnish and install optical interfaces of appropriate transmit power rating (SR, IR, LR or VLR) to support the link attenuation calculations. Design Builder shall submit for approval the interfaces to be used for the network system.

O. Equipment shall support 850 nm wavelength transmission for multimode fiber.

P. Equipment shall support 1310 nm wavelength transmission for single mode fiber.

Q. Equipment shall support all Metro Ethernet Forum specifications, not necessarily limited to, MEF-2, MEF-3 and MEF-4.

R. Equipment shall support all ITU-T specifications for connection-oriented Ethernet, not necessarily limited to, G.8032 and G.8032.

S. Equipment shall support Power over Ethernet (POE).

2.3 EQUIPMENT FRAMES, RACKS, CABINETS AND ENCLOSURES (WHERE REQUIRED):

A. Racks shall include all equipment for the systems including, but not limited to the PA system (Audio System), Visual Display System and TVMs/TOMs.

B. IT and C&S departments shall cooperatively determine the location of their equipment in the new Communications Room.

C. Manufacturers: Subject to compliance with requirements, provide products as below or equivalent to:
   1. Chatsworth Universal Equipment Rack
   2. APX.
   3. Belden Inc.
   4. Cooper B-Line.
   5. Emerson Network Power Connectivity Solutions.
   6. Hubbell Premise Wiring.
   7. Leviton Commercial Networks Division.

8. Middle Atlantic Products, Inc.
9. Ortronics, Inc.
10. Panduit Corp.
11. Siemen Co.
12. Tyco Electronics Corporation;
13. AMP Products.
14. Rittal.

D. General Frame Requirements:

1. Distribution Frames: Chatsworth Universal Equipment Rack 84” H’ x 19’’W, 45 RMU Standard Equipment Rack, Black Anixter #164164, CPI # 46353-703 or equivalent.
2. Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
3. Module Dimension: Width compatible with EIA 310-D standard, 19-inch (480-mm) panel mounting.
4. Finish: Manufacturer's standard, baked-polyester powder coat.

E. Floor-Mounted Racks: Modular-type, steel construction.

1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
2. Baked-polyester powder coat finish.

F. Modular Freestanding Cabinets:

1. Removable and lockable side panels.
2. Hinged and lockable front and rear doors.
3. Adjustable feet for leveling.
4. Screened ventilation openings in the roof and rear door.
5. Cable access provisions in the roof and base.
6. Grounding bus bar.
7. Rack-mounted, 550-cfm (260-L/s) fan with filter.
8. Power strip to accommodate all equipment.
9. Baked-polyester powder coat finish.
10. All cabinets keyed alike.

G. Wall Mounted Cabinets:

1. Single door wall-mount cabinet, for indoor use, or approved equal:
2. Nominal Dimensions 24” Tall x 24” Wide x 8” Deep;
3. 0.125" thick aluminum alloy type 5052-H32 or 14ga steel construction with fully welded seams;
4. NEMA Type 3R and/or 4X;
5. Solid door with 3 latch locking handles (all cabinets keyed alike) and seamless closed-cell neoprene gasket;
6. Power strip to accommodate all equipment;
7. Grounding bus bar

H. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.4 GROUNDING:

A. Comply with requirements in Division 07 05 26 "Grounding and Bonding" for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:

1. Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
2. Ground Bus Bar: Copper, minimum 1/4-inch-thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V. C. Comply with J-STD-607-A.

2.5 CCTV SYSTEM – POLICE OBSERVATION DEVICES (PODS):

A. MNR will procure, configure and test the CCTV system PODS for the project. The Contactor shall install the PODS, configure and test the CCTV PODS.

B. The information below is general for the equipment and shall be used by the contractor as supplemental information.

C. GENERAL:
1. The CCTV system POD is an out-door, pole/wall mounted enclosure that communicate with the Head-end equipment through a cellular network.
2. Each PODS shall consist of a POD enclosure manufactured by Solar Grid Surfer. Each POD shall have 4 Cameras connected to it.
3. The Contractor shall ensure the system provided meet all general and functional requirements specified in this section. If the system does not meet a specific requirement specified, provide explanation and proposed alternative. Submit requests for approval at least 45 days prior to the commencement on testing or on the first production unit.
4. The Contractor shall identify and manage all physical and logical interfacing among all existing and new systems provided under this contract to ensure that all communications, processes, and interactions between devices, subsystems and the overall system operate as defined by contractual requirements.
5. Survey equipment locations. Install equipment to provide Camera coverage for the areas required; provide unobstructed, display clear views of these areas at all current monitoring locations (Command Center(s) and desktop PCs); provide video recordings capable of being played back to produce the original, identifiable images which were recorded. Field of View (FOV) drawings shall be supplied demonstrating camera views of complete coverage. Pan-Tilt-Zoom (PTZ) camera coverage shall display as fixed position showing 70 degrees at 150 foot in layered PDF and AutoCAD formats allowing individual cameras FOV to be enabled/disabled.

6. Any variation to security devices shall require prior approval of the LIRR Office of security and shall be submitted under separate cover for an individual specific use/location per request.
7.

D. FEATURES AND FUCNTIONALITY:
1. In general, cables installed inside a cabinet or console shall be flexible type. The CCTV cameras will be IP and therefore utilize the system's Structured Cabling for communication from the CCTV camera to the security rack. Pan/Tilt/Zoom (PTZ) cameras shall run over single structured cable (signal and power) to support the operation of the camera motor to pan, tilt and zoom. Should at time of installation, power requirements for PTZ cameras be fully operational (signal and power) over separate Structures Cables, the Contractor shall submit this change to LIRR for approval.
2. The Contractor shall provide integration with MNR and MTA PD current Video Management System, Genetec.
3. Fasteners used to install certain equipment shall be tamper resistant.
4. All manufactured products shall be thoroughly tested and proven in actual use.
5. The manufacturer shall repair or replace without charge, manufactured products proven defective in material or workmanship for the stated warranty period from the date of shipment.
6. If applicable, all reference to fixed cameras shall require prior approval to specific locations, general interpretation of use is not permitted. Prior approval for all cameras (including but not limited to 360 degree viewing camera, elevator cameras, etc.) shall be required and approved by MNR and MTA PD.
7. It is the requirement and responsibility of the designer and installing contractor to fully configure all MNR conventions, such as but not limited to CCTV System naming, camera naming, IP addressing, and other MNR specific designations, e.g., device location coordinates (latitude/longitude/altitude) where required within MNR System

E. EQUIPMENT:
1. The Enclosure shall consist of the following:
   a. Cellular Modem: M2M Cellular Gateway Router
   b. Cellular Antenna
   c. Network Switch: Cisco IE 1000-8P2S-LM (2 per enclosure)
   d. UPS system
   e. Enclosure monitoring and control devices
   f. Surge protection
   g. NVR: Image Point Eclipse i5: 500 Gb MSATA, 16 Gb DDR4, Windows 10 Pro with and external HD of 4TB SSD.
   h. Genetec SCS Base version license for the installed devices
2. CCTV Camera:
   a. All cameras shall be IP (digital) cameras.
   b. All IP cameras shall be Pan-Tilt-Zoom (PTZ) unless prior written authorization is approved by the MNR and MTA PD. PTZ functionality can be either mechanical (motorized) or logical (software) based and shall be at the discretion of the MNR and MTA PD.
   c. PTZ cameras shall have a pre-defined "Home" position.
   d. All cameras shall be supplied with perpetual licenses
   e. All cameras shall be capable of bulk updating firmware, analytics, and camera configurations, as well as all other configurable settings.

f. There shall be sufficient and uniform lighting to capture all visible skins characteristics (that is, blemishes, moles, marks, etc.).
g. Camera Model: Panasonic WV-S2531LN 1080p H.265 (4 per enclosure)

2.6 COMMUNICATIONS CABLES:

A. Copper Cables:
1. General
a. All inside plant cables shall be installed inside rigid steel conduits, except where cable tray systems are utilized, or unless otherwise shown on the Contract Drawings.
b. All communication cables, that shall be provided and shall be installed inside, shall be provided with a durable Thermoset LSZH Cross-linked Polyethylene Insulation and Low Smoke Zero Halogen Jacket overall.
c. For internal wiring of electronic components: Where electronic components are the manufacturer's standard product line, internal wiring shall be the manufacturer's standard. The Design Builder shall submit samples of proposed types of wire and wiring methods for approval.
d. All inside plant cables shall be either UL listed Type XHHW-2 for service at 90C wet and dry or UL Listed Type CM and shall be specifically formulated and manufactured for low smoke and low flame spread as well as zero halogen classification per the following:
1) UL 1685/VW-1
2) IEEE 1202/FT-4
3) NFPA 130
2. Low Smoke, Zero Halogen Network Cables for Voice and Data: Selection and application of copper telecommunication cable shall be balanced twisted-pair telecommunications cabling meeting the requirements for Category 6 in accordance with TIA 568-C and meet the requirements of NEMA WC 63.1. All installed Network copper communication cables shall be minimum copper 4-pair, No. 24 AWG UTP, Category 6, tested to 500-megahertz for voice and data.
3. Complete construction shall pass IEEE 1202/FT4 flame test and be UL listed. Completed construction shall comply with NFPA 130, and below:
4. Insulation: LSZH Cross Linked Polyolefin, Nominal wall thickness 8-mils
5. Pairs: Two insulated conductors cabled together with varying lays.
6. Conductors shall conform to ASTM B3.
7. Color Code per ICEA S-80-576

Pair	Conductor 1	Conductor 2
1	White	Blue
2	White	Orange
3	White	Green
4	White	Brown

8. Cable the four pairs around a LSZH cross web separator at a nominal 5-inch lay.

9. Tape: Optional barrier tape over cabled core
10. Jacket: Low smoke, zero halogen, Polyolefin jacket with a nominal wall thickness of 25-mils on non-shielded and 31-mils on the shielded cables

B. Fiber Optic Communications Cable:

1. For Single Mode Fiber, the Design Builder shall install Dielectric SM Ribbon Fiber Optic Cable. For Multimode fiber, MNR Communications requires OM4 fiber.

2. Cable must conform with RUS 7 CFR 1755.900 requirements where applicable and be RUS/REA listed.

C. Control Cable:

1. The multi-conductor communication control cable shall be constructed of unshielded multiple insulated conductors of No. 16 to 24 AWG stranded tinned copper wires in accordance with ASTM B8 and B33. All conductors shall utilize 25-mils of low-smoke zero-halogen (LSZH) thermoset cross-linked polyolefin insulation conforming to ICEA S73-532 and be UL listed for both 90-degrees Centigrade wet and dry and 600-volt. Insulated conductors shall be cabled with a suitable binder tape and covered with an LSZH black, thermoset cross-linked polyolefin jacket. All cables shall be UL listed Type TC in accordance with UL 1277.
2. All individual insulated conductors utilized in multi-conductor cables shall meet all the requirements set forth herein, except that UL print is not required on the insulation. Multi-conductor cables shall also meet NFPA 130.

D. Backbone Distribution Telephone Cable: The cable shall consist of 2, 6, 12, 25, 50, or 100 unshielded twisted pairs of insulated No. 19 through 24 AWG solid copper wires protected inside a thermoset cross-linked polyethylene insulation as shown on the Contract Drawings. For the 25 pair No. 22, the wire insulation shall be 11-mils with a 50-mil jacket overall. For the 50 pair No. 19, the wire insulation shall be 16-mils with a 60-mil jacket overall. All of the pairs shall be cabled with a 1-mil binder tape over the core. The jacket shall be a flame-retardant, LSZH polyolefin. This cable shall be designed for (telephone) "punch-down" block termination. Provide ICEA P-61-694 standard colors designated for this cable type. The completed cable construction shall pass IEEE 1202/FT 4-flame test and be UL listed as Type CM.

E. Completed construction shall comply with NFPA 130.

F. Shield:

1. Shielding is required for backbone distribution cables installed in tunnels or as shown on the Contract Drawings. A 25-mil continuously corrugated and welded aluminum sheath shall be applied.
2. Shield Jacket: A black LSZH Polyolefin jacket overall with a nominal 70-mils.
3. Shielded backbone distribution cables shall meet requirements of RUS Bulletins 1753F-205 and 206 as applicable.
4.

2.7 CABLE LADDER RACK AND CONDUITS:

A. Refer to Communications spec 27 15 00 Communications Horizontal Cabling for further details.

PART 3 - EXECUTION

3.1 GENERAL COMMUNICATIONS SYSTEM INSTALLATION:

A. Prior to installation, The Contractor shall survey all sites to ensure submitted drawings accurately represent the current field condition. Design Builder shall make any modifications to drawings to reflect any changes based on survey results.
   1. Prepare forms to document information, such as names of participants, date of survey, room and cabinet location information, rack layout information, and such other information as may be required.
      a. Submit the form for approval.
      b. Submit the data for approval.
      c. Submit the survey schedule for approval. Conduct the survey in the presence of the Engineer, in accordance with the approved schedule.

B. Installation of all equipment shall be in accordance with manufacturer's recommendations, and approved drawings.

C. The communications closet at the stations shall not be used for the installation of any equipment.

D. All wiring shall be neatly installed, and wire ways shall be utilized wherever possible. All wiring shall be identified at both ends by wire markers.

E. The design shall utilize appropriate sized conduits, pull and junction boxes, condulets, troughs, cable tray, flexible conduit and fittings. The DB Contractor shall design all required cable types with associated spares to each location as required. The Design Builder is responsible for equipment start-up, testing and installation of required interconnections.

F. The Contractor is responsible for incidentals and appurtenances necessary to complete the work as specified herein and as shown on the Contract Drawings.

G. Install Communications system equipment in locations as approved on the Contract Drawings. All conduits to the equipment shall be properly sized GRSC.

H. Cabling to Communications system components shall be CAT6A, and cable lengths, including patch cords, shall not exceed 300 feet. Fiber optic cabling shall be installed as required.

I. The switch end of each Category cable shall be punched down to a new patch panel and shall be labeled with the device name of the attached device. The patch panel shall also be labeled with the attached device.

J. Fiber Optic Patch Panels shall be labeled with the room or cabinet that is at the other end, and the Patch Panel labels shall all be filled out and indicate the device on the opposite end or that the strand is spare.

K. No Ethernet connected device shall be installed until its cabling is properly labeled.

L. The device end of each Category cable shall be labeled indicating the originating rack or cabinet.

M. All wire runs shall be continuous, and color code of the wire in all circuits shall not change throughout the circuit unless otherwise noted.

N. The Contractor shall label each Communications system component with a label containing the following items, the Design Builder shall submit an example label to MNR for approval prior to labeling Communications system components:
1. Location designation
2. The equipment ID number from the approved installation drawings
3. The device ID

O. All labels used shall be machine printed yellow weatherproof labels and withstand rain, sleet, snow, dust, and temperatures of -20°F to 160°F. Font and font size shall be approved by MNR.

3.2 CCTV SYSTEM PODS INSTALLATION/CONSTRUCTION:

A. Installation:
1. Where applicable, provide camera dome mounting arms and brackets as recommended by the manufacturer. Camera mounts shall include but not be limited to the following types: pendant, pipe, I-Beam, pole, ceiling, hanging ceiling, embedded/recessed, outside corner, inside corner, shepherd's hook, cornice, etc.
2. Install all conduits for the CCTV System equipment being furnished under the Contract unless otherwise noted. All equipment and wiring shall be installed supervised by the Contractor in accordance with the manufacturers' recommendations.
3. Information shall be submitted for pre-approval before the installation begins, catalog cut sheets and shop drawings are to be submitted for approval.
4. The contractor shall perform all settings, adjustments, configurations and programming required for a complete and operational CCTV System, as approved and as directed by MNR and MTA PD. The contractor shall submit all settings, adjustments, and programming information for MNR and MTA PD approval.
5. The contractor shall configure the recording and camera control equipment at the Head end to parameters supplied by MNR and MTA PD.
6. Furnish and install required hardware and brackets to install the equipment as specified and as required. Furnish and install all required rack mounting kits to install the equipment as specified and as required.
7. Provide tamper resistant fasteners for any junction boxes and camera housings.
8. The Contractor shall use power over Ethernet (POE) technology to support camera and CCTV System device connectivity wherever possible.
9. All (POE) cable runs shall be less than 70 meters (210 feet) from point of origin (equipment head end) to point of termination (camera). For installations >70 meters (210 feet), fiber optic cabling shall be used for CCTV System device/camera connectivity.
10. For all POE-Cabled Cameras exceeding 70 meters, media converters may be used to convert CAT6 connections into Fiber Optic connections. Media converters shall be POE capable:
    a. For fiber optic cable applications, alternatively a secondary low voltage DC power cable shall be installed to support camera/device power. If a DC connection cannot be facilitated, the contractor shall be required to provide separate AC power to the remote camera/device location.

b. Alternatively, at the camera location with fiber optic cables, the cable shall be terminated on a small form factor POE switch to be installed within a junction box either attached to or located near the camera.
c. At the camera location, and for locations that exceed the 70-meter CAT6 limit and require multiple cameras to be installed within a defined area, the contractor may install a fiber optic cable to be terminated on a multi-port, small form factor, POE switch located within suitable equipment housing within a junction box either attached to or located near the camera.

11. The CCTV System Vendor shall have the responsibility for providing the Contractor with hardware and software design modifications, engineering expertise and on-site support services required to integrate the video surveillance system into the existing MNR and MTA PD systems.
12. The CCTV System Vendor shall provide, including but not limited to hardware and software, engineering expertise and on-site services to allow the viewing of on-screen images transmitted to the MNR and MTA PD systems via the video surveillance system. The CCTV System Vendor shall also verify all recording and data-collection functions and demonstrate video recording playback of archived video recordings from each location.
13. The CCTV System Vendor shall provide hardware and software engineering expertise and on-site services to oversee and supervise any modifications made to MNR and MTA PD systems by the Contractor's employees or sub-contractors.
14. The CCTV System Vendor and the Contractor shall take the necessary precautions required to maintain the Administrations warranties with the existing MNR and MTA PD system.
15. The CCTV System Vendor and the Contractor shall participate in all cutovers, tests and trials required to independently verify and validate the video download functionality between the video surveillance system and the existing MNR and MTA PD monitoring system.

B. Survey:
1. The contractor shall perform physical surveys of all proposed camera locations.
2. The contractor shall be responsible for determining optimum camera views of the affected areas and assets to be covered. The following locations, at a minimum, shall be viewable by CCTV cameras: facility ingress/egress points, public doorways, stairways, escalators, elevators, pedestrian and/or motor vehicle choke points (e.g., gates, connecting corridors, turnstiles, etc.), employee facility doorways, public hallways and corridors, balcony areas, train platform areas (end of platform, edge of platform), moving walkways, other points of interest (transportation arrival/departure information signs, information kiosks, etc.), agency identified critical infrastructure, vestibules, general public gathering areas, waiting rooms, facility dead-end areas, agency ticket vending machines, and ATM/cash machines.
3. All surveys shall be coordinated with MNR and MTA PD for final device design and placement.
4. During surveys, the Contractor shall use approved portable cameras (specific to the application), suitable lenses, portable power, and adjustable height support poles to facilitate determining camera placement locations (including camera height from the floor), installation requirements, required mounting hardware and configurations, proper fields of view (FOV), and distances to target.
5. The Contractor shall provide all required equipment (test cameras, lenses, portable power supplies, support poles, cables, and connectors) for all surveys.
6. The Contractor shall determine all appropriate camera mounting hardware required to support each camera installation.

7. Camera mounting heights shall be no less than 9 feet and no higher than 13 feet above the floor. Deviations in mounting heights shall be at the discretion and approval of MNR and MTA PD.
8. The Contractor shall measure and provide written detail on all camera fields of view including, but not limited to, camera placement, width of coverage (angle of lens), distance to target, and pixels on target (pixels per foot).
9. All changes in ceiling pitch, slopes of the floor, deviations in corridor widths, and wall angles/curves shall be accounted for during field of view surveys and camera location surveys to eliminate coverage dead spots or zones.
10. The contractor shall provide graphical representations (drawings) marking the boundaries/limits of the area of each camera's facial recognition coverage (reference standard measurements for facial identification in good conditions @ 80 pixels/foot). The contractor shall also provide MNR and MTA PD with distances and pixel/foot measurements for other selected targets within a camera's FOV (for record purposes).
11. Camera dead zones are to be no less than 5 feet and no greater than 20 feet (from the camera). Dead zone depths shall vary based on the following elements: camera type, lens type and characteristics, field of view (available, required), camera purpose (detection, recognition, and identification), physical layout of the facility being covered, operating environment, and camera mounting options. Final determination of a camera's dead zone shall be provided to the contractor by MNR and MTA PD.

3.3 TERMINATING COMMUNICATIONS WIRES:

A. Terminate all conductors to comply with the applicable industry.

B. Communication type cables shall be so terminated that the length of the individual conductors exposed outside of the cable jacket is held to a minimum. In order to accomplish this, terminate the wires of each cable as close together as possible, all as approved.

C. When terminating a new cable in an existing piece of equipment, where available facilities are not sufficient, provide new terminating facilities within the equipment and rearrange existing terminating facilities and terminations, if required, in order to terminate the new cable. Terminate the new cable in accordance with approved working drawings. Perform work of this nature only in the presence of a duly authorized representative of MNR.

D. The Contractor will be allowed to cut existing tags and remove them from wires without removing the wires from the terminal post. Apply new tags to existing cable pairs and wires carrying special circuits by means of an approved nylon cord in an approved manner. Exercise care in removing old tags to prevent damage to the wires or the insulation or braid on the wires.

E. Wiring shall be done in a neat and skillful manner and have a satisfactory final finished appearance.

F. Install cable, conduit and raceways in such a manner as to minimize visual impact.

G. The maximum run length for copper data cabling shall not exceed 300 feet. Calculate and submit for each run total cable length including the rise and drop of the cable from floor to ceiling.

H. Calculate the link budget requirements during design. Measure actual total attenuation of link prior to installation to ensure adequate transmit and receive power level. At each stage, submit for approval the calculated and measured link budget for all links.

I. All cable installation shall meet the minimum bend radius per cable manufacturer and MNR requirements.

J. Where it is required to make wiring changes, remove the existing lacing twine or tape from the wiring trees for the addition or removal of wires. After such changes have been made, reshape and re-tape the wiring trees in a neat manner and as approved, using cable ties manufactured by 3M Co., or approved equal. Wiring and tagging shall be done in a neat and skillful manner and have a satisfactory final finished appearance. The amount of slack required in cable and wire shall be as required.

K. Terminating wires and cables in equipment
   1. Pull the end of the wire or cable into the case or other equipment housing for an approved distance. Closely and neatly group the wires of the cable and bundle them at a maximum of 4-inch intervals using an approved cable tie.
   2. Loop the group of wires around in the equipment housings to allow for sufficient slack as directed and then spread out and terminate. Form and support the wires in an approved manner to remove the weight of the wires from the terminals. Ensure that the internal wiring does not become damaged and is not crowded out of shape.
   3. Some equipment is provided with hand holes to facilitate pulling and connecting wire and cable. Whenever a hand hole is removed, replace it in such manner as to make an absolutely watertight seal.
   4. Terminate cable pairs in the sequence indicated by the cable color code.

3.4 COMMUNICATION CABINETS:

A. The cabinet shall be of stainless steel construction, NEMA 4X "style" with the exception of 3-point latch door hardware vs. true NEMA 4X multiple clamping assemblies on the individual doors and partially open bottom

B. The cabinet shall contain all equipment rack hardware to accommodate the Communications systems, Security Equipment and electrical distribution and electronic communications equipment.

C. The cabinet shall provide for the mounting and termination of the following equipment and material as a minimum:
   1. Main electrical distribution panel with main breaker
   2. Protected power strips
   3. Power supplies
   4. Fiber optic cable splice enclosures
   5. Fiber optic cable slack, patch panels and cable management
   6. 10 Gigabit Ethernet network switch stack
   7. Health Data
   8. Temperature Data
   9. Cat 6 Patch panels
   10. Fiber optic media converters, modems, and patch panels
   11. Intrusion components
   12. All internal interconnection wiring, cabling, fiber optic cabling and patch cords between equipment racks and terminal blocks
      a. Utility lighting and convenience receptacles

D. The cabinet shall be provided with cooling and heating unit, as required to maintain a thermostatically-controlled stable operating temperature/environment based on the manufactures recommendations for the electric/electronic equipment installed within.

E. The total assembled cabinet structure shall be constructed as a rigid, self-supporting structure that when handled for shipping and placement on foundation shall not warp or deflect internally the roof, outer doors or skin.

3.5 CABINET GROUNDING:

A. Each cabinet shall be equipped with three (3) copper grounding bus bars (for Electrical system, Chassis and communications grounding). Bus bars shall be located near the bottom of the cabinet and be mounted on insulators that electrically isolate the cabinet from the bus bar.

B. Bus bars shall be 12 X 1 X 1 /4 inch thick, solid copper bar, predrilled for connection of individual grounds.

C. The grounding bus bars shall each be bonded to each other with a #4 AWG green insulated copper conductor. The ground bus in the electrical distribution section will be connected to a single #2 group tap on the station ground grid.

D. Internal chassis grounding arrangement shall utilize #6 AWG green insulated, stranded ground wire connected to the Chassis Grounding Bus bar (CGB) per contract drawings.

E. Electrical system ground wire from the station electrical panel enclosure shall be grounded to the cabinet distribution panel ground bus and in turn bonded to the ground bus in the electrical distribution section, per Contract Drawings.

F. Protected Terminal Block ground shall be connected to the CGB using #6 AWG ground wire per Contract Drawings.

G. All electronic equipment grounds shall be grounded; using #1 0 AWG green insulated stranded copper conductors, to the Telecommunications Grounding Bus bar (TGB).

H. Shields from signal cables shall be grounded to the TGB.

I. Refer to Communications spec 27 05 26 Grounding and Bonding for Communications Systems for further details.

3.6 START UP AND INSPECTION:

A. Perform standard tests of all data network and telephone system cabling. Tabulated results of these tests shall be submitted for Design Professional's approval.

1. Inspection:

a. Visually inspect the installation of all equipment to ensure compliance with construction and electrical codes and normally accepted standards of workmanship. If, upon inspection, changes are found to be necessary, the Design Builder shall make such changes promptly at no additional expense to the Contracting Party, or to the Authority.

b. Visually inspect UTP jacket materials for UL or third party certification markings. Inspect cabling terminations in telecommunications rooms and at SIOs to confirm color code for T568B pin assignments, and inspect cabling connections to confirm compliance with EIA/TIA-568-C.1, EIA/TIA-568-C.2.

3.7 COMMUNICATIONS SYSTEM TESTING:

A. The Contractor shall plan for, perform, monitor, and document all tests required to prove the design and acceptability of the Communications system, including all elements, subsystems, and the system as a whole, installed under this Contract. The Contractor shall furnish Communications system equipment that meets the criteria specified for all tests. Testing shall not commence until all designs affecting the respective equipment and MNR or its designated representative has approved all related testing procedures. The testing shall be provided for all Communications system equipment and systems.

B. The Contractor shall perform all Acceptance Tests for both individual systems as well as the integrated system as per this specification section. This shall include functionality, performance, reliability and interoperability testing (with the systems currently installed) of the systems in the solution. Design Builder shall submit test plan, procedures, and expected results to the Engineer for approval prior to work.

C. Data sheets shall be provided to the Engineer prior to time of testing to verify and document that each and every piece of equipment used during testing shall be in compliance with all applicable manufacturer, UL, IEEE, MNR or governmental requirements.

D. MNR may require the Contractor to submit proof of test acceptability of any item at any time during the duration of this Contract. A statement by the Design Builder, manufacturer, or supplier of any item, without the appropriate substantiating evidence, shall not constitute adequate proof of acceptability, unless approved by MNR.

E. Perform testing for every network interface device in this contract as follows:
   1. The Contractor shall perform all Acceptance Tests for both individual systems as well as the integrated system as per this specification section and section 27 15 00. This shall include functionality, performance, reliability and interoperability testing (with the systems currently installed) of the systems in the solution. Design Builder shall submit test plan, procedures, and expected results to the Engineer for approval prior to work.
   2. Data sheets shall be provided to the Engineer prior to time of testing to verify and document that each and every piece of equipment used during testing shall be in compliance with all applicable manufacturer, UL, IEEE, MNR or governmental requirements.
   3. The above shall be submitted by the Design Builder to the Engineer for approval at least three (3) months prior to the commencement of the testing. The Design Builder shall incorporate all changes initiated by the Engineer, if such changes are required, and resubmit the test procedure for final approval. The tests shall be conducted in strict adherence to the approved testing procedures. No changes in testing procedures shall be made unless specifically approved in writing by the Engineer. As part of testing, Design Builder shall include 15% additional time for unplanned tests as directed by the Engineer.
   4. These tests shall attempt to duplicate the connectivity configuration of the system when installed at MNR.

5. Any malfunctions or irregularities shall be documented and corrected by the Design Builder. A re-inspection and retesting of the corrected malfunctions and irregularities shall be performed to the extent directed by, and witnessed by, the Authority. Such tests shall be at no additional expense to the Contracting part, or to the Authority.
6. Acceptance testing shall be witnessed by the Authority's representatives, which may include the Authority's craft personnel in training.
7. The priorities for acceptance testing and placing into service of equipped circuits shall be subject to the Engineer's directives and approval.
8. The Design Builder shall provide all personnel, material, instruments and apparatus to conduct the acceptance tests. The Design Builder shall certify that all test equipment used has been accurately and currently calibrated.
9. A record shall be kept of all completed tests, whether successful or not. When a test is unsuccessful, the Design Builder shall take whatever remedial action is necessary, and rerun the test until it is successfully completed. The reason for each unsuccessful test and the remedial action taken shall be provided in writing to the Engineer. All parts and labor used for repair of the system during testing shall be provided by the Design Builder at no additional expense to the Contracting Party, or to the Authority. If any spare parts are used by the Design Builder during testing, they shall be replaced by the Design Builder at no additional expense to the Contracting Party, or to the Authority.
10. Certified test reports showing compliance with the requirements of the Contract and OEM Specification for the equipment furnished under this Contract shall be submitted to the Engineer's approval. Testing shall be performed on all equipment required under this Contract.

3.8 CCTV SYSTEM TESTS:

A. Upon installation, Contractor is required to demonstrate the operability of the CCTV system functions to the satisfaction of MNR and MTA PD The Contractor shall provide the services of the CCTV System manufacturer for the startup and testing of the CCTV System.

B. Validate the following for each camera at locations specified by MNR and MTA PD:
   1. Camera is operable and properly displays image at required locations
   2. Pan/Tilt/Zoom features of each camera are operable within the manufacturer’s CCTV System remotely from the MNR and MTA PD Operation Command Center and within the then current integrator by version with full operational capabilities.
   3. Upon alarm from Security System camera at (or in the vicinity) of alarm location is displayed at the security workstation.

C. Video Monitors and Workstations
   1. Can properly view any camera requested throughout the facility.

D. Digital Network Storage:
   1. Properly stores all required video in format specified.
   2. Functionality of operations (playback/rewind/..) of approved playback software properly operates.

E. Integration with Security system:
   1. Upon alarm from security systems, CCTV System shall provide video surveillance of these areas within the then current integrator of the MNR and MTA PD Security system.

3.9 FINAL VERIFCATION TESTS

A. General Communications System:
   a. Perform verification tests for UTP systems after the complete cabling and workstation outlet/connectors are installed.
   b. Voice Tests. These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and DSN telephone call.

B. Public Address System:
   a. Engage a factory-authorized service representative to perform startup service.
   b. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
   c. Complete installation and startup checks according to manufacturer's written instructions.
   d. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.
   e. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

3.10 WARRANTY

A. Communications System equipment:
   1. The equipment shall be warrantied against any defects in material and workmanship, under normal use, for a period of 2 years from date of installation. If system is found by manufacturer to be defective within the warranty period, manufacturer shall repair and/or replace any defective parts, provided the equipment is returned to manufacturer.

END OF SECTION

SECTION 27 05 00 – COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 GENERAL:

A. This Section covers general work of all Sections under Division 27. Drawings and general provisions of the Contract, including General and supplemental Conditions and Division 1 specifications sections, apply to this section.

B. The contractor shall comply with all requirements mandated under the NY State General Services contracts for Signal Wiring and Cabling. The Contractor will comply with all applicable governmental regulations and with all local ordinances.

C. The Communications System Work under this Contract consists of, but not necessarily be limited to, furnishing and installing fiber optic and copper communications network interfaces and equipment with associated power supplies, cabinets, wiring and cabling, housing, mounts, penetration, brackets, conduits, fitting and connectors at designated network access sites to support communication needs of the systems required under this Contract. Completely install, connect, and test all systems, equipment, devices, etc. shown or noted or required to final connections and leave ready for satisfactory operation. Provide any minor items omitted from the design, but obviously necessary to accomplish the above intent. Please see Contract Drawings for specific locations requiring work. Locations shall include all field locations under Contract, and all remote and central locations to interface with this Contract for Metro-North Railroad (MNR) station platforms and customer areas.

D. Any item not specifically shown on the drawings or called for in the specifications, but normally required to conform to the intent, are to be considered as part of the Contract.

E. The Communications systems provided shall be fully integrated with the existing MNR Communications Systems.

F. Contractor shall be responsible to ensure that all equipment (to be furnished and installed under Contract) and cabling have the correct connector types and are configured with the correct configuration options.

G. The Contractor shall bear full responsibility for all the designs of layouts for furnishing, removals and installations required under this Contract. All design drawings submitted for approval shall be checked, approved and countersigned by a Professional Engineer licensed by the State of New York. Submit drawings showing all cabling and wiring necessary for a functional system such as communications wiring between new equipment and existing equipment / patch panels / termination blocks both inside and outside the cabinet, and wiring for powering of new equipment, the proposed method of installation of chases, rack layouts, brackets, conduit, equipment layouts, and other field requirements. The contractor shall not proceed with such work until approval has been received. Such approval is for the sole responsibility of minimizing delays and rework in the field due to late identification of unacceptable practices and shall not relieve the Contractor of the responsibility for the accuracy, constructability and operational integrity of the Work.

H. Architectural and Engineering specifications may have additional conditions or requirements that affect the work defined by this division of specifications. Contractor shall be responsible for the coordination of all conditions and other trade requirements that may impact schedule, scope of work, work progress, or other factors that may affect the overall ability for contractor to execute the requirements of this division of specifications.

I. Section Includes:

1. Sleeves for pathways and cables.

2. Sleeve seals.

3. Grout.

4. Common communications installation requirements

1.2 DEFENITIONS

A. Every effort has been made to use industry standard terminology throughout this specification, but industry standard terminology is not used by all manufacturers and in many cases, industry standard terminology does not exist. Contractor shall notify the Architect and/or Engineer to define any terminology used in this Specification if they believe any question could arise.

B. “Architect”: the Architect of record

C. “As Directed”: as directed by the Architect or the Engineer

D. “Connect”: shall mean make final electrical connections for a complete operating piece of equipment.

E. “Contractor”: the individual, partnership or corporation to whom the Contract for the Telecommunications work has been awarded.

F. “Engineer”: The Engineer of record

G. “Equal”: shall be of the same quality, appearance and utility to that specified, as determined by the Owner’s Representative. Contractor bears the burden of proof of equality

H. “Finished Spaces”: spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcited spaces, crawlspaces, and tunnels.

I. “Furnish”: to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories, and all other items customarily required for the proper and complete application

J. “Install”: to join; unite; fasten; link; attach; set up or otherwise connect together; complete, tested, and ready for normal satisfactory operation

K. Owner/Owner’s Representative: Metro-North Railway, New York

L. “Provide”: shall mean furnish and install complete with all details and ready or use

M. “Submit”: submit to the Architect and/or the Engineer for review

1.3 GLOSSARY

A. ANSI: American National Standards Institute

B. ASTM: American Society of Testing and Materials

C. BICSI: Building Industry Consulting Services International

D. EIA: Electronic Industries Association

E. EMI: Electromagnetic Interference

F. FCC: Federal Communications Commission

G. IEEE: Institute of Electrical and Electronics Engineers

H. NEC: National Electric Code

I. NEMA: National Electrical Manufacturer’s Association

J. NFPA: National Fire Protection Association

K. NRTL: National Recognized Testing Laboratories

L. OSHA: Occupational Safety and Health Administration

M. RCDD: Registered Communications Distribution Designer

N. TIA: Telecommunications Industry Association

O. TBB: Telecommunications Bonding Backbone

P. TGB: Telecommunications Grounding Busbar

Q. TMGB: Telecommunications Main Grounding Busbar

R. UL: Underwriter’s Laboratories, Inc.

S. CCTV: Closed Circuit Television

T. AWG: American Wire Gauge

U. AMP: Ampere

V. ASCE: American Society of Civil Engineering

W. mAMP: Millie Ampere

X. AC: Alternative Current

Y. DC: Direct Current

Z. V: Voltage

AA. EMF: Electromagnetic Frequency

BB. COM: Communication

CC. CPU: Central Processing Unit

DD. FOC: Fiber Optic Cable

EE. FOV: Field of View

FF. IEEE: Institute of Electrical and Electronic Engineering

GG. IP: Internet Protocol

HH. RU: Rack Unit

II. NVR: Network Video Recorder

JJ. MTA: Metropolitan Transpiration Authority

KK. MNR: Metro North Rail-Road

LL. NEC: National Electrical Code

MM. NFPA: National Fire Protection Association

NN. UL: Underwriter Laboratory

OO. UTP: Unshielded twisted pair

PP. LAN: Local Area Network

QQ. VMS: Video Management System

RR. PA: Public Address

SS. PoE: Power over Ethernet

TT. PoE+: Power over Ethernet (Plus)

UU. PB: Pull Box

VV. PDU: Power Distribution Unit

WW. JB: Junction Box

XX. SIA: Security Industry Association

YY. TCP/IP: Transmission Control Protocol/Internet Protocol

ZZ. TIA: Telecommunications Industry Association

AAA. UL: Underwriters Laboratory

BBB. NEMA: National Electrical Manufacturer's Association

CCC. ANSI: American National Standards Institute

DDD. ASTM: American Society for Testing and Materials

EEE. ADA: Americans with Disabilities Act

FFF. UTP: Unshielded Twisted Pair

GGG. WAN: Wide Area Network

HHH. IEC: International Electro Technical Commission

III. PC: Personal Computer

JJJ. UPS: Uninterruptible Power Supply

KKK. BICSI: Building Industry Consulting Service International

LLL. RCDD: Registered Communications Distribution Designer

1.4 CODES AND STANDARDS

A. General: All work, including but not limited to: cabling, pathways, support structures, wiring, equipment, installation and workmanship shall comply with the latest editions of the requirements of the Authority Having Jurisdiction (AHJ), National Electrical Code, National Electrical Safety Code, all applicable local rules and regulations, equipment manufacturer's instructions, and the National Electrical Contractors Association (NECA) Standard of Installation. In case of discrepancy or disagreement between the documents noted above, the Contractor shall satisfy the most stringent requirements.

B. Other sections of this document contain References to Codes and Standards that are applicable to the section.

C. The installation shall comply fully with all government authorities, laws and ordinances, regulations and codes applicable to the installation.

D. Should any change in plans or specifications be required to comply with governmental regulations, the Contractor shall notify the Owner at the time of submitting the Shop Drawings.

E. Local electrical and building codes may be differ with national codes. Follow the most stringent code or recommendations. Where there are instances of ambiguity refer to the Owner/Engineer for interpretation.

F. All equipment shall be equal to or exceed the minimum requirements of NEMA, IEEE, ISO, ASME, ANSI and Underwriters' Laboratories.

G. Comply with the following Standards and Codes:

1. Building Industry Consulting Service International (BICSI) Telecommunications Distribution Methods Manual, current edition.
2. Building Industry Consulting Service International (BICSI) Installation Transport Systems Information Manual, current edition.
3. National Fire Protection Association (NFPA):
   a. NFPA 70 National Electrical Code.
   b. NFPA 75 Protection of Electronic Computer / Data Processing Equipment
   c. NFPA 101 Life Safety Code
4. Underwriters Laboratories, Inc. (UL) Standards
5. National Electrical Manufacturers Association (NEMA) Standards
6. American National Standards Institute (ANSI) / Telecommunications Industry Association (TIA) Standards / Electronic Industries Association (EIA)
   a. ANSI/TIA -568-C.0 Set Generic Telecommunications Cabling for Customer Premises
   b. TIA/EIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces
   c. TIA/EIA-606-A Administration Standard for Commercial Telecommunications Infrastructure
   d. J-STD-607-B Telecommunications Grounding and Bonding for Customer Premises
7. Federal Communications Commission Title 47
   a. FCC Part 15
   b. FCC Part 68
8. Leadership in Energy and Environmental Design (LEED)
9. U.S. Green Building Council (USGBC)
10. International Organization for Standardization (ISO)
11. Americans with Disabilities Act (ADA)
12. Building Code of New York State
13. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
14. New York State Electrical Code (NYSEC)
15. Institute of Electrical and Electronics Engineers (IEEE) Standards
16. Advanced Television System Committee (ATSC)
17. Audi Engineering Society (AES)
18. Institute of Electrical and Electronics Engineers (IEEE) Standards
19. Federal Occupational Safety and Health Administration.
20. OSHA Standards 29 CFR 1926 and 1910

B. Equipment shall meet all FCC rules and regulations including but not limited to the rules governing lightning and surge protection, electromagnetic interference and electromagnetic compatibility.

1.5 SUBMITTALS

A. General Procedures

1. All submittals shall comply with the requirements of Division 01.
2. Forward all submittals in related groups. Individual or incomplete submittals are not acceptable.
3. Labeling shall be approved by Owner prior to testing of cables.
4. Identify each item by manufacturer, brand, trade name, number, size, rating, or whatever other data is necessary to properly identify and check materials and equipment.
5. Identify each submittal item by reference to Specification Section paragraph in which item is specified, or Drawing and Detail number
6. Prepare details not less than ¼ inch = 1 foot scale.
7. Contents: Each submittal shall contain the following information:
    a. Project name and address
    b. b. Number of submittal
    c. c. Date of submittal
    d. d. Name and address of contractor
    e. e. Table of contents
    f. f. Product name and manufacturer
    g. g. Page number(s)
    h. h. Page number(s) of the corresponding Specification or Drawing number(s) of the
    i. corresponding Contract Documents.
8. Requests for substitutions of equipment or materials outside of the approved,

B. List of Submittals:

1. Pre-Construction Submittals:
    a. Product data sheets
    b. Shop drawings
    c. Factory tests
    d. Proof of certification as a certified installer for the system(s) to be installed
    e. Proof of project registration with system manufacturer(s) for extended warranty
    f. Manufacturer product and application wiring for approval.
2. During Construction:
    a. Installation/commissioning schedules
    b. Pull schedules
    c. Field test reports
3. Commissioning:
    a. Commissioning plans
    b. Method statements
    c. Testing and commissioning schedules
4. Post Construction:
    a. As-built drawings (both hard copy and electronic copy)
    b. Warranties

C. Product Data Sheets:

1. Product Data Sheets shall include construction details, material descriptions, dimensions of individual components and profiles and finishes. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

2. Certify that the data sheets depict the components to be installed to make up the complete system as described in the Contract Documents.
3. Contents: The product data sheet submittal shall consist of the following:
    a. Cover Sheet
    b. Project name and address
    c. Number of submittals
    d. Date of submittal
    e. Name and address of the Communications Contractor
    f. Table of Contents
    g. Product name and manufacturer
    h. Page number(s)
    i. Page number(s) of the corresponding Specification or drawing number(s) of the corresponding Contract Documents.
    j. Manufacturers' technical specifications and data sheets of all items specified herein. Submit pertinent pages only.
    k. Identify clearly the particular product being submitted; do not use highlighters. Use appropriate markings and arrows.
    l. Identify any options or accessories that are applicable to the project.
    m. Show compliance with specified standards.
    n. Show compliance with any parameters required by this specification.
    o. Show compliance with specified testing agency listings; show the limitations of their labels or seals, if any.
    p. Show any special coordination requirements for the product.

D. Samples:
1. Submit samples of cables and outlets fully labeled and other accessories to be installed under these Contract Documents.
2. Provide samples physically identical with proposed material or product.
3. Where selection is required, provide full set of all options.
4. Where non-specified products are proposed, provide full set of all options. Operation and Maintenance Data manuals.

E. Shop Drawings and Calculations
1. Contents: Each shop drawing submittal shall consist of the following:
2. Title Block:
    a. Project name and address
    b. Number of submittal
    c. Date of submittal
    d. Name and address of the Communications Contractor
    e. Drawing scale
3. Diagrams showing evidence of compliance with Contract Documents and coordination with other trades.
4. Associated wiring diagrams of all equipment, with types and model numbers specified under these Contract Documents.
5. Submit drawings (to scale) showing:
    a. Point-to-point wiring diagrams for all cables installed under this work
    b. Detailed plan views and elevations of all telecommunications spaces showing racks, termination blocks and cable paths
    c. Equipment and wall elevations, mounting locations and dimensions and labeling of equipment

d. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
e. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
f. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.
g. Drawings to show evidence of coordination with other trades
h. Sample reports showing the proposed format for cable test reports
i. Fully dimensioned housing and mounting drawings, including information on finishes.
j. Specific notation of field measurements at accurate scale.
k. Identification of specific products and materials used.
l. Cross-reference all related Contract Documents (drawings, detail numbers, Specifications sections, etc.)
m. Compliance with specified standards.
n. Dimensions at accurate scale.

6. Submit Calculations for:
   a. Confirmation of pathways sizing
   b. Grounding
   c. Seismic restraint components
7. Preparation and Transmittal
   a. Do not reproduce Contract Documents as shop drawings.
   b. Provide space for action marking adjacent to the title block.
   c. Submit all shop drawings submittals for each system, subsystem, or unit of work as one submittal.

F. Submittal log.

G. Pull Schedules
1. Contents: The schedules shall include, but are not limited to:
   a. Cover Sheet
   b. Project name and address
   c. Number of pull schedule submittal.
   d. Date of pull schedule submittal.
   e. Name and address of the Communications Contractor.
2. Schedule fields shall reflect labeling fields.
3. Schedule fields shall include, as appropriate:
   a. Sequential line number
   b. Outlet labeling
   c. Cable labeling
   d. Cable Length
   e. Jack labeling
   f. Patch Panel/Termination Frame label
   g. Position/port numbers
   h. Rack labeling

H. Factory and Field Test Reports
1. Contents: Each field test submittal shall consist of the following:
   a. Cover Sheet
   b. Project name and address

c. Number of submittal
d. Date of submittal
e. Name and address of the Communications Contractor
f. Table of Contents
g. Component (cable, system, equipment, etc) type and number
h. Page number(s)
i. Page number(s) of the corresponding Specification or Drawing number(s) of the corresponding Contract Drawings.

2. Component test results as specified.
3. Preparation and Transmittal
   a. During construction submit hard copies printed in a summary format showing one-line item per cable tested for all cables. Each line must show the full cable label, test type, cable length, date and time tested and the test result, sorted by cable label. Submit hard copies of the full test result printout for the cables of the furthest two and closest two outlets. Submit a soft copy of the complete test results of all cables tested.
   b. Submit test results no later than five days after the date of testing.
   c. Post construction submit hard copies of both the summary and full test format for all cables installed, sorted by cable label. Submit a soft copy consisting of the complete test results.
   d. Submit manufacturer's test record for each reel of cable delivered to the project copies of such data are to be kept for inclusion in the documentation and made available to the owner/owner representative upon request.

I. As-Builts (Record Documents)
1. Contents: Each submittal shall consist of the following:
   a. Title Block
   b. Project name and address
   c. Number of submittal
   d. Installation schedule, including all cross-connection and patching schedule
   e. Date of submittal
   f. Name and address of the Communications Contractor
   g. Drawing scale
   h. Floor plans indicating outlet locations and labels.
2. The as-built drawings shall include, but are not limited to block diagrams, frame and cable labeling, cable termination points, equipment room layouts and frame installation details. The as-builts shall include all field changes made up to construction completion:
   a. Field directed changes to pull schedule.
   b. Station cable routing changes.
   c. Riser cable routing or location changes.
   d. Associated detail drawings
3. Two (2) Sets of Operation and Maintenance Manuals including wiring diagrams, parts lists, shop drawings and manufacturers' information on all equipment and cables provide by the Contractor. Manuals shall be provided in a high quality, 3-ring binder and completely indexed. Submit manuals to the Owner not more than 1 week after project completion.
4. Preparation and Transmittal
   a. Prepare as-built packages in an AutoCAD Format.
   b. Space for action markings shall be adjacent to the title block.
   c. Provide two (2) copies of Record Drawings and one (1) electronic copy minimum AutoCAD 2007 format on CD
   d. Voice cable cross connect schedule (cut sheet) showing detailed identification of cross-connects between riser (house pairs) and horizontal cable runs

J. Qualifications
   1. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
   2. Seismic Qualification Certificates: For floor-mounted cabinets, brackets, mounts, cable trays, accessories, and components, from manufacturer.
      a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
      c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

K. Resubmittals will be reviewed for compliance with comments made on the original submittal only and should be marked with a resubmittal number and dated.

1.6 QUALITY ASSURANCE

A. All products shall be installed new, best of their respective kinds, free from defects, listed by Underwriter's Laboratories for the intended use, and bearing their label.

B. Any given item of equipment or material shall be the product of one manufacturer throughout the facility. Multiple manufacturers of any one item will not be permitted, unless specifically noted otherwise.

C. Obtain from the manufacturers detailed instructions for installation of that manufacturers' products.

D. Ensure that all components meet all regulatory requirements for the respective component being used.

E. All products, services and materials provided and performed under the scope of this Specification shall conform to the manufacturer's requirements.

F. Contractor is solely responsible for quality control of the Work and must comply with the Quality Control requirements specified herein.

G. All materials shall be new and unused and free from defects. All materials shall meet all applicable codes provided a standard has been established for the material in question.

H. All products and materials to be clean, free of defects, and free of damage and corrosion.

I. Installer Qualifications:
   1. In order to provide proper coordination, uniform quality and system integrity, the equipment and installation specified within this Specification shall be provided and installed by a single contractor with a proven track record in the field of the specified system. Personnel shall be competent and qualified by experience and training for the installation.
   2. Contractor shall be trained and certified by the manufacturer of the proposed system as a Certified Installer. A copy of the certificate shall be included with the bid.

3. Bidder must submit their Manufacturing Quality Program Manual (MQPM) and a sample of the proposed product with their bid.
4. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall always be present when Work of this Section is performed at Project site.
5. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection

1.7 SUBSTITUTION, DEVIATIONS AND CHANGES

A. Substitutions:
1. Requests for substitutions are only permitted for materials specified with an "or approved equal" clause or other language of same effect in the Contract Documents. Substitutions for the main system components shall be equivalent products from one of the manufacturers included in the list of approved manufacturers.
2. The systems specified in this document shall be an end-to-end solution that is sourced from a single manufacturer or partnered manufacturers.
3. Any proposed substitution in whole or part, must be submitted for review and approval.
4. Any proposed substitutions shall conform to the Contract Documents. Supply proof acceptable to the Owner in the form of a written guarantee that the substituted product(s) meet or exceed the Specifications. The substitution must be accepted in writing by the Owner.

B. Deviations
1. Any deviations or changes involving extra work are not permissible without prior review and written approval by the Owner.

1.8 DELIVERY, STORAGE AND HANDLING

A. Protect from loss or damage. Replace lost or damaged materials and equipment with new at no increase in Contract Sum.

B. Contractor will receive, handle, store, secure and be responsible for owner furnished equipment until installed and accepted by owner.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.10 COORDINATION

A. Carefully check space requirements and the physical confines of the area of work to ensure that all material can be installed in the spaces allotted thereto, including conduits and cable supports.

B. Transmit to the Owner in a timely manner all information required for coordinating and related work to be provided in ample time for installation.

C. Contractor shall note that the construction schedule may dictate that work must be carried out simultaneously on more than one floor, in more than one building.

D. Attend weekly construction meetings, at the project site or other location, as requested by the Engineer, and or Owner/Owner's representatives. Contractor must ensure that a senior level manager attends the meetings – not just the onsite foreman.

E. The Contractor shall, without extra charge, make reasonable modifications (coordinated with Owner) in the layout as needed to meet field conditions, prevent conflict with work of other trades or for proper compliance with the design intent.

F. The Contractor shall coordinate with the Owner with sufficient lead-time to ensure access to secure office and lab spaces and to schedule work to avoid disturbing existing functional spaces – preferably by performing disruptive work at night/early morning hours.

G. Coordinate arrangement, mounting, and support of communications equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope So connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

H. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

I. Where applicable, coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

J. Where applicable, coordinate sleeve selection and application with selection and application of fire stopping specified in Division 07 Section "Fire stopping ".

1.11 CERTIFICATION AND WARRANTY

A. All work and all items of equipment and materials shall be warranted for a minimum period of one year from the date of acceptance of the work. Where a manufacturer's warranty is longer than one year, the Contractor shall offer the extended warranty. The Contractor shall, upon notification of any defective items, repair or replace such items within 24 hours without cost to the Owner, all to the satisfaction of the Owner/Engineer.

B. Furnish a warranty in accordance with any General Conditions

C. Furnish a manufacturer's "Permanent Link" performance warranty for all EIA/TIA 568-C category 6 workstation cables for a minimum period of 25 years from the date of acceptance of the work. Where a manufacturer's warranty is longer than 25 years, the Contractor shall offer the longer warranty. The "Permanent Link" Performance Warranty shall be issued and signed by the component manufacturer and shall list Metro-North Railway as the holder of the warranty. The "Permanent Link" Performance Warranty shall cover labor and material for all "Link"

components. Describe as part of the bid response, in consideration of the product set submitted in your bid response, your ability of offer such a manufacturer's extended warranty.

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop, unless otherwise indicated.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.
   1. Manufacturers: Subject to compliance with requirements, or comparable product by one of the following:
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Metraflex Co.
      d. Pipeline Seal and Insulator, Inc.
      e. Approved equal.
   2. Sealing Elements: interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.
   3. Pressure Plates: Plastic, or Carbon steel. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 ACCESS AND ACCESS PANELS

A. General: Provide access to materials and equipment that require inspection, replacement, repair or service. Provide access panels and/or doors as required to allow service of all equipment components. Provide access panels where items installed require access and are concealed in floor, wall, furred space or above ceiling. Ceilings consisting of lay-in or removable splined tiles do not require access panels. Locations of equipment requiring access shall be noted on record drawings. Access panels shall have same fire rating classification as surface penetrated.

B. Coordination: Coordinate and prepare a location, size, and function schedule of access panels required to fully service equipment and deliver to Owner.

C. Construction: Panels shall be at least 12 inches by 12 inches, and located to provide optimum access to equipment for maintenance and servicing. Verify access panel locations and construction with Owner's Representative.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time. Telecommunications Main Bus Bar:

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS SYSTEM INSTALLATION:

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications' equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

F. Cutting, patching, painting and restoration of any existing surfaces damaged performing the work under the scope.

G. All labels used shall be machine printed yellow weatherproof labels and withstand rain, sleet, snow, dust, and temperatures of -20°F to 160°F. Font and font size shall be approved by MNR.

3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with fire stop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pathway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
   1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with fire stop materials. Comply with requirements in Division 07 Section "Penetration Fire stopping."

K. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 IDENTIFICATIONS

A. Refer to Division 27 Section “Identification for Communications Systems”

B. Comply with TIA/EIA-606-A

C. Comply with requirements in Division 26 Section “Identification for Electrical Systems”

3.5 GROUNDING

A. Refer to Division 27 Section “Grounding and Bonding for Communications Systems”

B. Comply with ANSI/TIA-607-B and ANSI/NECA/BICSI-607

C. Comply with requirements in Division 26 Section “Grounding and Bonding for Electrical Systems”

3.6 FIRE STOPPING

A. Apply fire stopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Fire stopping materials and installation requirements are specified in Division 07 Section "Fire stopping."

END OF SECTION

SECTION 27 05 26 – GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

A. Section includes:
   1. Grounding and Bonding for Communications Systems.

B. Related Sections:
   1. Division 27 Section "Communications Equipment Room Fittings" for cabinets, racks, enclosures, cable management and ladder rack.
   2. Division 27 Section “Pathways for Communications Systems”.
   3. Division 26 Section “Grounding and Bonding for Electrical Systems”.
   4. Division 26 Section "Identification for Electrical Systems."

1.2 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Grounding: Indicate locations of grounding bus bars.
   2. Elevations and mounting details.
   3. System line diagram.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

D. Source quality control reports.

E. Field quality control reports.

F. Maintenance data

1.3 QUALITY ASSURANCE

A. Installer Qualifications: All installation of the Telecommunication Ground Systems shall be done by a licensed electrician.
   1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of an RCDD, or Installer Level 2.
   2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, Commercial Installer, Level 2, who shall always be present when Work of this Section is performed at Project site.
   3. Field test: certified third-party organization.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Grounding: Comply with ANSI-J-STD-607-A.

D. Labeling: Comply with ANSI/TIA-607-A "Architect": The Architect of record

1.4 PROJECT CONIDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weather tight, wet work in spaces is complete and dry. Association

1.5 COORDINATION

A. Coordinate layout and installation of communications pathways with the other trades installing equipment in the ceiling.

B. Coordinate grounding and bonding of communications systems with the electrical installer.

C. Coordinate the labeling scheme for the communications systems with the Owner.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

A. Comply with ANSI J-STD-607-A and with requirements of Division 26 Section "Grounding and Bonding for Electrical Systems".

B. Grounding Electrode System
   1. When required the Grounding Electrode System shall meet the following
      a. Active grounding system constantly replenishing moisture into the soil
      b. Provide low resistance to ground
      c. Provide season to season stability
      d. Be maintenance-free for 30 years
      e. Contain no hazardous materials or chemicals
   2. Manufacturers:
      a. Lyncole Grounding Solutions: Lyncole XIT Grounding System
      b. Approved equal Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop, unless otherwise indicated.

C. Telecommunications Main Grounding Bus Bar
   1. Not used.

D. Telecommunications Grounding Bus Bar
   1. The TGB must be a predrilled copper busbar with holes for use with standard- sized lugs, have a minimum dimension of 6.3 mm (0.25 in) thick by 51 mm (2 in) wide, and be variable in length. It must be listed by an NRTL.

2. Hole patterns on the Busbars shall accommodate two-hole lugs per the recommendation of BICSI and ANSI-J-STD-607-A standards.
3. Insulators shall electrically isolate Busbars from the wall, or other mounting surfaces, thereby controlling the current path.
4. Provide required stainless-steel hardware to fasten the two-hole ground lugs to the Busbar.
5. Manufacturers:
    a. Chatsworth Products, Inc. (CPI), Telecommunications Grounding Busbar: Part Number 13622-012, 12" x 2" (300 mm x 50 mm)
    b. Approved equal

E. Grounding Conductors
1. Telecommunications grounding connectors shall have a minimum size of 6/0 AWG.
2. Telecommunications Bonding Backbone shall be size 2/0 AWG.
3. All Telecommunication grounding conductors shall be copper conductors, calculated so that no more than 40 V can be present along its entire length.

2.2 BONDING ACCESSORIES

A. Two Mounting Hole Ground Terminal Block
1. Ground terminal block shall be made of electroplated tin aluminum extrusion.
2. Ground terminal block shall accept conductors ranging from #14 AWG through 2/0.
3. The conductors shall be held in place by two stainless steel set screws.
4. Ground terminal block shall have two 1/4" (6.4 mm) holes spaced on 5/8" (15.8 mm) centers to allow secure two-bolt attachment to the rack or cabinet.
5. Ground terminal block shall be UL Listed as a wire connector.
6. Manufacturer:
    a. Chatsworth Products, Inc. (CPI), Two Mounting Hole Ground Terminal Block
        1) Part Number 40167-001,
    b. Approved equal

B. Compression Lugs
1. Compression lugs shall be manufactured from electroplated tinned copper.
2. Compression lugs shall have two holes spaced on 5/8" (15.8 mm) or 1" (25.4 mm) centers, as stated below, to allow secure two bolt connections to busbars.
3. Compression lugs shall be sized to fit a specific size conductor, sizes #6 to 4/0, as stated below.
4. Compression lugs shall be UL Listed as wire connectors.
5. Manufacturer:
    a. Chatsworth Products, Inc. (CPI), Compression Lugs in different sizes
    b. Approved equal.

C. Antioxidant Joint Compound
1. Oxide inhibiting joint compound for copper-to-copper, aluminum-to-aluminum or aluminum-to-copper connections.
2. Manufacturer:
    a. Chatsworth Products, Inc. (CPI), Antioxidant Joint Compound
    b. Approved equal.

D. C-Type, Compression Taps
1. Compression taps shall be manufactured from copper alloy.

2. Compression taps shall be C-shaped connectors that wrap around two conductors forming an irreversible splice around the conductors; installation requires a hydraulic crimping tool
3. Compression taps shall be sized to fit specific size conductors, sizes #2 AWG to 4/0, as stated below.
4. Compression taps shall be UL Listed.
5. Manufacturer:
    a. Chatsworth Products, Inc. (CPI), Compression Taps
    b. Approved equal

E. Pedestal Clamp With Grounding Connector
1. Pedestal clamp shall be made from electroplated tinned copper or bronze. Installation hardware will be stainless steel.
2. Pedestal clamps shall be sized to fit a specific size conductor, size #6 and/or 2/0, as stated below.
3. Pedestal clamp installation hardware shall be sized to attach to round and/or square raised access floor pedestals that are 1-1/8" to 1-3/4" in diameter, as stated below.
4. Pedestal clamp shall provide straight (in-line) or cross (intersection) support for up to two conductors.
5. Pedestal clamp shall be UL Listed as grounding and bonding equipment.
6. Manufacturer:
    a. Chatsworth Products, Inc. (CPI), Pedestal Clamps:
    b. Approved equal

F. Pipe Clamp With Grounding Connector
1. Pipe clamp shall be made from electroplated tinned bronze. Installation hardware will be stainless steel.
2. Pipe clamp shall be sized to fit up to two conductors ranging in size from #6 to 250 MCM; conductors must be the same size.
3. Pipe clamp installation hardware shall be sized to attach to pipes, sizes 1" to 6" (.75" to 6.63" in diameter), as stated below.
4. Pipe clamp shall be UL Listed as grounding and bonding equipment.
5. Manufacturer:
    a. Chatsworth Products, Inc. (CPI), Pipe Clamps
    b. Approved equal

G. Equipment Ground Jumper Kit
1. Kit includes one 24"L insulated ground jumper with a straight two hole compression lug on one end and an L-shaped two hole compression lug on the other end, two plated installation screws, an abrasive pad and a .5 once tube of antioxidant joint compound.
2. Ground conductor is an insulated green/yellow stripe #6 AWG wire
3. Lugs are made from electroplated tinned copper and have two mounting holes spaces .5" to .625" apart that accept 1/4" screws.
4. Jumper will be made with UL Listed components
5. Manufacturer:
    a. Chatsworth Products, Inc. (CPI), Ground Juper Kit: Approved equal Equipment

PART 3 - EXECUTION

3.1 GENERAL

A. All installation of the Telecommunication Ground Systems shall be done by a licensed electrician. This includes but not limited to:
   1. 1. All Busbars
   2. 2. All bonding conductors
   3. 3. Bonding to all non-active (non-current carrying) metal support structures, rack, runway
   4. etc. within each Telecommunication Room or Space, Coordinate this bonding with thE supplier and installer of rack, runway etc.

B. NOTE: The TMGB/TGB is to provide a single point ground reference within the room and IS NOT TO BE USED AS AN AC EQUIPMENT GROUND.

C. The TBB should not be placed in ferrous metallic conduit. If it is necessary to place grounding and bonding conductors in conduit that exceeds 1m (3 ft) in length, the conductors shall be bonded to each end of the conduit using a grounding bushing or a No. 6 AWG conductor, minimum.

D. Each telecommunications grounding and bonding conductor shall be labeled. Labels shall be located on conductors as close as practicable to their point of termination in a readable position. Labels shall be nonmetallic and include the information “IF THIS CONNECTOR OR CABLE IS LOOSE OR MUST BE REMOVED, PLEASE CALL THE BUILDING TELECOMMUNICATIONS MANAGER” Refer to ANSI/TIA/EIA 606 for additional labeling requirements.

3.2 INSTALLATION

A. Outdoor grounding and bonding connections.
   1. All outdoor grounding and bonding (earthing) connections shall be accomplished using exothermic welding.

B. Wall-Mount Busbars
   1. Attach busbars to the wall with appropriate hardware according to the manufacturer’s installation instructions.
   2. Conductor connections to the TMGB or TGB shall be made with two-hole bolt-on compression lugs sized to fit the busbar and the conductors.
   3. Each lug shall be attached with stainless steel hardware after preparing the bond according to manufacturer recommendations and treating the bonding surface on the busbar with antioxidant to help prevent corrosion at the bond.
   4. The wall-mount busbar shall be bonded to ground as part of the overall Telecommunications Bonding and Grounding System.

C. Rack-Mount Busbars and Ground Bars
   1. When a rack or cabinet supports active equipment or any type of shielded cable or cable termination device requiring a ground connection, add a rack-mount horizontal or vertical busbar or ground bar to the rack or cabinet. The rack-mount busbar or ground bar provides multiple bonding points on the rack for rack and rack-mount equipment.

2. Attach rack-mount busbars and ground bars to racks or cabinets according to the manufacturer's installation instructions.
3. Bond the rack-mount busbar or ground bar to the room's TMGB or TGB with appropriately sized hardware and conductor.

D. Ground Terminal Block
1. Every rack and cabinet shall be bonded to the TMGB or TGB.
2. Minimum bonding connection to racks and cabinets shall be made with a rack-mount two hole ground terminal block sized to fit the conductor and rack and installed according to manufacturer recommendations.
3. Remove paint between rack/cabinet and terminal block, clean surface and use antioxidant between the rack and the terminal block to help prevent corrosion at the bond.

E. Pedestal Clamp
1. At minimum, bond every sixth raised access floor pedestal with a minimum #6 AWG conductor to the TMGB or TGB using a pedestal clamp sized to fit the pedestal and the conductor and installed according to the manufacturer's recommendations.
2. If pedestal clamps are used to construct a signal reference grid, bond the signal reference grid to the TMGB or TGB and bond each rack and/or cabinet to the signal reference grid using a compression tap or similar non-reversible bonding component sized to fit both conductors.
3. Remove paint between the pedestal and pedestal clamp, clean surface and use antioxidant between the pedestal and the clamp to help prevent corrosion at the bond.
4. Remove insulation from conductors where wires attach to the pedestal clamp.

F. Pipe Clamp
1. Bond metal pipes located inside the data center computer room with a minimum #6 AWG conductor to the TMGB or TGB using a pipe clamp sized to fit the pipe and the conductor and installed according to the manufacturer's recommendations.
2. Remove paint between the pipe and pipe clamp, clean surface and use antioxidant between the pipe and the clamp to help prevent corrosion at the bond.
3. Remove insulation from conductors where wires attach to the pipe clamp.

G. Equipment Ground Jumper Kit
1. Bond equipment to a vertical rack-mount busbar or ground bar using ground jumper according to the manufacturer's recommendations.
2. Clean the surface and use antioxidant between the compression lugs on the jumper and the rack-mount busbar or ground bar to help prevent corrosion at the bond.

H. Bonding conductor
1. Where building steel is available within the room, the TMGB/TGB should be bonded to the nearest structural steel column, provided that its bonding effectiveness has been verified via two-point bonding testing. This connection would be an acceptable alternative to routing a Bonding Conductor for Telecommunications (BCT) to the main electrical panel board.
2. A bonding conductor can be routed between TMGB and the nearest effectively grounded AC electrical branch circuit panel board, provided a low ground impedance of the panel board has been verified with a ground impedance tester. This connection would be an acceptable alternative to routing of a BCT to the main electrical panel board.
3. The size of any bonding conductors shall follow the recommended sizes shown on T series drawings.

4. All cabling used to bond grounds are to be tagged with labels with the point of origin and destination i.e. going to/coming from, with printed labels.

3.3 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with ANSI/TIA -606-A. Comply with requirements in Division 26 Section “Identification for Electrical Systems”.

B. Provide nonmetallic pre-printed labels, white background with black printing that can Be permanently mounted to the busbar.

C. The bonding conductors for telecommunications, TBB conductor, and each grounding equalizer shall be green or marked with a distinctive green color.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Firestopping."

END OF SECTION

SECTION 27 05 28 – PATHWAY FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

A. Section includes:
   1. Raceway and boxes for Communications Systems.
   2. Cable Trays for Communications Systems.

B. Related Sections:
   1. Division 27 Section “Common Work Results For Communications”
   2. Division 27 Section "Communications Equipment Room Fittings" for cabinets, racks, enclosures, cable management and ladder rack.
   3. Division 27 Section “Communications Horizontal Cabling”
   4. Division 26 Section "Raceway and Boxes for Electrical Systems"
   5. Division 26 Section "Hangers and Supports for Electrical Systems"

1.2 SUBMITTALS

A. Refer to Division 27 Section “Common Work Results For Communications”

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

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

D. Indicate layout, tray type, support framing, components and fittings, connections, dimensions, support points, finishes, and accessories

E. Manufacturer’s installations instructions.

F. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

G. Source quality control reports.

H. Field quality control reports.

I. Maintenance data.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Cable installer must have personnel certified by BICSI on staff.
   1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of an RCDD, or Installer Level 2.

2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, Commercial Installer, Level 2, who shall always be present when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD, or Commercial Installer, Level 2 to perform the on-site inspection.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with ANSI/TIA-569-A.

D. Cable tray shall be listed and labeled by Underwriters Laboratories (UL) as required.

E. NEC Compliance: Comply with NEC, as applicable to construction and installation of cable tray and cable channel systems (Article 318, NEC).

F. NFPA Compliance: Comply with NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance" pertaining to installation of cable tray systems

1.4 PROJECT CONIDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weather tight, wet work in spaces is complete and dry.

1.5 COORDINATION

A. Coordinate layout and installation of communications pathways with the other trades installing equipment in the ceiling.

PART 2 - PRODUCTS

2.1 PATHWAYS FOR COMMUNICATIONS SYSTEMS

A. All pathways for communications systems shall comply with ANSI/TIA-569-A and BICSI Telecommunications Distribution Methods Manual.

B. Comply with the requirements of Division 26 Sections "Cable Trays for Electrical Systems", "Hangers and Supports for Electrical Systems", and "Raceways and Boxes for Electrical Systems". Comply with ANSI J-STD-607-A and with requirements of Division 26 Section "Grounding and Bonding for Electrical Systems".

C. Cable Support:
1. Provide all manufacturer's approved and supplied fittings and accessories required to protect, support and install a cable support system.
2. NRTL labeled for support of Category 6A cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
3. Support brackets with cable tie slots for fastening cable ties to brackets.
4. Lacing bars, spools, J-hooks, and D-rings.

5. Straps and other devices.

D. Cable Trays:
   1. Not used.

E. Ladder Rack
   1. Not used.

F. J-Hooks
   1. Not used.

G. Conduit and Boxes:
   1. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."
   2. Conduit Size is minimum 3/4” U.O.N. by MNR.
   3. A 1½ inch conduit from room to MNR DLC
   4. A 1½ inch conduit telephone company demarcation point.
   5. A 1½ inch conduit from room to ticket office if applicable.
   6. A 1½ inch conduit from room to each TVM or set of TVMs at the station.
   7. A 1 inch conduit from room to the location of each customer information sign or monitor at the station.
   8. All conduit runs shall be installed to allow for the installation of fiber optic or copper cable.
   9. MNR installed telephone
   10. Three, 3 inch sleeves to allow for cable entrance into room.
   11. Outlet boxes shall be no smaller than 4 inches (100 mm) wide, 4 inches (100 mm) high, and 2-1/2 inches (64 mm) deep.
   12. Flexible Conduit: Refer to Electrical Specifications and NEPA 70 NEC

H. Innerduct
   1. Used to protect the fiber in conduit and to facilitate future cable installation in pathways connecting the various zones on site.
   2. All outdoor pathways for incoming service connections from Telecom Manholes to Telecom cabinets shall be provided with textile innerduct to enable future pulls.
   3. Specifications: Multi celled textile innerduct.
      a. Pyramid
      b. Max Cell
      c. Approved Equal

I. Expansion Joints
   1. Refer to section 26 05 43 Underground Ducts and Raceways for Electrical Systems
      a. Expansion fittings shall be provided as PVC or steel to match conduit type and sizes being installed and complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
      b. The expansion joints shall be provided to account for thermal expansion and contraction.
      c. Refer to structural details for the movements to be accommodated in all required planes, at the accessway interfaces.
      d. Provide all fittings, couplers, hold down straps, end caps as required to mate pathways on either side of the flexible expansion joint, seamlessly for a complete system.
      e. Expansion fittings shall be arranged to cross expansion joints at right angles.

f. Cabling shall be installed in smooth wall innerduct to allow safe pulls across and through the expansion joint fitting.

J. Sleeves for Pathways and Cables
1. Refer to section 27 05 00 “Common work Results for Communications”.

K. Fire Stopping
1. Refer to section 27 05 00 “Common work Results for Communications”.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

3.2 PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.

B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings". Drawings indicate general arrangement of pathways and fittings.

C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

D. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

E. Install manufactured conduit sweeps and long-radius elbows whenever possible.

F. Pathway Installation in Communications/Electrical Rooms:
1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 3 inches (76 mm) above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

G. Sleeve Installation for Communications Penetrations

1. Refer to section 27 05 00 “Common work Results for Communications”.

H. Firestopping
1. Refer to section 27 05 00 “Common work Results for Communications”.

I. Category Rated Cables
1. Furnish and install Low Smoke Zero Halogen cables for Operations Network in the subway system.

J. Indoor Category 6 Cables

1. Furnish, install and terminate indoor Unshielded Twisted Pair Cable

   a. Plenum rated (CMP), 4 Pair Cable, solid conductor, rated for applications up to 350 MHz, FEP insulated and FEP jacketed, flame rating UL 910 and NFPA 262 (meets “limited combustibility” requirements as defined in NEC article 800 and NFPA 70 standard for building materials used in air plenums), per EIA/TIA T568B Color Code. Panduit p/n PUP6004BU-UY for blue, PUP6004YL-UY for yellow, PUP6004WH-UY for white, Belden/Mohawk M58280, ADC/TE Connectivity p/n TN6SP-BLRB for blue, TN6SP-RDRB for red, TN6SP-YLRB for yellow, TN6SP-WTRB for white. Plenum cable shall be used in accordance with NEC code requirements U.O.N.

   b. Low Smoke Zero Halogen, 4 Pair Cable, solid conductor, rated for applications up to 350 MHz (Draka, ADC/TE Connectivity, Belden). LSZH cable shall be used in all station environment installations.

2. Furnish, install and terminate indoor Shielded Twisted Pair Cable

   a. Plenum rated, 4 Pair Cable, 23 AWG solid conductor, rated for applications up to 350 MHz.

K. Outdoor Category 6 Cables

1. Furnish, install and terminate outdoor Unshielded Twisted Pair Cable when the planned cable runs are potentially exposed to moisture or temperature extremes (for building facility installations) OSP, 4 pair cable, solid conductor, rated for applications up to 350 MHz, Belden/Mohawk p/n M57622 or M57623, ADC/TE Connectivity p/n TN6TOSP-BK02, or approved equal.

2. Furnish, install and terminate outdoor Shielded Twisted Pair Cable when the planned cable runs are potentially exposed to moisture or temperature extremes.

   a. OSP, 4 pair cable, solid conductor, rated for applications up to 350 MHz, Belden/Mohawk p/n M58175, or approved equal.

L. Category 6 Patch Cords

1. Furnish Category 6,24AWG, 4-pair patch cord for each installed data jack in the cabinet. Patch cords shall be Panduit p/n UTPSP7/10BU, ADC/TE Connectivity 6645-2-78X-YY (X=color, YY=length), or approved equal. All CAT6 patch cords shall be color coded per the cable color above, and terminated using the T568B Wiring Code U.O.N.

2. Furnish Category 6 RJ45 patch cord for connecting desktops and printers to the network, for each horizontal cable run.

3. Furnish and install Cat 6, 24AWG stranded for Communications applications.
4. Furnish and install Cat 6, 28AWG stranded for wiring inside data cabinet and CCTV cabinet. Patch cords shall be Panduit p/n UTP28SP7BU, or approved equal.

END OF SECTION

SECTION 27 05 53 – PATHWAY FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

A. The work shall consist of but not limited to:
   1. Material and labor to label all components of the Premises Distribution Systems which includes but not limited to.
      a. All copper and fiber horizontal (station) cables and associated termination patch panels, outlet faceplates, and connectors.
      b. All other equipment and pathways related to Division 27, as described in TIA 606-A standard.

B. Provide all required records for Class 3 Administration as described by of TIA 606-B standard

C. Related Sections:
   1. Division 27 Section "Communications Equipment Room Fittings" for cabinets, racks, enclosures, cable management and ladder rack.
   2. Division 27 Section “Communications Horizontal Cabling”
   3. Division 27 Section "Pathways for Communications Systems."

1.2 SUBMITTALS

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

B. Submit actual Label samples. Failure to include actual label samples with the submittal package for this Section shall lead to rejection of the submittal.

C. Submit labels on project record documents (as builds) reflecting the actual labels installed.

1.3 QUALITY ASSURANCE

A. Comply with ANSI/TIA/EIA -606-B

1.4 CLASS OF ADMINISTRATION

A. The labeling scheme used shall meet all the requirements of a Class 3 facility as defined by ANSI/TIA/EIA 606-B, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

B. Type, format, wording, printing, and placement of labels shall be coordinated with Owner’s existing administration plan. Items and/or issues not addressed in Owner’s established

administration plan shall be addressed in accordance with TIA/EIA 606-B Standard (e.g. cable tray, conduits, junction boxes, grounding systems, etc).

C. All annexes to the ANSI/TIA/EIA 606-B standard shall be followed, unless approved by the OWNER, in writing.

1.5 COORDINATION

A. Coordinate the labeling scheme for the communications systems with the OWNER.

PART 2 - PRODUCTS

2.1 GENERAL

A. Comply with requirements of ANSI/TIA/EIA-606-B and UL969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements of Division 26 Section "Identification for Electrical Systems".

C. The identification for the communications systems shall meet all the requirements of a Class 3 facility as defined by ANSI/TIA/EIA-606-B, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

D. Identify all the components of the communications systems.
   1. For fire-resistant plywood, do not paint over manufacturer's label.

E. Labels shall be preprinted or computer-printed type.

F. Type, format, wording, printing, and placement of labels shall be coordinated with Owner’s existing administration plan. Items and/or issues not addressed in Owner’s established administration plan shall be addressed in accordance with ANSI/TIA/EIA-606-B Standard (e.g. cable tray, conduits, junction boxes, grounding systems, etc).

G. Manufacturers
   1. Panduit
   2. Brady Corporation
   3. Equivalent

H. Labeling System
   1. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
   2. Shall be preprinted or computer printed type. Hand written labels are not acceptable.
   3. Where insert type labels are used provide clear plastic cover over label.
   4. PC-based software, WINDOWS compatible, capable of supporting alpha numeric characters and Windows True Type Fonts.
   5. Compatible with laser printers.
   6. Label sizes supported:
      a. Minimum: 0.8" W x 0.2" H.
      b. Maximum: 3.0" W x 12.0" H.

I. The switch end of each Category cable shall be punched down to a new patch panel and shall be labeled with the device name of the attached device. The patch panel shall also be labeled with the attached device.

J. Fiber Optic Patch Panels shall be labeled with the room or cabinet that is at the other end, and the Patch Panel labels shall all be filled out and indicate the device on the opposite end or that the strand is spare.

K. No Ethernet connected device shall be installed until its cabling is properly labeled.

L. The device end of each Category cable shall be labeled indicating the originating rack or cabinet.

M. The contractor shall label each Communications system component with a label containing the following items, the Contractor shall submit an example label to MNR for approval prior to labeling the equipment:
   1. Location designation
   2. The equipment ID number from the approved installation drawings
   3. The device ID

N. All labels used shall be machine printed yellow weatherproof labels and withstand rain, sleet, snow, dust, and temperatures of -20°F to 160°F. Font and font size shall be approved by MNR.

PART 3 - EXECUTION

3.1 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with ANSI/TIA/EIA-606-B. Comply with requirements in Division 26 Section "Identification for Electrical Systems". Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

B. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of ANSI/TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with ANSI/TIA/EIA - 606-B for Class 3 level of administration including optional identification requirements of this standard.

C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

E. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
    a. Individually number the wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular devices as shown.
    b. Label each unit and field within distribution racks and frames.

F. Identification within Connector Fields in Communications Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA/EIA- 606-B, for the following:
1. Cables use flexible vinyl or polyester that flexes as cables are bent.

H. Grounding and bonding for communications systems Identification:
1. Identify system components, wiring, and cabling complying with ANSI/TIA/EIA-606-B. Comply with requirements in Division 26 Section “Identification for Electrical Systems”.
2. Provide nonmetallic pre-printed labels, white background with black printing that can be permanently mounted to the busbar.
3. The bonding conductors for telecommunications, TBB conductor, and each grounding equalizer shall be green or marked with a distinctive green color.

END OF SECTION

SECTION 27 11 00 –COMMUNICATIONS ROOM FITTINGS

PART 1 - GENERAL

1.1 SUMMARY:

A. This section encompasses requirements related to all Communications and shared Communications/Electrical spaces:

B. Section includes:
1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks.
4. Grounding.

C. Related Sections:
1. Division 27 Section “Common Work Results For Communications”
2. Division 27 Section “Communications Horizontal Cabling”
3. Division 27 Section “Pathways for Communications Systems”.

1.2 SUBMITTALS

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

B. Shop Drawings: For communications and shared Communication/Electrical equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies, and location and size of each field connection.
2. Equipment racks: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Cable installer must have personnel certified by BICSI on staff.
1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of an RCDD, or Installer Level 2.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, Commercial Installer, Level 2, who shall always be present when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD, or Commercial Installer, Level 2 to perform the on-site inspection.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Telecommunications Pathways and Spaces: Comply with ANSI/TIA-569-A.

D. Grounding: Comply with ANSI/TIA-607-A.

1.4 PROJECT CONIDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and work above ceilings is complete

1.5 COORDINATION

A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers.
   1. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
   2. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with ANSI/TIA-569-C

B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots for fastening cable ties to brackets.
   1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
   2. Support brackets with cable tie slots for fastening cable ties to brackets.
   3. Lacing bars, spools, J-hooks, and D-rings.
   4. Straps and other devices.

C. Sleeves for Pathways and Cables: Refer to Division 27 Section “Common Work Results for Communications”

D. Conduit and Boxes: Refer to Division 26 Section "Raceway and Boxes for Electrical Systems."
   a. Expansion fittings shall be arranged to cross expansion joints at right angles.
   b. Cabling shall be installed in smooth wall innerduct to allow safe pulls across and through the expansion joint fitting.

2.2 NETWORK CABINET

A. Outdoor termination enclosure for the mounting of outdoor plant fiber and copper cables associated patch panels, network equipment, and patch cords.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers:
   1. Hoffman

C. The cabinets shall provide protection in extreme environments indoors and out.

D. General Frame Requirements:
   1. Wall mounted, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
   2. Finish: Manufacturer's standard, baked-polyester powder coat.
   3. The cabinet enclosure shall be seismically rated and braced according to IBC 1621. The installation shall be signed and sealed by a professional engineer.
   4. Provide all mounting components and accessories to securely fix racks to wall.

E. The cabinet shall contain all equipment rack hardware to accommodate the Communications systems, ISP equipment and electrical distribution and electronic Communications equipment.

F. The total assembled cabinet structure shall be constructed as a rigid, self-supporting structure that when handled for shipping and placement on foundation shall not warp or deflect internally the roof, outer doors or skin.

G. The cabinet shall provide for the mounting and termination of the following equipment and material as a minimum:
   1. Protected power strips
   2. Din Rails
   3. Power supplies
   4. Fiber optic cable splice enclosures
   5. Fiber optic cable slack, patch panels and cable management
   6. Ethernet network switch stack
   7. Cat 6A Patch panels
   8. Fiber optic media converters, modems, and patch panels

H. Grounding and bonding kit.

I. UL Listed – 508A, NEMA Type 4X.

2.3 NETWORK CABINET GROUNDING

A. Each cabinet shall be equipped with three (3) copper grounding bus bars (for Electrical system, Chassis and communications grounding). Bus bars shall be located near the bottom of the cabinet and be mounted on insulators that electrically isolate the cabinet from the bus bar.

B. Bus bars shall be 12 X 1 X 1 /4 inch thick, solid copper bar, predrilled for connection of individual grounds.

C. The grounding bus bars shall each be bonded to each other with a #4 AWG green insulated copper conductor. The ground bus in the electrical distribution section will be connected to a single #2 group tap on the station ground grid.

D. Internal chassis grounding arrangement shall utilize #6 AWG green insulated, stranded ground wire connected to the Chassis Grounding Bus bar (CGB).

E. Electrical system ground wire from the station electrical panel enclosure shall be grounded to the cabinet distribution panel ground bus and in turn bonded to the ground bus in the electrical distribution section.

F. Protected Terminal Block ground shall be connected to the CGB using #6 AWG ground wire.

G. All electronic equipment grounds shall be grounded; using #1 0 AWG green insulated stranded

H. copper conductors, to the Telecommunications Grounding Bus bar (TGB). Shields from signal cables shall be grounded to the TGB

2.4 CCTV CABINET

A. Outdoor termination enclosure for the mounting of outdoor plant fiber and copper cables associated patch panels, network equipment, and patch cords.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers:
   1. Hoffman

C. The cabinets shall provide protection in extreme environments indoors and out.

D. General Frame Requirements:
   1. Wall mounted, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
   2. Finish: Manufacturer's standard, baked-polyester powder coat.
   3. The cabinet enclosure shall be seismically rated and braced according to IBC 1621. The
   4. installation shall be signed and sealed by a professional engineer.
   5. Provide all mounting components and accessories to securely fix racks to wall.

E. The cabinet shall contain all equipment rack hardware to accommodate the CCTV systems, and electrical distribution and electronic Communications equipment.

F. The total assembled cabinet structure shall be constructed as a rigid, self-supporting structure that when handled for shipping and placement on foundation shall not warp or deflect internally the roof, outer doors or skin.

G. The cabinet shall provide for the mounting and termination of the following equipment and material as a minimum:
   1. Protected power strips
   2. Din Rails
   3. Power supplies
   4. Fiber optic cable splice enclosures

5. Fiber optic cable slack, patch panels and cable management
6. Ethernet network switch stack
7. Cat 6 Patch panels
8. Air Conditioning
9. Heater

H. Grounding and bonding kit.

I. UL Listed – 508A, NEMA Type 4X

2.5 CCTV CABINET GROUNDING

A. Each cabinet shall be equipped with three (3) copper grounding bus bars (for Electrical system, Chassis and communications grounding). Bus bars shall be located near the bottom of the cabinet and be mounted on insulators that electrically isolate the cabinet from the bus bar.

B. Bus bars shall be 12 X 1 X 1 /4 inch thick, solid copper bar, predrilled for connection of individual grounds.

C. The grounding bus bars shall each be bonded to each other with a #4 AWG green insulated copper conductor. The ground bus in the electrical distribution section will be connected to a single #2 group tap on the station ground grid.

D. Internal chassis grounding arrangement shall utilize #6 AWG green insulated, stranded ground wire connected to the Chassis Grounding Bus bar (CGB).

E. Electrical system ground wire from the station electrical panel enclosure shall be grounded to the cabinet distribution panel ground bus and in turn bonded to the ground bus in the electrical distribution section.

F. Protected Terminal Block ground shall be connected to the CGB using #6 AWG ground wire.

G. All electronic equipment grounds shall be grounded; using #1 0 AWG green insulated stranded copper conductors, to the Telecommunications Grounding Bus bar (TGB).

H. Shields from signal cables shall be grounded to the TGB

2.6 THREE-BAY STATION COMMUNICATIONS CABINET (NOT USED)

2.7 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm).

2.8 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:
   1. Connectors: Mechanical type, cast silicon bronze, solderless compression type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
   2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
   3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
   4. Comply with ANSI/TIA-607-A.

2.9 LABELING

A. Comply with ANSI/TIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 GENERAL

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and housing when so directed by service provider. The expansion project will reuse existing incoming service infrastructure.

B. Compliance: Comply with powering, conduit entry and grounding practices as described herein and as required by code.

C. Coordination of Access: Coordinate the installation of access covers, hinged panels or pull-out drawers to ensure complete access to terminals and interior components. Access shall be designed such that demounting or de-energizing of equipment is not required to gain access to any equipment.

D. Service Loop: Fasten removable covers containing any wired component with a continuous hinge along one side with associated wiring secured and dressed to provide an adequate service loop. Appropriate stop locks shall be provided to hold hinged panels and drawers in a serviceable position.

E. Comply with NECA 1.

F. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

G. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.2 INSTALLATION

A. A. Contractor shall install all communications equipment and associated power supplies in required enclosures.

B. Contractor shall provide all cabling interconnections from switches to/ from each system

3.3 FIRESTOPPING

A. Comply with ANSI/TIA -569-C, Annex A, "Firestopping".

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.5 TESTING

A. Provide Preliminary Testing, Inspection, Performance Verification Testing, and Commissioning services for systems and equipment in accordance with specifications.

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with ANSI/TIA -606-A. Comply with requirements in Division 26 Section "Identification for Electrical Systems". Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

B. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of ANSI/TIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with ANSI/TIA -606-A for Class 3 level of administration including optional identification requirements of this standard.

C. Labels shall be preprinted or computer-printed type.

END OF SECTION

SECTION 27 13 00 –COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 SUMMARY:

A. Section includes:
1. Pathways.
2. Fiber optic and UTP cable.
3. Cable connecting hardware, patch panels, and cross-connects.
4. Cabling identification products.
5. Cabling management system.

B. Related Sections:
1. 270500 “Common Work Results for Communications”
2. 271500 Communications Horizontal cabling
3. 270526 “Grounding and Bonding for Communications Systems”
4. 270528 “Pathways for Communications Systems”
5. 270553 “Identification for Communications Systems”
6. 271100 “Communications Equipment Room Fittings”

1.2 BACKBONE CABLING DESCRIPTION

A. Backbone cabling system shall provide interconnections between the field (CCTV, network, etc.) cabinet and Communications rooms. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to backbone cross-connection. Patch cords shall be provided by others.

B. Backbone cabling cross-connects will be located in Communications rooms. Bridged taps and splitters shall not be used as part of backbone cabling.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in ANSI/TIA-568-C.0, when tested according to test procedures of this standard.

1.4 SUBMITTALS

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

B. Shop Drawings:
1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. Cabling administration drawings and printouts.
3. Wiring diagrams to show typical wiring schematics including the following:
a. Cross-connects.

b. Patch panels.
c. Patch cords.

4. Cross-connects and patch panels. Detail mounting assemblies and show elevations and physical relationship between the installed components.
5. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements.
   a. Qualification Data: For Installer, qualified layout technician, installation
   b. supervisor, and field inspector.
   c. Source quality-control reports.
   d. Field quality-control reports.
   e. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
   1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of an RCDD, or BICSI Installer 2 Copper, or BICSI Installer 2 Fiber, or BICSI Technician.
   2. Installation Supervision: Installation shall be under the direct supervision of BICSI Technician, BICSI Installer 2 Copper or BICSI Installer 2 Fiber, who shall be present at all times when Work of this Section is performed at Project site.
   3. Field Inspector: Currently registered by BICSI as RCDD, or BICSI Installer 2 Copper to perform the on-site inspection.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 50 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Telecommunications Pathways and Spaces: Comply with ANSI/TIA-569-C.

E. Grounding: Comply with ANSI-J-STD-607-B.

1.6 DELIVERY, STORAGE AND HANDLING

A. All optical fibers shall be 100% attenuation tested. The attenuation shall be measured at 1310 nm and 1550 nm for single-mode fibers. The manufacturer shall store these data values for each cable reel for a minimum of 5 years. These values shall be available upon request.

1.7 PATHWAY

A. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
   1. Support brackets with cable tie slots for fastening cable ties to brackets.
   2. Lacing bars, spools, J-hooks, and D-rings.

3. Straps and other devices.

B. Cable Trays: refer to section 27 05 28 Pathways for communications systems.

C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" and section 27 05 28 Pathways for communications systems. Flexible metal conduit shall not be used, UON.

PART 2 - PRODUCTS

2.1 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels.

2.2 UTP BACKBONE CABLE

A. NOT USED

2.3 FIBER OPTIC CABLE (WHERE APPLICABLE)

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. Corning
   2. Approved equal

B. Description: Single-mode OS2 optical fiber cable with fiber counts as indicated on drawings, with mechanical and transmission performance specifications that meet or exceed ANSI/TIA/EIA-568-C.3
   1. Comply with ANSI/TIA -568-C.0
   2. Comply with ANSI/TIA -598-C.3
   3. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
      a. Communications, indoor/outdoor rated OS2 complying with UL 1666.

2.4 UTP CABLE HARDWARE

A. NOT USED

2.5 FIBER OPTIC CABLE HARDWARE

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. Leviton
   2. Corning
   3. Approved equal.

B. General Requirements for Cable Connecting Hardware: Comply with ANSI/TIA -568-C.3.

C. Where applicable, use 12-ports fiber patch panel from Leviton (Vertigo)

D. Fiber optic connectors for single-mode cables shall as a minimum conform to the performance specifications in Annex A of ANSI/TIA-568-C.3:
   1. Duplex LC connector.
   2. Manufacturer recommended connector for optimal performance with approved cable type
   3. Durability: < 0.2dB change, 500 re-matings, FOTP-21
   4. Reflectance loss: -20dB minimum
   5. Insertion loss of mated pair at 1310 nm and 1550 nm to be less than 0.7 dB at acceptance for every connector
   6. Optimally keyed, allowing reproducible mating conditions each time a connection is made between connector and coupler
   7. Fitted with color-coded strain relief boots to ensure durable and robust connections
   8. Fitted with a tight fitting, polymer cap over the connector to prevent ingress of dirt and dust until the connector is fitted to a coupler
   9. All connectors to be straight-pull and side-pull resistant, preventing accidental optical disconnect; comply with FOTP-21
   10. Maximum of 0.2 dB increase in insertion loss for a 20 lbs. straight pull
   11. Maximum of 0.5 dB increase in insertion loss for a 5 lbs. side pull
   12. Ultimate pullout from coupling shall require a minimum of 25 lbs

E. Fiber Enclosures: Provide rack mountable, 1U and 2U fiber optic patch panels.

F. Fiber Panel adapters shall be 6-LC duplex for single-mode terminations.

G. Fiber Optic connectors shall be field installable, pre-polished LC single-mode and multimode connectors.

2.6 FIBER OPTIC PATCH CORDS

A. The Owner will install and connect equipment in the racks. Contractor shall include duplex patch cords for 25% of the strands installed in each room and unit pricing for additional cords. Coordinate patch cord length with the Owner.

B. Description: Optical fiber patch cords for use with patch panels.

C. Specifications:
   1. Fiber type: Single-mode.
   2. Patch cord outside diameter: 3.0mm
   3. Patch cord minimum length: 3m
   4. Connectors of same specifications as the one used in the patch panels.
   5. Cords shall meet or exceed the minimum mechanical and optical characteristics for optical fiber patch cords as specified in ANSI/TIA/EIA-568-C.3.

D. Configuration: 2-strand, Duplex construction; to match optical patch panel connector type.

E. Acceptable manufacturers:
   1. Corning

2. Approved equal

2.7 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors

B. Comply with ANSI/TIA-607-B and ANSI/NECA/BICSI-607.

2.8 IDENTIFICATION PRODUCTS

A. Comply with ANSI/TIA -606-A, TIA-598, and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test cables on reels according to ANSI/TIA -568-B.2.

C. Factory test UTP cables according to ANSI/TIA -568-C.0.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
   1. Install plenum cable in environmental air spaces, including plenum ceilings.
   2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and ANSI/TIA -569-C.

B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.

C. Comply with ANSI/TIA -569-C for pull-box sizing and length of conduit and number of bends between pull points.

D. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

E. Install manufactured conduit sweeps and long-radius elbows whenever possible.

F. Pathway Installation in Communications Equipment Rooms:
   1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
   2. Install cable trays to route cables if conduits cannot be located in these positions.
   3. Secure conduits to backboard when entering room from overhead.
   4. Extend conduits 3 inches (76 mm) above finished floor.
   5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

G. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

H. Outdoor termination enclosure for the mounting of outdoor plant fiber and copper cables associated patch panels, network equipment, and patch cords.

3.3 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. B. General Requirements for Cabling:
   1. Comply with ANSI/TIA -568-C.0, and ANSI/TIA -568-C.1 standards.
   2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
   3. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
   4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
   5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
   6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.

7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before unreeling. Heat lamps shall not be used for heating.
9. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
10. All installed cabling must be routed through the cable management systems and be bundled using re-closeable Velcro wire ties. Ties must be neatly cable-sized and secured to existing cable-racks or walls.

C. UTP Cable Installation:
1. Not Used.

D. Fiber Optic Cable Installation:
1. Comply with ANSI/TIA -568-C.0.
2. Do not exceed minimum bend radius recommended by the manufacturer at all times
3. Use innerduct at any times the fiber cables are mixed with other media type in the same pathway.

E. E. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Group connecting hardware for cables into separate logical fields.

G. Separation from EMI Sources:
1. Comply with BICSI TDMM and ANSI/TIA -569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall

H. be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
d. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
e. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.4 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."Comply with ANSI/TIA -569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

A. Refer to section 270526 “Grounding and Bonding for Communications Systems”

B. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

C. Comply with ANSI/NECA/BICSI-607.

D. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

E. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with ANSI/TIA -606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
1. Administration Class: 3.
2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with ANSI/TIA -606-A for Class 3 level of administration, including optional identification requirements of this standard.

D. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

F. Cable and Wire Identification:
   1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
   2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
   3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
   4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
      a. Individually number the wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device.
      b. Label each unit and field within distribution racks and frames.
   5. Identification within Connector Fields in Equipment Rooms and Telecommunications Rooms: Label each connector and each discrete unit of cable-terminating and connecting hardware.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA 606-A, for the following:
   1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.7 FIELD QUALITY CONTROL

A. Optical fiber cable testing:
   1. Field-test instruments shall have the latest software and firmware installed.
   2. Link and channel test results from the OLTS and OTDR shall be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.
   3. Fiber endfaces shall be inspected at 200X or 400X magnification. 200X magnification is suitable for inspecting multimode and singlemode fibers. 400X magnification may be used for detailed examination of singlemode fibers. Scratched, pitted or dirty connectors shall be diagnosed and corrected.
      a. It is preferable that the endface images be recorded in the memory of the test instrument for subsequent uploading to a PC and reporting.
   4. Testing shall be performed on each cabling segment (connector to connector).
   5. Testing shall be performed on each cabling channel (equipment to equipment) that is planned for use per the owner's instructions.
   6. Testing of the cabling shall be performed using high-quality test cords of the same fiber type as the cabling under test. The test cords for OLTS testing shall be between 1 m and 5 m in

length. The test cords for OTDR testing shall be approximately 100 m for the launch cable and at least 25 m for the receive cable.

7. Optical loss testing
   a. Backbone link
      1) Singlemode backbone links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, One Reference Jumper or the equivalent method.
      2) Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.
      3) Use the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B and ANSI/TIA/EIA-526-7, Method A.1 or the equivalent method. The user shall follow the procedures established by these standards or application notes to accurately conduct performance testing.
8. OTDR Testing
   a. Fiber links shall be tested at the appropriate operating wavelengths for anomalies and to ensure uniformity of cable attenuation and connector insertion loss.
      1) Singlemode: 1310 nm and 1550 nm
   b. Each fiber link and channel shall be tested in both directions.
   c. A launch cable shall be installed between the OTDR and the first link connection.
   d. A receive cable shall be installed after the last link connection.
9. Magnified Endface Inspection
   a. Fibers shall be inspected at 250X or 400X magnification. 250X magnification is suitable for inspecting multimode and singlemode fibers. 400X magnification may be used for detailed examination of singlemode fibers.
10. Length Measurement
    a. The length of each fiber shall be recorded.
    b. It is preferable that the optical length be measured using an OLTS or OTDR.
11. Polarity Testing
    a. Paired duplex fibers in multi-fiber cables shall be tested to verify polarity in accordance with Clause E.5.3 of ANSI/TIA-568-C.0. The polarity of the paired duplex fibers shall be verified using an OLTS.

B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

C. Prepare test and inspection reports.

D. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

E. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

F. Test results documentation
   1. Test results saved within the field-test instrument shall be transferred into a Windows™ based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., “as saved in the field-

test instrument". The file format, CSV (comma separated value), does not provide adequate protection of these records and shall not be used.

2. The test results documentation shall be available for inspection by the Owner or the Owner's representative during the installation period and shall be passed to the Owner's representative within 5 working days of completion of tests on cabling served by a telecommunications room or of backbone cabling. The installer shall retain a copy to aid preparation of as-built information.
3. The database for the complete project, including twisted-pair copper cabling links, If applicable, shall be stored and delivered on CD-ROM prior to Owner acceptance of the building. This CD-ROM shall include the software tools required to view, inspect, and print any selection of the test reports.
4. Circuit IDs reported by the test instrument should match the specified label ID
5. The detailed test results documentation data is to be provided in an electronic database for each tested optical fiber and shall contain the following information
    a. The identification of the customer site as specified by the end-user
    b. The name of the test limit selected to execute the stored test results
    c. The name of the personnel performing the test
    d. The date and time the test results were saved in the memory of the tester
    e. The manufacturer, model and serial number of the field-test instrument
    f. The version of the test software and the version of the test limit database held within the test instrument
    g. The fiber identification number
    h. The length for each optical fiber
        1) Optionally the index of refraction used for length calculation when using a length capable OLTS
    i. Test results to include OLTS attenuation link and channel measurements at the appropriate wavelength(s) and the margin (difference between the measured attenuation and the test limit value).
    j. Test results to include OTDR link and channel traces and event tables at the appropriate wavelength(s).
    k. The length for each optical fiber as calculated by the OTDR.
    l. The overall Pass/Fail evaluation of the link-under-test for OLTS and OTDR measurements
    m. Optional
        1) A picture or image of each fiber end-face
        2) A pass/fail status of the end-face based upon visual inspection.

G. Record copy and as-built drawings
    1. Provide record copy drawings periodically throughout the project as requested by the Construction Manager or Owner, and at end of the project on CD-ROM. Record copy drawings at the end of the project shall be in CAD format and include notations reflecting the as built conditions of any additions to or variation from the drawings provided such as, but not limited to cable paths and termination point. CAD drawings are to incorporate test data imported from the test instruments.
    2. The as-built drawings shall include, but are not limited to block diagrams, frame and cable labeling, cable termination points, equipment room layouts and frame installation details. The as-builts shall include all field changes made up to construction completion:
        a. Field directed changes to pull schedule.
        b. Field directed changes to cross connect and patching schedule.
        c. Horizontal cable routing changes.
        d. Backbone cable routing or location changes.

H. Associated detail drawings.

END OF SECTION

SECTION 27 15 00 –COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY:

A. Section includes:
   1. Pathways.
   2. UTP cabling.
   3. Cable connecting hardware, patch panels.
   4. Telecommunications outlet/connectors.
   5. Cabling identification products.
   6. Cabling administration system.

B. Related Sections:
   1. Division 27 Section “Common Work Results For Communications”.
   2. Division 27 Section "Communications Room Fittings".
   3. Division 27 Section "Pathways for Communications Systems”.
   4. Division 27 Section "Identification for Communications Systems”.
   5. Division 27 Section "Grounding and Bonding for Communications Systems”.

1.2 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware (Cabling Subsystem 1) provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the Communications Room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
   1. EIA/TIA -568-C.0 specifies that the cable lengths are dependent on the application and upon the media chosen. All Ethernet applications are limited to 100 m on UTP media; therefore, the maximum permanent link length is 95 m (295’). Analog phone, fax and ISDN applications are allowed to exceed this limitation.
   2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector. Consolidation points should be avoided.
   3. Bridged taps and splices shall not be installed in the horizontal cabling.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in EIA/TIA -568-B.1 and EIA/TIA -568-B.2 when tested according to test procedures of this standard. SUBMITTALS

1.4 SUBMITTALS:

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

B. Shop Drawings:
   1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
   2. Cabling administration drawings and printouts.
   3. Wiring diagrams to show typical wiring schematics, including the following:
      a. Cross-connects.
      b. Patch panels.
      c. Patch cords.
   4. Cross-connects and patch panels. Detail mounting assemblies and show elevations and physical relationship between the installed components.
   5. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements.

C. Samples: For workstation outlets, jacks, jack assemblies, and faceplates for color selection and evaluation of technical features.

D. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

E. Source quality-control reports.

F. Field quality-control reports.

G. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
   1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of an RCDD.
   2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, or Level 2 Installer, who shall be present at all times when work if this section is performed at Project site.
   3. Field Inspector: Currently registered by RCDD.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 50 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Telecommunications Pathways and Spaces: Comply with EIA/TIA -569-A.

E. Grounding: Comply with ANSI/TIA-607-A.

PART 2 - PRODUCTS

2.1 PATHWAY

A. For cable trays, conduit and boxes refer to Section 27 05 28 “Pathways for communications Systems” and Division 26 “Raceway and Boxes for Electrical Systems

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels.

2.3 OUTSIDE PLANT UTP CABLE

A. The end-to end cabling and connectivity solution shall be Category 6A.

B. 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. Belden
   2. Berk-Tek/Leviton
   3. Siemon Co.
   4. Approved equal

C. Description: 100-ohm, 4-pair Outdoor rated cable, covered with a blue thermoplastic jacket.
   1. Comply with ICEA S-90-661 for mechanical properties.
   2. Comply with TIA 802.3 AF and TIA 802.3AT for PoE requirements.
   3. Comply with ANSI/TIA -568-C.1 for performance specifications.
   4. Comply with ANSI/TIA -568-C.2, Category 6A.
   5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
      a. Communications Plenum Rated: Type CMP, complying with NFPA 262.
      b. Communications, Outdoor Rated, used for outdoor locations.

2.4 FIBER OPTIC CABLE

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. Corning
   2. Siemon Co.

B. Description: Multimode indoor/outdoor optical fiber cable.

C. OM4 50/125uM multimode optical fiber cable, LSZH, suitable for indoor/outdoor use, riser, non-armored with riser-rated, UV-stabilized jacket (no Gel).

D. Fiber strand counts shall be:
   1. 2-strand
   2. 6-strand

2.5 UTP CABLE HARDWARE

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. Leviton
   2. Siemon Co
   3. Approved equal

B. General Requirements for Cable Connecting Hardware: Comply with ANSI/TIA -568-C.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
   1. Use: For use in standard 19" mount, rack and telecom cabinet applications.
   2. Number of Jacks per Field: One for each four-pair Category 6A cable indicated, plus spares and blank positions adequate to suit specified expansion criteria.
   3. Provide rack mountable RJ 45 patch panel compliant with Category 6A specification.
   4. Store cable reserve with no bends sharper than 2" bend radius.
   5. Port counts: 24 or 48-port patch panels as required.

D. Patch Cords: Factory-made, four-pair cables in 48-inch (1200 mm), 72-inch (1800-mm), 96-inch (2400 mm), and 120" (3600 mm) lengths; terminated with eight-position modular plug at each end.
   1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
   2. Provide one patch cord for each outlet to match the cabling category of the outlets they connect. Coordinate with owner for additional cables before purchasing.
   3. Provide station cords in 96" (90%) and 120" (10%) lengths
   4. Provide various lengths of patch cords at the Communications room end as to assure a neat installation.
   5. Provide unit prices for each length of patch cords to be used for additional patch cords as needed.
   6. Provide outdoor rated patch cords that are Category 6A compliant, in coordination with the Owner.
   7. Patch Cords shall be provided by others.

2.6 FIBER OPTIC CABLE HARDWARE

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. Corning
   2. Siemon Co.

B. General Requirements for Cable Connecting Hardware: Comply with ANSI/TIA -568-C.3.

C. Rack Mount Optical Fiber Panel
   1. Fiber enclosure shall be available in 1RU, 2RU, 3RU, and 4RU versions to accommodate termination and splicing of fiber.
   2. Adapter bulkhead shall accept LC modules/cassettes
   3. Fiber cable management for routing, storage, and protection shall accept patch cords, tight-buffer fiber, and backbone cables.
   4. Rear fiber cable management rings shall be stackable and configurable in ¼, ½, or full ring arrangements.
   5. Enclosure shall be constructed of 16-gauge steel with a powder-coated black finish and be mountable in a 19" rack or enclosure frame.
   6. An optional locking door feature shall be available.
   7. Enclosure shall incorporate a sliding tray (in 1RU & 2RU) that removes completely from enclosure for ease of field terminations and splicing
   8. Enclosure shall feature sliding tray glides (with stop) forward and backward, providing accessibility to front and rear bulkhead after installation
   9. Enclosure shall have minimum 15" depth for high density fiber termination and/or splicing
   10. Enclosure shall have removable rubber grommets that allow for pre-terminated fiber trunk install, protection of cable, and minimizes dust build-up

D. Fiber optic connectors for Multimode cable shall as a minimum conform to the performance specifications in Annex A of ANSI/TIA 568-C.3:
   1. Duplex LC connector.
   2. Manufacturer recommended connector for optimal performance with approved cable type.
   3. Durability: < 0.2dB change, 500 re-matings, FOTP-21
   4. Reflectance loss: -20dB minimum
   5. Insertion loss of mated pair at 1310 nm and 1550 nm to be less than 0.7 dB at acceptance for every connector
   6. Optimally keyed, allowing reproducible mating conditions each time a connection is made between connector and coupler
   7. Fitted with color-coded strain relief boots to ensure durable and robust connections
   8. Fitted with a tight fitting, polymer cap over the connector to prevent ingress of dirt and dust until the connector is fitted to a coupler
   9. All connectors to be straight-pull and side-pull resistant, preventing accidental optical disconnect; comply with FOTP-21
   10. Maximum of 0.2 dB increase in insertion loss for a 20 lbs. straight pull
   11. Maximum of 0.5 dB increase in insertion loss for a 5 lbs. side pull
   12. Ultimate pullout from coupling shall require a minimum of 25 lbs
   13. Fiber enclosure: Provide rack mountable, 1U and 2U fiber optic patch panels as required.
   14. Fiber panel adapter shall be 6-LC duplex for Multimode fiber terminations. Fiber optic connectors shall be field installable, pre-polished LC Multimode connectors.

2.7 FIBER OPTIC PATCH CORDS

A. Description: Optical fiber patch cords for use with patch panels.

B. Specifications:
   1. Fiber type: Multimode.
   2. Patch cord outside diameter: 3.0mm
   3. Patch cord minimum length: 3m
   4. Connectors of same specifications as the one used in the patch panels.

5. Cords shall meet or exceed the minimum mechanical and optical characteristics for optical fiber patch cords as specified in ANSI/TIA/EIA-568-C.3.

C. Configuration: 2-strand, Duplex construction; to match optical patch panel connector type.

D. Acceptable manufacturers:
1. Corning
2. Siemon Co

2.8 MEDIA CONVERTERS

A. Media converters shall be provided where noted on drawings to interface devices requiring UTP connections of 10/100/1000BASE-T in locations that exceed standards compliant distances on UTP copper cabling.

B. Media converters shall be hardened, to withstand harsh environmental conditions

C. DIN rail mountable

D. Sealed IP30 packaging

E. Convection cooled, requiring no fans

F. Media converter shall be capable of providing power over Ethernet where power receptacles are provided.

G. Shall interface with strand counts and fiber types as indicated on drawings.

2.9 TELECOMMUNICATIONS OUTLET/CONNECTORS

A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.

B. Multimode LC Connectors
1. Connector type: LC
2. Mode: 50 µm MM
3. Ferrule: Composite
4. Insertion Loss: <0.10dB

C. Workstation Outlets: Two and Four -port-connector assemblies mounted in single faceplate. Refer to detail drawings for configurations.
1. Plastic Faceplate: High-impact plastic. Coordinate color with Division 26 Section "Wiring Devices."
2. For use with snap-in jacks accommodating any combination of UTP and/or fiber work area cords.
   a. Flush mounting jacks, positioning the cord at a 45-degree angle.
3. Factory labeled by silk-screening or engraving for stainless steel faceplates.
4. Machine printed, in the field, using adhesive-tape label.
5. Snap-in, clear-label covers and machine-printed paper inserts.

D. Outdoor rated Data Outlets: Four -port-connector assemblies mounted on single faceplate. Refer to detail drawings for configurations.
   1. IP67 –rated environmental sealing (dust/water protection)
   2. Provide gasketed fittings to provide watertight fit.
   3. Dual gang, 4-port outlet. Backbox to be provided with a DIN rail adapter plate to allow mounting within the lightpole base.
   4. Metal Faceplate: Stainless steel, complying with requirements in Division 26 Section "Wiring Devices."
   5. For use with snap-in jacks accommodating any combination of UTP and/or fiber work area cords.
      a. Flush mounting jacks, positioning the cord at a 45-degree angle.

2.10 GROUNDING

A. Comply with requirements in Division 27 Section "Grounding and Bonding foR Communications Systems".

B. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

C. Comply with ANSI/TIA-607-A.

2.11 IDENTIFICATION PRODUCTS

A. Comply with ANSI/TIA -606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Division 27 Section "Identification for Communications Systems".

C. Comply with requirements in Division 26 Section "Identification for Electrical Systems".

2.12 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP cables on reels according to ANSI/TIA -568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Cabling and its installation shall comply with authority having jurisdiction (AHJ) and applicable regulations.

B. The cable shall not be subjected to pulling tension exceeding the pulling strength rating of the cable.

C. The cable bend radius shall be greater than or equal to the minimum bend radius requirement during and after installation.

D. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
   1. Install plenum cable in environmental air spaces, including plenum ceilings.
   2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

E. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

F. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

G. Maintain compatibility with the environmental conditions by means of enhanced cabling components, protection, separation, and isolation applicable to each area; refer to Annex F of ANSI/TIA-568-C.0.

3.2 INSTALLATION OF PATHWAYS

A. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.

B. Comply with ANSI/TIA -569-A for pull-box sizing and length of conduit and number of bends between pull points whenever possible.

C. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

D. Install manufactured conduit sweeps and long-radius elbows whenever possible.

E. Pathway Installation in Communications Equipment Rooms:
   1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.

2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 3 inches (76 mm) above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

F. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.3 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:
1. Comply with ANSI/TIA -568-C.0.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before unreeling. Heat lamps shall not be used for heating.
10. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:
1. Comply with ANSI/TIA -568-B.2.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Open-Cable Installation
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:
   1. Comply with BICSI TDMM and ANSI/TIA -569-C for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
   2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
      a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
      b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
      c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
   3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
      a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
      b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
      c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
   4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
      a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
      b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
      c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
      d. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
   5. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.4 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. Comply with ANSI/TIA -569-A, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article

3.5 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with

a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with ANSI/TIA -606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
   1. Administration Class: 3.
   2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
   3. An alpha-numeric convention can be used for the horizontal cabling and outlets. (example: room#, unique outlet designation and position #. 101-A1,2)

B. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with ANSI/TIA -606-A for Class 3 level of administration, including optional identification requirements of this standard.

D. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

F. Cable and Wire Identification:
   1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
   2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
   3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
   4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
      a. Individually number the wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device.
      b. Label each unit and field within distribution racks and frames.
   5. Identification within Connector Fields in Equipment Rooms and Telecommunications Rooms: Label each connector and each discrete unit of cable-terminating and connecting hardware.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA 606-A, for the following:
   1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.7 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with ANSI/TIA-568-C.0.
   2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.
   3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
   4. UTP Performance Tests:
      a. Test for each outlet. Perform the following tests according to ANSI/TIA -
      b. 568-B.1 and ANSI/TIA-568-B.2:
         1) Wire map.
         2) Length (physical vs. electrical, and length requirements).
         3) Insertion loss.
         4) Near-end crosstalk (NEXT) loss.
         5) Power sum near-end crosstalk (PSNEXT) loss.
         6) Equal-level far-end crosstalk (ELFEXT).
         7) Power sum equal-level far-end crosstalk (PSELFEXT).
         8) Return loss.
         9) Propagation delay.
         10) Delay skew.
   5. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.
      a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
      b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.
   6. Optical fiber cable testing: test fiber optic cable in accordance with ANSI/TIA -568-C.3, Annex E.

B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

C. Prepare test and inspection reports.

3.8 DEMONSTRATON

A. Engage a factory-authorized service representative to train Owner's maintenance personnel in cable-plant management operations, including moves adds and changes, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

END OF SECTION

SECTION 27 16 00–INTERCOM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY:

A. Section includes:
   1. Pathways.
   2. UTP cabling.
   3. Cable connecting hardware, patch panels.
   4. Telecommunications outlet/connectors.
   5. Cabling identification products.
   6. Cabling administration system.

B. Related Sections:
   1. Division 27 Section “Common Work Results For Communications”.
   2. Division 27 Section "Communications Room Fittings".
   3. Division 27 Section "Pathways for Communications Systems”.
   4. Division 27 Section "Identification for Communications Systems”.
   5. Division 27 Section "Grounding and Bonding for Communications Systems”.

1.2 GENERAL REQUIREMENTS

A. This section requires furnishing and installing of intercom units and related equipment at locations indicated on the Contract Drawings.

B. Furnish and install all items required for a complete and operational intercom system.

1.3 CODES AND STANDARDS

A. All items furnished and installed under this specification shall comply with the latest edition of applicable codes, provisions and all applicable standards.

1.4 SUBMITTALS:

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

B. Shop Drawings:
   1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
   2. Cabling administration drawings and printouts.
   3. Tagging/labeling nomenclature and related product data.
   4. Wiring diagrams to show typical wiring schematics, including the following:
      a. Cross-connects.
      b. Patch panels.
      c. Patch cords.

C. Samples: For workstation outlets, jacks, jack assemblies, and faceplates for color selection and evaluation of technical features.

D. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

E. Source quality-control reports.

F. Field quality-control reports.

G. Maintenance data.

H. Test results shall be submitted for approval

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer must have personnel certified by BICSI on staff.
   1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of an RCDD.
   2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, or Level 2 Installer, who shall be present at all times when work if this section is performed at Project site.
   3. Field Inspector: Currently registered by RCDD.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Telecommunications Pathways and Spaces: Comply with EIA/TIA -569-A.

D. Grounding: Comply with ANSI/TIA-607-A.

PART 2 - PRODUCTS

2.1 NON IP-BASED INTERCOM SYSTEM

A. The intercom units shall be designed to permit their use, as a manufacturer-recommended standard application, in the configuration indicated on the Contract Drawings. The system shall consist of master and sub units (staff stations) as indicated on the Contract Drawings.

B. The intercom units shall be designed to operate on 12 VDC. Furnish and install power supplies as required.

C. Operation of an intercom unit to call another unit shall activate a tone at the called unit to alert personnel at that location that an intercom call is about to be made.

D. The system shall be capable of operating at distances up to 650 feet over 22 AWG wire.

E. The intercom units shall be the LEF-3 series as manufactured by Aiphone Communication Systems, www.aiphone.com, Bellevue, WA, telephone 800-692-0200, or approved equal.

2.2 GROUNDING

A. Comply with requirements in Division 27 Section "Grounding and Bonding foR Communications Systems".

B. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

C. Comply with ANSI/TIA-607-A.

2.3 IDENTIFICATION PRODUCTS

A. Comply with ANSI/TIA -606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Division 27 Section "Identification for Communications Systems".

C. Comply with requirements in Division 26 Section "Identification for Electrical Systems".

2.4 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP cables on reels according to ANSI/TIA -568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install all equipment being furnished, unless otherwise indicated on the Contract Drawings or specified herein. Install system in accordance with manufacturer’s printed instructions and recommendations.

B. Install all modules in enclosures in accordance with manufacturer’s printed instructions.

C. Install all networking and line cards in accordance with manufacturer’s printed instructions.

D. Program the system to operate as recommended by the manufacturer’s printed instructions.

3.2 INSTALLING ADA-COMPLIANT NON IP-BASED INTERCOM

A. Install all equipment being furnished, unless otherwise indicated on the Contract Drawings. Install equipment as approved and at locations indicated on the Contract Drawings.

B. All fasteners used to install intercom shall be tamper resistant.

C. For installation of intercom in elevators or elevator hall call stations:
   1. Coordinate this work with the elevator cab manufacturer/rebuilder.
   2. For each intercom, furnish and install an ADA-compliant elevator control panel or elevator hall call station with all required LEDs, pushbuttons, and engraved lettering required to operate the speakerphone.
   3. For installations in passenger elevators and at elevator hall call stations, protect the microphone and speaker with a vandal-resistant, stainless steel mesh and a waterproof cloth, as recommended by the speakerphone manufacturer.

D. For systems with intercom in elevators, furnish a sign near the elevator machine room telephone indicating directions for calling elevator speakerphones.

E. For systems installed at station areas:
   1. Wire the system so that: the intercom calls the fare booth feature phone; the elevator machine room feature phone may selectively call each elevator speakerphone/intercom and fare booth feature phone. Fare booth feature phones and elevator machine room feature phones are restricted to the ADA-Compliant Passenger Assistance Telephone/Intercom System.
   2. Wire and program the system so that: the intercom calls the fare booth feature phone and the existing Station Command Center at the Rail Control Center.

F. Via an adhesive label on the feature intercom or other approved means, furnish and install a listing of the station numbers which may be called from the feature phone.

G. For each intercom equipped with a heater, install wiring as required in a 3/4 inch conduit from the heater to the 117Vac source indicated on the Contract Drawings.

3.3 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with ANSI/TIA -606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
   1. Administration Class: 3.
   2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
   3. An alpha-numeric convention can be used for the horizontal cabling and outlets. (example: room#, unique outlet designation and position #. 101-A1,2)

B. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with ANSI/TIA -606-A for Class 3 level of administration, including optional identification requirements of this standard.

D. Cable and Wire Identification:
   1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
   2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
   3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
   4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
      a. Individually number the wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device.
      b. Label each unit and field within distribution racks and frames.
   5. Identification within Connector Fields in Equipment Rooms and Telecommunications Rooms: Label each connector and each discrete unit of cable-terminating and connecting hardware.

E. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA 606-A, for the following:
   1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Submit, for approval, detailed step-by-step test procedure for the speakerphone/intercom units.
   2. Final Verification Tests: Perform verification tests for the intercom system after the complete communications cabling are installed.
      a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
      b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

C. Prepare test and inspection reports.

3.5 DEMONSTRATON

A. Engage a factory-authorized service representative to train Owner's maintenance personnel in cable-plant management operations, including moves adds and changes, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

END OF SECTION

DIVISION 28
ELECTRONIC SAFETY AND SECURITY

SECTION 28 31 00 - FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fire alarm system; complete, including all wiring, raceways, terminal cabinets, pull boxes, outlet and mounting boxes, initiating devices, alarm indicating devices, annunciator(s), control equipment, tests, and all other accessories and miscellaneous items required for a complete operating system even though each item is not specifically mentioned or described.

B. Verify requirements with Jurisdictional authorities, i.e.: Insurance authority or Underwriter, Fire Department or Marshal, or Building Department. Provide system complete, functional and acceptable to Jurisdictions without penalty of any type to the insurance premium rate. The Design Builder shall be completely responsible for all aspects of coordination with other sections of these specifications and drawings. No change will be issued for lack of coordination or lack of verification of requirements of Jurisdictional Authorities.

C. Related Sections
   1. Section 01 33 00 – Submittal Procedures
   2. Section 26 05 00 - Common Work Results for Electrical
   3. Section 26 05 28 – Hangers and Supports for Electrical Systems
   4. Section 26 05 33.13 – Conduit for Electrical Systems
   5. Section 26 05 33.16 - Boxes for Electrical Systems

1.2 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI/ASME A117.1, A117.3 Standard for Accessible and Usable Building and Facilities.

B. National Electrical Manufacturer’s Association (NEMA)

C. National Fire Protection Association (NFPA):
   1. NFPA 70 – National Electrical Code
   2. NFPA 72 – National Fire Alarm Code
   3. NFPA 90A – Standard for the Installation of Air conditioning and Ventilating Systems
   4. NFPA 101 – Life Safety Code

D. Underwriters Laboratory, Inc. (UL):
   1. UL-864 – Control Units and Accessories for Fire Alarm Systems
   2. UL-1076 – Proprietary Burglar Alarm Units and Systems

E. International Fire Code (IFC)

F. The Americans with Disabilities Act (ADA)
   1. Public Law 101 - 336.

G. Underwriters Laboratories (UL) or Factory Mutual (FM) Approval.

H. Local Code requirements where applicable.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is an authorized representative of the fire alarm control panel (FACP) manufacturer for both installation and maintenance of units required for this Project. Installer shall be able to produce, upon request, references and proof of five (5) years minimum experience in the installation of systems of comparable size and performance to that specified.

B. Manufacturer's Representative:
   1. The system shall be commissioned by the authorized Manufacturer's Local Representative whose organization is factory-certified to service the system and maintains a qualified technical and engineering staff to program and service the system. This distributor shall fully stock and show evidence that they maintain a complete inventory of spare parts to properly and promptly service the system.
   2. Before commencing work, submit Representative's data showing the commissioned fire alarm systems of the same type and design as specified. Include the names and locations of at least five such installations. Identify the type and design for each system and furnish documentation that the system has performed satisfactorily for the preceding 48 months.

1.4 SYSTEM DESIGN REQUIREMENTS

A. Verify requirements with jurisdictional authorities (i.e. Insurance Carrier or Underwriter, Fire Department or Marshall, or local Building Code Department). This Design Builder shall be responsible for providing a complete and functional system, acceptable to the jurisdictions involved.

B. Qualification of System Technician: Installation drawings, shop drawing and as-built drawings shall be prepared by or under the supervision of an individual who is experienced with the type of work specified herein and is currently certified by the National Institute of Certification in Engineering Technologies (NICET) as an engineering technician with minimum Level III certification in the fire alarm and detection system program. Design Builder shall submit data for approval showing the name and certification of all involved individuals with such qualifications at or prior to submittal of drawings. All submittals shall be stamped by a Registered Fire Protection Engineer.

C. Qualification of Fire Protection Engineer: The fire protection/life safety aspects of this project shall be supervised and reviewed by a qualified fire protection engineer. The fire protection engineer shall review all fire protection submittals and certify in writing that the design is in compliance with all applicable codes. A qualified fire protection engineer is defined as a registered professional engineer (PE) who has passed the National Council of Examiners for Engineering and Surveys (NCEE) fire protection engineering.

D. Notification circuits shall be designed with 20 percent spare capacity for future visual notification devices.

1.5 SUBMITTALS

A. Submit the following information in accordance with the requirements of section 01 33 00 and General Conditions of Contract:

B. Design Builder shall submit shop drawings, product data and calculations to the Authority Having Jurisdiction, Fire Department/Marshall, Owner's Insurance Underwriter and/or other regulatory agency, and obtain approvals prior to submission to Engineer for review. Include approval documentation with submission to Engineer.

C. Provide complete submittals, which shall include schematic wiring drawings of the control panel showing internal and external control panel wiring and all devices. Floor plans/device layout drawings, sequence of operation, annunciator wiring schematics, battery calculations, and specification sheets for all equipment, all devices shall be provided. Drawings shall be formatted for full size sheets and to scale (1/8"=1'-0" minimum). Partial submittals will not be accepted.

D. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit to Engineer the following operation and maintenance information in accordance with the requirements of Metro North and General Conditions of Contract:
   1. Instruction books and/or leaflets
   2. Recommended renewal parts list
   3. Final as-built drawings
   4. Complete Wiring diagrams
   5. NFPA 72 Test Report/Certificate

1.7 DEFINITIONS

A. Alarm-Initiating Device: A system component that originates transmission of a change-of-state condition, such as a manual pull station, smoke detector, heat detector, supervisory switch, etc.

B. Alarm Signal: Signifies a state of emergency requiring immediate action. Pertains to signals such as the operation of a manual station.

C. Class A Wiring: Circuits arranged and electrically supervised so a single break or single ground fault condition will be indicated by a trouble signal at the FACP and the circuit will continue to be capable of operation for its intended service in the faulted condition no matter where the break or ground fault condition occurs.

D. Class B Wiring: Circuits electrically supervised such that a single break or a single ground fault condition will be indicated by a trouble signal at the FACP no matter where the break or ground fault condition occurs.

E. Hard-Wired System: Alarm, supervisory, and initiating devices directly connected, through individual dedicated conductors, to a central control panel without the use of multiplexing circuits or devices.

F. Multiplex System: One using a signaling method characterized by the simultaneous or sequential transmission, or both, and the reception of multiple signals in a communication channel, including means for positively identifying each signal (also referred to as an Addressable System).

G. Supervisory Signal: Indicates abnormal status or need for action regarding fire suppression or other protective system.

H. Trouble Signal: Indicates that a fault, such as an open circuit, ground, etc. has occurred in the system.

I. NOT USED.

1.8 SYSTEM DESCRIPTION

A. General: UL and FM listed. Complete, zoned, non-coded, addressable, microprocessor-based fire detection and alarm system with manual and automatic alarm initiation, intelligent analog addressable smoke detectors, and automatic alarm verification for alarms initiated by certain smoke detectors as indicated.

B. Signal Transmission: Multiplex signal transmission dedicated to fire alarm service only.

C. Audible and Visual Alarm Indication: By sounding of audible notification devices and visual alarms.

D. System connections for alarm-initiation and alarm-indicating circuits: Class B (Style 4) wiring.

E. NOT USED.

1.9 RECORD DOCUMENTS

A. The As-Built drawings:
   1. Submit, in accordance with the Contract Terms and Conditions, the following As-Built drawings:
      a. Contract base sheet drawings with any and all changes included and noted.
      b. The approved contract panel drawings and annunciator panel drawings
      c. Conduit plan showing the device address for all intelligent/analog-initiating devices.

B. The Operation and Maintenance Manual:
   1. Submit an Operation and Maintenance Manual including:
      a. A complete set of equipment, component and device specification and data sheets
      b. A complete set of system drawings.
      c. A copy of the NFPA 72 Test Report/Certificate,
      d. A printed record of all test activity including the sensitivity readings for all intelligent/analog smoke detectors, the required system and component warrantee papers, and the name and address of the installer.

C. Five (5) sets of keys to all locks shall be provided in a proper key box or binder with each set of keys properly and legibly marked and tagged. Loose keys will not be accepted.

D. All documents and items described above shall be submitted for approval and turnover prior to the final testing and system certification with the exception of the NFPA 72 Test Report/Certificate which shall be delivered by hand to the Owner within two (2) days of the actual test and acceptance. One copy of the Test Report/Certificate shall be submitted to the Engineer.

1.10 ACCEPTANCE OF SYSTEM

A. Total acceptance of the system will only be made after the required tests, complete record document package and the instruction period have been provided.

1.11 GUARANTEE

A. Guarantee the labor, materials and equipment provided under this Contract against system defects for a period of one (1) year after the date of final acceptance of this work by the Owner.

B. Provide service by the equipment supplier during the guarantee period, seven (7) days a week, including holidays, within four (4) hours after notification. Repairs shall be affected within twenty-four (24) hours of notification.

C. Should the Design Builder fail to comply with the above requirements, the Owner will then have the option to make the necessary repairs and back charge the Design Builder without any loss of warranty or guarantee as provided by the Contract.

D. Any guarantee which is in conflict with the above will not be acceptable.

1.12 EXTRA MATERIALS

A. Spare Parts: At the completion of the project, the Design Builder shall turn over to the Owner, with transmittal documentation, the following extra materials described below (match products installed, package with protective covering for storage, and identify with labels describing contents):
   1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but not less than one unit.
   2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but not less than one unit.
   3. Smoke Detectors and Heat Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than one unit of each type.
   4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than one unit of each type.
   5. Keys and Tools: One extra set for access to locked and tamperproof components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. All devices shall be compatible with the existing fire alarm system.

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

A. Control of System: By the FACP. Provide all programming required for a complete and operating fire alarm and detection system, to the complete satisfaction of the Owner and the Engineer. Backup of program shall be provided.

B. System Supervision: Automatically detect and report open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.

C. Priority of Signals: Automatic alarm response functions resulting from an alarm signal from one zone or device are not altered by subsequent alarm, supervisory, or trouble signals. An alarm signal is the highest priority. Supervisory and trouble signals have second- and third-level priority. Higher-priority signals take precedence over signals of lower priority, even when the lower-priority condition occurs first. Annunciate and display all alarm, supervisory, and trouble signals regardless of priority or order received.

D. Noninterference: A signal on one zone shall not prevent the receipt of signals from other zones.

E. Transient voltage Protection: Provide protection on all circuits in accordance with manufacturer's recommendation.

F. System Reset: All zones are manually resettable from the FACP after initiating devices are restored to normal.

G. Transmission to Remote Alarm Receiving Station: Automatically route alarm, supervisory, and trouble signals to a remote alarm station by means of a digital alarm communicator transmitter and two (2) telephone lines.

H. Loss of primary power at the FACP initiates a trouble signal at the FACP and the annunciator. An emergency power light is illuminated at both locations when the system is operating on the secondary power supply.

I. Basic Alarm Performance Requirements: Unless otherwise indicated, operation of a manual station, automatic alarm operation of a flame or heat detector, operation of a sprinkler flow device, or verified automatic alarm operation of a smoke detector initiates the following:
   1. Notification-appliance operation.
   2. Audible and visual annunciation of ‘alarm’ condition at the FACP and the remote annunciator(s).
   3. Identification, in plain-text English via alpha-numeric display, at the FACP and the remote annunciator(s) of the device originating the alarm.
   4. Transmission of an alarm signal to the remote alarm receiving station.
   5. Unlocking of electric door locks in designated egress paths.
   6. Release of fire and smoke doors held open by magnetic door holders.
   7. Shutdown of fans and other air-handling equipment serving zone where alarm was initiated.
   8. Closing of smoke dampers in air ducts of system serving zone where alarm was initiated.
   9. Recording of the event in the system memory.
   10. Alarm Silencing, System Reset and Indication: Controlled by switches on the FACP and the remote annunciator.

11. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
12. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
13. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.

J. Activation of a smoke detector in an elevator lobby or a combination smoke/heat detector in an elevator hoistway or elevator machine room shall initiate the elevator recall operation and the facility fire alarm system.
1. The FACP shall transmit appropriate signal(s) to the elevator controller(s) to initiate elevator recall operation. Verify interconnection details with Elevator Manufacturer and Elevator Installer.

K. Activation of a heat detector in the elevator hoistway or elevator machine room shall initiate the elevator shutdown operation and the facility fire alarm system. The elevator shutdown operation is intended to shut down the elevator power (prior to sprinkler operation) by activating a shunt trip in the fused switch serving the elevator, which is accomplished as follows:
1. A field-mounted relay activated by the heat detector in the elevator hoistway or elevator machine room or the FACP closes the shunt trip for the fused switch serving the elevator power, causing the elevator to shut down, and operates the building notification appliances and annunciator. Aforementioned shunt trip shall be monitored and powered (24VDC) by the fire alarm system at all times.

L. NOT USED.

M. NOT USED.

N. Removal of an alarm-initiating device or a notification appliance initiates the following:
1. A "trouble" signal indication at the FACP and the annunciator(s).
2. Identification, in plain-text English via alpha-numeric display, at the FACP and the remote annunciator(s) of the device or zone involved.
3. Recording of the event by the system printer.
4. Transmission of trouble signal to remote alarm receiving station.

O. Permissible Signal Time Elapse: The maximum permissible elapsed time between the actuation of any fire alarm or fire-detection system alarm-initiating device and its indication at the FACP is ten seconds.

P. Circuit Supervision: Indicate circuit faults by means of both a zone and a trouble signal at the FACP. Provide a distinctive indicating audible tone and (LED) indicating light. The maximum elapsed time between the occurrence of the trouble condition and its indication at the FACP is 200 seconds.

Q. FACP Alphanumeric Display: Plain-English-language descriptions of alarm, supervisory, and trouble events; and addresses and locations of alarm-initiating or supervisory devices originating the report. Display monitoring actions, system and component status, system commands, programming information, and data from the system's historical memory.

2.3 MANUAL PULL STATIONS

A. Description: Fabricated of metal or plastic, and finished in red with molded, raised- letter operating instructions of contrasting color.
   1. Single-action mechanism, with positive visual indication of activation, initiates an alarm. Pull stations shall incorporate a key reset device.
   2. For manual pull stations exposed to weather, provide weatherproof protective shield factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm.
   3. Integral Addressable Module: Arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.
   4. Pull station body shall be red, with clearly visible operating instructions provided on the cover. The word "fire" shall appear on the front of the station in raised letters of contrasting color.

2.4 SMOKE DETECTORS

A. General requirements:
   1. Operating Voltage: 24-V dc, nominal.
   2. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
   3. Plug-in Arrangement: Detector and associated electronic components are mounted in a module that connects in a tamper-resistant manner to a fixed base with a twist-locking plug connection. Terminals in the fixed base accept building wiring.
   4. Integral Visual-Indicating Light: LED type. Indicates detector has operated.
   5. Sensitivity: Can be tested and adjusted in-place after installation.
   6. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
   7. Photoelectric Smoke Detectors include the following features:
      a. Sensor: LED or infrared light source with matching silicon-cell receiver.
      b. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
      c. Where combination smoke/thermal detectors are noted to be utilized on the drawings, provide integral Thermal Detector: Fixed- temperature type with 135 degrees F setting.
   8. Ionization Detectors (to be utilized only where specifically noted on plans) shall include the following features:
      a. Responsive to both visible and invisible products of combustion.
      b. Self-compensating for changes in environmental conditions.

   9. NOT USED.

2.5 HEAT DETECTORS

A. Heat Detector, Fixed-Temperature/Rate-of-Rise Type: Actuated by temperature that exceeds a fixed temperature of 135 degrees F. Rate-of-rise element shall be rated at 15 degrees F per minute.
   1. Mounting: Plug-in base, interchangeable with smoke detector bases.
   2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.6 NOTIFICATION DEVICES

A. Description: Equip for mounting as indicated and have screw terminals for system connections.

B. Existing facilities: New notification devices in existing facilities shall match existing installed devices relative to sound and tone.

C. Combination Devices: Factory-integrated audible and visible devices in a single- mounting assembly. Device shall have field selectable output for audible and visual settings.

D. Electronic Horns: Electronic sounder, rated for 24-V dc operation; with provision for housing the operating mechanism behind a grille. Horns produce a sound-pressure level of 90 dB, measured 10 feet from the horn. Housing shall be red in color, with the word “FIRE” clearly printed in white. Device shall have field selectable output for audible setting.

E. NOT USED.

F. NOT USED.

G. Visible Alarm Devices: Xenon strobe lights listed under UL 1971 with clear or nominal white polycarbonate lens. Mount lens on an aluminum faceplate. Housing shall be red in color, with the word "FIRE" clearly printed in white.
   1. Strobe Leads: Factory connected to screw terminals.
   2. Minimum strobe intensity for devices is noted on drawings.
   3. All strobe lights visible within the same area shall be fully synchronized.
   4. Device shall have field selectable output for visual settings.

H. NOT USED.

2.7 NOT USED.

2.8 REMOTE DEVICE LOCATION-INDICATING LIGHTS AND IDENTIFICATION PLATES

A. Description: LED indicating light near each smoke detector that may not be readily visible, and each sprinkler water-flow switch and valve-tamper switch. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single gang plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the smoke detector or valve is located. For water-flow switches, the identification plate also designates protected spaces downstream from the water-flow switch.

B. Mounting: Mounted in ceiling/wall in close proximity to smoke detector.

2.9 NOT USED.

2.10 EXTERIOR EQUIPMENT

A. Any devices, junction boxes, or equipment associated to the fire alarm system located exterior to building shall be gasketed and approved for use in wet environments. Conduit to exterior devices shall be sealed in order that water cannot gain access to interiors of devices via conduit system.

2.11 WIRE

A. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 degrees C, color-coded insulation.
   1. Low-Voltage Circuits: No. 16 AWG, minimum.
   2. Line-Voltage Circuits: No. 12 AWG, minimum.
   3. Power-Limited Circuits: NFPA 70, Types FPL, FPLR, or FPLP, as recommended by manufacturer.

2.12 PULL BOXES AND TERMINAL CABINETS

A. Pull boxes shall be Hoffman NEMA type 1 hinged cover cabinets only. Sizes as shown on the fire alarm system drawings. Paint all pull box doors red and label F/A PULL BOX. Pull boxes shall be rated for the environment they are placed in (i.e. NEMA 1, NEMA 3R, NEMA 4X, etc.)

B. Terminal cabinets:
   1. Terminal cabinets shall be Hoffman NEMA type 1 hinged cabinets with a painted steel removable subplate and 'T' handle latch. No locks are required.
   2. Each terminal cabinet shall have a factory painted red finish.
   3. Provide on the door of each terminal cabinet a red lamacoid nameplate with ¾ inch white letters to read Fire Alarm Terminal Cabinet # .
   4. Flush cabinets shall be the same type except for factory supplied flush mounting trim.
   5. Provide one (1) IDEAL (389-061) terminal block per wire entering and leaving the terminal cabinet, plus 10% spare terminal blocks. Mount terminal blocks vertically and use the appropriate terminal block mounting channel and terminal block end plates (89-062) as recommended by the manufacturer. Each terminal shall be properly identified and the respective Terminal Cabinet Directory as shown in the drawings shall be attached to the inside cover with an adhesive backed vinyl envelope.

PART 3 - EXECUTION

3.1 INSTALLATION

A. SCOPE
   1. The system shall electrically supervise all wiring between the control panel and all initiating and indicating devices.
   2. The system shall be capable of differentiating between a system trouble condition and the activation of a supervisory device.
   3. A complete NFPA 72 test shall be done and a system status report issued prior to the start of any modification to existing functioning fire alarm systems.

B. EQUIPMENT INSTALLATION
   1. All wiring shall be installed in conduit except as otherwise shown. Entire conduit system housing fire alarm cabling shall be red in color. Prepainted EMT conduit shall be as manufactured by Allied Tube and Conduit or approved equal.
   2. All conduits, cabinets and device back boxes shall be recessed unless shown otherwise on the drawings and as directed by the Architect or Engineer.
   3. Provide smoke detector above fire alarm control panel and each auxiliary power supply (not shown on floor plans).

4. All spot type detectors shall be located on the suspended ceilings, except as noted. If suspended ceilings do not exist, the detectors shall be mounted on the slab.
5. All detectors shall be centered in the ceiling tiles and back boxes and conduits shall be recessed in areas with suspended ceilings. The back boxes and conduits for detectors on the slab shall be surface mounted with conduits run perpendicular/parallel to the walls.
6. All detectors shall be located at the highest point on the ceiling or slab except as specifically noted.
7. Exact location of all automatic detectors shall be as directed by the manufacturer's representative.
8. Smoke detectors shall not be located within three (3) feet of or in the direct air stream from supply air diffusers. Additionally, smoke detectors shall not be located within three (3) feet of return air grilles.
9. Automatic detectors shall not be mounted on or within three (3) feet of doorways, beams, columns or walls, except smoke detectors at doors with door holders shall be mounted between two (2) and four (4) feet from the doors.
10. NOT USED.
11. All manual stations located at egress doors shall be located adjacent to and within five (5) feet of the respective egress doors.
12. NOT USED.
13. NOT USED.
14. The conduit, device back boxes, pull boxes, terminal cabinets, panels and wiring as shown on the Fire Alarm System drawings shall be installed as shown. The device back boxes and conduit wire fill shall be in compliance with the National Electrical Code.
15. Provide white lamacoid nameplates on the ceiling grid with ¼ inch red letters to identify all above ceiling devices.
16. The fire detection and alarm system shall be operational at all times, except that when work is being performed on the system during normal working hours only those portions actually undergoing modification shall be out of service. All detectors in the construction area shall be bagged with plastic bags during the working hours and de-bagged after working hours.
17. At the end of each workday, and before workmen leave the site, proper operation of the system shall be demonstrated to the designated Owner’s representative.

C. WIRING INSTALLATION

1. All alarm initiating devices and supervisory initiating devices shall be connected on Class B (Style 4) OR Class A two (2) wire Signaling Line Circuits (SLC). Unsupervised wiring (point wires) shall not be permitted. T-tapping and parallel branch circuit wiring shall be permitted on the addressable SLCs, in accordance with the manufacturer’s recommendations.
2. All alarm indicating devices shall be connected on Class B OR Class A two (2) wire electrically supervised circuits and on a minimum of two active circuits.
3. Wiring to initiating and supervisory devices and to fire alarm annunciators shall be with two- (2) conductor, twisted solid copper UL listed fire alarm system wire subject to manufacturer’s recommendations (#16 AWG minimum).
4. Wiring to alarm indicating devices shall be with two- (2) conductor twisted solid copper UL listed jacketed fire alarm system wire subject to manufacturer's recommendations (#14 AWG minimum).
5. All other wiring shall be as recommended by the system manufacturer.
6. No splicing of wires is permitted except on terminal blocks in annunciators, control panels or properly labeled terminal cabinets as shown on the drawings. The use of wire nuts or similar type devices is not permitted. All devices shall have terminals for each wiring connection. No splicing of any type shall be permitted in pull boxes, to include crimp terminals.

7. All wires shall be labeled at both ends with ¾" x 1-3/9" Scotch Code SWD Write- On Tape and SMP Write-On Marking Pen only.
8. Use plastic wire ties and wire tie mounts to insure a neat quality appearance.

3.2 TESTS

A. Prior to the acceptance test of the project by the Owner, a factory-trained technician from the equipment supplier shall inspect, test and adjust the complete Fire Alarm System according to NFPA-72, including, but not limited to, the following:
   1. NOT USED.
   2. Visual inspection of all equipment.
   3. Verification of alarm, supervisory and trouble signals at all receiving locations and circuits, including audible and visual alarms, annunciators, control panels, and central monitoring control panel.
   4. Test each alarm initiation device for alarm and correct annunciation.
   5. Test each alarm bell and strobe light for proper operation.
   6. Test the sensitivity of each smoke detector with a manufacturer's detector test set (the fire alarm control panel shall be UL listed for this purpose). Retain a printed recorded of all firing voltages. Correlate firing voltage records to the device addresses as shown on the as-built drawings.
   7. Test the operation of each magnetic door holder, elevator recall and elevator shutdown operation, damper closure and smoke control
   8. Check all end of line devices for proper installation and polarity.

B. All smoke detector sensitivity adjustments and tests shall be performed:
   1. From the Fire Alarm Control Panel with each detector in its exact operating location and not at some convenient place.
   2. Only under normal, balanced and completed maximum air flow conditions, with supply air systems constant and not undergoing balancing or other alterations, and air conditioning refrigeration systems operating properly.
   3. A complete printout showing all sensitivity readings shall submitted.

C. After the system has been installed, the DACT shall be completely tested by the equipment manufacturer's representative for proper operation. A letter shall be provided to the Owner by the manufacturer's representative confirming the test, indicating their approval and that all zones are capable of being transmitted to and satisfactorily received by the central monitoring station.

D. The Owner's acceptance test will only be made after the above tests are made and the copy of the NFPA 72 Test Report/Certificate results is turned over to the Owner for evaluation. The Owner's test will be the same as the above Design Builder's tests. Demonstrate to the Owner that no wire nuts or similar devices have been used in the system. Perform these tests in the presence of the Owner or the Owner's representative.

3.3 FIELD ADJUSTMENTS

A. Repair or replace at his expense any defective devices, equipment or wiring and perform additional testing required to demonstrate that the system is in full compliance with the drawings and specifications.

B. The cost of any re-testing as a result of the failure of the system to operate in accordance with these specifications and/or non-compliance with the drawings or applicable codes shall be paid by the Design Builder to the Owner. A purchase order shall be delivered to the Owner before the re-testing is scheduled or started.

END OF SECTION

DIVISION 31
EARTHWORK

SECTION 31 09 13 - GEOTECHNICAL INSTRUMENTATION AND MONITORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Preconstruction inspection survey and vibration and settlement monitoring to measure vibration levels and movements at the Hertz facility and existing Metro North Railroad structures adjacent to the proposed foundation construction and excavations such as driving of piles or any other construction or excavation activity that has the potential to impact the existing structures.
   2. Work Included:
      a. Inspection of the existing adjacent Metro North Railroad facilities and the Hertz structure.
      b. Development and implementation of a program to limit the construction vibrations in the affected area to acceptable level and to preclude damage to the existing adjacent structures.
      c. Monitoring and vibration using seismographs (accelerometers) during work including pile installation or any other construction or excavation activity.
      d. Establishing survey targets on the existing structures and monitor horizontal and vertical movements.
      e. Developing a program to monitor the ambient and construction vibrations and movements in the area of the existing structures during work including pile installation or any other construction or excavation activity.

B. Related Sections:
   1. Section 01 33 00 - Submittal Procedures.

C. Unit Prices:
   1. Provide unit prices for the following items on the Bid Form:
      a. Vibration and Movement Monitoring measured as specified in Paragraph 1.01E.1 will be paid for at the price provided on the Bid Form by the Design Builder and accepted by execution of this Contract.

D. Measurement Procedures:
   1. Vibration and Movement Monitoring:
      a. Lump Sum. Vibration and Movement Monitoring shall be measured as a lump sum which includes performing baseline inspections of the Hertz facility and Metro North Railroad structures, establishing survey targets on the existing structures, providing survey readings of said
      b. targets, providing services of a vibration specialist and vibration monitoring of the existing structures with seismographs, analysis of any reported damages to the existing structures, development of proposed repair procedures if necessary.

E. Payment Procedures:
   1. Vibration and Movement Monitoring:

a. 25% payment will be made upon submission and acceptance of pre- construction report. 75% upon completion of all pile driving or any other construction or excavation activity adjacent to the surrounding structures is completed.

1.2 SUBMITTALS

A. Submit the following information to the Engineer in accordance with the requirements of Section 01 33 00, Submittal Procedures.
   1. Qualification Statements:
      a. Staff Qualifications as described in Section 1.03
   2. Methods:
      a. Prior to the commencement of any construction activities, submit a comprehensive plan for the vibration control and monitoring of the adjacent structures to the Engineer for review and approval by Metro North Railroad.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. The Design Builder shall hire the services of an experienced vibration specialist who is capable of installing, operating, reading and interpreting seismographs on the existing structures for the purpose of monitoring vibrations. The qualifications of the vibration specialist shall include at least three (3) previous projects on which similar services were provided.
   2. All of the work shall be performed under the direct supervision of a professional engineer registered in the State of New York. The Engineer must have at least ten (10) years of responsible experience in similar work and have available professional level capability related to geotechnical and structural engineering evaluations. The Design Builder shall submit the resume of the vibration specialist for the Engineer's approval at least 20 calendar days prior to commencement of any construction operations.
   3. Prior to commencement of any construction operations, the Design Builder shall submit to the Engineer for approval, the information regarding the name of the firm engaged to perform vibration monitoring work, qualifications of the firm and resumes of key personnel performing the work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Seismographs/Accelerometers

B. Survey Targets

PART 3 - EXECUTION

3.1 PRECONSTRUCTION INSPECTIONS

A. At least 20 working days prior to commencing any construction activities, the Design Builder shall make a detailed pre-construction inspection of the existing Hertz facility and surrounding Metro North Railroad facilities and report the findings to the Engineer.

B. The pre-construction report shall be 8 ½ x 11 inch format including an index, names and responsibilities of the inspection party, notes and 4 x 6 in color prints of photographs with date and location captions, along with either a video or a CD documenting the existing condition of the structures and embankments. The scope and detail of the survey shall be sufficient to serve as a reference for comparison should evidence of damage be observed during construction. The pre-construction inspection report shall also include a comprehensive plan for the vibration/ settlement control and monitoring of the structures. The plan shall include, but not be limited to all of the provisions described in these specifications. Among other, the plan shall include materials, installation procedures, schedule of installation, and drawings indicating the location of the monitoring points.

C. Before commencing any construction activities including pile installation, driving or removal of sheet piles, or any other construction or excavation activity, the Design Builder shall establish survey targets along the side of the existing structures at convenient locations nearest the proposed construction locations. Provide the locations of the proposed survey targets on working drawings and submit to the Engineer for approval. These survey targets shall be monitored vertically and horizontally on a daily basis for a period of 5 days before commencing any construction operations to establish ambient baseline data.

D. Prior to commencing any construction activities including pile driving, sheet pile installation or any excavation operations, the Design Builder shall take seismograph (accelerometer) readings at one or more representative elements structures for 48 continuous hours to establish ambient baseline data. The Design Builder's vibration specialist shall interpret the readings and submit a vibration report to the Engineer prior to commencing any construction
   1. operations adjacent to the structures. The report shall show the seismograph locations and results of the ambient vibrationreadings.

E. Six copies of all preconstruction survey documentation, baseline survey point monitoring data, and baseline vibration data and reports shall be delivered to the Engineer prior to commencing any construction operations including pile driving, drainage pipe installation, sheet pile installation or any excavation operations.

3.2 VIBRATION MONITORING AND CONTROL PROGRAM

A. A vibration monitoring program shall be prepared by the Design Builder to monitor the adjacent existing Hertz facility and all Metro North Railroad facilities/structures. The structures are to be monitored by at least six (6) monitoring points located at least 10 ft apart as a minimum, however this is subject to approval by Metro North Railroad.

B. Whenever pile installation operations are being first conducted, a designated representative of the Design Builder shall visually inspect any structure adjacent to the work area with the Engineer

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:
   1. Section 01 14 00 - Work Restrictions
   2. Section 01 31 00 - Project Management and Coordination
   3. Section 01 33 00 - Submittal Procedures
   4. Section 01 50 00 - Temporary Facilities and Controls
   5. Section 01 71 00 – Examination and Preparation.
   6. Section 31 20 00 – Earth Moving

1.2 SUMMARY

A. This Section specifies requirements for:
   1. Clearing and grubbing.
   2. Selective clearing.
   3. Selective tree and shrub removal and trimming.
   4. Earth stripping and stockpiling.
   5. Disposal of spoil materials.

1.3 REFERENCES

A. Abbreviations and Acronyms:

B. Definitions:
   1. Clearing and Grubbing: Operations consisting of removing trees, shrubs, stumps, roots, fences not indicated to remain, and similar items indicated to be removed from the ground surface to clear designated areas within the Limits of Disturbance that are defined in the Contract Documents.

C. Reference Standards:
   1. American Association of State Highway and Transportation Officials (AASHTO):
      a. AASHTO M 43, Standard Specification for Size of Aggregate for Road and Bridge Construction.
      b. AASHTO T 85, Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate.
      c. ASSHTO T 104, Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.
   2. ASTM International (ASTM):

a. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft lbf/ft^3 (600 kN m/m^3)).

3. Municipality:
   a. Fire Code.
   b. General Construction Code.
4. State of New York:
   a. New York State Department of Environmental Conservation (NYSDEC):
      1) Regulations. http://www.dec.ny.gov/regulations/regulations.html
      2) State Pollution Discharge Elimination System (SPDES):
         a) Permit No. GP-0-10-001 - SPDES General Permit for Stormwater Discharges from Construction Activity.
         b) Permit No. GP-0-10-002 - SPDES General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4s).
   b. Official Compilation of the Rules and Regulations of the State of New York (NYCRR).
      1) The New York State Department of Labor (NYSDOL):
      2) 12 NYCRR Part 23 - Protection in Construction, Demolition and Excavation Operations.
      3) The New York State Department of Public Service (NYSDPS):
         a) 16 NYCRR Part 753 - Protection of Underground Facilities.
5. United States Government:
   a. Buy America Act (Pub. L. 103–429, 49 U.S.C. 5323(j))
   b. Federal Transit Administration (FTA):
      1) 49 CFR 661 Buy America Requirements.
   c. Occupational Safety and Health Administration (OSHA):
      1) 29 CFR 1910 Occupational Health and Safety Standards.
      2) 29 CFR 1926 Safety and Health Regulations for Construction.
   d. Environmental Protection Agency (EPA):
      1) 40 CFR 61 National Emission Standards for Hazardous Air Pollutants.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate utility-related work during clearing and grubbing activities with the Metro-North Railroad and Dig|Safety.New York to avoid tapping into established utilities.
      a. Comply with applicable requirements of OSHA and the State of New York statutes, especially NYCRR 16 Part 753 regarding underground utilities.
         1) At least 2 to 10 days prior to the start of digging or excavation Work not counting the day of the call prior to the start of digging or excavation Work, contact Dig|Safety.New York at 1-800-962-7962 or 811 to arrange for underground utility owners to locate and mark their underground utilities.
            a) Notify utilities prior to all excavations.
         2) If unexpected active underground facilities are encountered during the performance of the Work, immediate notify the Engineer.
         3) Cooperate fully with the owners of underground and overhead utilities when utility removal or rearrangement operations are in progress to ensure reasonable progress, minimize duplication of operations, and eliminate unnecessary interruption of services.
      b. Forward all utility information to the Metro-North Railroad for review.

B. Pre-Construction Meeting:
1. Prior to beginning clearing and grubbing operations, attend a mandatory pre-construction meeting with the Engineer held in accordance with the requirements specified in Section 01 31 00, Project Management and Coordination.

1.5 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Explosives and Blasting:
a. Blasting Permit:
1) In accordance with the local Fire Code, do not blast or carry on any blasting operations without first having obtained a blasting permit from the local Fire Commissioner as specified in Section 01 14 00, Work Restrictions.

B. Qualifications:
1. Surveyor Qualifications:
a. Employ the services of a Professional Surveyor registered in the State of New York, and having the additional qualifications as specified in Section 01 71 00, Examination and Preparation.

1.6 SUBMITTALS

A. Action Submittals:
1. Submit the following to the Engineer for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:
a. Product Data: Post-emergent herbicide
b. Shop Drawings, indicating site clearing method and machines to be used, and items to be removed.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. Regulatory Requirements:
1. Comply with the Laws, Codes, and Regulations pertaining to the work being performed.
a. All work is governed at all times by the applicable provisions of Federal Laws, including but not limited to, the following:
1) Occupational Safety and Health Administration (OSHA):
a) 29 CFR 1910 Occupational Health and Safety Standards.
b) 29 CFR 1926 Safety and Health Regulations for Construction.
2) Environmental Protection Agency (EPA):
a) 40 CFR 61 National Emission Standards for Hazardous Air Pollutants.
b. During clearing and grubbing activities, comply with the Maricopa County Air Quality Permit and Dust Control requirements, particularly Rule 310 and Rule 310.01.
2. Buy America Act:

a. Except for those products which are exempt under the specific statutory waivers stipulated in 49 CFR 661, all other products supplied under this Section must comply with the requirements of the Buy America Act.

3. Excavation:
   a. Comply with applicable requirements of OSHA; the State of New York statutes, especially 12 NYCRR Part 23 regarding excavation and NYCRR 16 Part 753 regarding underground utilities; and the local General Construction Code.

2.2 PERFORMANCE REQUIREMENTS

A. Fill Material:
   1. On-Site Fill Material:
      a. Provide clean, uncontaminated fill material excavated on-site and consisting of soil or soil-gravel-cobble mixed materials that are free of topsoil, vegetation, lumber, metal, and refuse; and that are free of rock or similar hard objects larger than 6 inches in any dimension in non- structural fill areas, and 4 inches in any dimension in structural fill areas.
         1) Excavate material from the areas on the Site where extensive excavation will be required, and place and compact backfill in accordance with the requirements of Section 312000, Earth Moving.

B. Herbicides:
   1. Post-emergent herbicide:
      a. Provide post-emergent herbicide designed for aquatic use with no restrictions on water use, specifically domestic use, after application.
      b. Submit Product Data to the Program/Project Manager for approval.
      c. Manufacturers:
         1) Dow AgroSciences LLC, Rodeo®, www.dowagro.com.
         2) Approved equal.

C. PROTECTION, PRESERVATION AND MAINTENANCE
   1. Meet the requirements of the local municipality for the protection, preservation, and maintenance of trees.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Prior to starting the actual clearing and grubbing work, carefully inspect the entire Site to locate the above and below grade structures, physical objects, and utilities designated to be protected or preserved as indicated in the Contract Documents.
   2. Locate existing exposed and buried active utilities, and determine the requirements for their protection, or their disposition with respect to the demolition work.
      a. Prior to performing excavation operations, contact utility owners to verify the location or existence of buried utilities and avoid damage to the utilities.

3.2 PREPARATION

A. Protection of In-Place Conditions:
   1. In order to define trees and other items to be protected or preserved during clearing and grubbing activities, direct the Surveyor to stakeout the Limits of Disturbance as indicated in the approved Erosion and Sediment Control Plan specified in Section 015000 Temporary Facilities and Controls, or as needed by permit conditions by NYSDEC.
   2. Provide temporary protection as specified in Section 015000 Temporary Facilities and Controls, for trees and other items to be protected or preserved during clearing and grubbing activities.
   3. Minimize interference with roads, streets, walks, and other adjacent occupied or used facilities when conducting Site clearing operations.

B. Surface Preparation:
   1. Project Environmental Requirements:
      a. Comply with regulations governing pollution controls.
      b. Erosion Control:
         1) During the performance of the Work of this Section, implement erosion control measures as specified in Section 01 50 00, Temporary Facilities and Controls.
      c. Dust Control:
         1) Using the necessary means and methods, control dust on the Site during performance of the Work of this Section.
            a) To prevent unnecessary spread of dust during the performance of the Work of this Section, thoroughly moisten surfaces and debris as required to prevent dust being a nuisance to the public, neighbors, and other concurrent work on the Site.
            b) The Contractor is responsible for providing the water used for controlling dust.
         2) During earth moving operations, comply with the dust control requirements of the local and county authorities.

C. Demolition / Removal:
   1. Fence Removal:
      a. When a fence is partly or wholly within the Limits of Disturbance as indicated in the approved Erosion and Sediment Control Plan specified in Section 015000 Temporary Facilities and Controls, is indicated to be removed in the Contract Documents, or is within the right-of-way; notify the property owner of the fence 30 days in advance of clearing and grubbing operations to remove the fence so that the fence's owner has the opportunity to make the necessary arrangements to relocate or rebuild the fence to maintain the security of the space enclosed or protected by the existing fence.
      b. If the owner of the fence fails to take the necessary steps to maintain the security of the fenced area within a reasonable amount of time, carefully remove the fence within the Limits of Disturbance or within the right-of-way, and neatly store this material on the fence owner's property adjacent to the Project area.

3.3 CLEARING AND GRUBBING

A. In areas where embankment is to be placed, clear and grub the areas to a depth not less than 6 inches below the existing ground level.

B. In areas that will be finish graded, clear and grub the areas to a depth not less than 8 inches below existing ground level.

C. In areas that will be excavated, clear and grub the areas to the following depths:
   1. In areas of excavation for sidewalks: 6 inches.
   2. In areas of excavation for roadway: 18 inches.
   3. In areas of excavation for riprap and rock lining: 6 inches below the bottom of the riprap structure.
   4. In areas of excavation for gravel: 6 inches.
   5. In areas of excavation for dirt/sand/weeds: 6 inches.

D. Remove stumps, downed timber, logs, snags, and trees which are not designated to remain.
   1. In order to minimize damage to trees that are to remain standing, fell trees toward the center of the area being cleared.
   2. In order to avoid damage to overhead utilities and existing structures, fell trees located in close proximity to these items in sections.
   3. Remove stumps and roots, matted roots, and similar subsurface debris to the depths as specified except as follows.
      a. In areas to be excavated and where embankment will be placed, dig out and remove stumps and roots completely.
      b. In areas other than areas to be excavated and where embankment will be placed, treat stumps which are over four inches in diameter with herbicide to prevent re-growth and leave them in place.
   4. Backfill stump holes and other depressions caused by clearing and grubbing operations with the specified fill material in horizontal layers not exceeding 8 inches loose depth, and thoroughly compact each layer to a density of 95 percent of the maximum dry density in accordance with ASTM D 698 under building, slab, walkway, and pavement footprints, but do not compact the backfill in planting areas.

E. When grubbing inside the drip line of trees indicated to remain, use only manual methods.
   1. Perform selective tree trimming and scar repair as required to preserve trees indicated to remain and protect them from damage or loss.

F. Remove brush, undergrowth, and heavy growths of grass and weeds.

G. Grubb or otherwise remove the natural obstructions in the soil; and remove such surface material which, in the opinion of the Program/Project Manager, is unsuitable for topsoil or backfill material.

H. Remove surface debris and rubbish of any nature.

3.4 RE-INSTALLATION

A. Re-install any items indicated to remain that were removed to facilitate clearing and grubbing operations.

3.5 SITE QUALITY CONTROL

A. Site Inspections: Engineer shall review all cleared areas for final approval.

3.6 CLEANING

A. Waste Management:
   1. Gather and dispose of spoils and vegetative waste, including dead and damaged plants and the trimmings accumulated from the operationsto clear and remove existing vegetation.
   2. Dispose of spoils and vegetative waste off-site in conformance withthe regulations imposed by the local authorities, and in an area approvedfor such disposal by the local authorities.
   3. Debris Removal:
      a. Remove clearing and grubbing debris accumulations generatedby clearing and grubbing activities from the Site on a daily basis.
         1) Should the Contractor elect to continue work beyond normal working hours, do not allow clearing and grubbing debris to accumulate for more than 48 hours.
         2) Debris to be removed includes sawn timber, wood, brush, branches, and similar items.
         3) Do not bury stumps on the Site, but provide for their disposal as specified hereinafter.
      b. Debris Disposal:
         1) Dispose of the debris from clearing and grubbing operationsoff- site in a lawful manner and at a site having current approval to conduct solid waste disposal activities.
         2) Burning of Spoil Materials:
         3) On-site burning of spoil materials is not allowed.

3.7 PROTECTION

A. All existing site items that are to remain are to be protected from site clearing activities at all times. Any items that are not to be removed and are damaged are to be replaced immediately at no cost to Metro North.

END OF SECTION

SECTION 31 17 26 - TACTILE WARNING SURFACE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. The manufacture shall furnish and delivery the thermoplastic warning material (tactile) in compliance with this specification including any and all required surface preparation operations.

1.2 CITED STANDARDS:

A. American Society for Testing and Materials (ASTM):

B. ASTM D 638 Tensile strength

C. ASTM D638 Min elongation 20%.

D. ASTM D570 Water absorption of plastic max 0.5%.

E. ASTM E303 Skid resistance min 45 in units (British Pendulum)

F. ASTM C482-02 Bond strength of ceramic tile to Portland cement.

G. ASTM G155 Operating Xenon arc light apparatus for exposure of nonmetallic materials – Fade resistance (weathering)

H. ASTM D1148-07a Rubber deterioration-Discoloration from ultraviolet (UV) and heat exposure of light colored surfaces.

I. ASTM D1148 Xenon arc resistance/color min maintains 70% contrast.

J. ASTM F 1679 Slip resistance (0-270$^{0\,F}$) average .81

K. ASTM C 501 Wear resistance.

L. ASTM B117 Salt and Spray performance

M. ASTM C 1026 Freeze,Thaw,Heat performance

N. NYSBC – New York State Building Code 2010 or latest addition.

O. Americans with Disabilities Act (ADA). 2010 Standards for State and Local Government facilities: Title II

1.3 NOTED RESTRICTIONS:

A. The manufacture shall provide training for panel installation and replacement, technical services in site for at least one (1) day.

B. The site installation will be provided by LIRR.

C. Mechanical fasteners shall not be part of material.

D. The material and adhesive system shall be solvent free and contain no volatile organic compounds (VOCs)

1.4 QUALITY CONTROL:

A. The manufacturer must be ISO certified and provide proof of current certification.

B. The Contractor shall demonstrate familiarity with the installation system by providing a sample installation acceptable to LIRR per manufacturer instruction.

1.5 1.06 SUBMITTALS:

Submittals to be provided with Bid documents:

A. Working drawings, showing the following:

1. Manufacturer installation instruction on new and existing concrete surface, new and existing pavements.
2. Drawings and details showing typical dimensions, pattern, thickness and surface geometry.

B. Documentation of all aspects of detectable warning strips and their installation not described by the shop drawings, including, but not limited to the method of surface preparation of the tactile warning strips.

C. Recommended methods of maintenance and repair of the installed detectable warning tactile.

D. Estimated service life and units replacement cost for all replaceable components of the warning material.

E. Product data: Manufacturer's catalog cuts, specifications, and installation procedures, adhesive and sealant material. Provide any and all applicable MSDS sheets for all products used.

F. Product data for all type of product indicated and recommended by the tile manufacture.

G. Certified material test reports: submit certified test report from a qualified independent testing laboratory.

H. Warning material properties: result of test of the properties of the tactile under condition simulating those of the actual installation such as water absorption. Salt and spray performance, accelerated weathering, chemical resistance, freeze/thaw/heat, slip resistance, stain resistance, and wear resistance.

I. Samples:

a. One full size 24”x48” samples of the thermoplastic detectable warning panel.
b. Sealing and bonding material for each application.

J. Application instruction for product installation on new and existing concrete surface.

K. Warranty as requested in Section 1.07.

1.6 WARRANTY:

A. Provide a minimum of manufacturer’s five (5) years limited warranty against defective materials and workmanship, and chipping of panels.

B. Provide a minimum of manufacturer’s one (1) years limited warranty against panel damaging, dome braking and panel quality.

PART 2 - PRODUCTS

2.1 GENERAL:

A. The preformed thermoplastic detectable warning material (tactile) shall meet the latest Public Rights-of-Way Accessibility Guidelines as published by the U.S. Access Board requirements, this specification and be approved for use by the LIRR.

2.2 WARNING PANELS.

A. The material must be impervious to degradation by motor fuels, salt, shemical, etc. The truncated domes must be an integral part of the preformed thermoplastic material. The material shall consist of one preformed thermoplastic part and adhesive only. Machanical fasteners shall not be part of the material.

B. Panel sizes shall be 24”x36” and 24”x48”.

C. Size. The truncated domes in a detectable warning surface shall have a base diameter of 0.9 inches minimum to 1.4 inches maximum, a top diameter of 50% of the base diameter minimum to 65% of the base diameter maximum, and a height of 0.2 inches.

D. Alignment. Domes shall be in staggered pattern for warning panel installed at platform and could be aligned on a square grid in the predominant direction of travel to permit wheels to roll between domes for detectable warning panel installed on ramps or curb ramps.

E. Spacing. Truncated domes in a detectable warning surface shall have a center-to-center spacing of 1.6 inches minimum and 2.4 inches maximum, and a base-to-base spacing of 0.65 inches minimum, measured between the most adjacent domes on square grid.

F. Color: The color of the tiles shall be safety yellow to match tactile material currently used by the LIRR. The tile shall be substantially the same color throughout the thickness of the tile material.

G. The material shall differ in sound and feel from adjacent platform surface in “sound-on-crane” and resiliency.

2.3 CONFIGURATION.

A. The detectable warning material shall be supplied as kit that contains the domed preformed thermoplastic material and an adhesive system.

2.4 EQUIPMENT.

A. The equipment used for the installation of the detectable warnings panels shall be recommended by the tile manufacture.

B. Propane Heat Torch: As recommended by tile manufacturer. LIRR will purchase the propane heat torch with fan-shaped nozzle under a separate order.

C. Roller: As recommended by tile manufacturer. LIRR will purchase the propane heat torch under a separate order.

D. Holed corrugated inserts: As recommended by tile manufacturer shall be provided with detectable warning tiles in an amount recommended by manufacturer.

PART 3 - EXECUTION

3.1 GENERAL.

A. Transmit submittals and deliverables required by this Section.

B. Allow fifteen (15) days for review of submittals by LIRR.

C. Furnish products as indicated.

D. Ensure substrates are in suitable condition to receive the Work of this Section.

3.2 PROTECTION, DELIVERY AND MISCELLANEOUS.

A. Deliver material to the site where instructed by LIRR, in good condition and properly protected against damage to tactile.

B. Detectable warning material shall be placed in a box with cardboard stiffeners and impact absorbers to prevent damage in transit. The cartons in which packed shall be non-returnable, and be labeled for ease of identification size and quantity.

C. The LIRR reserves the right to inspect all delivered product.

D. Defective finished products shall be rejected. Manufacture shall be responsible for the cost of corrections and replacement.

E. Furnished panels and other related materials shall be delivered at a location designated by LIRR and confirm times 48 hours in advance.

3.3 USE AND INSTALLATION:

A. Install panels within the Railroad's Right-of-Way platform, ramp and ADA access route.

B. The material must be pliable during the application process to be capable of fully conforming to access route contours and geometries.

C. The material must be able to be cut to match access route geometries (such as radius) using a pair of heavy duty scissors only. To facilitate faster application and to avoid potentially hazardous airborne fiber particles, diamond cutting blades and carbon-tipped saw blades shall not be required for cutting the material.

D. To overcome the low tensile strength of substrate surfaces without exposed aggregates (such as concrete laitance), the adhesive system must include a two component sealer with a max. viscosity of 300cP, and to ensure sufficient film thickness the adhesive system must also include an overlaying two component bonder paste with a minimum viscosity of 400,000 cP. Viscosities determined in accordance. Viscosities determined in accordance ASTM D4440 (25^0C; 1Hz; 10% stain).

E. The required (two-components if required) adhesive materials must be supplied in ready-to-use, self-mixing, dispensing systems that shall not require the applicator to perform measuring or mixing operations.

F. To facilitate optimized contact surface between the thermoplastic detectable warning material and the adhesive system, the entire underside of the thermoplastic detectable warning material must be uniformly roughened.

G. To facilitate optimized contact surface between the thermoplastic detectable warning material and the adhesive system, the thermoplastic detectable warning material must have air evacuation holes spaced no more than 2.4 in. apart when measured in square grid.

H. The material shall not require the use of mechanical fasteners, which can turn into potential tripping hazards.

I. The regular application process shall not include the use of flammable liquids such as acetone, where skin contact causes drying and cracking of the skin.

J. The regular application process shall not require mechanical preparation of the application, such as scouring with a dust generating diamond cup grinder.

K. The material must be able to be applied in ambient temperature down to 45^0F or rising surface temperature, If substrate surface temperatures exceed
   1. 90°F do not attempt to apply more than a 4 ft. x 2ft. section at one time.

L. The facilitate simpler and faster application, the regular application process shall not require separate application of perimeter sealing or caulking, or the use of masking or duct tape.

M. The applied material, including adhesive, shall have a combined thickness of max 0.17 in. (excluding the truncated domes).

N. The minimize air borne particle generation it shall not be necessary to scuff the underside of the material with a grinding cup or diamond blade, even when applying material in a non-linear pattern, such as a radius.

O. The texture shall contrast with that of the surrounding surface.

P. To facilitate ease of mobilization and avoid heavy lifting, the regular application process shall not require the use of sandbags.

END OF SECTION

SECTION 31 20 00 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Section 31 10 00: Site Clearing

B. Section 31 50 00: Excavation Support and Protection

1.2 SUMMARY

A. The work specified in this section consists of excavation for trackway and pavement; excavation and placement of compacted fill and backfill for structures; cut-and-cover subways, and drainage; construction of embankments; subgrade and foundation preparation; and subsurface extraction of miscellaneous structures and facilities indicated to be removed.

1.3 REFERENCES AND DEFINITIONS

A. Earthwork Terminology: Terms used in this Section and not defined herein shall be interpreted in accordance with the definitions given in ASTM D653.

B. Approved Material: Material which meets specified requirements for use as embankment, fill or backfill.

C. Backfill: Soil or soil-rock material used to backfill excavations and to backfill excavated spaces around foundation walls, building walls, retaining walls, and abutments.

D. Borrow: Soil material used in embankment or other construction which is excavated from any location other than required on-site excavations.

E. Embankment: Soil or soil-rock material placed to raise the subgrade or natural grade of the site for embankment construction.

F. Excavation is the removing of all materials encountered within the indicated or specified limits, regardless of the nature of the material encountered and the method by which removed, and further defined in Article 1.05 below.

G. Excess Excavation: Material excavated beyond or below cross section shown, as well as unavoidable overbreakage in rock.

H. Imported Material: Soil or granular material which is hauled in from off-site areas.

I. Optimum Moisture Content: The water content at which a soil can be compacted to a maximum dry unit weight by a given compactive effort.

J. Relative Compaction: The ratio, expressed as a percentage, of the in-place dry density of fill material as compacted in the field to the maximum dry density of the same material as determined by laboratory test ASTM D1557, Method D.

K. Relative Density: Refer to ASTM D4253 and ASTM D4254.

L. Soil Classification: Soil classification is based on the Unified Soil Classification system given in ASTM D2487. Group symbols, when used, conform with the symbols of ASTM D2487.

M. Subgrade: Subgrade is the lowest elevation of excavation and the highest elevation of embankment required to accommodate the indicated construction.

N. Unsuitable Material: Excavated material or material below the natural ground surface in embankment areas or below subgrade elevation in excavated areas, which is unsuitable for its planned use as determined by the (Project Manager) (Engineer). Unsuitable material is further defined as material determined to be:
   1. Of such unstable nature as to be incapable of being compacted to specified density using ordinary methods at optimum moisture content; or
   2. Too wet to be properly compacted and circumstances prevent suitable in-place drying prior to incorporation into the work; or
   3. Otherwise unsuitable for the planned use.
   4. The presence of excessive moisture in a material is not, by itself, sufficient cause for determining that the material is unsuitable. The existence of unsuitable material may be indicated in the Contract Documents.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

B. Pre-Installation Meetings:

C. Sequencing:

D. Scheduling:

1.5 QUALITY ASSURANCE

A. Inspections and Tests: The Contractor shall provide quality control inspections and tests as specified under Article 3.14 to assure compliance with specified requirements.

B. Laboratory and Geotechnical Services: Engage the services of an approved independent soils testing laboratory to perform the above-specified inspections and tests. Foundation and subgrade preparation and the placement and compaction of fills shall be performed under the surveillance of a (state) registered geotechnical engineer employed by the Contractor.

C. Tolerances:
   1. Construct finished subgrades to plus 0 or minus 1/2 inch of the elevations indicated.
   2. Construct finished grade of slopes not steeper than 3:1 plus or minus 1/2 inch and on slopes steeper than 3:1 plus or minus 2 inches. Do not encroach upon the trackway bed or roadbed.

3. Maintain the moisture content of fill material as it is being placed within plus or minus two percent of the optimum moisture content of the material as determined by the laboratory tests herein specified.

D. Blasting operations, should they be acceptable to (Engineer), shall be accomplished by a subContractor/Contractor specializing in, and having a continuous record of not less than five years successful experience in blasting operations. Contractor's blasting superintendent shall have not less than one year's full-time experience in responsible charge of blasting operations within the 36-month period preceding the start of the Project. Contractor's blasting superintendent must be accepted by (Engineer) before blasting starts, and shall not be changed without prior concurrence from (Engineer). Designate a qualified individual to maintain accurate explosives accountability records and supervise transportation, handling, and use of blasting materials including detonating devices.

E. Reference Standards:
1. American Society for Testing and Materials (ASTM):
   a. C33, Specification for Concrete Aggregates.
   b. C131, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
   c. C136, Test Method for sieve Analysis of Fine and Coarse Aggregates.
   d. C535, Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
   e. D422, Test Method for Particle-size Analysis of Soils.
   f. D427, Test Method for Shrinkage Factors of Soils by the Mercury Method.
   g. D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft.^{3}(600 kN-m/m^3)).
   h. D1140, Test Method for Amount of Material in Soils Finer than the No. 200 (75- m) sieve.
   i. D1556, Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   j. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft.^{3} (2,700 kN-m/m^3)).
   k. D2167, Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
   l. D2216, Test Method for Laboratory Determination of Water (moisture) Content of Soil and Rock.
   m. D2487, Classification of Soils for Engineering Purposes (United Soil Classification System).
   n. D2922, Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   o. D4253, Test Methods for Maximum Index Density of Soils Using a Vibratory Table.
   p. D4254, Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
   q. D4318, Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
2. Title 29 Code of Federal Regulations, Part 1926, Safety and Health Regulations for Construction (OSHA).
3. New York State Department of Environmental Conservation:
   a. 1. 6NYCRR Part 360 Solid Waste Management Facilities.
4. New York State Department of Transportation (NYSDOT) Standard Specifications:
   a. 203-2 Select Borrow

b. 703-02 Crushed Stone
c. 703-07 Concrete Sand

5. Regulatory Requirements for Excess Soil Metro-North Railroad Construction Projects

1.6 SUBMITTALS

A. In accordance with Section 013300, submit the following:
1. A schedule of all tests specified to be performed by the Contractor.
2. Three (3) copies each of test reports of all tests specified to be performed.
3. Samples: Furnish and deliver samples of fill and backfill materials as selected by the (Engineer) for testing and analysis.
4. Permits for disposal of excavated material:
   a. Obtain written permits and releases from owners of property where material will be deposited.
   b. Submit copies of each permit and release from each property owner absolving the Owner from responsibility in connection with such disposal.
5. Delivery Tickets: Submit a delivery ticket with each load of imported borrow material delivered to the site, stating the type of fill material and the quantity.
6. Certification of Clean Fill
   a. Prior to bringing any fill material on to Metro-North Railroad property, the Contractor shall sign and submit to METRO NORTH RAILROAD a Clean Fill Certificate noting that the material being brought on site is appropriate for general construction use under the applicable provisions of the Environmental Protection Agency and the New York State Department of Environmental Conversation. The certificate shall also identify the source of the material. The Certificate signed by the Contractor shall also certify that there are no contaminants in the material that pose a threat to persons or to the environment, and that they have supplied all available test results for the material to Metro-North Railroad.
7. Blasting plan including:
   a. General plan showing locations where blasting is proposed, with narrative descriptive;
   b. Plan for monitoring extraneously electrical currents and radio-signals, including lightning detection and other instrumentation, with narrative describing specific application;
   c. Types of explosives and types of detonators;
   d. Methods of stemming charge holes;
   e. Type and weight of protective blast mats;
   f. Certification of antennae and other instrumentation provided in compliance with U.S. Bureau of Mines regulations governing all components of monitoring system;
   g. Proposed methods of storing and handling explosive devices of the Project;
   h. Identifications and qualifications of individuals assigned responsibilities for blasting;
   i. Detailed description of type and amount of explosive for each location; hole pattern and depth; type of detonator; method of detonation; stemming; delay pattern; distance to each utility, above and below ground; and distance from public and private structures which may be affected by blasting;
   j. Name of independent firm which will monitor blasting.
8. Copies of blasting permits and licenses.
9. Notices:
   a. Of intention to blast: deliver to utility, railroad, and property owners not less than 30 days before blasting.

b. Of immediate intent to blast: deliver to utility, railroad, and property owners not less than 72 hours before scheduled blasting.

10. Furnish photocopies of valid federal, state, and local licenses and permits which authorize licenses to transport, store, and use explosives at the worksite.

1.7 SITE CONDITIONS

A. Unfavorable Weather Conditions:
   1. Excavating, filling, backfilling, and grading work shall not be performed during weather conditions which might damage or be detrimental to the condition of existing ground, in-progress work, or completed work. When the work is interrupted by rain, excavating, filling, backfilling, and grading work shall not resume until the site and soil condition (moisture content) are suitable for compaction.
   2. Subgrade shall be free from mud, snow, ice, and deleterious material when work is resumed.
   3. Soil material which is too wet for compaction shall be left to drain, to be aerated and dried by disking and harrowing or other approved method until the moisture content of the area is uniform and within the specified limits.

B. Erosion Prevention: Protect stockpiles, ditches, embankments, filled, backfilled, and graded areas to prevent erosion until such time as permanent drainage and erosion control measures have been installed.

C. Barricade open excavations and post with warning lights those excavations occurring on property adjacent to or within public access. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

D. Do not allow proofrolling equipment to enter area within seven feet of piers, abutments, and retaining walls retaining more than ten feet if equipment's gross weight exceeds 35 tons. Do not operate vibratory compactor having a gross weight more than 5,000 pounds closer than five feet to face of retaining wall. Do not operate non-vibrating equipment having an axle load of 21,000 pounds or greater closer than three feet from back of retaining wall. Grade to essentially finish grade on both sides of wall before starting to proofroll.

E. Do not operate proofrolling equipment having one axle loading of more than 21,000 pounds within height-of-fill-being-retained of retaining walls retaining less than ten feet.

F. Before moving equipment, including proofrolling equipment that exceeds 21,000 pounds for any axle, across underground duct banks having less than four feet of

G. cover, place decking on the path of that equipment. Extend decking outward from each side of the duct bank for a distance equal to the depth of the bottom of the duct bank, but not further than four feet. Decking shall consist of a three inch thick timber platform or one inch thick steel plate. If duct bank is exposed, do not place decking directly on duct bank.

H. Use of Explosives:
   1. Do not endanger life and property.
   2. Provide services of an organization certified to be qualified and licensed to transport, store, handle, and detonate explosive charges, and to monitor conditions detrimental or hazardous to use of explosives.
   3. Blasting Operations:

a. Shall not be implemented before receiving (Engineer's) consent for each operation; consent shall not relieve Contractor from full responsibility for damages caused by each operation.
b. Shall be prohibited until spheric antennae, or other acceptable lightning detection and stray signal and electrical current detection and monitoring equipment, has been installed and is operating.
c. Shall not occur before blasting plan and descriptive narrative plan has been approved by the Engineer.
d. Shall not occur within 50 foot radius of concrete younger than 72 hours.
e. Shall ensure that explosive charges will be of a magnitude not greater than that which will produce a particle velocity of more than two inches per second at the ground line of the nearest structure.

I. Toxic and Combustible Substances:
1. During excavation, provide equipment and carry out such tests as necessary to detect presence of toxic and combustible substances.
2. If the presence of noxious or explosive gas is indicated, immediately discontinue excavation operations and notify the (Engineer) (Project Manager). Do not resume work at this location until the necessary safety measures have been enforced and further tests indicate the absence of noxious and explosive gases.
3. Take action to safeguard persons and property in accordance with rules and regulations of jurisdictional agencies and utility owners.
4. Promptly notify utility owners when problems concerning their facilities become apparent.

1.8 CLASSIFICATION OF EARTHWORK

A. Excavation and backfill are classified according to the purpose of the work, as follows:
1. Trackway and Pavement Excavation: All excavation involved in grading and construction of the trackway, parking areas, landscaped areas, walkways, roads, driveways, and connections thereto.
2. Structure Excavation and Backfill: The removal of material for the construction of foundations for aerial structures, bridges, buildings, retaining walls, headwalls, and other structures, and other excavation indicated as structure excavation. Structure backfill includes furnishing material, if necessary, and placing and compacting backfill material around structures to the lines and grades indicated.
3. Cut-and-Cover Excavation and Backfill: The removal of material for the construction of underground tunnel and station structures constructed by the
4. cut-and-cover method, and furnishing material, if necessary, and placing and compacting backfill around such structures to the lines and grades indicated.
5. Borrow Excavation: The excavation of borrow material from either on-site or off-site locations and hauling the material to the location of its placement in embankment or other construction.
6. Salvaging Topsoil: The removal of topsoil to the depth indicated or otherwise determined by the Project Manager, stockpiling the material on-site, and maintaining the stockpile until the material is reused in the work.
7. Ditch Excavation: Includes excavating ditches within or outside the right-of-way, including channels for changing the course of streams. The excavation required to construct a ditch or channel with a bottom width of less than 12 feet will be classed as Ditch Excavation. The excavation required to construct a ditch or channel with a bottom width of 12 feet or more will be classified as Trackway and Pavement Excavation.

B. Excavation shall be classified according to type of material removed, as follows:
   1. Common Excavation: Includes removal of all material of whatever nature encountered in the work, except material classified as Rock Excavation or Subsurface Extraction as defined below.
   2. Rock Excavation: Includes removal of material in place which cannot be loosened or broken down with one pass of a crawler tractor weighing not less than 55,000 pounds, with a maximum draw-bar pull of not less than 57,000 pounds-force, pulling a single 24-inch hydraulic ripper tooth approved by the tooth manufacturer for use with the tractor under full hydraulic down pressure, or equipment of equivalent ripping capacity.
   3. Subsurface Extraction: Includes removal of utilities, walls, foundations, and other miscellaneous subsurface man-made structures which interfere with construction and are designated to be removed, and the cleaning of such items if they are indicated to be salvaged. Removal of such obstructions at or above grade is specified in 31 10 00, Site Clearing.

C. Embankment: Construction includes constructing embankments and dikes, including the preparation of the areas upon which they are to be placed; the construction of temporary surcharge embankment above the grading plane; and the placing and compacting of approved material in areas where unsuitable material has been removed.

D. Subgrade and foundation preparation includes fine grading and compaction of excavations, moisture-conditioning and compaction of subgrades, and original ground upon which pavement, surfacing, base, subbase, ballast, subballast, structures, or embankment are to be constructed. Subgrade preparation includes the placement and compaction of structural fill material in holes, pits, and other depressions within the trackway area and areas to be paved and landscaped.

E. Structure Excavation: The removal of material for the construction of foundations for aerial structures, bridges, buildings, retaining walls, headwalls and other structures, and other excavation indicated as structure excavation.

F. Structure Backfill: Structure backfill includes furnishing structure fill material for raising grades, and placing and compacting structural fill material around structures to

G. the lines and grades indicated. Structure backfill includes borrow excavation and material when required.

PART 2 - PRODUCTS

2.1 FILL AND BACKFILL MATERIALS

A. General Requirements:
   1. Fill, backfill, and embankment material: Inert, nonexpansive soil, free from organic matter and other deleterious substances, and of such quality that it will compact thoroughly without the presence of voids when watered and rolled. Excavated on-site material will be considered suitable for fill, backfill, and embankment construction if it is free from organic matter and other deleterious substances and conforms to the requirements specified herein.
   2. Excavated material which is suitable for fill, backfill, and embankment construction shall be conditioned for reuse and properly stockpiled for later filling and backfilling operations. Conditioning shall consist of spreading material in layers not to exceed 8 inches and raking free of debris and rubble. Rocks exceeding four inches in largest dimension and deleterious

material shall be removed from the site and disposed of as specified herein under Disposal of Surplus Material.

3. Where conditions require the importing of fill or backfill material, the material shall be an inert, nonexpansive soil or soil-rock material free of organic matter and meeting or exceeding the minimum requirements specified herein for the location.
4. Fill, backfill, and embankment material shall conform to the following minimum requirements, unless otherwise specified:
   a. Liquid Limit (ASTM D4318): 40 maximum
   b. Plasticity Limit (ASTM D4318): 15 maximum

B. Specific Requirements:
1. Common Fill: Well-to-moderately well-graded soils consisting of sands, silts, and clays, with or without gravel, as excavated, screened or blended, having the following physical properties and gradation:
   a. Laboratory Dry Density: 95 pcf minimum
   b. Dry Change (ASTM D427): 15 percent maximum
   c. Gradation (ASTM D422):

Sieve Opening	Percent Passing By Weight
4 inch square	100
3 inch square	85 minimum
U.S. No. 200	50 maximum

C. Common Embankment: Common fill, with the following additional requirements:
1. Laboratory Dry Density: 100 pcf minimum
2. Material Retained on
3. U.S. No. 10 Sieve (ASTM D422): 50 percent maximum
4. Material Passing U.S. No. 40 Sieve:
   a. Liquid Limit (ASTM D4318): 25 maximum
   b. Plasticity Index (ASTM D4318): 6 maximum
5. Select Fill: Well-to-moderately well-graded soils consisting of sands, silts, and clays, with or without gravel, as excavated, screened or blended, having the following physical properties and gradation:
   a. Laboratory Dry Density: 100 pcf minimum
   b. Dry Change (ASTM D427): 10 percent maximum
   c. Gradation (ASTM D422):

Sieve Opening	Percent Passing By Weight
1-inch square	100
3/8 inch square	75 minimum
U.S. No. 4	20 minimum
U.S. No. 10	10 minimum
U.S. No. 200	45 maximum

   d. Sand Equivalent 15 minimum
6. Structural Fill: Well-to-moderately well-graded granular soils, as excavated, screened or blended, having the following mechanical properties and gradation:
   a. Laboratory Dry Density: 100 pcf minimum

b. Dry Change (ASTM D427): 12 percent maximum
c. Material Retained on U.S. No. 40 Sieve (ASTM D422): 50 percent maximum
d. Material Passing U.S. No. 40 Sieve:
   1) Liquid Limit (ASTM D4318): 25 maximum
   2) Plasticity Index (ASTM D4318): 6 maximum
e. Gradation (ASTM D422):

Sieve Opening	Percent Passing By Weight
2 inch square	100
1 inch square	75 minimum
3/8 inch square	30 minimum
U.S. No. 4	25 minimum
U.S. No. 10	15 minimum
U.S. No. 40	8 minimum
U.S. No. 200	15maximum but not more than 75 percent of the fraction passing No. 40 Sieve.

f. Sand Equivalent 15 minimum

7. Structural Embankment: Structural fill, except 100 percent shall pass a four-inch square sieve.
8. Rock Fill: Sound, dense rock and boulders to 24 inch maximum size, containing sufficient gravels, sands, crushed or broken rock, and enough fine material to fill all interstices. Material passing U.S. No. 40 Sieve, liquid limit: 30 percent maximum.
9. Select Rock Fill: As specified for Rock Fill, except that the maximum size of rock fragments and boulders shall be such that the material can be readily placed in layers not over 8 inches thick.

2.2 MATERIALS FOR EARTHWORK

A. Fill and Backfill Materials: Where specific fill, backfill, and embankment materials are not indicated on Contract Drawings, conform to the following requirements:
   1. Embankment: Structural Embankment.
   2. Rock Fill: Fill or embankment may be Rock Fill at depths greater than 6 feet below finished subgrade, and Select Rock Fill at depths from one to 6 feet below finished subgrade.
   3. Subgrade and Foundation: Structural Fill for a depth of not less than 12 inches.
   4. Backfill against Concrete Walls and Waterproofing: Select Fill.
   5. Backfill for Wingwalls, Retaining Walls, and Abutments: Structural Fill.
   6. Backfill for Abandoned Vaults (including airways, cross adits, and similar voids): Structural Fill.
   7. Backfill Under Supporting Walls and Columns and Similar Locations: Class 4000 concrete.
   8. Backfill Where Not Otherwise Indicated: Common Fill or Common Embankment.

2.3 SOURCE QUALITY CONTROL

A. Fill backfill, and embankment materials proposed to be used in the work shall be tested in the laboratory for compliance with specified requirements as follows:,
   1. Moisture-Density Relationship: ASTM D1557, Method D.
   2. Moisture Content: ASTM D2216.
   3. Relative Density: ASTM D4253 and D4254.
   4. Liquid Limit: ASTM D4318.
   5. Plastic Limit and Plasticity Index: ASTM D4318.
   6. Dry Change (percent volumetric change): ASTM D427.
   7. Percentage of Wear: ASTM C131 or C535 as applicable.
   8. Sieve Analysis: ASTM D422, and ASTM C136, as applicable.
   9. Percent Passing No. 200 sieve: ASTM D1140.

B. Where classification of soils is necessary to meet specified requirements, perform laboratory tests in accordance with ASTM D2487.

C. All imported materials shall be free of hazardous substances as listed in 6NYCRR Part 370-373 and shall not contain substances in levels that exceed the most recent NYSDEC soil cleanup criteria. All imported materials shall come with a signed standard Metro North Railroad "Clean Fill Certification" form prior to bringing fill onto the site.

2.4 SOURCE OF MATERIALS

A. To the extent that it is available, obtain material from excavation operations. If sufficient suitable materials are not available to meet embankment, fill and backfill requirements, obtain material meeting specified requirements from outside sources at no additional cost to the Owner.
   1. Earth excavation may contain excess moisture in its natural state or may take on excess moisture during handling and stockpiling. Manipulation to dry material to proper moisture content prior to compaction may be necessary. Earth excavation will not be considered as unacceptable backfill material by virtue of its moisture content only.

B. Use only material whose quality, source and zone of placement in the fill have been approved.

C. If borrow areas are provided by the Owner within the right-of-way, dress and shape such areas to ensure positive drainage when borrow operations are completed.

PART 3 - EXECUTION

3.1 STAKING AND GRADES

A. Layout the work, establish all necessary markers, benchmarks, grading stakes, and other stakes as required, in accordance with the requirements specified in Section 01050, Field Engineering.

B. Perform surveys in accordance with the requirements of Section 01050. Surveys shall include:
   1. Initial survey of original ground.
   2. Final surveys when excavations, backfills and embankments are completed.

3.2 EXISTING UTILITIES

A. Verify on site the location and depth (elevation) of all existing utilities and services before performing any excavation work. Perform excavation within 3 feet of a utility line by hand.

B. Remove abandoned sewers, piping, and other utilities encountered during excavation and plug the ends.

C. Report immediately to the Engineer any active utility lines encountered, which are not indicated in the Contract Documents, and notify utility owners involved. The Project Manager and utility authorities shall be permitted free access to determine the measures deemed necessary to repair, relocate, or remove the utility.

3.3 EARTHWORK GENERAL REQUIREMENTS

A. Erosion Protection: Prevent erosion of the site at all times. Construct temporary berms and dikes and cut temporary swales to promote natural drainage of site.

B. Construction Traffic: Disperse travel paths of traffic and construction equipment over entire width of compacted surfaces so as to aid in obtaining uniform compaction. Protect exposed soil layers with high moisture content from excessive wheel loads.

C. On-Site Excavation or Borrow Pits: Do not excavate or remove any material from the project site or right-of-way which is not within the designated excavation, as indicated by the slope and grade lines.

D. Salvaging Topsoil:
   1. Salvage topsoil within the neat lines indicated on the Contract Drawings, and stockpile on the site at a location determined by the (Engineer) (Project Manager). Prevent topsoil from contamination by other materials, and provide adequate drainage and erosion protection.
   2. Place stockpiled topsoil in areas designated on Contract Drawings.

E. Stockpiling of Fill and Backfill Material:
   1. Excavate and separately stockpile suitable fill and backfill material. Save sufficient suitable excavated material, if available, for later filling, backfilling, and embankment construction.
   2. Store materials from required excavations which are suitable for fill, backfill, and embankment as excavated, in stockpiles segregated by type.
   3. Establish excavated material stockpiles on site only in locations where they will not interfere with the progress of the work. Off-site stockpiling, if necessary, shall be the responsibility and at the expense of the Contractor.

F. Disposal of Surplus Material:
   1. Haul from the site and legally dispose of excess excavated materials and those materials determined to be not suitable for fill or backfill.
   2. Location of disposal site and length of haul shall be the Contractor's responsibility.
   3. Surplus material may be disposed of within the site as directed by the (Engineer) (Project Manager).

G. Maintenance of Excavations, Slopes, and Embankments:

1. Excavate and remove material outside the limits of excavation which is unstable and constitutes potential slides, and material which comes into excavations for any reason including from the driving of piles.
2. Maintain slopes and embankments until final completion and acceptance of the work. Promptly repair slides, slipouts, washouts, settlements, and subsidences which occur for any reason, and refinish the slope or embankment to the indicated lines and grades.

3.4 SUBSURFACE EXTRACTION

A. Remove subsurface facilities and obstructions to the extent indicated.

B. When subsurface facilities are encountered during excavation which interfere with new construction, and such facilities are not indicated, notify the Engineer promptly for corrective determination.

3.5 ROUGH GRADING AND FILLING

A. Prior to commencement of structural earthwork, perform such soil and rock removal and filling as may be required to facilitate the progress of the work and bring all elevations to the rough grading lines indicated on Contract Drawings. Grading shall be by blading or as herein specified under Article 3.06.

B. Fill or backfill wells, test pits, or holes which will not be completely removed by excavation, with Class 4000 concrete, crushed stone, or clean select fill, and compact as herein specified in layers not exceeding 6 inches after compaction.

C. Fill or backfill holes, swales, and low points which will not otherwise be removed in the course of the work, to the indicated grades

3.6 DEWATERING – PUMPS AND DRAINAGE

A. At all times during construction of the work and at its completion for final inspection, by the (Engineer), provide and maintain ample means and suitable equipment, consistent with conditions encountered, to promptly remove and properly dispose of all water entering excavations or other parts of the work.

B. Control surface and subsurface water in excavations at all times until the structures to be built therein are completed and backfilled to approximately final grades.

C. Dispose of water in a suitable manner approved by the Engineer so as to avoid damage to adjacent property, existing structures and all work under construction. Do not pump drainage water onto the streets without the written permission in advance from the Engineer and the authority having jurisdiction.

D. Provide and maintain, settling basins and sumps for catching and holding settleable matter. These shall be frequently cleaned and maintained. Wherever water containing mud, clay, sand or other material in suspension, is pumped from the excavations, make suitable provision to insure that the

flow will be unobstructed. Take precautions to avoid pumping water through freshly placed concrete.

E. At no time shall the uplift pressure on any structure exceed 80 percent of the downward pressure produced by the weight of the structure and any backfill in place. The Contractor shall submit his proposed methods of controlling uplift pressure to the (Engineer) for approval prior to the start of excavation.

3.7 EXCAVATION

A. General Excavation Requirements:

1. Perform excavating as indicated and required for trackway and roadway beds, for concrete footings, foundations, exterior paving, floor slabs, concrete walks, and for site levels and grading, and provide shoring, bracing, underpinning, cribbing, pumping, and planking as required.
2. The bottoms of excavations shall be level, firm, undisturbed earth, clean and free from loose material, debris, and foreign matter.
3. Excavate to the lines and grades indicated on the Contract Drawings.
4. Support and maintain excavations so that sides are stable and will not move. Excavations may be maintained by sloping cut faces where space permits, or by providing structural support of earth walls as specified in Section 02160, Excavation Support Systems.
    a. Where the sides of excavations are sloped, angle of slopes shall be as approved by the (Engineer) (Project Manager) but shall not be steeper than allowed by the Title 29 Code of Federal Regulations, Part 1926, Safety and Health Regulations for Construction (OSHA).
    b. Maintain sides and slopes of excavations in safe condition until backfilling is completed.
    c. Where the Contractor elects to slope the sides of excavations, backfill of the over-excavated areas shall be made in the same manner specified for the adjacent excavated area. All additional backfill required shall be at no additional cost to the Owner.
5. Limits of excavations shall allow for adequate working space for installing forms, wall waterproofing, and as required for safety of personnel. Cut excavations in solid rock accurately to the neat lines indicated on Contract Drawings, or to the width of the duct bank or concrete encasement.
6. Remove unstable bottom material. Remove large stones, debris, and incompressible soils from common excavation bottoms to a minimum depth of 12 inches. Where required to excavate to rock, it shall be understood to mean sound bedrock. Remove friable and unsound material.
7. Except as otherwise indicated, preserve the material below and beyond the lines of excavations. Where excavation is carried below the indicated grade, backfill to the indicated grade as herein specified.
8. Excavation and its restoration, for convenience of the Contractor, shall be at no additional expense to the (Owner).
9. Place excavated material at sufficient distance from edge of excavation so as not to cause cave-ins or bank slides, but in no case closer than 3 feet from the edge of excavations.
10. Unauthorized over excavations for footings and foundations shall be filled with (Class 4000 concrete) (approved materials) to indicated elevations.
11. Condition excavated earth material which is suitable for fill, backfill, or embankment for re-use and properly stockpile for later filling and backfilling operations as herein specified. Test, screen, and mix as necessary to meet specified requirements.

12. Proceed with caution in areas of utility facilities; expose them by hand excavation or other methods acceptable to the facility owner.
13. If unsuitable materials are encountered at the required subgrades, the (Engineer) (Project Manager) may authorize the removal of such unsuitable materials and replacement with suitable compacted fill or with concrete.

B. Rock Excavation:
1. Rock which cannot be broken up and removed by ripper equipment shall be excavated and removed by drilling and blasting.
2. Use pre-splitting to establish a shear plane in the rock along the cut periphery or proposed break lines to reduce overbreakage. Pre-split a periphery plane to the depth to be excavated prior to other blasting within the limits of that particular plane; except that the Contractor will not be required to pre-split to slopes flatter than one-to-one. Pre-split by drilling appropriately sized holes at intervals of not more than 3 feet, to the depth of the cut, along the plane of the proposed
3. cut; load and stem such holes with an appropriate light charge explosive, and detonate all holes in the particular plane simultaneously.
4. If the depth of the cut is more than can be drilled from the top, an 18 inch offset will be allowed in the slope to begin succeeding drilling operations. The end result shall be a relatively smooth shear plane with localized irregularities which do not exceed 2 feet behind or 1 foot in front of the shear plane surface and which do not extend within the neat lines of the excavation.
5. Where footings or foundations are to be placed on rock which is not horizontal, key the center of the foundation approximately 12 inches in depth throughout an area approximately equal to the dimensions of the column or footing to be placed on the rock, or the entire width of the slab, at not more than 10-foot intervals. Remove loose fragments, and clean and fill all seams with lean concrete.
6. Material excavated beyond or below the indicated cross section shall be at the Contractor's expense. Fill overbreakage to required invert with Class 4000 concrete or crushed stone as approved, at no additional expense to the (Owner).
7. Leave the side slopes of rock cuts with reasonably uniform faces whether the excavation is carried beyond the specified side slopes or not. Remove all loose rock on cut slopes immediately after blasting. Conform sloped surfaces to the typical section indicated or to natural cleavage planes, where these are compatible with the typical section.
8. Solid rock boulders 24 inches in greatest dimension and boulders of lesser dimension, broken rock, and all stones occurring within the construction limits and not required for other construction, may be used for rock fill if suitable.

C. TRENCHING, BEDDING AND BACKFILLING FOR UTILITY LINES
1. General
   a. Beddings of trenches shall be well drained and bottoms accurately graded. Hand dig bell holes and depressions for joints after the trench bottom has been graded.
   b. Remove rock or boulders encountered in trench bottoms to the depth required to provide for a thoroughly compacted bed of approved material, at least six (6) inches deep, in the trench bottom.
   c. Pipe Embedment
      1) Extend bedding material six (6) inches below the bottom of the pipe and up to the spring line of the pipe. Bedding shall be sand, crushed stone or 3/8" washed gravel as per the contract drawings.

2) Extend initial backfill material twelve (12) inches above top of pipe. Backfill shall be sand, crushed stone or 3/8" washed gravel as per the contract drawings.
3) Place material in loose, uniform layers not over six (6) inches thick and compact to 90% of maximum density as determined by ASTM D1557.

2. Backfilling
   a. Do not backfill trenches until required open trench utility tests have been performed and approved by the Engineer. Backfill trench with unclassified fill in maximum twelve (12) inch layers and compact to the required density.

3.8 EMBANKMENT CONSTRUCTION

A. Place initial layer of embankment, fill and backfill only on subgrade which has been inspected and accepted by the (Engineer) (Project Manager).

B. Construct embankments to lines, grades, and contours indicated, in layers as nearly uniform and horizontal as is consistent with the indicated finished contour and profile. Maximum thickness of the layers shall conform to the following requirements:
   1. Common Embankment and Structural Embankment: 8 inches before compaction and 6 inches after specified compaction.
   2. Rock Fill: At more than 6 feet below the finished surface indicated on Contract Drawings, limit thickness of rock layers to maximum diameter of rocks placed therein, but in no case more than 24 inches. At 6 feet or less below the finished surface, limit thickness of rock layers to 8 inches.

C. Compact each layer to specified density for entire width of the fill or embankment. Achieve required compaction by rolling with compaction equipment suitable for type and condition of the particular material. Roll in a longitudinal direction parallel to longest dimension, starting at outer edges and progressing toward the center. Fill voids in rock fill with suitable embankment fill material.

D. Moisture-condition embankment fill material as required to achieve its compaction to the specified density, within the tolerances specified herein.

E. Do not compact material which contains excessive moisture. In such cases, scarify to the full depth of the layer having excessive moisture content and dry by reworking, mixing with dry materials, or other approved methods.

F. Remove material which cannot be compacted to required density within specified tolerances, and replace with suitable material at no additional expense to the (Owner).

G. Where pipes, culverts, or structures extend into embankments, construct embankment to at least 2 feet over and 10 feet on either side of the pipe, culvert, or structure location prior to excavation.

H. Do not commence final shaping until above specified requirements have been completed. Shape entire surface of trackway and the slopes of cuts and embankments to true grade, alignment, and cross section indicated. Leave cut slopes in rock with uniform surface, and remove all loose overhanging rock. Open ditches, drains, and culverts resulting from construction operations to drain effectively.

I. Where utility facilities and structures are supported in place, use special equipment and techniques as required to achieve specified compaction under and around them.

J. When backfilling against structures, place material approximately simultaneously on both sides of structures to equalize opposing horizontal pressures.
   1. Compact embankment, fill or backfill materials within five feet of retaining walls, abutments or other structures using lightweight compactors.
   2. Backfilling against new structures without approval is prohibited.

K. When backfilling on tops of structures, place material in six inch lifts over full area.

L. Prior to placing embankment against slop greater than one vertical to four horizontal cut benches into existing slopes. Height of bench not to exceed two feet unless otherwise approved.

3.9 SUBGRADE PREPARATION

A. Perform all cutting, blading, and shaping as required to cut and shape the subgrade to the grades and elevations indicated.

B. Subgrade preparation includes fine grading, reworking as necessary, and preparation of cut, fill, or embankment upon which structure and equipment foundations, pipe, subballast, subbase, base, and pavement will be placed.

C. Remove rigid pavements and slabs which would be within five feet of finished grade and subgrade. Rigid pavements and slabs which will be five feet and more below finished grade and subgrade may be left in-place only if broken into pieces not larger than three feet in greatest dimension.

D. Scarify and mix entire surface of subgrade to a depth of at least 6 inches.

E. Moisture-condition scarified subgrade to 3 percent above optimum moisture content. If subgrade stabilization material is required, incorporate it into subgrade at this time.

F. After the material has been thoroughly mixed and moisture-conditioned, accurately construct and fine grade the subgrade to indicated line, grade, and contour with high and low spots eliminated. Compact for full width to the specified density. Remove soft spots developed during working, fill with approved material, and re-compact.

G. Where feasible, use pneumatic-tired roller for compaction, suitable to produce the specified density. Where compaction by roller is not feasible, use mechanical tampers or vibratory compactors.

H. Finish subgrade to straightedge or template within specified tolerances with the finished surface bladed to a uniform, dense, smooth texture.

3.10 FOUNDATION PREPARATION

A. Complete construction of the excavation support and dewatering systems prior to placement of structure and equipment foundations.

B. Avoid disturbing bottom of excavation. If bottom is disturbed, restore and stabilize the bearing foundation at no additional expense to the (Owner).

C. If material at bottom of the excavation is rock, remove loose material and roughly level the bearing foundation to indicated elevation. If the bottom contains occasional rock outcroppings or rock in only a portion of the area, remove such rock to a depth of 6 inches below indicated subgrade and backfill with approved material.

3.11 SUBGRADE FILLING/RAISING GRADE

A. Construct compacted fill for raising of subgrade to indicated elevation by approved and accepted methods. Spread fill material in uniform lifts not exceeding 8 inches in uncompacted thickness. Fill material which does not contain sufficient moisture to compact properly shall be sprinkled with water; if it contains excess moisture it shall be aerated or permitted to dry to the proper water content. Fill material and water shall then be thoroughly mixed before being compacted. Compact each layer of spread fill material to the specified density.

B. Control of fill shall consist of field inspection and testing to determine that each layer has been compacted to the required density and to ensure that optimum moisture is being obtained. Any layer or portion of a layer that does not attain the compaction required shall be scarified and recompacted until the required compaction is obtained.

C. Perform spreading and compacting as required to produce the required density, and a uniform surface smooth and true to grade.

3.12 COMPACTION

A. Compaction Density: Compact each layer of embankment, fill, and backfill material to not less than the indicated or specified compaction. Required compactions are defined as Class I or Class II, as follows:
   1. Class I Compaction: 90 percent relative compaction as determined by ASTM D1557, Method D, if the material is cohesive; or 70 percent relative density as determined by ASTM D4253, Dry Method, and ASTM D4254, Method A, if the material is granular.
   2. Class II Compaction: 95 percent relative compaction as determined by ASTM D1557, Method D, if the material is cohesive; or 75 percent relative density as determined by ASTM D4253, Dry Method, and ASTM D4254, Method A, if the material is granular.

B. Required Compactions:
   1. Embankment or fill where the surface will be subgrade or bearing foundation: Class II for full depth.
   2. Backfill around Structures: Class I under top 12 inches; Class II for top 12 inches.
   3. Cut-and-Cover Backfill: Class I to 36 inches above structure or utility; Class II for balance.
   4. Original Ground or Cut Subgrade: Except as specified in Articles 3.09 and 3.10 where original ground or cut subgrade, or fill less than 1 foot thick, will be subgrade or bearing foundation, scarify the surfaces and provide Class II compaction for at least 12 inches in depth. Include the following additional requirements:
      a. Provide Class II compaction for original ground within 3-1/2 feet of top of rail profile and 2-1/2 feet of finished pavement grade, for full width of trackway and pavement plus three feet on each side thereof.

b. Provide Class II compaction for top 6 inches of undisturbed original ground upon which embankments are to be constructed.

3.13 BACKFILLING

A. Use materials removed from site excavations if such material meets specified requirements.

B. Backfilling is required around all substructures. Fill all abandoned vaults, shafts, airways, adits, holes, pits, and other voids.

C. Place backfill in layers not to exceed 8 inches of loose material, and compact each layer to specified density before the next layer is placed.

D. Place backfill material in such manner that unbalanced horizontal loads will not be applied to a newly-placed structure or portion of structure, utilities, or pipelines. Do not backfill around portions of structures requiring backfill on only one side or on less than all sides, until the concrete has reached the specified strength to withstand the earth pressures.

E. When placing material for backfill around waterproofed structures, protect such structures and the waterproofing thereof with a shield when necessary to prevent displacement or injury by stones or other hard substances in the backfill.

F. Do not backfill on or against structural concrete until the specified 28-day concrete strength has been attained.

G. Complete backfill for end bents and abutments, including backfill for wingwalls, in accordance with the above specified time limit. Step slopes behind abutments, unless otherwise indicated, to prevent backfill from acting as a wedge against the abutment. Provide drainage behind abutments and wingwalls as indicated.

H. Do not use compaction equipment and methods that produce excessive horizontal or vertical earth pressures.

3.14 FINISH GRADING

A. Finish grade all areas to elevations and grades indicated. In areas to receive topsoil and landscape planting, finish grading shall be performed to a uniform 6 inches below the grades and elevations indicated.

B. Place and spread stockpiled topsoil to a uniform thickness of 4 to 5 inches (approximately) in areas to receive topsoil and landscape planting. Place and spread to a uniform thickness approximately 1 to 2 inches below finish grades indicated.

3.15 FIELD QUALITY CONTROL

A. Inspections and Tests by the Contractor:

1. Density Tests: Compacted fill, backfill, and embankment shall be tested to verify compliance with specified requirements in accordance with ASTM D2922. Minimum frequency of tests shall conform to the following requirements:
    a. Expansive Horizontal Areas: One test per 100 cubic yards, or fraction thereof, of fill or backfill placed.
    b. Confined Areas, Trenches and Embankments: One test per lift of fill, backfill, or embankment placed.
2. Tests for compaction shall be made in accordance with test procedures outlined in ASTM D1557, Method D, as applicable. Field testing of soils or compacted fill in place shall be performed in accordance with applicable requirements of ASTM D2922.
3. Compaction is not required under pile supported slabs.
4. Moisture Content Tests: Compacted fill, backfill, and embankment shall be tested to verify compliance with specified requirements in accordance with ASTM D3017. Minimum frequency of tests shall be as specified above for density tests.

B. Inspections by the (Engineer)
1. Site preparation, cutting and shaping, excavating, filling, backfilling, and embankment construction shall be carried out under the inspection of the (Engineer) , who will have the Contractor perform appropriate field and laboratory tests, as necessary, to evaluate the suitability of fill and backfill material, the proper moisture content for compaction, and the degree of compaction achieved. Fill or backfill that does not meet the specified requirements shall be removed or recompacted until the requirements are satisfied.
2. Cutting and shaping, excavating, conditioning, filling, backfilling, and compacting procedures require approval of the Engineer as they are successively performed. Work found to be unsatisfactory or work disturbed by subsequent operations before approval is granted shall be corrected in an approved manner as directed by the (Engineer).

END OF SECTION

SECTION 31 23 19
DEWATERING

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes requirements for dewatering operations. The work shall consist of controlling, handling, treating and disposing of groundwater during dewatering activities. Work includes providing systems for treatment of groundwater before discharge to an on-site treatment system or publicly owned treatment works (i.e. municipal sewer system.) Dewatering shall be conducted in accordance with all applicable rules and regulations

B. The Contractor is responsible for assuring that a POTW is available for discharge, and if a POTW is not available, for identifying, obtaining and complying with any regulatory permit needed, unless the water will be contained within a tank and trucked away to an appropriate disposal facility

C. Dewatering operations will be allowed to discharge to an on-site frac tank provided by the Contractor. If groundwater goes off site for disposal, no on site pre-treatment is required.

D. If water is to be discharged to the local POTW, the water must be tested prior to discharge to ensure it meets the local use limits. The temporary storage system (i.e. frac tank) must include a settling or other 'treatment' system sufficient to allow the removal of contaminants to the extent that the discharged water meets the local Use Ordinance Limits. Water shall be stored until the results of the testing are available.

E. All transporters and disposal sites used must be approved by the Engineer, and Metro-North Department of Environmental Compliance and Services.

F. The use of an existing on-site treatment system can only be used upon approval by the Engineer and Metro-North Department of Environmental Compliance and Services.

G. All groundwater removed from excavations, including that generated during initial dewatering, shall at a minimum, be treated to minimize sediment and settleable solids.

H. If a permit is required under the Environmental Conservation Law (ECL), the Contractor is responsible for all permitting efforts required, and all details of the permit are to be included and followed. The permit requirements become part of this specification and contract documents. Dewatering plans developed by the Contractor are to be approved by Metro-North Railroad Department of Environmental Compliance and Services prior to submittal to the Regional Permit Administrator (RPA) as directed in the Permit.

1.02 RELATED SECTIONS

Section 01 33 60 – Safety, Health and Environmental Control
Section 01 35 43 – Environmental Protection
Section 01 74 19 – Construction Waste Management and Disposal
Section 02 61 00 – Sampling, Testing, Handling, Loading, Removal, and Disposal of Soils

1.03 NOTED RESTRICTIONS

A. If a POTW is available, the Contractor is responsible for meeting all requirements of the POTW. Dewatering effluent must be pre-treated so that the concentrations of total suspended solids, oil & grease, and all other contaminants in the effluent meet the conditions of the local POTW.

B. If a POTW is not available, the Contractor is responsible for identifying, obtaining and complying with any required temporary discharge permits required by the NYSDEC or any other regulatory agency.

1.04 REFERENCES

A. New York State Department of Environmental Conservation (NYSDEC) State Pollutant Discharge Elimination (SPDES) Regulations

B. United States Department of Labor (USDOL), Occupational Safety and Health Administration (OSHA), Title 29, Code of Federal Regulations (CFR) 1910.120 Hazardous Waste Operations and Emergency Response

C. Metro-North Commuter Railroad Company Standards, Technical Provisions for Environmental Engineering Controls for Petroleum Contaminated Soils and Water.

D. County and Local POTW Sewer Use Limits, and all other applicable rules and regulations

1.06 SUBMITTALS

A. Groundwater Treatment System Schematic Diagram and Design Calculations for all system components, processes, and removals.

B. Groundwater Treatment System Shop Drawings and Catalog Cuts.

C. Operation and Maintenance (O&M) Plan which may include provisions for removal of settled solids from sedimentation (frac) tanks, replacement of bag filters, carbon servicing, and general system cleaning to remove scaling, deposits, etc.

D. Safety, Health, and Environmental Control Plan (SHECP) pursuant to OSHA 29 CFR 1910.120 specific to the operation and maintenance of groundwater treatment systems which may include provisions for handling and cleaning bag filters and confined space entry (cleaning of sedimentation tanks) with written verification by Certified Industrial Hygienist (CIH) approving the SHECP.

E. Groundwater Treatment System Monitoring Plan shall include methods for sample collection and analysis from the end point of various treatment system components to assess treatment component removal efficiency as referenced in Articles 3.04 and 3.05.

F. Qualifications, applicable up-to-date licenses, and safety certificates for all treatment system operators, waste handling Design-Builder, and waste receiving facilities.

G. Obtain approval from all regulatory agencies having jurisdiction before full construction service activation.

1.07 DELIVERABLES:

A. The Contractor shall submit all completed permit applications necessary to conduct dewatering, groundwater treatment, and discharge of dewatering effluent to Metro-North's Department of Environmental Compliance for review. The Contractor revise the permit applications as required by Environmental Compliance. Upon incorporation of revisions required by Environmental Compliance, the Contractor is responsible for submitting, obtaining and complying with all permits.

B. Bills of Lading for disposal of settled solids.

C. Documented daily volume of dewatering

1.05 QUALITY ASSURANCE

A. Verify that groundwater treatment systems meet discharge permit requirements.

B. Verify compliance with referenced standards and regulations.

C. The Contractor shall be liable for all damage claims by Metro-North, other agencies, and municipalities (as applicable) due to dewatering.

PART 2 - PRODUCTS

2.01 GENERAL

A. The groundwater treatment system shall consist of gravity sedimentation tanks, filtration, or other industry accepted treatment system components necessary to meet applicable discharge limits as established in any municipal or agency permit obtained by the Contractor for the project.

B. Power and water supply required for system servicing.

C. Piping and all other accessories to convey groundwater from the Project site to the treatment system and discharge location.

D. Control panels, as needed, for the treatment system and associated pumps.

E. All valves, sampling ports, meters, gauges, and controls to maintain adequate flow rates and treatment efficiency and to document discharge volume.

F. All equipment shall be designed for its intended use in a potentially wet and hazardous environment, for potential contact with petroleum substances, and presence of stray electrical current.

G. The Contractor is responsible for all sampling and analysis necessary to evidence that the dewatering discharge meets all applicable discharge limits.

PART 3 - EXECUTION

3.01 PREPARATION

A. Design, install, operate, and maintain a groundwater treatment system to reduce identified contaminant concentrations to required levels stipulated in applicable discharge permit(s) from the NYSDEC and/or local POTW

3.02 DESIGN

A. Design of the groundwater treatment system shall be based upon site-specific data and an industry accepted treatment scheme to address site-specific contaminated groundwater.

B. Design the groundwater treatment system to meet discharge criteria as stipulated in the applicable NYSDEC and local POTW discharge (and/or effluent limitations) permits and supplemental requirements as may be stipulated in these permit(s).

C. Design the groundwater treatment system to operate continuously, without interruption and provide adequate removal efficiency to meet the permit requirements.

D. Dewatering shall be piped directly to sedimentation tanks and the use of open settling ponds are not recommended due to potential volatilization of contaminants.

E. Verify installation complies with manufacturer's instructions and standards.

F. The design shall also consider the presence of various metal compounds and various other contaminants in the groundwater.

G. At a minimum, the design shall incorporate meters, gauges, and sampling ports for the measurement of flow rate, total flow, operating pressures, and influent and effluent concentrations.

H. The design shall also incorporate adequate ventilation systems in the excavation area for potential volatilization of contaminants from sumps and seepage.

3.03 INSTALLATION

A. The groundwater treatment system and associated components shall be located, operated and maintained such that all utilities within the area shall be protected from damage.

B. Protect all benchmarks, survey control points, boring locations, monitoring wells, and piezometers from damage or displacement during dewatering storage and groundwater treatment activities at the Project site.

C. Protect any on-site drainage basins, outfalls and connections thereto from damage, accumulation of silts, sediments or other solids from groundwater conveyed within or discharged from the Project site in accordance with Section 31_25_00 Stormwater Pollution Prevention–Erosion and Sedimentation Control.

D. Signs shall be posted inside and outside the treatment system building or enclosure with emergency contact information in the event of system failure or malfunction.

E. All system components, piping, and connections shall be water and vapor tight.

3.04 START-UP AND TESTING:

A. Start the groundwater treatment system in accordance with manufacturer's operating procedures, design considerations, and applicable permit requirements.

B. Conduct initial treatment system testing to verify compliance with discharge limitations.

C. The air within the treatment system building, and excavation as needed, shall be monitored for oxygen levels and potential contaminant concentrations to assure adequate ventilation system operation.

3.05 OPERATION:

A. Operate the groundwater treatment system in accordance with manufacturer's operating procedures, design considerations, and applicable permit requirements.

B. Keep a Groundwater Treatment System Log Book to include all measurements of system performance such as operating pressures, temperatures, influent, mid-fluent, and effluent concentrations, and flow rates and volumes.

C. Provide the requisite personnel with appropriate training and certification to operate the groundwater treatment system as required in the discharge permit(s).

D. Maintain the treatment system and its various components in accordance with the manufacturers recommended maintenance routines and procedures.

E. Inspect system components daily for the presence of oil, ice, settled solids accumulation, flow rates, pressures, and effluent color and appearance.

F. Additional treatment components shall be installed and operated as necessary to maintain the flow rates necessary for de-watering and to assure compliance with the effluent limitations.

G. In the event pre-finishing component concentrations meet the discharge limits; bypass of these system components shall be conducted.

H. Provide all required sampling, analysis and reporting for the sampling of the discharge.

I. Dewatering shall cease and Environmental Compliance shall be immediately contacted if a sampling result shows an exceedance of a discharge limit or a sheen or discoloration are identified.

END OF SECTION

SECTION 31 23 23 - COMPACTION TESTING AND INSPECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide laboratory compaction testing.

B. Provide laboratory gradation testing.

C. Provide field density testing.

1.2 RELATED SECTIONS

A. Section 014300 – Quality Assurance

B. Section 014529 – Testing Laboratory Services

C. Section 312000 – Earth Moving

D. Section 321100 – Base Courses

E. Section 321200 – Flexible Paving

F. Section 321600 – Curbs, Gutters, Sidewalks and Driveways

1.3 REFERENCES

A. ASTM D422 – Particle Size Analysis of Soils

B. ASTM D698 – Moisture – Density Relations of Soils and Soil Aggregate Mixtures using

C. 5.5 lb. Rammer and 12-inch Drop

D. ASTM D1556 – Density of Soil in Place by the Sand-Cone Method

E. ASTM D1557 – Test Methods for Moisture – Density Relations of Soils ad Soil Aggregate Mixtures Using 10 lb. Rammer and 18-inch Drop

F. ASTM D6938-10 – Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)

1.4 TESTING SERVICES

A. The Contractor shall pay for all testing services.

B. The test services shall include:
   1. Review and check/test the Contractor's proposed materials for compliance with the specifications.
   2. Compaction tests of materials modified or placed by the Contractor including asphalt paving for compliance with the applicable specifications.
   3. Qualifications of the proposed materials and portions.
   4. Any additional testing required due to the failure of material to meet the specification requirements.
   5. Any additional testing required due to the changed in the materials or proportions by the Contractor.

1.5 RESPONSIBILITIES OF THE CONTRACTOR

A. Submit at least three testing agencies to the Engineer for approval. See Section 014529 for additional requirements for selection of a testing agency, testing and laboratory work.

B. Submit to the Engineer the materials and portions for use with a request for approval. This submittal shall include the results of the testing performed to qualify the material

C. Inform approved testing agency sufficiently in advance to allow reasonable mobilization time.

1.6 TESTING PROCEDURES

A. Determine the moisture-density curve for each material in accordance with ASTM D1557 or AST D698.

B. Determine in-place densities for materials in accordance with ASTM D1556 or ASTM D6938.

C. Determine the gradations above the number 200 sieve of each material in accordance with ASTM 422.

D. Determine the Liquid Limit and Plastic Limit, where applicable.

1.7 ACCEPTANCE CRITERIA

A. Compaction results must meet or exceed the minimum values specified. Any material or area that tests below the specified values shall be corrected and retested until it passes. All correction work shall be performed at no additional cost to Metro-North.

B. Gradation results shall meet al requirements specified.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 31 40 00 - SHORING AND UNDERPINNING

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Detection of movement

B. Shoring and underpinning

C. Concrete piers and walls

D. Fill and backfill

E. Temporary supports

F. Restoration

1.2 REFERENCED SECTIONS:

A. Division 1 – General Requirements- Submittal Procedures.

B. Section 31 20 00 – Earth Moving

C. Section 31 50 00 - Excavation Support and Protection.

1.3 REFERENCES

A. Municipality’s Supplemental Building Code

1.4 DEFINITIONS

A. Shoring: Props or posts of timber or other material in compression or bending, used for temporary support of excavations, formwork, or unsafe structures.

B. Sheeting: A line of timber or planks, plain or tongue-and-grooved on sides, driven endwise into the ground to protect subgrade operations.

C. Underpinning: Permanent construction, as indicated, which directly transmits existing structure foundation loads to a lower bearing elevation or strata, and which preserves the structures being underpinned.

D. Support: Facilities required to prevent movement of existing structures until the completion of the underpinning.

E. Lagging: A temporary or permanent excavation support structure consisting of heavy timber boards, planking, or sheathing secured in place by steel H-piles.

F. Restoration: Reconstruction by repair or replacement of portions of structures removed or altered by underpinning and support operations.

G. Parcel: An area as indicated, including the structures thereon, and any vaults and permanent closure walls connected thereto.

1.5 SUBMITTALS

A. Requirements: Refer to Section 01 33 00 - Submittals for submittal requirements and procedures. Shop Drawings and supporting calculations for shoring and underpinning shall be submitted to the Engineer for review and approval.

B. Excavating, Shoring, and Underpinning Program: Prepare and submit a written schedule and procedure, along with detailed drawings, of the proposed excavations, shoring, and underpinning work to the Engineer for review.

C. Shop Drawings: Submit Shop Drawings, indicating method, staging, and necessary details for construction of underpinning and support for each structure on which work is to be performed. Show details of shop assemblies when required for restoration of structures. Shop Drawings and calculations shall be prepared, sealed, and signed by a professional engineer currently registered in the State of New York.

D. Calculations: Submit design analyses and calculations to support Shop Drawings.

E. Procedures:
1. Submit procedure for detection of movement, as specified in Article 3.01 herein.
2. Submit procedure for preloading (jacking load) new foundations.
3. Submit procedure for proof load testing and preloading (jacking load) of lateral support systems, such as strut and tieback assemblies.

F. Jacking Gage Calibration: Submit data for the pressure gage and jack combinations certified by an accepted testing laboratory not earlier than 14 days prior to start of use for underpinning.

G. Restoration: Submit procedures, methods, and materials lists for restoration of structures and facilities.

1.6 SITE CONDITIONS

A. Access: In cases where parcels are not available upon Notice to Proceed, parcels will be available as indicated in the Contract Specifications. Notify the Railroad and the local municipality at least 30 days in advance of the date on which the Design- Builder requires occupancy of parcels to be underpinned, supported, and restored.

B. Staging and Working Space: Working areas for underpinning and support are shown on the Contract Drawings. If additional working areas beyond those obtained by the railroad are necessary, obtain use of such areas at no additional expense to the railroad.

C. Permits: The Contractor will obtain and pay for permits for entry into structures and for the right to perform underpinning, support, and restoration as indicated. The
   1. Contractor shall obtain and pay for all other permits, give all notices required, and make all other arrangements necessary.

D. Temporary Partitions: Where indicated or required, build closed temporary partitions of suitable materials to isolate the work site from the portions of the structure not occupied by the Contractor.

E. Maintenance of Services: Locate, protect, support, and maintain uninterrupted all utilities, equipment, services, and owner's and tenant's chattels within the limits of the underpinning work, or relocate same as indicated or required.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Requirements: The Contractor shall furnish all materials, tools, equipment, facilities, and services as required for providing the necessary shoring and underpinning work and facilities. Jacks and jacking equipment shall be more than adequate for the imposed loads and shall be provided with calibrated gages.

B. Shoring and Bracing Materials: Provide heavy timber posts, beams, planks, boards, pipe struts, pin piles, and accessories as required.

C. Lagging and Sheeting Material: Provide heavy timber boards, planking, or sheathing as required. Lagging boards shall be secured in place by steel H-piles, with boards inserted between the H-flanges.

D. Piles: Refer to Section 31 62 16.16

E. Concrete: Refer to Sections 03 10 00 - Concrete Forming and Accessories, 03 20 00 - Concrete Reinforcing, and 03 30 00 - Cast-In-Place Concrete for requirements. Concrete shall be regular concrete weighing not less than 145 pounds per cubic foot, with a minimum compressive strength at 28 days of 4,000 psi.

F. Grout: Refer to Section 03 60 00 - Grouting, for requirements.

G. Structural Steel: Refer to Sections 05 12 00 - Structural Steel Framing, and 05 50 00 - Metal Fabrications, for requirements.

PART 3 - EXECUTION

3.1 DETECTION OF MOVEMENT

A. For each existing structure that may be affected by the work, install settlement markers on each footing, building corners, wall or surrounding improvements to be monitored. Settlement markers shall be capable of being read to an accuracy of 0.005 foot.

B. Take and record readings not less than once per week during performance of the work until the permanent structures is complete to the ground level.

C. Stop work; notify the Engineer, and take immediate remedial action if movement of the existing structure occurs during performance of the work.

D. Upon completion of the work, take weekly readings of the measurement points for a period of 4 weeks or longer if movement persists, and report the results to the Engineer.

E. The detection of movement shall be performed by a qualified licensed land surveyor or civil engineer.

3.2 SHORING AND UNDERPINNING

A. Existing footings, foundations, grade beams, retaining walls, or pavement which may be affected by excavation operations shall be shored or underpinned adequately or otherwise protected against settlement and shall be protected against lateral movement.

B. Provide soldier piling, lagging and sheeting, tie-backs, slurry diaphragm wall, and cementitious grouting, as required, to hold back earth at excavations and as required to prevent cave-ins and earth sloughs.

C. Footings, foundations, grade beams, retaining walls, or pavements which have been undermined by earthwork and pile-driving operations shall be filled and supported with concrete extended to undisturbed bearing earth or bedrock.

D. Concrete may be placed as a stiff mix of minimum slump (dry pack), or concrete may be pneumatically placed (shotcrete), or concrete may be placed by conventional methods with concrete formed to hold it in proper position.

3.3 CONCRETE PIERS AND WALLS

A. Install concrete underpinning piers and walls as indicated, with the bottom at the indicated or bearing elevation and the top approximately three inches below the structure to be underpinned. Dry pack the space within three days after concrete placement is completed.

B. Where earth forms are indicated, install waterproof building paper or board between the earth and concrete to prevent water loss from the fresh concrete.

C. Do not remove support of existing structure until concrete piers or walls have attained design strength.

3.4 FILL AND BACKFILL

A. Provide engineered fill and backfill in accordance with applicable requirements of Section 31 20 00 – Earth Moving, after acceptance of the underpinning by the Engineer.

3.5 TEMPORARY SUPPORTS

A. Install temporary supports where necessary to support structures to be underpinned and those that will be affected by underpinning and restoration work.

3.6 RESTORATION

A. Restore existing structures to conditions equivalent to those existing prior to the start of shoring and underpinning work, including repair of any settlement-related damage.

END OF SECTION

SECTION 31 50 00 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Detection of movement

B. Soldier piles and lagging

C. Sheet piling

D. Bracing and tiebacks

E. Soil anchors

F. Soil mix walls

G. Removal of excavation support systems

H. Restoration

1.2 REFERENCED SECTIONS:

A. Shoring and underpinning for safeguarding structures are specified in Section 31 40 00 - Shoring and Underpinning.

B. Instrumentation for monitoring earth and structure movements, as well as subsurface water levels, is specified in Section 31 09 13 - Geotechnical Instrumentation and Monitoring.

C. Excavation and other earthwork operations are specified in Section 31 20 00 – Earth Moving.

D. Trenching for utilities is specified in Section 31 20 00 – Earth Moving.

E. Coordinate the work of this Section with the work of Section 31 20 00 – Earth Moving, and Section 31 40 00 - Shoring and Underpinning.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A36 Specification for Structural Steel
   2. ASTM A328 Specification for Steel Sheet Piling
   3. ASTM A416 Specification for Uncoated Seven-Wire Stress-Relieved Steel Strand for Prestressed Concrete
   4. ASTM A563 Specification for Carbon and Alloy Steel Nuts
   5. ASTM A586 Specification for Zinc-Coated Parallel and Helical Steel Wire Structural Strand

6. ASTM A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
7. ASTM A690 Specification for High-Strength Low-Alloy Steel H-Piles and Sheet Piling for Use in Marine Environments
8. ASTM A722 Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete
9. ASTM C150 Specification for Portland Cement
10. ASTM C33 Specification for Concrete Aggregates
11. ASTM F432 Specification for Roof and Rock Bolts and Accessories
12. ASTM F436 Specification for Hardened Steel Washers

B. American Wood Preservers' Association (AWPA):
1. AWPA C3 Specification for Below Grade Preservative Treatment for Wood

C. Municipality's Supplemental Building Code, 2005

1.4 DEFINITIONS

A. Drainage Mat or Matting: A manufactured drainage material which is available in sheets or rolls and which may be used in excavation support systems to prevent buildup of hydrostatic pressure.

B. Lagging: A temporary or permanent excavation support structure consisting of heavy timber boards, planking, sheathing, or reinforced precast concrete planks secured in place by steel H-piles.

C. Proof Load: An applied load 25 percent greater than the design load, imposed by load test.

D. Sheeting: A line of timber or planks, plain or tongue-and-grooved on sides, driven endwise into the ground to protect sub grade operations.

E. Sheet Piling: Interlocking steel sheet piling installed vertically to hold back earth or retain soil and to keep water out of a foundation excavation. May be a temporary or permanent structure.

F. Shores/Shoring: Props or posts of timber or other material in compression, used for temporary support of excavations.

G. Soil Anchor: A pre-stressed frictional anchorage device, consisting of a high- strength steel tendon, fitted with a stressing anchor at one end and an anchor device, permitting force transfer to the soil, at the other end, installed in a prepared hole that is drilled or driven into the ground.

H. Soil Mix Wall: A multiple-augured, cement-grout reinforced earth technique, incorporating steel H-beam reinforcement, whereby existing soils are mixed in place with cement grout, forming a row of overlapped soil cement columns, creating a reinforced earth wall excavation support system.

I. Soldier Piles: Vertical steel H-piles installed to take the side thrust of horizontal lagging. Also called soldier beams.

J. Strut: A brace or supporting member which resists thrusts in the direction of its own length; may be vertical, diagonal, or horizontal.

K. Tie-Backs: An excavation-face support obtained by grouted steel bars, wire strands, or tendons, with or without a dead-man, in combination with face-retaining or bearing steel plates or board timbers.

L. Waler: A horizontal beam used to brace or support vertical sheeting or sheet piling.

1.5 DESIGN CRITERIA

A. Basic unit stresses for the working stress design of excavation support structures shall be taken from the following references:
   1. Structural Steel: Manual of Steel Construction, American Institute of Steel Construction (AISC), 13th edition.
   2. Reinforced Concrete: Building Code Requirements for Structural Concrete, American Concrete Institute, (ACI 318).
   3. Timber: National Design Specification for Wood Construction.

B. Design excavation support systems to support earth pressures, utility loads, equipment, applicable traffic and construction loads, and other surcharge loads in a manner which will allow the safe and expeditious construction of permanent structures without movement or settlement of the ground and in a manner which will prevent settlement of and damage to, or movement of, adjacent buildings, structures, utilities, or other facilities during the various stages of construction. Include evaluation of the effects of dewatering and flooding of excavation.

C. Design each component to support the maximum loads which may occur during various stages of construction. Include lateral pressure due to earthquake. For the purpose of this Section, the design load means the maximum load the support member will have to carry in actual practice, and the proof load means a specified test load greater than the design load.

D. Support of excavation structures shall be analyzed for all conditions which may occur during the various stages of construction. Among others, these conditions include: installation, relocation and removal of struts; flooding and dewatering of excavations; and concreting of excavation bottom. The loading conditions on opposite sides of a cut may not be equal. In this case, both sides shall be designed for and be compatible with the larger loading. The conditions to which the design applies shall be indicated on the Shop Drawings.

E. Carry the bottom of support system to a depth below the main excavation as adequate to prevent lateral and vertical movement. Where additional excavation is carried below the main excavation, provide means to prevent movement of the main excavation supports.

F. Design the excavation support system to allow the required free excavated space for workers, concrete formwork, wall waterproofing, and drainage systems.

G. Design excavation support systems for staged installation and removal to conform to construction and backfill sequences as indicated. Leave excavation support systems in place, except as specified otherwise herein or in the Contract Specifications.

H. Employ walers, struts, and tieback anchors for horizontal support as required for excavation faces to be retained by soldier piles and lagging or sheet piles. Provide struts with intermediate vertical and horizontal supports as required to prevent buckling. Struts shall be preloaded by wedging or jacking to 50 percent of the design load.

I. Provide diagonal bracing where needed for stability of the system. Use timber lagging, steel sheeting, or reinforced precast concrete sheeting or planking. Tiebacks and soil anchors will not be permitted to extend outside of the Metro- North Railroad right-of-way property limits, unless the Contractor has obtained written (notarized) permission from adjacent property owners to use their properties for such purposes.

J. Design piles or other vertical support members to be incorporated in a system employing tiebacks or soil anchors to have the capability of resisting vertical components of tieback loads without significant settlement during any stage of excavation and construction.

K. Timber support systems, except lagging, shall be employed only for utilities and minor structures. Timber supporting members and lagging to be left in place shall be pressure-treated with wood preservative.

L. Where lagging is employed, the Contractor shall design the lagging to safely support the indicated loads. Minimum thickness of lagging between soldier piles spaced up to 7 feet on center shall be 3 inches for excavations of depth up to 25 feet, and 4 inches for excavations of depth in excess of 25 feet.

M. Provisions shall be made to protect struts from excessive deformations and stress variations induced by temperature fluctuations.

N. In reviewing submittals, the Engineer will use the criteria and loads for structures indicated on the Contract Drawings. The conditions to which the design applies shall be indicated on the Shop Drawings.

1.6 SUBMITTALS

A. General: Refer to Section 01 33 00 - Submittal Procedures for submittal requirements and procedures. Shop Drawings and supporting calculations for excavation support systems shall be submitted to the Engineer for review and approval.

B. Pre-construction Surveys: Submit pre-construction surveys as specified in Article 1.08 A. herein.

C. Movement Detection Procedures: Submit procedures for detection of movement as specified in Article 3.01 herein.

D. Excavation Support Systems Program:
1. Prepare and submit a written schedule and procedure, along with detailed drawings, of the proposed excavations and excavation support systems.
2. Include installation procedures; method of concrete placement; excavation sequence; interface details; protection measures for existing structures and facilities; instrumentation and monitoring procedures to check performance, sequence, and method of removal; and contingency plans for excessive wall or foundation movements.
3. The program shall take into account that excavations cannot extend beyond the Metro-North Railroad right-of-way into adjacent properties above or below grade, unless otherwise indicated. Where tie-backs, soil anchors, soil nailing or similar support systems are required, the Contractor shall be solely responsible for securing permission from adjacent property owners to install such temporary and permanent systems. If the Contractor is unable to

secure such permission, support systems shall be installed completely within the Metro-North Railroad right-of-way.

a. Any such permission from adjacent property owners shall be in writing, and the owner's signature, granting such permission, shall be witnessed and properly notarized. Certified copies of all such permissions shall be submitted to the Engineer for record purposes.

E. Shop Drawings: Submit Shop Drawings and specifications for support systems, lagging, tie-back anchors, and internal bracing. Include the following:

1. Specific description of field quality control measures.
2. Details of interface with permanent structures.
3. Detailed description of tie-back soil anchors, and wales, if used, and the proposed installation procedure, including method of grouting anchors, grout type, and mix proportions.
4. Details of bracing struts and wales, if used, and the proposed installation procedures, including method and sequence of preloading.
5. Details of required preloading systems, pre-stressing systems, load measuring facilities, systematic schedule of preloading and pre-stressing operations, and sequence of construction.
6. Method and details for securing lagging in support system openings.
7. Proposed method of providing for utility penetrations.
8. Assembly and erection details of members and connections for the system.

F. Calculations: Submit appropriate design calculations to support Shop Drawings. Include maximum theoretical deflections of supporting members. Include calculations indicating the expected magnitude of vertical and lateral movement.

G. Professional Engineer's Certification: The excavation support systems program, Shop Drawings, calculations, and test reports shall be prepared, sealed, and signed by a professional engineer currently registered in the State of New York. The Contractor shall select an engineer with experience in the design and construction of excavations and excavation support systems and shall submit the selected engineer's resume demonstrating such experience.

H. Calibration Charts: Submit certified calibration charts for each jack-gage unit used for preloading.

I. Test Reports: Submit reports of performance tests and proof loading tests of soil anchors, certified by a professional engineer currently registered in the State of New York.

1.7 REGULATORY REQUIREMENTS

A. Regulatory requirements that govern the work of this Section include the following governing codes:

1. New York State Building Code, 2010
2. Municipality’s Supplemental Building Code

1.8 SITE CONDITIONS

A. Pre-construction Surveys: The Contractor shall submit to the Engineer, for review and approval, pre-construction surveys for existing structures and facilities located above or adjacent to the new

construction and which may be affected by the work. These surveys shall include photographs, maps, plans, written descriptions, and surveyed foundation levels as necessary to fully document pre- construction conditions.

B. Provision for Contingencies:
   1. Monitor performance of components of excavation support systems, both for vertical and horizontal movement, at regular intervals. Provide strut-monitoring devices, installed in accordance with the manufacturer's instructions, at locations indicated or required.
   2. Provide and secure approval for a contingency plan, or alternative procedures, to be implemented in the event of an unfavorable performance of the system.
   3. Have materials and equipment available to implement the approved contingency plan.

C. Existing Utilities:
   1. Proceed with caution in areas of utility facilities and structures. Expose existing utilities by hand-excavation or by other methods acceptable to the utility owner.
   2. If existing utility facilities and structures interfere with proposed method of excavation support, modify or relocate such facilities in accordance with the utility owner's recommendations.

D. Loads: Lateral loads shall not be transferred to new concrete structures by removal of excavation support systems until the new structure has attained its 28-day compressive strength, or except as otherwise indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND FACILITIES

A. The Contractor shall furnish all tools, equipment, devices, appurtenances, facilities, and services for the construction and removal of excavation support systems as indicated or required.

2.2 MATERIALS

A. General: Materials for excavation support systems may be new or used, provided they are sound and free from strength-impairing defects.

B. Soldier Piles/H-Piles: ASTM A690 or ASTM A36 shapes of sizes indicated on approved Shop Drawings. Provide soldier piles or H-piles of sizes required to contain lagging, sheeting, or planking as indicated.

C. Steel Sheet Piling: ASTM A328, continuous interlocking type, of sizes indicated on approved Shop Drawings, with suitable handling holes.

D. Timber: Structural grade lumber with a minimum fiber stress in bending of 1100 psi.
   1. Lagging: Heavy timber boards or planking of sizes indicated on approved Shop Drawings. Lagging boards or planking shall be secured and contained in place by H-piles (soldier piles), with boards inserted in the recesses between the H- flanges.
   2. Posts, Struts, and Walers: Heavy timber posts, beams, stringers, and planking, as required, of sizes indicated on Shop Drawings.

3. Preservative Treatment: Wood members required to be left permanently in place shall be pressure-treated with preservative material in accordance with AWPA C3.

E. Concrete: Refer to Section 03 10 00 - Concrete Forming and Accessories, Section 03 20 00 - Concrete Reinforcing, and Section 03 30 00 - Cast-In-Place Concrete for requirements. Provide Class 4000psi concrete with a minimum cement content of 6.5 sacks per cubic yard unless otherwise indicated. Lean concrete, where indicated, shall conform to requirements of Section 03 30 00 - Cast-In-Place Concrete.

F. Tiebacks:
1. Steel Bars or Rods: ASTM A615, Grade 60, threaded steel bars or bars conforming to requirements of ASTM A722 or ASTM F432, as applicable of sizes indicated on approved Shop Drawings. Provide complete with header or face plates conforming to ASTM A36 where required, nuts conforming to ASTM A563, and washers conforming to ASTM F436, as indicated or required.
2. Wire Strands: Single-strand or multiple-strand galvanized steel wire conforming to ASTM A416 or ASTM A586, as appropriate.
3. Grout: Pumpable concrete, with minimum compressive strength at 28 days of 4,000 psi. Concrete mix shall contain 6.5, 94-pound sacks of cement per cubic yard minimum. Aggregate size shall be commensurate with the space being filled. Comply with requirements of Section 03 30 00 - Cast-In-Place Concrete, as applicable.

2.3 SOIL ANCHORS

A. Product Standards: Comply with applicable requirements of PTI Post-Tensioning Manual, Chapter 4, Article 4.5, Soil Anchors. Provide soil anchors complete with stressing anchorage and bearing plates, sheathing and pre-stressing steel, grout and grout tube (if required), and the required drilling equipment.

B. Bars: ASTM A722 deformed pre-stress threadbars, with a minimum ultimate tensile strength of 150 ksi.

C. Wire Strand: ASTM A416, Grade 270, low relaxation, seven-wire stress-relieved strand, with ultimate tensile strength of 270 ksi.

D. Anchorage Grout: Portland cement, aggregate, water, and a manufactured non- corrosive expansive admixture, of suitable aggregate size and consistency for pressure grouting. Grout shall develop a minimum compressive strength at 28 days of 4,000 psi. The Contractor may substitute a high-strength, non-shrink, nonmetallic cementitious grout conforming to applicable requirements of Section 03 60 00 - Grouting.

2.4 SOIL MIX WALL SYSTEM

A. Soldier Piles: As specified above in Article 2.05.A, as applicable.

B. Materials and Equipment: Provide all materials and special equipment as required to perform the auguring, mixing, and grout injection and to complete the soil-mix wall system.

PART 3 - EXECUTION

3.1 DETECTION OF MOVEMENT

A. For each existing structure or facility within a zone extending upward from the bottom of the excavation on a slope of 2 horizontal to 1 vertical, install settlement detection devices on each footing, foundation, wall, or other feature to be monitored. Settlement detection devices shall be capable of being read to an accuracy of 0.005 foot.

B. Take and record readings not less than once per week during performance of the work.

C. Stop work; notify the Engineer, and take immediate remedial action if movement of the existing structure occurs during performance of the work. All construction activities shall be immediately halted when the settlement of any structure or facility reaches 0.3 inch, and shall not be resumed until after implementation of approved remedial measures.

D. Upon completion of the work, take weekly readings of the measurement points for a period of 4 weeks, or longer if movement persists, and report the results to the Engineer.

3.2 INSTALLATION REQUIREMENTS

A. Install excavation support systems for safety and preservation of existing improvements. Excavation support systems shall consist of structures designed by the to support the various excavations.

B. Construct support systems in accordance with approved Shop Drawings and in a manner that will ensure that supported faces will be stabilized. Provide for additional soil pressure caused by adjacent surcharge loads.

C. Welding and welder's qualifications shall conform with applicable requirements of Section 05 12 00 - Structural Steel Framing.

D. No part of the excavation support systems that will remain permanently in place shall be placed or allowed to deflect within the limits of permanent structures.

E. Piles and vertical members of excavation support systems shall be within 1.0 percent of plumb and within 2 inches of the plan location indicated on approved Shop Drawings.

F. Install lagging members as indicated and in a manner which will prevent loss of soil. Wedge lagging members against undisturbed earth or place compacted fill or slurry fill into voids behind lagging.

G. Do not use combustible waste or similar material for packing or soil retention in excavations.

3.3 INSTALLATION OF SOLDIER PILES AND LAGGING

A. Provide pre-bored holes for soldier piles adequate to accommodate pile sections indicated. Extend holes to depth below level of adjacent sub grade as necessary to provide firm bearing. Piles may be

driven below the bottom of the invert of the completed structure if soil conditions are favorable for the intended purpose.

B. After a pile has been seated plumb in the pre-bored hole, encase it with lean concrete from the bearing tip to level of adjacent sub grade excavation.

C. Provide timber lagging or reinforced precast concrete members, secured in place to soldier piles, contained in the recesses between the H-flanges. Install lagging horizontally with no gaps between boards or precast members.

D. As installation progresses, backfill voids between excavation face and lagging with sand or soil rammed into place. Provide drainage matting or burlap where necessary to allow drainage of ground water without loss of soil or sand packing.

E. If unstable material is encountered during excavation, take suitable measures to contain such material in place and to prevent soil displacement.

3.4 INSTALLATION OF SHEET PILING

A. Drive sheet piles in plumb position, with each pile interlocked with adjoining pile for its entire length so as to form a continuous diaphragm throughout the length of each run of wall. Drive to depth indicated.

B. Provide driving method so that interlocking members can be extracted, if required, without injury to adjacent fills.

C. Do not drive piles within 100 feet of concrete less than seven days old.

D. Methods of driving, cutting, and splicing shall conform with approved Shop Drawings and procedures.

3.5 SUPPORT SYSTEMS WITH BRACING AND TIEBACKS

A. Requirements: Provide walers, struts, rakers, shores, and tie-backs as necessary to support excavation faces retained by posts, or soldier piles.

B. Internal Bracing:
   1. Provide walers where required, at each level of bracing. As excavation proceeds, place walers on open face of support system wall. Wedge, drypack, and otherwise provide tight bearing between walers and support system wall, with ample bearing areas to provide uniform transfer of loads.
   2. Provide struts with intermediate bracing as needed to enable struts to carry the design load without distortion or buckling.
   3. Provide diagonal bracing as needed for stability of the system.
   4. Include web stiffeners, plates, angles, or bracing as needed to prevent rotation, crippling, or buckling of connections and points of bearing between structural members. Allow for eccentricities caused by field fabrication and assembly.
   5. Install and maintain internal bracing support members in tight contact with each other and with the surface being supported.

6. Design internal bracing support members for maximum loads which may occur during excavation and removal stages.

C. Tie-Backs:
1. Provide tie-back anchorage system as indicated or required. Install tie-back system in accordance with approved Shop Drawings.
2. Tie-backs shall not extend beyond the Metro-North Railroad right-of-way and easement properties, except as specified in Article 1.06.D.3. herein.
3. Install manufactured tie-back or anchorage systems in accordance with the manufacturer's instructions.
4. Stress installed tie-backs to proof loads indicated on approved Shop Drawings. Tie-backs which lose more than five percent of applied proof loads or deflect more than 6 inches shall be reinforced and strengthened to withstand applied proof loads.
5. Apply proof loads as herein specified, and provide means to measure each load application within an accuracy of plus or minus five percent.
6. After load-test approval, reduce tie-back proof load to the design load, and encase tie-back anchorage and bars or rods in grout, lean concrete, or compacted backfill, as indicated, maintaining the design load until tie-backs are fixed in place. Provide a method of fixation that will limit the load loss to not more than five percent of the design load in the transfer of loads from the jacks to the support system.

D. Proof Loading:
1. Perform proof loading of internal bracing members and tie-backs, including struts, shores, and similar members. Employ procedures that will produce uniform loading on bracing members and tie-backs without inducing eccentricities or overstressing and distortion.
2. Perform and accomplish proof loading by approved load testing or jacking procedures. Submit detailed Shop Drawings of proposed load testing and jacking procedures.
3. Apply proof loads as soon as possible after bracing and tie-backs are installed in accordance with methods, procedures, and sequences as indicated on approved Shop Drawings.
4. Coordinate excavation work with installation of bracing and tie-backs and with the application of proof loading. Provide steel shims and wedges, welded or bolted in place, to help maintain the proof-loading force on the bracing and tie-backs after release of load-testing pressures.

E. Creep Tests on Tie-Backs:
1. Load test tie-backs for creep at each level of support in the excavation, at the first installation on each side of the excavation, at horizontal intervals not exceeding 500 feet, and wherever a significant change occurs in the soil in which the tie- backs are anchored.
2. Perform a 24-hour load test on one out of each 100 tie-back anchors. Perform tests by applying the proof load and maintaining it constant for 24 hours.
3. Keep records of axial movement with incremental applications of the load, and the amount and time of load fall-off with no pumping of the jack or axial movement during the 24-hour period that the proof load on the anchor is maintained.
4. Redesign the tie-back system to attain specified limits if, during the 24-hour period, the axial deformation of the tie-back system exceeds 0.20 inch, or the decrease in jack pressure without pumping is more than five percent after correcting for temperature changes.

3.6 SOIL ANCHORS

A. Requirements: Provide soil anchors for all locations indicated on approved Shop Drawings. Soil anchors may be used for tie-backs specified in Article 3.05 herein as appropriate.

B. Installation and Testing Standards: Soil anchors shall be installed and tested in accordance with applicable requirements of PTI Post-Tensioning Manual, Chapter 4, Article 4.5, Soil Anchors.

C. Installation:
   1. Angle tolerances shall be within one degree of those indicated on approved Shop Drawings.
   2. Deviation from planned orientation shall be no more than 2 inches in 10 feet.
   3. Drilling of anchor holes shall be by a proven system that utilizes a hollow stem auger or other approved method as appropriate for the soil conditions.
   4. Clean or redrill any hole that caves, sloughs, or otherwise does not provide suitable anchorage.
   5. Use spacers or sheathing to ensure that anchor tendons do not contact wall of drill hole. Maintain at least 2 inches of grout space around each tendon.
   6. Do not extend adjustment screws on cross braces or centerhole jacks used for loading soil anchors beyond manufacturer's recommendations or two-thirds of threaded length, whichever is more restrictive.
   7. Each jack used to stress tendons shall be equipped with a pressure gage for determining the jacking load applied to the tendon. Pressure gages shall have an accurate reading dial at least 4 inches in diameter or a clearly readable digital display.
   8. The tensioning process shall be conducted so that the tension being applied and the elongation of the pre-stressing steel may be measured at all times. A record shall be kept of gage pressures, elongations, and anchorage seating values and shall be submitted for record as specified in Section 01 70 00 - Closeout Submittals.
   9. Grout shall be injected at the lowest part of the anchor. Grout may be placed through the stem of the auger, through grout hoses, tubes, or pipes. Non-rigid hoses shall be attached to the lower end of the anchor with a break-away attachment that permits the hose to be removed as grout is placed. Pump pressure shall be maintained as grout hose or tube is removed.
   10. Locate soil anchors so as not to damage or destroy active utility facilities. Any deviation shall obligate the Contractor to repair, replace, or otherwise restore such damage to the satisfaction of the utility owner.

D. Tests: Test each soil anchor after being grouted for its entire bond length and after grout has attained a minimum compressive strength of 3000 psi. One anchor or one percent of anchors in any wall section, whichever is greater, shall be designated as a performance test anchor. Performance test anchors shall be installed and tested prior to placement of production anchors. All production anchors shall be proof tested.

3.7 SOIL MIX WALLS

A. Design and construct soil-mix walls as indicated or required. Construct walls in the ground without excavating and replacing the existing soils. Existing soils shall be mixed in place with cement grout, produced by multiple-shaft auguring equipment, forming a row of overlapped soil-cement columns or piers that make the wall. Install regularly spaced H-piles for wall reinforcement as indicated on approved Shop Drawings. Carry toe of wall and H-piles at least 3 feet below design sub grade.

3.8 REMOVAL OF EXCAVATION SUPPORT SYSTEMS

A. If removal is required wholly or in part, perform such removal in a manner that will not disturb or damage adjacent buildings, structures, construction, or utilities. Fill voids immediately with lean concrete or with approved backfill compacted to the relative compaction for the location as specified in Section 31 20 00 – Earth Moving.

B. Excavation support systems shall be left in place until the concrete walls and structures to receive the transferred loading from the removed support system have reached 100 percent of the specified compressive strength at 28 days. Demonstrate with strength test results that the concrete has reached the specified strength before load transfer from the support system to the concrete structure may be performed.

C. Soil-mix walls shall be left in place.

D. Remove from the site all elements of excavation support systems to the following minimum depths below the level of surfaces to be constructed or restored:
   1. Between intersection of cross streets: 6 feet.
   2. Across intersection of cross streets: 8 feet.
   3. At temporary access ramps: 8 feet.

E. Repair damage to properties resulting from removal work.

3.9 RESTORATION

A. Restore existing structures to conditions equivalent to those existing prior to the start of work, including repair of settlement-related damage.

END OF SECTION

DIVISION 32
EXTERIOR IMPROVEMENTS

SECTION 32 11 00 - BASE COURSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:
   1. Section 01 33 00 - Submittal Procedures.
   2. Section 01 41 00 - Regulatory Requirements.
   3. Section 01 43 00 - Quality Assurance.
   4. Section 31 10 00 - Site Clearing.
   5. Section 31 20 00 - Earth Moving.
   6. Section 32 12 00 - Flexible Paving.

1.2 SUMMARY

A. This Section specifies requirements for furnishing, placing, and compacting:
   1. Subbase courses.
   2. Base Courses.

1.3 REFERENCES

A. Abbreviations and Acronyms:
   1. BUD: NYSDEC beneficial use determination.
   2. NYSDEC: New York State Department of Environmental Conservation.
   3. NYSDOT: New York State Department of Transportation.
   4. RAP: Reclaimed asphalt pavement.
   5. RCA: Recycled concrete aggregate.

B. Definitions:
   1. Elongated Particle: A flat or elongated particle is one that has its greatest dimension more than 3 times its least dimension.

C. Reference Standards:
   1. American Association of State Highway Transportation Officials (AASHTO):
      a. AASHTO T 89 - Standard Method of Test for Determining the Liquid Limit of Soils.
      b. AASHTO T 90 - Standard Method of Test for Determining the Plastic Limit and Plasticity Index of Soils.
      c. AASHTO T 99 – Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-1b) Rammer and a 305-mm (12-in.) Drop.
      d. AASHTO T 146 - Standard Method of Test for Wet Preparation of Disturbed Soil Samples for Test.

e. AASHTO T 191 - Standard Method of Test for Density of Soil In-Place by the Sand-Cone Method.
f. AASHTO T 224 - Standard Method of Test for Correction for Coarse Particles in the Soil Compaction Test.

2. ASTM International (ASTM):
   a. ASTM C88 - Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
   b. ASTM C117 - Standard Test Method for Materials Finer than 75-µm (No.200) sieve in Mineral Aggregates by Washing.
   c. ASTM C131 - Standard Test Method for Resistance to Degradation of Small- Size coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
   d. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   e. ASTM D75 – Standard Practice for Sampling Aggregates.
   f. ASTM D448 – Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
   g. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN- m/m^3)).
   h. ASTM D2922 - Standard Test Methods for Density of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth).
   i. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
   j. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
3. State of New York:
   a. Official Compilation of the Rules and Regulations of the State of New York (NYCRR).
      1) 6NYCRR Part 360 - Solid Waste Management Facilities.
      2) 16 NYCRR Part 753 - Protection of Underground Facilities.
   b. New York State Department of Transportation (NYSDOT):
      1) NYSDOT Standard Specifications (U.S. Customary Units). https://www.dot.ny.gov/main/business-center/engineering/specifications.
      2) New York State Standard Sheets (U.S. Customary Units). https://www.dot.ny.gov/main/business-center/engineering/cadd-info/drawings/standard-sheets-us.
4. United States Government:
   a. Occupational Safety and Health Administration (OSHA):
      1) 29 CFR 1910 Occupational Health and Safety Standards.
      2) 29 CFR 1926 Safety and Health Regulations for Construction.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Notify utilities prior to all excavations.
   2. Do not interfere with persons, firms, corporations, or utilities, removing, changing, replacing, or employing protective measures at their property or structures.
      a. Allow these persons, firms, corporations, or utilities to take such measures as they may consider necessary or advisable under the circumstances.

b. Cooperate fully with the owners of underground and overhead utilities when utility removal or rearrangement operations are in progress to ensure reasonable progress, minimize duplication of operations, and eliminate unnecessary interruption of services.
c. Measures employed or not employed by these entities do not relieve the Contractor of his responsibilities.

1.5 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Special Inspections:
a. Under the Building Code of New York State, special inspections by the code-required Approved Agency may be necessary to obtain approval of the Work of this Section.
b. Code-Required Approved Agency for Performing Special Inspections:
1) To perform the special inspections required by the Building Code of New York State, the Engineer acting as Metro-North's agent will employ an independent Approved Agency.
2. Testing and Inspection Agency:
a. To perform testing and inspections not considered special inspections by the Building Code of New York State, employ an independent Testing Laboratory.

B. Qualifications:
1. Testing Laboratory's Qualifications:
a. To perform testing and inspections required by this Section, employ a Testing Laboratory having the qualifications specified in Section 01 43 00, Quality Assurance.
b. Submit the Testing Laboratory's qualifications to the Engineer for approval.

C. Certifications:
1. Subbase Certificate of Compliance:
a. Submit certification from the source of subbase materials indicating that the subbase material meets NYSDOT requirements for Type 1 or Type 2 subbase.

1.6 SUBMITTALS

A. Action Submittals:
1. Submit the following to the Engineer for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:
a. Product Data:
1) Subbase course material.
2) Subbase gradation.
b. Certificates:
1) Subbase Certificate of Compliance.
c. Qualification Statements:
1) Testing Laboratory's qualifications.

B. Informational Submittals:
1. Submit the following to the Engineer for information in accordance with the requirements of Section 01 33 00, Submittal Procedures:

a. Source Quality Control Submittals:
   1) Source of subbase material.
   2) Samples of for each material for preliminary testing or certificates.
b. Site Quality Control Submittals:
   1) Plasticity Index Test Results.
   2) Magnesium Sulfate Soundness Test Results.
   3) Relative Compaction Test Results.
   4) Gradation Test Results.
   5) Moisture Density Test Results.
   6) Compaction Test for Crushed Aggregate Results.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
   1. Transport aggregate base in suitable vehicles with covers to prevent stray particles from falling off the vehicles onto the streets.

B. Storage and Handling Requirements:
   1. Stockpiling:
      a. Stockpile subbase material except as specified herein.
         1) Stockpile gravel.
      b. Stockpiling reclaimed bituminous material for Type 1 Subbase Alternate C is not required.

1.8 SITE CONDITIONS

A. Ambient Conditions:
   1. Do not perform excavating, backfilling, or compacting operations when either weather conditions or the condition of the materials are such, in the opinion of the Engineer, that the work cannot be performed satisfactorily.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Suitable Material:
   1. Provide suitable material conforming to the material requirements of Section 203 of the NYSDOT Standard Specifications and to the requirements specified herein.
      a. If glass is furnished, furnish glass conforming to the requirements of Section 203.
      b. If recycled concrete aggregate (RCA) is furnished, submit documentation showing that the material obtained is from a New York State Department of Environmental Conservation (NYSDEC) registered or permitted construction and demolition (C&D) debris processing facility as specified in section 360-16.1 of 6NYCRR Part 360.
      c. If blast furnace slag is furnished, submit documentation showing that the material has undergone a NYSDEC beneficial use determination (BUD) prior to its use as specified in section 360-1.15 of 6NYCRR Part 360.

B. Subbase:
1. Provide subbase courses consisting of either NYSDOT Type 1 or NYSDOT Type 2 subbase as specified in section 304 of the NYSDOT Standard Specifications and herein.
2. NYSDOT Type 1 Subbase:
a. Furnish materials consisting of approved blast furnace slag, stone, sand, and gravel, or blends of these materials with not more than 30 percent by weight of glass; or one of the following alternates:
1) Type 1 Subbase Alternate A:
a) Furnish subbase consisting of at least 95 percent, by weight, of recycled concrete aggregate (RCA), and free from organic and other deleterious material.
b) This Type 1 Subbase material may contain up to 5 percent, by weight, of asphalt and/or brick.
2) Type 1 Subbase Alternate B:
a) Furnish subbase consisting of a mixture of recycled concrete aggregate (RCA) complying with the requirements specified for Type 1 Subbase Alternate A mixed with stone, sand, gravel, or blast furnace slag.
b) This Type 1 Subbase material may contain up to 5 percent, by weight, of asphalt and/or brick.
3) Type 1 Subbase Alternate C:
a) Furnish subbase consisting of at least 95 percent, by weight, of bituminous material reclaimed from bituminous pavement and/or shoulders (RAP), well-graded from coarse to fine so at the time of placement it has a maximum top size of 50 mm, and free from organic or other deleterious material, including tar.
b) The gradation requirements specified in this Section do not apply when the material consists of RAP.
c) No soundness or Plasticity Index testing is required for this Type 1 Subbase Alternate C.
3. NYSDOT Type 2 Subbase:
a. Furnish NYSDOT Type 2 Subbase materials consisting of approved blast furnace slag or of stone that is the product of crushing or blasting ledge rock, or a blend of blast furnace slag and of stone.
b. If, in the opinion of the Engineer, the NYSDOT Type 2 Subbase material becomes unstable during construction, it may be necessary to add a mixture of natural suitable material to the RAP at no increase in the Contract Price.
1) Acceptance of the final product will be based on an evaluation by the Engineer.
4. Gradation (Job Mix):
a. Provide material consisting of particles where not more than 30 percent, by weight, of the particles retained on a 1/2-inch sieve is flat or elongated.
1) Acceptance for this requirement will normally be based on a visual inspection by the Engineer.
2) If the Engineer elects to test the subbase, greater than 30 percent flat or elongated material will be rejected.
b. Provide continuously and well graded subbase material when tested in accordance with ASTM C117 and ASTM C136, and having the gradation indicated in Table 32 11 00-1.

Table 32 11 00-1 Subbase Gradation

Sieve Size Designation (Square Openings)	Design Range Percentage by Weight Passing Sieve	
	NYSDOT Type 1	NYSDOT Type 2
4-inch	-	-
3-inch	100	-
2-inch	90 – 100	100
1/4-inch	30 – 65	25 - 60
40	5 – 40	5 - 40
200	0 – 10	0 - 10

5. Plasticity Index:
   a. Furnish subbase so its material passing the 40-mesh sieve has a Plasticity Index of 5.0 or less when tested in accordance with the requirements of AASHTO T 146 Method A (Wet Preparation), AASHTO T 89, and AASHTO T 90.
6. Soundness:
   a. Unless material meeting the requirements of Type 1 Subbase Alternate C is used, furnish subbase having 20 percent or less magnesium sulfate soundness loss after 4 cycles in the Los Angeles abrasion machine as determined in accordance with Grading B as specified in ASTM C131.
7. Submit the gradation and Product Data for material furnished in the subbase to the Engineer for approval.
   a. If glass, blast furnace slag, and/or recycled asphalt product (RAP) is provided, submit Product Data documentation to the Engineer for approval.

C. Base Course:
1. Aggregate:
   a. Provide crushed aggregate complying with the requirements specified herein unless the use of a different type of material is specifically authorized on the Contract Drawings.
   b. Crushed Aggregate:
      1) Provide clean, hard, sound, and durable crushed stone, rock, or gravel or a combination thereof; and which has the following additional properties:
      2) Provide crushed aggregate uniform in quality, and free of soft, friable, thin elongated, or laminated pieces; disintegrated material; organic material; oil, alkali, and other deleterious substances.
         a) Gradation (Job Mix):
            (1) Provide continuously and well graded crushed aggregate when tested in accordance with ASTM C117 and ASTM C136, and having the gradation indicated in Table 32 11 00-2.

Table 32 11 00-2 Crushed Aggregate Gradation

Sieve Sizes (Square Openings)	Design Range Percentage by Weight Passing Sieve		
	Type A	Type B	Type C
3 inches	100	-	-
2 inches	-	-	-
1-1/2 inches	-	100	-
1-1/4 inches	-	-	100
1 inch	-	-	-
3/4 inch	-	-	-
Number 4	30-75	30-70	38-65
Number 8	20-60	20-60	25-60
Number 30	10-40	10-40	10-40
Number 200	0-12	0-12	3-12

(2) Special Gradation Requirements:

b) When crushed rock is required, provide material with at least one rough, angular surface produced by crushing; and a gradation complying with the requirements of ASTM D448.

c) For sizes 3/4 inch or larger maximum sizes, the portion of the material retained on a No. 4 sieve must be 50 percent by weight.

d) For sizes less than 3/4 inch, the portion of the material retained on a No. 8 sieve must be 50 percent by weight.

(3) When gravel is required, provide material having particles that are fully or partially rounded and water-worn.

e) Crushed rock obtained by crushing rock which exceeds the maximum gradation sizes specified in ASTM D 448 may be combined with gravel provided it is uniformly distributed throughout and blended with the gravel.

f) Plasticity Index:

(4) Unless otherwise indicated, provide material having a plasticity index not more than 5 when tested in accordance with the requirements of AASHTO T 146 Method A (Wet Preparation), AASHTO T 89, and AASHTO T 90.

g) Soundness:

(5) Provide crushed aggregate having a percentage of wear not exceeding 40 after 500 revolutions in the Los Angeles abrasion machine as determined in accordance with Grading B as specified in ASTM C131.

2.2 SOURCE QUALITY CONTROL

A. Tests and Inspections:
   1. Except when materials will be provided from a previously approved source, notify the Engineer of the source of aggregate in writing at least 10 Days in advance of delivering the material to allow sufficient time for required material acceptance testing.
      a. Submit the source of subbase material to the Engineer for approval.
   2. Prior to the start of production, at the start of production, and at intervals during production, submit Samples of each material for preliminary testing to the Testing Laboratory for testing and as the basis for approval of specific lots of aggregates.
      a. The Engineer will determine the sampling points and intervals.
   3. In lieu of material testing, the Engineer may accept certified test results from the State that indicate the aggregate complies with the specified requirements.

B. Non-Conforming Work:
   1. Correct deficiencies uncovered by the measurements or Samples.

C. Coordination of Other Tests and Inspections:
   1. Notify the code-required Approved Agency responsible for performing special inspections when aggregate base for this Contract is being placed and/or tested.
   2. Cooperate with the code-required Approved Agency when they are performing required material verifications and other special inspections.
      a. Provide full access to the Work.

PART 3 - PRODUCTS

3.1 EXAMINATION

A. Verification of Conditions:
   1. Inspect the Site to verify existing conditions, and take field measurements to ensure the proper fit of the finished Work.
   2. Underground Utilities:
      a. Comply with applicable requirements of OSHA, the State of New York statutes, especially NYCRR 16 Part 753 regarding Underground Utilities, and the Local General Construction Code.
         1) At least 2 to 10 days prior to the start of digging or excavation Work not counting the day of the call prior to the start of digging or excavation Work, contact Dig|Safety.New York at 1-800-962-7962 or 811 to arrange for underground utility owners to locate and mark their underground utilities.

B. Pre-Installation Testing:
   1. Ensure that substrates are in suitable condition to receive the work.
   2. If it is evident that the subgrade is pumping at any time prior to placing overlying material onto the subgrade, the Engineer may at no increase in Contract Price require proof rolling with a pneumatic-tire roller or other approved equipment in order to identify the limits of the unacceptable area.
   3. After completion of excavations other than utility excavations, and prior to scarification and compaction of the subgrade, proof-roll the excavation surface to detect soft or loose zones.

a. Notify the Engineer if any soft or loose zones are encountered during the proof-rolling.

C. Evaluation and Assessment:
1. Notify the Engineer of unexpected subsurface conditions, and discontinue working in the affected area until notified to resume work.
2. If unexpected active underground facilities are encountered during the performance of the Work, immediate notify the Engineer.

3.2 PREPARATION

A. Protection of In-Place Conditions:
1. Exercise extreme caution to prevent debris from falling into manholes or other structures.
a. In the event that debris should fall into a structure, remove it immediately.
2. Dust Control:
a. Comply with the requirements specified in the Fugitive Dust Plan specified in Section 01 41 00 for protecting adjacent properties.
b. Provide effective dust control measures on the Site to prevent the spread of dust during earth moving operations.
c. Thoroughly moisten excavation areas by dampening the soil, or employ other similar methods as approved by the Engineer.

B. Surface Preparation:
1. Subgrade:
a. With the exception of areas where new construction is required and compacted fills have been constructed, adjust the moisture content of the subgrade to that required for compaction by adding water, by adding and blending in dry suitable material, or by drying the existing material as required.
1) Maintain the proper subgrade moisture content until the subgrade is compacted and the overlying material is placed.
b. Correct ruts and soft yielding places caused by improper drainage conditions, hauling, or other causes before placing the base course.

C. Demolition / Removal:
1. Strip and properly dispose of unsuitable material in the area of the required subgrade including removing existing pavement and obstructions such as stumps, roots, rocks, and similar items from the subgrade area.
a. Clear and grub unpaved subgrade area in accordance with the requirements of Section 31 10 00, Site Clearing.
b. Demolish existing pavement where indicated on the Contract Drawings, and properly dispose of demolition debris off-site unless otherwise allowed by the Engineer.
1) Remove existing pavement under proposed median islands.

3.3 INSTALLATION

A. Subbase:
1. Furnish, place, and compact the subbase course of the proper Type to the lines, grades, thicknesses, and typical sections indicated in the Contract Documents.

a. Provide subbase material the Contractor is capable of placing and fine grading to the required tolerances.

2. Should the subbase course become unstable at any time prior to the placement of the overlying course, correct the unstable condition to the satisfaction of the Engineer at no increase in the Contract Price.
   a. Perform any required modification prior to placing the material on the grade.
3. Relative Compaction:
   a. Remove soft, loose, and disturbed materials; replace them with acceptable materials; and compact the replacement material as directed by the Engineer.
      1) If soft or loose zones are found under proposed slab, pavement, or foundation areas, excavate the soft or loose material to a depth reviewed in advance by the Engineer, then fill with structural fill as specified in Section 31 20 00, Earth Moving, and compact as specified for such fill.
      2) After adjusting the moisture content to that required for compaction, scarify and loosen the subgrade to a depth of at least 6 inches.
      3) Below future slabs, pavements, and foundations, scarify the exposed native and pre-existing fill subgrade soils to a depth of 8 inches.
      4) In areas where fill material is required, a layer of approximately 3 inches of the fill material may be spread and compacted with the subgrade material to provide a better bond.
   b. Compact the material to the relative density specified.
      1) Construct the cut and fill areas to achieve a uniform soil structure having the minimum dry density specified in Table 32 11 00-3 when the compaction is tested in accordance with Method A in AASHTO T 99 and AASHTO T 191, or with ASTM D2922 and ASTM D3017.
   c. Adjust the minimum dry density percent obtained from AASHTO T 99 in accordance with the coarse particle correction procedures specified in AASHTO T 224 for maximum density determination, to compensate for the rock content larger than that which will pass a Number 4 sieve.

Table 32 11 00-3 Minimum Dry Density Required

Location	Minimum Dry Density
Subgrade under pavement	100 percent
Subgrade under curbs, gutters, and sidewalks	90 percent

4. Grading in Areas Not to be Paved:
   a. Where grade only is called for on the Contract Drawings, grade the area to meet the tolerances for the subgrade where subbase or base material is to be placed.
   b. Construct the surface to a straight grade from the finished pavement elevations shown on the Contract Drawings to the elevation of the existing ground at the extremities of the area to be graded.
5. Grading in Areas to be Paved:
      1) Where pavement or structures are called for on the Contract Drawings, grade the area in an orderly sequence, placing base course directly following the grading.

2) Do not allow grading operations to precede base course placement by more than 1200 feet unless otherwise specifically approved by the Engineer.
3) At the end of each day's operations, place the first lift of base course no more than 300 feet behind the finished subgrade area.
a) Do not allow drop-offs on opposite sides of pavement at the same time.
b) When excavating for concrete work, such as curb, gutter, or sidewalk, place the excavated material in uniform windrows that do not interfere with property access or traffic flow in streets.

B. Base Course:
1. Prior to placing aggregate base course materials, properly prepare the subgrade as specified herein.
a. Verify that the subgrade has been properly prepared to receive the aggregate base course.
2. Place base course material in lifts to provide a course to the lines, grades, dimensions, moisture, density, and typical sections as indicated in the Contract Documents.
a. Aggregate base course measuring 6 inches or less in compacted thickness may be placed in a single layer.
b. Deliver the aggregate to the roadbed as a uniform mixture, and spread the aggregate in one operation.
c. Avoid segregation of the material into pockets of fine and coarse material.
3. Aggregate base course measuring more than 6 inches in compacted thickness must be built up from successive layers, each of approximately equal compacted thickness not to exceed 6 inches per layer.
a. Clean previously constructed layers of loose and foreign material prior to placing the next layer.
4. After distributing the aggregate base course, water the material and, immediately thereafter, blade the material to a uniform layer that will net the required thicknessafter compaction.
a. Apply a quantity of water that will assist compaction, taking care to avoid wetting the subgrade or any lower base course during the watering operation to an extent that is detrimental to the Work.
1) Moisture condition the material within the range of plus or minus 2 percent of optimum moisture, and compact the material to a dry density greater than 95 percent of maximum dry density as determined in accordance with the requirements of ASTM D 1557.
b. Keep the surfaces of the compacted material in lower layers moist until the material is covered by the next layer.
c. If the materials deposited are not uniformly blended together, continue the blading operation as necessary to eliminate segregation.
5. Compact the material to assure a compacted relative density of 100 percent as determined using the methods and other criteria defined in this Section.
6. Upon completion of the entire operation, the base surface must be true, even, uniform, and conform to the grade and cross-section specified or shown on the Contract Drawings.
a. Finish the base course by blading the surface of the aggregate base course using equipment designed especially for this purpose.

C. Special Techniques:
1. Excavation Safety:
a. Sole responsibility for making all excavations in a safe manner is the Design-Builder's.
b. Provide suitable protection against bodily injury.

D. Tolerances:
1. Subgrade Tolerances
a. Subgrade upon which pavement, sidewalk, curb and gutter, driveways, or other structures are to be directly placed may not vary more than 1/4 inch from the specified grade and cross-section.
b. Subgrade upon which subbase or base material is to be placed may not vary more than 3/4 inch from the specified grade and cross- section.
c. Variations within these specified tolerances must be compensating so that the average grade and cross-section specified are met.
2. Base Course Tolerances:
a. Finished Surface Tolerance:
1) The finished surface of the aggregate base course may not vary more than 1/2 inch above or below required grade and cross-section when tested with a 16-foot straightedge applied parallel with and at right angles to the centerline.
2) Do not add thin layers of material to the top layer of base course to meet the specified grade.
3) If the elevation of the top layer is 1/2 inch or more below grade, scarify the top layer of the base to a depth at least 3 inches, add new material, and blend and re-compact the material to bring it to grade.
4) If the finished surface is above the design grade, cut the material back to grade and re-roll the surface.
b. Thickness Tolerance:
1) The completed thickness of the aggregate base course may not vary more than 1/2 inch of the design thickness.
c. Moisture Content Tolerance:
1) During placing operations, the moisture content of the material may not vary by more than 1-1/2 percentage points from the optimum moisture content as determined in accordance with the requirements specified in ASTM D 1557.

3.4 REPAIR/RESTORATION

A. Restore to their original condition those portions of the Site not designated for alteration.

3.5 SITE QUALITY CONTROL

A. Site Tests and Inspections:
1. During the period when aggregate base is being placed, the Testing Laboratory and the code-required Approved Agency must perform routine and other testing of materials.
a. Advise the Testing Laboratory and code-required Approved Agency sufficiently in advance of operations to allow testing personnel to be assigned and to provide sufficient time for quality tests to be performed and completed.
b. The Testing Laboratory and the code-required Approved Agency will perform additional materials testing due to changes in materials or proportions requested by the Contractor or testing required due to failure of material to meet specified requirements.
c. Failure of the Testing Laboratory or the code-required Approved Agency to detect defective work will not prevent its rejection later when the defect is discovered, neither does it obligate the Engineer or Metro-North to grant final acceptance of the Work.

2. Keep testing results on file at the Site, and submit copies of the test results to the Engineer for information.

B. Site Tests:
1. Plasticity Index Test:
   a. Test Procedure:
      1) Have the Testing Laboratory test the Plasticity Index of the materials performed in accordance with the method specified in ASTM D4318.
   b. Acceptance Criteria:
      1) Materials complying with the requirements specified are acceptable.
2. Magnesium Sulfate Soundness Test:
   a. Test Procedure:
      1) Have the Testing Laboratory test the Magnesium Sulfate Soundness of the subgrade performed in accordance with the method specified in ASTM C88.
   b. Acceptance Criteria:
      1) Materials complying with the requirements specified are acceptable.
3. Relative Compaction Test:
   a. Test Procedure:
      1) Have the Testing Laboratory test the relative density of the subgrade compaction performed in accordance with Method A in AASHTO T 99 and AASHTO T 191, or with ASTM D 2922 and ASTM D 3017.
   b. Acceptance Criteria:
      1) Subgrade compaction having the at least the minimum dry density specified in Table 32 11 00-3 is acceptable.
4. Gradation Test:
   a. Test Procedure:
      1) Have the Testing Laboratory perform Gradation Tests on samples taken from material delivered to the Site at a rate of 1 test for each 300 tons placed, or once a day, whichever is greater.
      2) Sampling will be performed in accordance with the requirements specified in ASTM D 75.
      3) Testing will be performed in accordance with the requirements specified in ASTM C 117 and ASTM C 136.
   b. Acceptance Criteria:
      1) The average value of individual gradation tests for all sieve size determinations must comply with the specified gradations within plus or minus 8 percent for sieves larger than No. 4, within plus or minus 5 percent for sieves No. 30, and within plus or minus 3 percent for sieves No. 200.
5. Moisture Density Test:
   a. Test Procedure:
      1) Have the Testing Laboratory perform Moisture Density Tests on samples taken from material delivered to the Site at a rate of 1 test for each 300 tons placed, or once a day, whichever is greater.
   b. Acceptance Criteria:
      1) Material represented by the samples will be acceptable if the compaction meets the specified moisture density criteria.
6. Compaction Test for Crushed Aggregate:
   a. Test Procedure:
      1) Have the Testing Laboratory perform Compaction Tests at a rate of 1 test for each 500 square yards per lift placed.

2) Testing will be performed as specified in ASTM D 2922 and ASTM D 3017

b. Acceptance Criteria:

1) Areas represented by the tests will be acceptable if the compaction meets the specified compaction criteria.

7. Inspections:

a. When it is believed a deficiency in thickness, or an excess of plasticity exists, take measurements or samples in the same pattern as that defined in Section 32 12 00, Flexible Paving.

C. Non-Conforming Work

1. Correct deficiencies uncovered by the measurements or Samples.

a. Rework and retest areas represented by noncompliant tests.

b. Do not add thin layers of material to the top layer of base course to meet the specified grade.

1) If the elevation of the top layer is 1/2 inch or more below grade, scarify the top layer of the base to a depth at least 3 inches, add new material, and blend and re-compact the material to bring it to grade.

c. If the finished surface is above the design grade, cut the material back to grade and re-roll the surface.

3.6 PROTECTION

A. Limit traffic on compacted aggregate base course to final surfacing traffic and vehicles applying moisture control.

1. Equipment used to construct adjoining sections may be routed over completed portions of the base course provided no damage results and the equipment is routed over the full width of the base course so rutting or uneven compaction is avoided.

B. Maintain the base course in a condition complying with specified requirements until the Work is accepted.

END OF SECTION

SECTION 32 12 00 - FLEXIBLE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:
   1. Section 01 33 00 - Submittal Procedures.

1.2 SUMMARY

A. This Section specifies requirements for existing ground preparation and asphaltic concrete paving.

1.3 REFERENCES

A. Reference Standards:
   1. American Association of State Highway and Transportation Officials (AASHTO):
      a. AASHTO T 168 – Standard Method of Test for Sampling Bituminous Paving Mixtures.
      b. AASHTO T 245 – Standard Method of Test for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
   2. ASTM International (ASTM):
      a. ASTM D 29 – Standard Test Methods for Sampling and Testing Lac Resins [*withdrawn 2005 without replacement*].
      b. ASTM D 36 - Standard Test Method for Softening Point of Bitumen (Ring-and- Ball Apparatus).
      c. ASTM D 464 - Standard Test Methods for Saponification Number of Naval Store Products Including Tall Oil and Other Related Products.
      d. ASTM D 465 - Standard Test Methods for Acid Number of Naval Stores Products Including Tall Oil and Other Related Products.
      e. ASTM D546 Standard Test Method for Sieve Analysis of Mineral Filler for Bituminous Paving Mixtures
      f. ASTM D692 Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures
      g. ASTM D946 Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction
      h. ASTM D1073 Standard Specification for Fine Aggregate for Bituminous Paving Mixtures
      i. ASTM D1188 Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
      j. ASTM D 2041 - Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.

k. ASTM D2726 Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
l. ASTM D2950 - 09 Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods
m. ASTM D3549 Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens

3. American Wood Preserver's Association (AWPA):
   a. AWPA P5 Standard for Waterborne Preservatives.
   b. AWPA C1 Pressure Treatment.
   c. AWPA C14 Pressure Treatment – Highway.
4. State of New York:
   a. New York State Department of Transportation (NYSDOT):
      1) NYSDOT Standard Specifications (U.S. Customary Units). https://www.dot.ny.gov/main/business-center/engineering/specifications.
      2) New York State Standard Sheets (U.S. Customary Units). https://www.dot.ny.gov/main/business-center/engineering/cadd-info/drawings/standard-sheets-us.
   b. Official Compilation of the Rules and Regulations of the State of New York (NYCRR).
      1) 12 NYCRR Part 23 - Protection in Construction, Demolition and Excavation Operations.
      2) 16 NYCRR Part 753 - Protection of Underground Facilities.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Testing Laboratory:
      a. Metro-North will engage a qualified testing agency to perform tests and inspections.

1.5 SUBMITTALS

A. Action Submittals:
   1. Submit the following to the Engineer for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:
      a. Product Data:
         1) Design mix formula to be used.
         2) Sources of all ingredient materials, copies of all aggregate tests, penetration of the asphaltic cement, and percentages by weight and number of pounds of each of the materials making up the batch.
      b. Certificates:
         1) NYSDOT certified mixing plant to be used. Provide proof of certification.
      c. Special Procedure Submittals:
         1) Specifications of equipment to be used for paving operations.

B. Informational Submittals:
   1. Submit the following to the Engineer for information in accordance with the requirements of Section 01 33 00, Submittal Procedures:
      a. Site Quality Control Submittals:

1) Test reports, trip tickets, temperature records and other certifications that show materials are in compliance with specifications.

b. Final density and smoothness test results.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:

1. Transport asphaltic mixtures in tight vehicles having clean and smooth metal beds.
   a. When necessary, insulate truck bodies.
   b. Just before the vehicles are loaded, lightly coat the inside surface of the vehicles with a whitewash of lime and water, soap solutions, or detergents as approved by the Engineer; or with fuel oil applied by a high pressure fog system.
2. Cover each load with canvas or other suitable material to protect the mixture from the weather.
3. Deliver stone at a temperature not exceeding 350°F.

B. Storage and Handling Requirements:

1. Heating and Storing Asphaltic Paving Mixture Ingredients:
   a. Heat asphaltic cement in approved receptacles to a temperature between 275°F and 350°F.
   b. Keep asphaltic cement uniform in composition and consistency.
   c. Heat aggregate in approved revolving driers.
2. Hot Asphaltic Mixture Holding Bins:
   a. Store hot asphaltic mixtures at the mixing plant or satellite sites in bins that are currently approved by NYSDOT.
   b. After storage, maintain the mixture as indicated in Table 32 12 00-1.

Table 32 12 00-1 Hot Asphaltic Mixture Storage Requirements

Test Property	**Allowable Variation**
Temperature	± 20°F from pug mill discharge temperature
Gradation	Within job mix formula tolerance
Asphalt Content	Within job mix formula tolerance
Asphalt Cement Recovered from Mixtures:	
Penetration @ 77°F	Loss not to exceed 50% of the penetration of the asphalt sampled prior to mixing.
Viscosity @ 140°F	Viscosity not to exceed 4 times the viscosity of the asphalt sampled from the plant prior to mixing.

1.7 SITE CONDITIONS

A. Ambient Conditions:
   1. Spread and compact mixtures during daylight.
   2. Schedule the placement of asphaltic paving material when the Precipitation Probability from the U.S. Weather Bureau, obtained within 3 hours prior to the start of such operations is less than 50 percent.
      a. Notify the Engineer of the exact time at which the above information was obtained.
   3. Do not lay mixtures in wet weather.
   4. Do not lay permanent asphaltic mixtures when surface temperatures are below those listed in Table 32 12 00-2:

Table 32 12 00-2 Minimum Surface Temperatures for Laying

Compacted Lift Thickness	Minimum Surface Temperature
3 inches or greater	40° F
Between 1 inch and 3 inches	45° F
1 inch or less	50° F

      a. Take surface temperatures at 3 locations in the area being paved.
      b. The controlling temperature are the average of the 3 readings.
   5. Temporary pavements are not subject to the above requirements, but must be placed as approved by the Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Asphalt Cement:
   1. Furnish viscosity grade AC-20 asphalt cement complying with the requirements specified for material designation 702-03 in Section 702 of the NYSDOT Standard Specifications, and with the requirements specified for Penetration Grade 60-70 specified in ANSI/ASTM D946.

B. Coarse Aggregates:
   1. Furnish coarse aggregates complying with the requirements specified in ASTM D692 as amended or supplemented by the requirements specified in Section 401-2.02 of the NYSDOT Standard Specifications.
   2. Furnish coarse aggregates having the gradation specified in Table 32 12 00-1.

C. Mineral Filler:
   1. Furnish finely divided mineral matter, such as rock dust, hydrated lime, hydraulic cement, fly ash, loess, or another material as determined and approved by the Engineer.

2. Furnish mineral filler sufficiently dry to flow freely and essentially free from agglomerations, organic impurities, and other objectionable materials.

D. Sand:
1. Conform to the requirements for fine aggregate in ASTM D-1073 and as amended or supplemented by Section 401-2.02 of the NYSDOT Standard Specification.

E. Aggregate Base:
1. Conform to NYSDOT Standard Specifications Section 304, Type 2.

F. Wood Header:
1. Preservative: Wolman CCA Type C in accordance with AWPA Standard P5.
2. Pressure treated to conform to AWPA Standard C1 and C14.

2.2 MIXES

A. Asphaltic Paving Mixture:
1. Provide a bituminous plant mix composed of a mixture of aggregate, filler and bituminous material.
   a. Thoroughly coat the aggregate with asphaltic cement.
2. Provide a bituminous plant mix complying with the requirements indicated in Table 32 12 00-2.

Table 32 12 00-2 Plant Mix Composition

Use	**Asphaltic Binder**		**Asphaltic Surface Course**	
Screen Sizes	**General Limits % Passing**	**Job Mix Tolerance %**	**General Limits % Passing**	**Job Mix Tolerance %**
1-1/2-inch	100	-		-
1-inch	95-100	-		-
1/2-inch	70-90	±6		±7
1/4-inch	48-74	±7		±7
1/8-inch	32-62	±7		±7
No. 20	15-39	±7		±7
No. 40	8-27	±7		±4

Table 32 12 00-2 Plant Mix Composition

Use	**Asphaltic Binder**	**Asphaltic Surface Course**

Screen Sizes	General Limits % Passing	Job Mix Tolerance %	General Limits % Passing	Job Mix Tolerance %
No. 80	4-16	±7		±2
No. 200	2-8	±7		
Asphalt Content %	4.5-6.5±0.4		5.8-7.0±0.4	
Mixing and Placing Temperature Range °F	250°-325°		250°-325°	

3. Base aggregate tolerances on the total weight of the aggregate and the bitumen tolerances on the total weight of the mix.

2.3 SOURCE QUALITY CONTROL

A. Tests:
1. Gradation Test:
a. Test Procedure:
1) Have the Testing Laboratory perform Gradation Tests in accordance with the method specified in ASTM D546.
b. Acceptance Criteria:
1) Coarse aggregate and mineral filler meeting the gradation requirements indicated in Table 32 12 00-1 pass the Gradation Test.

Table 32 12 00-1 Coarse Aggregate and Mineral Filler Gradation	
Sieve Size	**Percent Passing (by Weight)**
No. 30	100
No. 80	85-100
No. 200	65-100

B. Non-Conforming Work:
1. Do not furnish coarse aggregate and mineral filler that fail the Gradation Tests.

PART 3 - PRODUCTS

3.1 PREPARATION

A. Ensure substrates are in suitable condition to receive the work.
   1. Contractor shall clean all existing joints/cracks of all deleterious material in accordance to NYSDOT Section 633, Conditioning Existing Pavement.
   2. Contractor shall seal all existing cracks with a joint and crack filler prior to asphalt overlay in accordance to NYSDOT Section 633, Conditioning Existing Pavement and NYSDOT Section 702, Materials and Manufacturing.
   3. Contractor shall mill/grind a minimum 3'x3' area of existing asphalt pavement to a depth of 1½" below existing manhole cover elevations at locations where rims are flush with existing pavement prior to asphalt overlay installation.
   4. Contractor shall mechanically sweep pavements surfaces immediately prior to commencement of asphalt overlay installation.

B. Protection of In-Place Conditions:
   1. Temporary Pavement:
      a. Furnish and lay temporary pavement wherever required to properly maintain traffic over backfilled trenches and at such other locations as may be directed by the Engineer.
      b. Temporary pavement shall consist of asphaltic binder mixtures, laid to adequate thickness and compaction.

3.2 INSTALLATION

A. Equipment:
   1. Mixing Plants:
      a. Furnish mixing plants approved by NYSDOT for use in NYSDOT construction.
      b. Ensure that the plant and plant operations are in accordance with the requirements of Section 401-3.01 "Quality Control" of the NYSDOT Standard Specifications.
   2. Asphaltic Pavers:
      a. Furnish self-power pavers having an activated screed or strike-off assembly capable of spreading and finishing courses in widths approved by the Engineer.
      b. Furnish pavers capable of spreading and finishing narrow widths of pavement.
      c. Furnish pavers equipped with a receiving hopper with sufficient capacity for uniform spreading operation and automatic flow controls.
      d. Furnish pavers having a heated screed or strike-off assembly to produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.
      e. Furnish pavers equipped with approved automatic transverse slope and longitudinal grade screed controls to automatically adjust the screed and increase or decrease the mat thickness to compensate for irregularities in the surface being paved.
         1) Provide controls capable of maintaining the proper transverse slope and readily adjustable for transitions.
   3. Rollers:
      a. Furnish tandem type power driven rollers capable of providing a pressure not less than 225 pounds per inch width of the main roll.
         1) Furnish smooth true rolls without flat spots or other imperfections.

b. Furnish self-propelled, pneumatic rubber-tired rollers with wheels mounted, grouped, and spaced to provide uniform coverage with each pass.
   1) Furnish rollers with rear group wheels that do not follow in the tracks of forward group wheel.
   2) Furnish rollers with a maximum wheel load of 5600 pounds.
   3) Furnish rollers with a tire compression on pavement, where the area of contact is measured on a hard, unyielding surface, of 80 psi, plus or minus 5 psi, for each wheel; and having a total maximum load per axle, whether single axle or a group of axles in the same alignment, of 22,400 pounds.
   4) Control wheel loads and tire pressures to produce the required degree of compaction without rutting of the surface to be rolled.

B. Headers:
   1. Install wood headers where indicated. Brace headers to support ballast until paving is installed.

C. Placing:
   1. Place surface courses and binders over aggregate base using an approved mechanical spreader.
      a. Keep the number of longitudinal joints to a minimum.
      b. Limit hand placement of asphaltic material to those areas where machine spreading and finishing is not practical.
   2. Ensure the temperature and consistency of the mix at time of application comply with the specified requirements.

D. Spreading:
   1. Do not allow the asphaltic mixture to be placed in a continuous strip exceeding 800 feet long.
   2. Lay adjacent strips immediately after each previous strip is placed until the full width of the roadway surface has been covered.

E. Binder Mixture:
   1. Using an asphaltic paver, lay the binder mixture to a depth which after final compaction is equal to the specified depth.
      a. In areas where the use of the paver is impractical, as determined by the Engineer, other approved means of spreading and compaction may be permitted.
   2. Hand Laying Binder Mixture:
      a. Uniformly spread binder mixture using hot iron rakes with tines not less than 1/2 inch longer than the loose depth of the mixture, or using a mechanical spreader, to a depth which, after final compaction, is equal to the specified depth.
      b. Thoroughly compact the binder mixture using approved tamping irons adjacent to curbs, manholes, rails, and similar structures; and with approved rollers to a surface that is parallel to and below the finished grade and crown of the finished surface.
      c. If the binder mixture breaks up, shows lack of bond, or other defects before the surface mixture is laid, take it up, and remove and replace it with suitable material at no increase in the Contract Price.

F. Surface Course Mixture:
   1. Before the surface mixture is laid, paint the contact surfaces of curbs, gutters, headers, and manholes with a thin uniform coating of approved hot asphaltic cement, liquid asphalt, or emulsified asphalt.

2. Using an asphaltic paver, lay the surface course mixture to a depth which after final compaction is equal to the specified depth.
    a. In areas where the use of the paver or mechanical spreader is impractical, other approved means of spreading and compaction may be permitted.
3. Hand Laying Surface Mixture:
    a. Uniformly spread surface course mixture using hot iron rakes with tines not less than 1/2 inch longer than the loose depth of the mixture to a depth which, after final compaction, is equal to the specified depth.
    b. No walking will be permitted on the surface mixture during the laying operations.
    c. After spreading and raking the surface mixture, carefully lute surface course mixture from the sides before compaction.

G. Compaction:
1. Rolling:
    a. Proceed rolling continuously at the following rates:
        1) For binder, base course, and drainage medium mixtures, when spread by hand, not in excess of 400 square yards per hour per roller.
        2) For binder, base course, and drainage medium mixtures, when spread by machine, not in excess of 600 square yards per hour, per roller.
        3) For asphaltic concrete surface mixtures, when spread by hand, not in excess of 300 square yards per hour per roller.
        4) For asphaltic concrete surface mixtures, when spread by machine, not in excess of 400 square yards per hour per roller.
    b. Immediately after spreading the mixture, using approved tamping irons thoroughly compact the mixture adjacent to curbs, manholes, and rails; and by rolling using approved rollers continuously from commencement to final completion at a speed not exceeding 3 mph.
    c. Make the initial rolling using steel-wheeled, power-driven, tandem type rollers parallel to the center line of the paved surface beginning at the curbs or edges of the paved surface and working toward the center, overlapping on successive trips by one-half the rear wheel of the roller.
    d. Immediately following the initial rolling, further compact the mixture by using pneumatic rubber-tired rollers for a minimum of eight passes.
        1) Smooth shallow ruts and ridges with tandem rollers immediately following the rubber-tired rolling.
2. Final Roll:
    a. Continue rolling until no further compression results; the mixture has cooled; no marks show under the roller; and the surface is smooth and free from depressions, waves, bunches and unevenness.
    b. After the mixture has been rolled, test the surface with an approved straight edge and surface testing machine laid parallel to the center line of the paved surface.
3. Vibratory Compaction:
    a. When permitted by the Engineer, use vibratory compaction in accordance with Section 402-3.07 "Option 2" of NYSDOT Standard Specifications and Section 402-3.04 "Rollers" of NYSDOT Standard Specifications.
    b. Compaction testing requirements are to conform to NYSDOT Standard Specifications Section 402-3.07.

H. Joints:

1. Lay the surface mixture in a continuous operation, and pass the roller over the unprotected end of the freshly laid mixture only when the lying of the course is to be discontinued for such length of time as to permit the mixture to become chilled.
    a. Provide for a proper bond with the new mixture by cutting or trimming back the joint to expose an unsealed or granular surface for the full-specified depth of the course.
2. At the end of each day's work, form joints by laying and rolling against boards of the thickness of the compacted mixture, placed across the entire width of the pavement.
3. When the laying of the mixture is resumed, paint the exposed edge of the joint with a thin coat of approved hot asphaltic cement or liquid asphalt, rake a fresh mixture against the joint, thoroughly tamp and roll.
4. Hot smoothing irons may be used for sealing joints.

3.3 SITE QUALITY CONTROL

A. Site Tests:
1. Test final density and smoothness after rolling and before acceptance.
2. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
3. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
4. In-place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to AASHTO T 168.
    a. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job- mix specifications.
    b. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM 2726.
        1) One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
        2) Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
5. Replace and compact hot-mix asphalt where core tests were taken.
6. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.
7. Site Inspections:

B. Non-Conforming Work:
1. Portions of the completed wearing course that are defective in finish, compression, composition or density, shall be taken up, removed and replaced with suitable material properly laid in accordance with these specifications.

3.4 PROTECTION

A. Traffic:
1. No traffic of any kind will be allowed on the pavement until permitted by the Engineer.

END OF SECTION

SECTION 32 16 00 - CURBS, GUTTERS, SIDEWALKS, AND DRIVEWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:
   1. Section 01 33 00 - Submittal Procedures.
   2. Section 01 50 00 - Temporary Facilities and Controls.
   3. Section 03 10 00 - Concrete Forming and Accessories.
   4. Section 03 20 00 - Concrete Reinforcing.
   5. Section 03 30 00 - Cast-In-Place Concrete.
   6. Section 31 20 00 - Earth Moving.

1.2 SUMMARY

A. This Section specifies requirements for:
   1. Various types of curb, gutter, sidewalk, sidewalk ramps, driveways, and alley intersections.
   2. Contraction joints and expansion joints in curb, gutter, sidewalk, sidewalk ramps, driveways, and alley intersections.

1.3 REFERENCES

A. Abbreviations and Acronyms:
   1. NYSDOT: New York State Department of Transportation.

B. Reference Standards:
   1. American Concrete Institute (ACI):
      a. ACI 305R - Guide to Hot Weather Concreting.
      b. ACI 306R - Guide to Cold Weather Concreting.
   2. ASTM International (ASTM):
      a. ASTM C33 - Standard Specification for Concrete Aggregates.
      b. ASTM C150 - Standard Specification for Portland Cement.
      c. ASTM D 1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
      d. ASTM D 1752 – Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Filler for Concrete Paving and Structural Construction.
      e. ASTM D 2628 – Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
   3. City of White Plains, NY:

a. The White Plains Supplemental Building Code, http://www.cityofwhiteplains.com/templates/template_text_image_right_panel.aspx?ID=White%20Plains%20Supplemental%20Building%20 Code:
   1) White Plains General Construction Code.
b. Department of Public Works:
   1) Standard Construction Details. http://www.cityofwhiteplains.com/dataimages/dpw_standard_construction_details.pdf.
   2) The City of White Plains Specifications.

4. State of New York:
   a. New York State Department of Transportation (NYSDOT):
      1) NYSDOT Standard Specifications (U.S. Customary Units). https://www.dot.ny.gov/main/business- center/engineering/specifications.
      2) New York State Standard Sheets (U.S. Customary Units). https://www.dot.ny.gov/main/business-center/engineering/cadd-info/drawings/standard-sheets-us.
5. United States Government:
   a. Americans with Disabilities Act. (Pub. L. 101–336, 104 Stat. 327, 42 U.S.C. 12101–12213 and 47 U.S.C. 225 and 611) [ADA].
   b. Buy America Act (Pub. L. 103–429, 49 U.S.C. 5323(j))
   c. Department of Justice:
      1) 2010 ADA Standards for Accessible Design,
      2) 28 CFR 35 - Nondiscrimination on the Basis of Disability in State and Local Government Services
      3) 28 CFR 36 – Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities.
   d. Federal Transit Administration (FTA):
      1) 49 CFR 661 Buy America Requirements.
   e. United States Code:
      1) 42 U.S.C. Sections 12101–12213.
         a) Equal Opportunity for Individuals with Disabilities.
            (1) Americans with Disabilities Act of 1990 (ADA) [P.L. 101-336].
            (2) ADA Amendments Act of 2008 [P.L. 110–325]
      2) 49 U.S.C. Section 5323(j).
         a) Buy America Act [P.L. 103–429].

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Depending on where the curb, gutter, sidewalk, sidewalk ramp, driveway, or alley entrance construction is to occur and the owner of the right-of- way, coordinate with and obtain the required approvals from the appropriate State and municipal departments, including but not limited to, the following:
   a. New York State Department of Transportation (NYSDOT).
   b. Local authority having jurisdiction over public streets.
   c. Metro North.
2. Adhere to each owner's specifications and/or permits, and comply with additional requirements of the owners, regarding the Work of this Section.

3. If the owner of the right-of- way is other than the Metro North, the identity of the owner of the right-of- way will be provided on the Contract Dr*awings.

B. Sequencing:
1. Include provisions for traffic control during concreting operations in the Traffic Control Plan required by Section 01 50 00, Temporary Facilities and Controls, including provisions for the placement and maintenance of barriers required to protect the curbs, gutters, sidewalks, sidewalkramps, driveways, and alley entrances from traffic for a minimum of 7 days after concrete placement.

1.5 QUALITY ASSURANCE

A. Certifications:
1. Expansion Joint Filler Certificates of Compliance:
a. Prepare Certificates of Compliance for the expansion joint fillerthat include the following information:
1) Description of material supplied.
2) Quantity represented by the Certificate.
3) A means of identifying the material, such as a label, lot number,or marking.
4) A statement certifying the material complies with the requirements of specifications cited.
5) The name, title and signature of a person having the authorityto bind the manufacturer or Supplier of the material.
b. Submit the Certificates of Compliance for the expansion joint filler to the Engineer for approval.

B. Site Samples:
1. Granite Curbing:
a. Sample the granite curb materials containing discoloration other than cleanable surface stains, and submit the Samples to theEngineer for evaluation.

1.6 SUBMITTALS

A. Action Submittals:
1. Submit the following to the Engineer for approval in accordance with the requirements of Section 01 33 00,Submittal Procedures:
a. Product Data:
1) Concrete.
2) Expansion joint filler.
3) Granite Curbs.
4) Detectable warnings on sidewalks.
b. Shop Drawings:
1) Working Drawings for the curb, gutters, sidewalks,sidewalk ramps, driveways, and alley entrances.
2) Detectable warnings on sidewalks.
c. Samples:
1) Discolored granite curbing.
d. Certificates:
1) Certificates of Compliance for expansion joint filler.

e. Special Procedure Submittals:
1) Manufacturer's data for machinery used in lieu ofconventional concrete forms.

B. Informational Submittals:
1. Submit the following to the Engineer for informationin accordance with the requirements of Section 01 33 00, Submittal Procedures:
a. Special Procedure Submittals:
1) Sidewalk, Curb, or Driveway Permits.
b. Manufacturer's Reports:
1) Manufacturer's data for machinery used in lieu ofconventional forms.

1.7 SITE CONDITIONS

A. Ambient Conditions:
1. Cold Weather Concreting:
a. Perform cold weather concrete work in accordance with the requirements of ACI 306R.
2. Hot Weather Concreting:
a. Perform hot weather concrete work in accordance with the requirements of ACI 305R and the following additionalrequirements:
1) Do not deliver concrete having a temperature exceeding90 degrees Fahrenheit to the Work Site.
2) Cool the mix's ingredients before mixing to prevent the temperature of the mix from exceeding 90 degrees Fahrenheit.
3) Furnish windbreaks, shading, fog spraying, sprinkling, or wet covering when necessary.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Buy America Act:
1. Except for those products which are exempt under the specific statutory waivers stipulated in 49 CFR 661, all other products supplied under this Section must comply with the requirements of the Buy America Act.

2.2 DESIGN CRITERIA

A. Paving for Parking Areas and Access Drives
1. In accordance with the local Construction Code, provide paving for parking areas and access drives capable of withstanding a wheel load of at least 4,000 pounds unless otherwise indicated in the Contract Documents.
a. Construct the base course of non-absorbent approved materialrolled or compacted to grade.
b. Bring the wearing surface to a smooth but non-slip, non-dustingfinish; and maintain it in this condition.

c. Provide finished pavement composed of 1-1/2-inch trap rock penetrated with 1-1/2 to 2 gallons of asphaltic oil per square yard of paved area, and equal to at least a 4-inch compacted thickness of bituminous macadam.

B. Stamped Brick Concrete Sidewalk:
1. Provide concrete having a minimum compressive strength of 4000 psi at 28 days, and a maximum slump of 5 inches, for stamped brick concrete sidewalk.

C. Pedestrian Ramps:
1. Provide pedestrian ramps complying with Americans with Disabilities Act (ADA), the local authority having jurisdiction, and New York State Department of Transportation (NYSDOT) standards.

D. Submit Product Data for the materials proposed for the Work of this Section to the Engineer for approval.

E. Submit Working Drawings for the curb, gutters, sidewalks, sidewalk ramps, driveways, and alley entrances to the Engineer for approval.

2.3 MATERIALS

A. Caulking Compound:
1. Provide a colored caulking compound matching the concrete color.
2. Caulking Compound Manufacturers:
a. Euclid Chemical Company, http://www.euclidchemical.com/.
b. Manufacturer providing an equivalent product approved by the Engineer.

B. Concrete and Concrete Reinforcing:
1. Provide concrete reinforcing complying with the requirements specified in Section 03 20 00, Concrete Reinforcing.
2. Provide concrete complying with the requirements specified in Section 03 30 00, Cast-In-Place Concrete.

C. Concrete Color Admixtures:
1. Provide water-reducing, set-controlling concrete color admixtures that produce durable and structurally sound architectural colored concrete.
2. Integral Concrete Color Manufacturers:
a. L. M. Scofield Company, http://www.scofield.com/lkch_cchart.html.
1) CHROMIX P (powdered).
2) CHROMIX L (mixed liquid in buckets and totes).
b. Manufacturer providing an equivalent product approved by the Engineer.

D. Concrete Color Hardener:
1. Provide dry-shake concrete color hardeners capable of forming a high- performance concrete skin that improves surface durability.
2. Concrete Hardener Manufacturers”
a. L. M. Scofield Company, LITHOCHROME® Color Hardener, http://www.scofield.com/lkch_cchart.html.
b. Manufacturer providing an equivalent product approved by the Engineer.

E. Concrete Release Agent:
1. Provide a liquid or powdered release agent.
   a. Powdered Release Agent: Provide a clear or pigmented water- repellent powder capable of forming a lubricant barrier between fresh concrete and mat stamping tools for easy release.
   b. Liquid Release Agent: Provide a parting agent capable of keeping stamping tools from sticking to wet concrete.
2. Liquid Concrete Release Agent Manufacturers:
   a. Super Stone Inc., http://www.superstone.com/.
      1) Super Stone Release Powder.
      2) Super Stone Bubble Gum Liquid Release®.
   b. Manufacturer providing an equivalent product approved by the Engineer.

F. Concrete Sealer:
1. Provide a waterproofing concrete sealer that will become apermanent part of the concrete matrix itself.
2. Concrete Sealer Manufacturers:
   a. Endur-O-Seal USA, Inc., http://enduroseal.com/index.html.
   b. Manufacturer providing an equivalent product approved by the Engineer.

G. Detectable Warnings:
1. Provide detectable warnings tiles manufactured from a colorfastand UV-stable, homogenous glass and carbon composite.
2. Surface Applied Detectable Warnings:
   a. Provide 1/8-inch thick surface applied detectable warnings tiles with beveled edges, fiberglass truncated domes, and designed to be secured with color matched fasteners and structural adhesive or pressed into place in freshly poured concrete.
3. Cast-In-Place Detectable Warnings:
   a. Provide nominal 1/4-inch thick cast-in-place tiles having embedment ribs 3 inches apart on center through the entire length of tile.
4. Detectable Warnings Manufacturers:
   a. ADA Solutions, Inc., http://www.adatile.com/.
      1) For new construction, provide 24"x60"Cast-in-PlaceComposite Tactile with 2.35" dome spacing.
      2) For retrofitting existing ramps, provide 24"x60" Surface Mount Composite Tactile with 2.35" dome spacing.
   b. Manufacturer providing an equivalent product approved by the Engineer.
5. Submit Shop Drawings and Product Data for detectable warnings tothe Engineer for approval.

H. Expansion Joint Filler:
1. Provide expansion joint filler complying with the material requirements specified in NYSDOT Standard Specification Section 705 Joint Materials and ASTM D 1751, ASTM D 1752, or ASTM D 2628.

I. Stone Curbing:
1. Provide granite or bluestone curbing complying with the requirements specified in NYSDOT Standard Specification Section 714-01 Stone Curb.
2. Provide granite that is sound and durable, free from seams which impair its structural integrity, and of a smooth splitting and machining character.
   a. Natural color variations that are characteristic of the deposit are acceptable.

3. Cut curb materials indicated on the Contract Drawings to conform to the shape and size shown on *New York State Standard Sheet 609-01 Stone Curb and Granite Curb* and as indicated on the Contract Drawings and herein.
   a. Curbs on Straight Sections:
      1) Provide 2-foot minimum lengths for straight segments of Economy and sloped curbs.
      2) Provide 3-foot minimum lengths for all other straight curb types.
   b. Curbs on Curved Sections:
      1) No minimum length requirements are specified for curb segments on curves with radii of 200 feet or less.
      2) When directed by the Engineer, cut curb segments on curves with radii 100 to 200 feet in 3 to 4 feet straight lengths.
      3) With the exception of Economy and sloped curbs, shape segments on curves with radii of 100 feet or less to the required curvature, and cut the ends cut on radial lines.
      4) Furnish Economy and sloped curbs only in straight segments and on curves with radii less than 10 feet, and cut their ends on radial lines.
   c. Curb Widths:
      1) Provide curbing having the bottom width of the various types indicated in Table 32 16 00-1 Curb Widths:

Table 32 16 00-1 Curb Widths	
NYSDOT Curb Type	**Curb Width**
A,B,C,D,E,T2 and Economy	4 inch minimum for 2/3 of length

Table 32 16 00-1 Curb Widths	
NYSDOT Curb Type	**Curb Width**
F1,G1,M and T1	4 inch minimum for entire length
R1 and R2	8 inch minimum for entire length
S	5 inch minimum for entire length

   d. Curb Finishes:
      1) Finish the curb surfaces as indicated on the Contract Drawings or *New York State Standard Sheet 609-01 Stone Curb and Granite Curb*.
         a) Top Surfaces:
            (1) Finish top surfaces to approximately true planes.
            (2) When sawed, hammered or thermal finishes are applied, projections and depressions cannot be greater than 3/16 inch.
               a. Saw marks normal to the sawing process are permitted if within the 3/16 inch tolerance.
         b) Arris Lines:
            (1) Ensure the top front arris lines are straight and true with no variations greater than 1/8 inch measured from a 2 foot straightedge placed along the arris line.

(2) Ensure the back arris lines on curb types E, F1, M, T1, and T2 curb and the lower front arris lines on types E, F1, M, R1, R2, S, T1 and T2 curbs are straight and true with no variations from a straight line greater than 1/4 inch measured in the same manner.

a. Back arris lines are not required for types R1, R2, and S curbs.

(1) Exposed arris lines at the joints are not permitted to project beyond the plane of a split face, and are not permitted to fall under the plane of a split face more than 1/4 inch.

c) Back Surfaces:

(2) Back surfaces are not permitted to have projections or depressions exceeding a batter of 1 inch in 3 inches for a distance of 3 inches from the top.

d) Front Exposed Faces:

(3) Front exposed faces of straight Types A, F1, and G1 curbs, when split, are not permitted to have projections greater than 1 inch or depressions greater than 1/2 inch measured from a vertical plane passing through the arris line at the top of the split face.

(4) For radius units the front exposed faces when split, are not permitted to have projections greater than 1 1/4 inch.

(5) The entire face of Type G1 curb is considered to be an exposed face.

(6) Front exposed faces of types M, R1, R2, S, T1 and T2 curbs, when split, are not permitted to have projections or depressions greater than 1/2 inch measured from a vertical plane passing through the arris line at the top of the split face.

(7) Front faces below grade are not permitted to have projections or depressions greater than 1 inch measured in the same manner.

(8) No projection on the exposed face of type C curb are not permitted to extend over 1/4 inch beyond a vertical plane extending from the intersection of the pavement grade line and the curb face.

(9) The exposed face of type C curb are not permitted to have depressions greater than 1/2 inch measured from the plane of the face through the top arris line.

e) Ends:

(1) Ensure the ends of curbs are approximately square with the planes of the exposed curb surfaces and are finished so that when the curbs are set, no space greater than 3/4 inch shows in the joints for the full length of the exposed joint.

(2) Ensure the curb ends below the pavement surface or shoulder break no more than 8 inches from the joint plane on curb types A, B, C, D, E and T2 curbs, and not more than 2 inches on types G1, R2, and T1 curbs.

(3) Saw the ends of types F1, G1, M, R1, R2 ,S and T1 curbs at locations called for on the Contract Drawings.

f) Drill Holes:

(4) Drill holes are not permitted in exposed curb surfaces.

2) Exceptions to Finish Requirements:

a) Economy Type Curbs:

(1) Split top surfaces so no projections or depressions are greater than 1/2 inch.
(2) Ensure front arris lines do not vary from a straight line more than 1/2 inch.
(3) Ensure exposed joint openings do not exceed 1-1/2 inches.
(4) Drill holes are permitted in top and face surfaces.

b) Sloped Type Curbs:
(5) Ensure exposed faces are smooth and quarry split to an approximately true plane having no projection or depression greater than 1 inch from a 2 foot straightedge placed as closely as possible to the plane of the curb face.
(6) Drill holes not more than 3 inches long and 1/2 inch deep are permitted in the face.
(7) Ensure arris lines at joints do not project beyond the plane of the split face and do not fall more than 1/2 inch under the plane of the split face.
(8) Ensure curb ends are approximately square with the plane of the exposed curb surfaces and finished so that when the curbs are set, no space greater than 1-1/2 inches show in the joints for the full width of the face.

2.4 MIXES

A. Stamped Brick Sidewalk Concrete Mix:
1. Provide concrete color admixtures to provide an integral red color in the concrete mix.
2. Provide Portland cement conforming to the requirements specified for Type I, II or V concrete in ASTM C150, depending on soil conditions
3. Provide aggregate conforming to the requirements specified in ASTM C33.
4. Provide fresh, clean, and potable mixing water
5. Provide a mix containing the integral color, Portland cement, aggregate, water, water reducer, between 4 to 7 percent entrained air, and accelerator and retarders as approved by the Engineer.
6. Do not allow chloride additives in the mix.

2.5 ACCESSORIES

A. Concrete Formwork:
1. Provide concrete formwork complying with the requirements specified in Section 03 10 00, Concrete Forming and Accessories.

PART 3 - PRODUCTS

3.1 EXAMINATION

A. Verification of Conditions:

1. Inspect the locations intended to receive cast-in-place concrete for deficiencies which would prevent proper execution of the concretework.

B. Evaluation and Assessment:
1. Do not proceed with concrete placement until deficiencies discovered by inspection are corrected to the satisfaction of the Engineer.

3.2 PREPARATION

A. Protection of In-Place Conditions:
1. Obstructions to Access:
a. Do not place excavated material where it will interfere with accessto property or traffic flow in the street.
2. Pedestrian and Vehicular Traffic:
a. Adequately protect pedestrian and vehicular traffic by furnishing suitable protective barricades and lighted red lanterns aroundthe work, and arrange the work so inconvenience, delay, and hazardto pedestrian and vehicular traffic is minimized.
1) Erect and maintain suitable barricades and fences aroundthe work area while excavation or other work is in progress.
2) The local authority may require that the Work be arranged to make it possible to completely remove obstructions to traffic on Saturdays, Sundays, holidays, and at the discretion of the authority, during periods of unusually heavy traffic volume.
a) If this requirement is not complied with, the local authority may backfill and temporarily resurface all or part of the work covered by the Street Opening Permit using its own forces, or another contract, or otherwise; and the Contractor will be completely responsible for reimbursing the local authority for expenses incurred thereby.
3) Provide warning flags or signs and suitably lighted flashinglights.
4) Provide a watchman if so ordered by the local authority.
5) If interference with the free flow of traffic occurs, designate competent persons to direct and expedite traffic by meansof lights or flags.
6) Unless otherwise authorized by the Local authority, maintain vehicular traffic at all times during the progress of the workbeing performed under the Street Opening Permit.
3. Existing Structures:
a. At least 24 hours before commencing street openings or work to be done under the provisions of a street opening permit, givewritten notice of street opening to any company whose pipes, conduits, or other structures are laid in the street in which the work is.
b. Carefully support, maintain in operation, and protect from injury pipes, conduits, or other structures; and, in case of injury, restore the pipes, conduits, or other structures to as good a condition as they were before the beginning of such opening or work.

B. Surface Preparation:
1. Construct and compact the subgrade true to grades and lines shown on the Contract Drawings and as specified in Section 31 20 00, Earth Moving.
a. Remove soft or unsuitable material to a depth not less than 6inches below the subgrade elevation, and replace it with material acceptable to the Engineer.

b. If the Engineer determines that the existing subgrade consists of soils with swelling characteristics, bring the moisture content as close as possible to the optimum required for compaction.
   1) Obtain optimum moisture content by the addition of water, by the addition and blending of dry suitable material, or by drying the existing material.
c. Compact the subgrade to a relative density of 90 percent minimum.

C. Demolition / Removal:
1. Sidewalk, Curb, and Driveway Removal:
   a. Cut existing pavements and concrete joined to new construction.
      1) Smoothly saw cut concrete to neat, straight, vertical, true lines so the adjoining surface will not be damaged.
         a) The minimum depth of cut is 1-1/2 inches or 1/4 of the thickness (D/4), whichever is greater.
         b) Clean-cut asphalt concrete only with approved equipment and methods
            (1) Paint trimmed edges with a light coating of asphalt cement or emulsified asphalt immediately prior to constructing the new abutting asphalt concrete.
         c) Do not rip or root outside the limits of cuts.
      2) Remove existing concrete sidewalks and driveways that abut the new sidewalks and driveway entrances to a distance required to maintain the slope, or where sidewalks are concerned not to exceed 1-inch per foot.
      3) Saw cutting is required at the match lines.
   b. Do not place material displaced by the construction on the base and/or surfacing material already in place on adjacent roadways.
2. Excavation:
   a. Store excavated material in neat piles, placed so interference with the use of the roadway or sidewalks is minimized.
   b. If so ordered by the Local authority, promptly remove excavated material from the site of the work.

3.3 SIDEWALK, CURB, AND DRIVEWAY CONSTRUCTION

A. Construct or replace sidewalks, curbs, and driveways in accordance with the grades and specifications determined or promulgated by the local authority having jurisdiction; and perform the Work so it meets the grade and alignment of the adjoining sidewalk, curb, and driveway and/or established lines and grades.
1. Follow the current standard specifications of, and obtain prior approval from the local authority having jurisdiction .

B. Sheathing and Shoring:
1. Except where the excavation is in rock or otherwise authorized by the local authority having jurisdiction, in trenches in excess of 3 feet deep place tight sheathing at least 2 inches thick and securely fasten it in place with whalers and braces for the duration of the work
   a. Drive the sheathing to the same depth as the lowest part of the pipe, conduit, or structure proposed to be installed.
   b. Carry sheathing down so the bottom of the sheathing is not more than one foot above the bottom of the excavation.
   c. If the horizontal distance from the edge of a proposed excavation to the nearest edge of the pavement, water main, or other surface or subsurface structure is more than the

vertical depth of the proposed excavation measured from the highest point of the pavement, water main, or other surface or subsurface structure, the Authority may authorize omitting the sheathing and shoring in whole or in part.

2. Whenever conditions make it necessary, the Authority may require that the sheathing be driven ahead of the excavation as the excavation proceeds.
3. Unless otherwise authorized in writing by the Authority, leave sheathing and shoring in place with a cutoff line 18 inches below the ground surface.

C. Portland Cement Concrete Curbs, Gutters, Sidewalks, and Driveways:
   1. Concrete Formwork:
      a. Furnish conventional concrete forms as specified in Section 03 1000, Concrete Forms and Accessories, unless otherwise approved.
         1) Carefully set forms that conform to the dimensions of the curb, gutter, sidewalk, sidewalk ramp, driveway, or alley entrance to line and grade, and securely stake them into position.
         2) Water the forms and subgrade immediately in advance of placing concrete.
         3) Clean forms thoroughly each time they are used.
         4) Coat forms with a light oil or other releasing agent which will not discolor the concrete.
      b. Construct concrete curbs and gutters by using conventional concrete forms, or when approved by the Engineer by means of an appropriate machine.
         1) If applicable, submit the manufacturer's data for machinery used in lieu of conventional forms to the Engineer for approval of the equipment.
      c. All construction requirements applicable to the use of conventional forms also apply to the use of the machines.
         1) If machines approved by the Engineer and specifically designed for such Work are used, the results must be equal to or better than those produced by the use of conventional forms.
         2) If the results are unsatisfactory to the Engineer, discontinue using the machines and make necessary repairs at no increase in Contract Price.
   2. Placing Concrete:
      a. Place the concrete in the forms.
      b. Spade concrete away from the forms so there will be no rock pockets next to the forms.
      c. Compact concrete using mechanical vibrators approved by the Engineer.
      d. Continue tamping or vibrating the concrete until mortar flushes to the surface, and the coarse aggregate is below the concrete surface.
   3. Finishing and Curing Concrete:
      a. Finish and cure the concrete as specified in Section 03 3000, Cast-In-Place Concrete.

D. Formwork Removal:
   1. Exercise care to prevent damage when removing concrete forms.
   2. Do not remove the front face form before the concrete has taken initial set and has sufficient strength to carry its own weight.
   3. Do not remove gutter forms and rear forms until the concrete has hardened sufficiently to prevent damage to the edges.

E. Expansion Joints:
   1. Unless otherwise specified or shown, construct expansion joints in accordance with the local authority and New York State Department of Transportation (NYSDOT) standards.

2. Construct expansion joints in a straight line and vertical plane perpendicular to the longitudinal line of the sidewalk, curb, or gutter except, in the case of a curved alignment, construct expansionjoints along radial lines of the curve.
3. Construct expansion joints to the full depth and width of the concrete,and match the joints in the adjacent pavement, sidewalk, curb, or gutter.
4. Extend the expansion joint material through the concrete from the surface to one inch into the subgrade.
5. Construct expansion joints at all radius points, driveways, alley entrances, and at adjoining structures.
    a. Construct expansion joints with a maximum interval of 100 feet between joints.

F. Contraction Joints:
1. Unless otherwise specified, construct contraction joints in accordance with the local authority and New York State Department of Transportation (NYSDOT) standards.
2. Construct contraction joints in a straight line and vertical planeperpendicular to the longitudinal line of the sidewalk, curb, or gutter, except, in the case of a curved alignment, construct contraction joints along radial lines of the curve.
3. Construct contraction joints to a depth of 1-1/2 inches at 10 foot intervals on all sidewalks regardless of the width.
4. Unless an expansion joint is required, construct contraction joints to coincidewith each form joint.
5. Provide sidewalk score marks at least 1/2 inch deep at the mid-pointof the contraction joint.

G. Edges:
1. Shape all edges with a suitable tool formed to round the edges to aradius as indicated on the local authority and New York StateDepartment of Transportation (NYSDOT) standard drawings.

H. Depressed Curbs for Driveway Entrances:
1. If approved in writing by the local authority, existing curbs may be cut or lowered to provide drivewayentrances or exits.
    a. Do not cut bluestone and granite curbs, but lower them in an acceptable manner.
    b. If authorized by the Engineer, concrete curbs may be cut provided the cutting can be satisfactory done.
2. Do not cut or lower existing curbs, or construct new depressed curbs,to provide driveway entrances or exits unless in each case an adequate driveway ramp or apron is provided and installed between the curb and the abutting property line, and extends over the entire width of the existing or proposed driveway.
3. Satisfactory surface the driveway ramp or apron with 7-inch thick reinforced concrete, or macadam at least 4 inches thick, or at least 2 inches of bituminous surfacing material laid over 4 inches of crushed stone.
4. The depressed curb cannot be longer than the limits established bythe Local authority.
5. Unless otherwise authorized, construct the portion of the driveway ramp or apron common with the sidewalk from 7-inch thick reinforced concrete.
6. Where depressed curbs or portions of depressed curbs are no longerused or needed for driveway entrance purposes, raise and restorethe depressed curbs or portions thereof to their full height to conformwith adjoining curbs or to the grade established by the Local authority.

I. Sidewalks:
1. Provide concrete sidewalk, including pedestrian ramps, at the locations shown on the Contract Drawings or as directed by the Engineer.

a. Locate expansion joints at existing joints of adjacent sidewalks, at street light and utility pole bases, and other structures where possible.
    1) Space expansion joints no more than 20 feet apart.

2. Promenade Style Concrete Sidewalks:
    a. Reinforce promenade style concrete sidewalk with WWF 6 x 6 - W6x W6 welded wire fabric.
    b. Finish the sidewalks to have a broomed finish in one direction, normally at right angles to the adjacent form work.
        1) Finish the sidewalks using a magnesium float instead of a wood float.
    c. To cure the concrete, in lieu of linseed oil apply a curing material immediately after finishing the concrete, and cover the concrete with polyethylene sheeting for 3 days.
        1) Spray 2 coats to apply a combined coverage of 250 square feet per gallon, or roll 1 coat at the rate of 250 square feet per gallon, in accordance with the manufacturer's recommendations.
        2) Curing Material Manufacturers:
            a) Durok Building Materials, Inc.
            b) Manufacturer providing an equivalent product approved by the Engineer.
    d. Where directed by the Engineer, saw cut sidewalks to a minimum depth of 2 inches and having neat and sharp edges using a power unit having single or multiple rotary blades.

3. Stamped Brick Concrete Sidewalk:
    a. Provide a 5-inch thick integrally colored concrete slab.
        1) Add the approved integral color into the revolving drum mixing truck at the Site to obtain a uniformly colored concrete.
    b. Screed and bullfloat the concrete.
    c. After the concrete has been screeded and bullfloated, broadcast color hardener of the prescribed color into the plastic surface at a rate of 60 pounds per 100 square feet in accordance with the color hardener manufacturer's directions and.
        1) Apply the color hardener at this dosage in two applications broadcast perpendicular to each other, and float the concrete after each application.
            a) During this first application, approximately 2/3 of the total color hardener dosage will be steel troweled into the concrete.
        2) Submit the color hardener manufacturer's directions to the Engineer for information.
    d. Once the concrete has attained the correct plasticity, release and imprint the slab.
        1) Immediately prior to the imprinting of the concrete, apply a liquid or powdered release agent in accordance with the manufacturer's directions.
            a) Submit the liquid or powdered release agent manufacturer's directions to the Engineer for information.
        2) Upon attainment of full concrete strength, remove excess release agent by power washing, acid washing as necessary to blend color variations, or a combination the two.
    e. 6 to 8 hours after the concrete has been poured, follow the manufacturer's application instructions attached to sealer container to apply the first wet coat of concrete sealer using a garden variety sprayer until the surface of the concrete becomes shiny wet but has not puddled in any area.
        1) Ensure that the surface is semi-dry before each application of concrete sealer, and do not apply concrete sealer in freezing weather.
        2) Place a small amount of powdered release agent into the sealer to enhance its color.

3) Spread puddled or excess sealer over the surrounding surface using a soft nylon household broom.
4) After the first application, allow a minimum of 7 days for the hydration and curing of the concrete.

f. Prior to applying the final application of concrete sealer, hose off the surface to remove any contaminants from the surface.
1) Do not allow the concrete sealer to puddle.

g. Fill the void from the top of the expansion joint to the finished grade of the concrete by applying a colored caulking compound matching the concrete color.

4. Standard Concrete Sidewalk:
a. Finish the sidewalks to have a broomed finish in one direction, normally at right angles to the adjacent form work.
1) Finish the sidewalks using a magnesium float instead of a wood float.

b. To cure the concrete, in lieu of linseed oil apply a curing material immediately after finishing the concrete, and cover the concrete with polyethylene sheeting for 3 days.
1) Spray 2 coats to apply a combined coverage of 250 square feet per gallon, or roll 1 coat at the rate of 250 square feet per gallon, in accordance with the manufacturer's recommendations.
2) Curing Material Manufacturers:
a) Durok Building Materials, Inc.
b) Manufacturer providing an equivalent product approved by the Engineer.

c. Where directed by the Engineer, saw cut sidewalks to a minimum depth of 2 inches and having neat and sharp edges using a power unit having single or multiple rotary blades.

5. Detectable Warnings on Sidewalks:
a. Provide detectable warnings on sidewalk curb ramps and other locations as detailed in the Contract Documents or as directed by the Engineer.
1) On pedestrian curb ramps and blended transitions include detectable warnings surfaces in complying with the latest ADA Standards for Accessible Design, local authority, and New York State Department of Transportation (NYSDOT) standards.

J. Backfilling:
1. Do not backfill until the work being done has first been inspected, and the backfilling has been authorized by the local authority having jurisdiction.
a. If backfilling occurs before the work has been inspected, the Engineer can require the Contractor to uncover the work at no increase in the Contract Price so proper inspections can be made.

2. Unless otherwise specified, backfill behind the curbs, sidewalk, or sidewalk ramps with soil native to the area and to the lines and grades shown on the Contract Drawings.
3. To backfill the bottoms of trenches, provide clean earth, sand, or rock dust containing no broken rock, stone, or frozen earth up to 2 feet above the completed pipe or other structure.
a. For the backfill placed 2 feet and higher above the top of a completed pipe or other structure, provide approved material containing no frozen earth, consisting of less than one-third broken rock, and having no stones exceeding 1/2 cubic foot in size.

4. Pack the space between and the bottom and sides of the trench and the pipe or other structure by hand until full, and thoroughly tamp the material as fast as it is placed up to the top of the pipe or other structure; then by hand carefully deposit and tamp the backfill cover material in layers not more than 6 inches thick to at least 3 feet higher than the top of the pipe or other structure.

a. Furnish a light tamper weighing from 6 to 8 pounds for tamping, and perform the tamping so compacted backfill is secured without injuring or disturbing the completed pipe or structure.
b. Use at least one worker for tamping for each worker engaged in backfilling.

5. Backfill above the 3 feet above the top of the pipe or other structure in successive horizontal layers not exceeding 6 inches in depth, and thoroughly compact each layer using approved pneumatic tamping equipment or other means approved by the local authority.
6. Do not use power equipment or other mechanical means for backfilling unless measures for adequately compacting the backfill material have been furnished, and then only with the prior written authorization of the local authority.
7. Except with the prior written authorization of the local authority, do not use flooding or puddling with water to compact the backfill.

K. Special Techniques:
1. Identification:
a. Stamp the Contractor's name and the year the Work is performed on curb, gutter, sidewalk, and driveway Work done by the Design- Builder.
b. Locate this information on each end of the curb, gutter, sidewalk, or sidewalk ramp with letters not less than 3/4 inch in height.
2. Tunneling:
a. Tunneling under pavements or sidewalks is not permitted.
3. Driving Small Pipes or Conduits:
a. Small pipes or conduits having a dimension of 6 inches or less may be driven beneath pavements or sidewalks if the surface is not disturbed or injured provided that:
1) Prior written approval from the local authority is obtained.
2) No excavation is closer than one foot to the edge of a sidewalk or 18 inches to the edge of a pavement.
3) The pipes or conduits are enclosed in sleeves or larger pipes so the required replacements or repairs may be made in the future without disturbing or injuring to the pavement or sidewalk.
4) If a pavement, sidewalk, or subsurface pipe or structure is damaged by driving the pipe or conduit, repair and make good the damage at the no increase in the Contract Price.

L. Tolerances:
1. Curb and Gutter: 1/4 inch when measured with a 10 foot straight edge.
2. Sidewalk and Sidewalk Ramps: 1/8 inch when measured with a 5 foot straight edge.

3.4 REPAIR/RESTORATION

A. Repair sidewalks, curbs, and driveways in accordance with the grades and specifications determined or promulgated by the local authority; and perform the Work so it meets the grade and alignment of the adjoining sidewalk, curb, and driveway and/or established lines and grades determined by the local authority.
1. Follow the current standard specifications of the local authority, subject to the prior approval of the local authority.

B. Repair any portion of concrete damaged while stripping forms; or if the damage is severe, replace the concrete at no additional increase in Contract Price.

C. Remove and replace any section of the Work deficient in depth or not conforming to the Contract Drawings or Specifications at no additional increase in Contract Price.

D. Temporary Resurfacing:
   1. Immediately after backfilling excavations, place an acceptable temporary resurfacing on them.
      a. Maintain temporary resurfacing even with the roadway or other surface as directed until permanent restoration of the surface is completed and approved by the Local authority having jurisdiction.
   2. Provide temporary resurfacing consisting of not less than 2 inches of approved premixed bituminous paving material, or if permitted by the local authority provide 6 inches of temporary concrete flush to surface; except where top soil, seeded areas, or sod have been disturbed by the excavation or other work, restore the entire ground area to the same condition as existed before the work began.

E. Permanent Restoration:
   1. Do not permanently restore the surface over a street opening excavation until satisfactory settlement of the backfill has taken place and approved by the local authority having jurisdiction and Construction Commission.
   2. Complete the permanent pavement no later than the date indicated on the Street Opening Permit.

F. Concrete Pavement Restoration:
   1. Before proceeding with concrete pavement resurfacing, neatly cut the existing concrete pavement back a distance not less than 18 inches beyond the edges of the excavation, taking care not to remove any existing steel reinforcement.
      a. Do not reduce this distance without prior approval of the local authority having jurisdiction.
      b. Under the following conditions, increase this distance:
         1) Where existing pavement has been undermined by the excavation or by other work, or where spalled or scaled surface areas of existing pavement adjoin the area to be resurfaced, remove additional pavement beyond the distance specified as ordered by the Engineer.
         2) If a portion of the proposed concrete resurfacing, as finally determined by the Engineer, is nearer than 4 feet from a joint, extend the removal to the joint.
         3) The smallest horizontal dimension of the concrete resurfacing cannot less than 4 feet.
   2. Do not disturb exposed subgrade unless, in the opinion of the Engineer, the subgrade is unstable.
      a. If the subgrade is unstable, remove the unstable material as ordered, and replace it with approved stable material in layers not exceeding 4 inches thick, and thoroughly compact and tamp each layer.
   3. Uniformly plumb and tool the upper edges of the existing concrete pavement to a depth no more than one inch leaving the remaining depth with straight but rough edges.
   4. Place deformed steel bar reinforcement, not less than 3/8-inch in size, 2 inches above the subgrade, spaced as ordered, and adequately tied in with the existing reinforcement, if any.
   5. Immediately prior to the placing of the new concrete resurfacing, thoroughly wash, wire brush, dampen, and paint the edges of the existing concrete pavement with a 1:1 neat cement coating.
   6. Proportion, mix, place, finish, and cure the concrete as ordered.

a. The Engineer may require using an approved, high early- strength, cement placed under approved methods.
b. Using admixtures and work in freezing weather is allowed only with the Engineer's prior approval and as directed.

7. Install approved joints where directed.
8. Do not open the resurfaced area to traffic until so ordered by the Engineer.

G. Bituminous Pavement Restoration:
1. Prior to replacing bituminous pavements, properly prepare the subgrade and place a reinforced concrete foundation of the required thickness and proportions on it in accordance with the requirements for concrete pavements specified herein.
2. Neatly cut the existing bituminous pavement back a distance not less than 6 inches from the edges of the new concrete foundation.
a. Thoroughly clean the entire exposed foundation in an acceptable manner, place a new bituminous pavement surface of approved type and thickness on the foundation, and roll the bituminous pavement in an acceptable manner.

H. Macadam Pavement Restoration:
1. Cut back the existing macadam pavement not less than one foot beyond the edges of the excavation.
a. Do not reduce this distance without prior approval of the Local authority having jurisdiction.
b. If the existing pavement has been undermined by excavation or by other work, the Local authority having jurisdiction may increase this distance.
2. Place 4 inches of approved crushed stone of the required size, properly tamp the crushed stone, then place 2 inches of asphaltic concrete on the subgrade, and compact and finish the asphaltic concrete in an acceptable manner.

I. Removed Trees:
1. If in order to construct, replace, or repair a sidewalk or driveway, it is necessary to remove a tree on city property, furnish and plant a new tree for each tree removed, of a species and size acceptable and in an approved location, in front of or adjoining the property.

3.5 SITE QUALITY CONTROL

A. Site Tests:
1. Curb and Gutter Tolerance Test:
a. Test Procedure:
1) With a 10-foot straight edge or curve template, the face, top, back, and flow line of the curbs and gutters will be checked longitudinally along the surface to verify they are constructed as indicated on the Contract Drawings within the allowable tolerances.
b. Acceptance Criteria:
1) Curbs and gutters having deviations within the specified allowable tolerance are acceptable.
2. Sidewalk and Sidewalk Ramp Tolerance Test:
a. Test Procedure:

1) With a 5-foot straight edge, the sidewalks and sidewalk ramps will be checked to verify they are constructed as indicated on the Contract Drawings within the allowable tolerances.

b. Acceptance Criteria:

1) Sidewalks and sidewalk ramps having deviations within the specified allowable tolerance are acceptable.

3. Gutter Drainage Test:

a. Test Procedure:

1) Gutters that have a slope of 0.8 foot per hundred feet or less and gutters having unusual or special conditions that cast doubt on the capability of the gutters to drain may be tested by applying water from a hydrant, tank truck, or other source to establish the flow in the length of gutter to be tested on a dry day.

2) 1 hour after the supply of water is shut off, the gutter will be inspected for evidence of ponding or improper shape.

b. Acceptance Criteria:

1) Ponded water in the gutter or on adjacent asphalt pavement to a depth of more than 1/2 inch is unacceptable.

B. Site Inspections:

1. Granite curbing will be inspected for dimensional compliance at the Site by the Engineer.

C. Non-Conforming Work

1. Correct any deviations in curbs, gutters, sidewalks, and sidewalk ramps in excess of the specified allowable tolerances at no increase in Contract Price.

a. Granite curbing not in compliance with the dimensions on the Contract Drawings or *New York State Standard Sheet 609-01 Stone Curb and Granite Curb* will be rejected by the Engineer.

2. If water is found ponded in gutters or on adjacent asphalt pavement to a depth of more than 1/2 inch, correct the defect or defects in a manner acceptable to the Engineer at no increase in contract Price.

3. Permitted Work by Local Authority:

a. The local authority having jurisdiction may, at his discretion, cause work contemplated in this Section that is covered by City permits to be done by the City's own forces, by contract, or otherwise, in which case the City must be reimbursed for any expense thereby incurred, and the Contractor may make no claim against the City for loss of anticipated profits or other losses.

3.6 CLEANING

A. Waste Management:

1. Haul demolished surface materials away from the Site as soon as practical, and do not use them as backfill.

3.7 PROTECTION

A. Plates:

1. Furnish plates over open excavations for the minimum possible time, and only when specifically requested when applying for Street Opening Permits, or at other times when directed by the local authority having jurisdiction.

a. Adequately anchor plates to assure covering the street opening.
b. Do not use vertical projecting lifting devices.
c. The Engineer, in order to reopen a street to the motoring public, has the right to require temporary pavement to be provided in lieu of plating.

2. From December 1 up to and including March 31 of each year, unless another time period is indicated, comply with the following additional requirements:
   a. Pay a per diem fee to the local authority as may be required.
   b. Place signs as follows.
      1) Provide highly reflective orange diamonds signs that are 2 feet on each side, have black letters and a black border, and are mounted so the lowest point of the sign is 7 feet above the curb or ground surface.
      2) Provide signs that have a 3/8-inch margin and a 5/8-inch border, and 5-inch tall letters placed so that one word is centered over the other.
   c. Facing oncoming traffic and 5 feet before the plate, place a sign reading “RAISE PLOW”.
   d. 200 feet before the plate, and at side streets closer than 50 feet, place signs reading "PLATE AHEAD”.
      1) This sign can be required at any time during the calendar year, or be waived at the discretion of the Engineer.

END OF SECTION

SECTION 32 17 00 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section specification covers the requirements for pavement markings where required.

1.3 REFERENCES

A. Reference Standards:
   1. Federal Highway Administration (FHWA):
      a. Manual on Uniform Traffic Control Devices (MUTCD)
   2. New York State Department of Transportation (NYSDOT)
      a. New York State Supplement to the Manual on Uniform Traffic Control Devices
      b. Standard Specifications
      c. Standard Details

1.4 ADMINISTRATIVE REQUIREMENTS

A. Division 01 Administrative Requirements apply to the Work of this Section.

B. Schedule system installations after coordination with Engineer, and the local Traffic Engineer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Material and equipment under this section shall be by manufacturer regularly engaged in work of this magnitude and scope for minimum of five years.

B. Acceptance of material will be based on the manufacturer's certificate of compliance with the NYSDOT Standard specification requirements.

C. All pavement markings material shall conform to NYSDOT Standard Specification Section 106 – Control of Material.

D. Deliver all pavement marking material packed and protected for timely installation, minimizing on-site storage time.

E. Pre-installation conference: Closely coordinate tolerances required in this section for completely coordinated and smooth installation.

F. Installer must be regularly engaged in work of this magnitude and scope for minimum of five years.

G. All work shall conform to all applicable codes.

1.6 SUBMITTALS

A. All submittals are to be in accordance with requirements of Section 01 33 00 - Submittal Procedures.

B. Action Submittals: Product Data, Certificates and Pavement Markings Design Plans shall conform to NYSDOT Standard Specification Section 685 – Epoxy Reflectorized Pavement Markings.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements: Ensure that copy of the manufacturer's Certificates of Compliance with NYSDOT Standard specification requirements is provided with each delivery of materials, components, and manufactured items that are accepted by certification. Only NYSDOT approved materials shall be accepted for the pavement markings.

B. Storage and Handling Requirements: Load, transport, unload, store pavement markings materials so that the material is kept clean and free from all damage in handling.

1.8 SITE CONDITIONS

A. Existing Conditions: If pavement marking placement conflicts with existing conditions, obtain Resident Engineer approval to adjust location.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Comply with NYSDOT Approved List for Materials and Equipment of Manufacturers and /or Suppliers issued by the Materials Bureau.

B. For a list of approved pavement markings materials refer to the NYSDOT Approved List for Materials and Equipment of Manufacturers and /or Suppliers:
https://www.dot.ny.gov/divisions/engineering/technical-services/materials-bureau/materials-and-equipment

2.2 DESCRIPTION

A. Epoxy reflectorized pavement markings and all other markings material shall conform to NYSDOT Standard Specification Section 685 – Epoxy Reflectorized Pavement Markings.

B. Regulatory Requirements:
   1. Buy America Act:
      a. Except for those products which are exempt under the specific statutory waivers stipulated in 49 CFR 661, all other products supplied under this Section must comply with the requirements of the Buy America Act.
      b. Items containing steel and /or iron have specified use restrictions under §106-11, Buy America, of the Standard Specifications. The appearance of a material of non-domestic origin on NYSDOT Approved List in no way implies its universal acceptability for use. The Contract documents govern.

2.3 DESIGN CRITERIA

A. Pavement Markings – All pavement markings shall be designed, furnished and installed in accordance with current NYSDOT Standard Specifications and Standard Details, and the MUTCD, including temporary pavement markings. The Design- Builder shall install street parking space markings and all other street pavement markings in coordination with the local Traffic Engineer. Restriping of parking spaces shall line up with parking meters. All road pavement markings with the exclusion of decorative crosswalks shall be epoxy paint with high visibility glass beads from an approved NYSDOT source.

2.4 PERFORMANCE REQUIREMENTS

A. Epoxy reflectorized pavement markings and all other markings material shall conform to NYSDOT Standard Specification Section 685 – Epoxy Reflectorized Pavement Markings.

PART 3 - PRODUCTS

3.1 EXAMINATION

A. Verification of Conditions: Prior to installing pavement markings, verify their locations and coordinate with other construction work to verify that the pavement markings will fit without interferences.

B. Prior to beginning installation of the pavement markings, verify that all other work affecting the installation of the pavement markings is complete to the extent that the pavement markings may be installed without adversely affecting other construction.

3.2 PREPARATION

A. The Contractor shall coordinate pavement markings work in the public streets with the local Traffic Engineer. At the time of pavement marking application, all pavement surfaces and existing durable markings shall be free of oil, dirt, dust and grease.

3.3 INSTALLATION

A. Pavement markings installation and testing procedures shall conform to the requirements specified in NYSDOT Standard Specification.

B. Pavement markings shall be installed as shown on the NYSDOT standard sheets or as shown on contract documents.

C. Epoxy pavement markings shall only be placed during conditions of dry weather, and dry pavement surfaces at the width, thickness, and pattern designated by the contract documents. Following an application of glass beads, the cured epoxy marking shall be an adherent reflectorized stripe.

D. After the application and curing of pavement markings an inspection by the Engineer shall be made for film thickness, line width and glass bead coverage and retention. Any defects determined by the Engineer shall be repaired or replaced as directed by and to the satisfaction of the Engineer.

END OF SECTION

SECTION 32 39 13 - MANUFACTURED METAL BOLLARDS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide and install bollards for restricting vehicular traffic from .pedestrian areas and for the protection of facilities.

1.2 SUBMITTALS

A. The Contractor shall submit the following.
   1. Product Data: Provide for each type of bollard, component, finish, and accessory specified.
   2. Color Samples: Submit manufacturer's standard colors for selection.
   3. Setting Drawings: Show embedded items and cutouts required for work specified in other Specifications.
   4. Maintenance Data: Submit manufacturer's field touch-up, cleaning and maintenance instructions.

1.3 QUALITY ASSURANCE AND QUALIFICATIONS

A. Manufacturer Qualifications:
   1. Engage a firm which can show three (3) years of experience in the design, manufacture of steel bollards of the type required under this Section.

B. All bollards at a particular Metro-North facility shall have a similar appearance.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:
   1. Deliver bollards and all accessories dry and undamaged, with manufacturer's protective coating intact, bearing original intact factory labels.
   2. Bollards and/or accessories which are damaged during delivery or while being unloaded shall not be stored on site. Remove such units from site and replace with new, undamaged material.

B. Storage of Materials:
   1. Store bollards and accessory materials under cover and in an area protected from dirt, damage, weather and from the construction activities. Do not store outside or allow items to become wet or soiled in any way while on site.
   2. Do not store in contact with concrete, earth or other materials that might cause corrosion, staining, scratching or damage to finish. Do not install system components which become dented, scratched or damaged in any way. Remove such components from site and replace with new, undamaged material.

C. Handling of Materials:
   1. Do not subject bollards and accessory materials to bending or stress.
   2. Do not damage edges or handle material in a manner that will cause scratches, warps or dents.

1.5 PROJECT CONDITIONS

A. Protection: Protect cast-in-place sleeves from debris and water intrusion by use of temporary covers or removable foam inserts.

1.6 Warranty

A. Provide manufacturer's standard warranty against defects in material and workmanship.
   1. Warranty Period:
      a. Five (5) years from date of invoice.
      b. Coatings: Two (2) years from date of invoice against peeling, cracking, or significant color change.

PART 2 - PRODUCTS

2.1 Bollards

A. Model: Reliance Foundry; R-1007-10, or an approved equal.

B. Size: 84 inches high x 10 ¾ inches outside diameter.

C. Finish: Reliance Foundry; Plastic Post Cover, Model R-7130, or an approved equal.

PART 3 - EXECUTION

3.1 Examination

A. Examine paving or other substrates for compliance with manufacturer's requirements for placement and location of embedded items, condition of substrate, and other conditions affecting installation of bollards.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

A. Installation of materials provided under this Section shall be in accordance with the manufacturer's installation instructions and setting drawings.

B. Damaged, cracked, chipped, deformed or marred bollards are not acceptable. Field touch-up minor imperfections in accordance with the manufacturer's instructions.

END OF SECTION

DIVISION 33
UTILITIES

SECTION 33 40 00 - STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. This section includes the fabricating, furnishing, installing and constructing drainage structures, high-density polyethylene (HDPE) drainage pipe, reinforced concrete pipe (RCP), and all necessary and required ancillary items in conformance with this section and NYSDOT Standard Sheets and Specifications.

1.2 STANDARDS AND REGULATIONS

A. New York State Department Of Transportation (NYSDOT) Standard Specification:
   1. Section 201 Clearing and Grubbing.
   2. Section 203 Excavation and Embankment.
   3. Section 206 Trench, Culvert and Structure Excavation.
   4. Section 603 Culverts and Storm Drains.
   5. Section 604 Drainage Structures.
   6. Section 621 Cleaning Culverts, Drainage Structures and Existing Roadside Sections.
   7. Section 623 Screened Gravel, Crushed Gravel, Crushed Stone, Crushed Slag.
   8. Section 655 Frames, Grates and Covers.

B. New York State Department Of Transportation (NYSDOT) Standard Detail:
   1. Sheets M203-5 Installation Details For Corrugated and Structural Plate Pipe And Pipe Arches.
   2. Sheet 604-2 Drainage Structure Details.
   3. Sheet 655-01 Rectangular Grates.
   4. Sheet 655-02 Parallel Bar Frames and Grates.
   5. Sheet 655-03 Cast Manhole Frames, Grates and Covers.
   6. Sheet 655-04 Reticuline Grates.
   7. Sheet 655-05 Cast Frames and Curb Boxes and Welded Frames.
   8. Sheet 655-06 Proof Loaded Cast Steel or Iron Manhole Frames, Grates and Covers.
   9. Sheet 655-07 Welded Frames and proof Loaded Cast Steel or Iron Frames and Curb Boxes.
   10. Sheet 655-08 Telescoping manhole Casting and Ring.

C. American Society for Testing and Materials (ASTM)
   1. ASTM F2306 Standard Specification for 12 in. to 60 in. [300 to 1500mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.
   2. ASTM F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
   3. ASTM F405 Standard Specification for Corrugated Polyethylene (PE) Pipe and Fittings.
   4. ASTM F667 Standard Specifications for Large Diameter Corrugated Polyethylene Pipe and Fittings.
   5. ASTM D3212 Standard Specifications for Joints for Drains and Sewers Plastic Pipes Using Flexible Elastomeric Seals.

6. ASTM F2510 Resilient Connectors between Reinforced Concrete Manhole Structures and Corrugated High Density Polyethylene Drainage Pipes.
7. ASTM F2487 Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Corrugated High Density Polyethylene Pipelines.
8. ASTM F1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.

1.3 RELATED SECTIONS

A. Section 03 10 00 – Concrete Forming and Accessories

B. Section 03 20 00 – Concrete Reinforcing

C. Section 03 30 00 – Cast-in-Place Concrete

D. Section 03 41 00 – Precast Structural Concrete

E. Section 01 33 00 – Submittals

1.4 RESTRICTIONS AND QUALITY CONTROL

A. Provide protection during installation in accordance with Title 29 Code of Federal Regulations, Part 1926, Safety and Health Regulations for Construction (OSHA).

B. The quality of materials, the process of manufacture, and the finished sections shall be subject to inspection by the Engineer. Such inspection may be made at the place of manufacture, or on the work site after delivery, or at both places, and the sections shall be subject to rejection at any time if material conditions fail to meet any of the specification requirements, even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the site shall be marked for identification and shall be removed from the site at once. All sections, which have been damaged beyond repair during delivery, will be rejected and, if already installed, shall be repaired to the Engineer's acceptance level, if permitted, or removed and replaced, entirely at the Contractor's expense.

C. All sections shall be inspected for general appearance, dimensions, soundness, etc. The surface shall be dense, close textured and free of blisters, cracks, roughness and exposure of reinforcement.

D. Imperfections may be repaired, subject to the acceptance of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final acceptance. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi (28 MPa) at the end of 7 days and 5,000 psi (34 MPa) at the end of 28 days when tested in 3- inch (76 mm) diameter by 6-inch (152 mm) long cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs.

1.5 SUBMITTALS

All submittals are to be in accordance with Section 013300—Submittals.

A. Drainage Structures

1. The Contractor shall submit shop drawings for manholes, catch basins, frames, covers and grates. The shop drawings shall show dimensions, reinforcement, typical pipe openings, frame attachment details, slab details, etc.
2. The manufacturer shall certify that the design complies with NYSDOT requirements.
3. The shop drawing shall cover all structure sizes that will be used on the project.

B. Drill Sheets
1. The Contractor shall submit Drill Sheets for each drainage structure based on the approved shop drawings. The Drill Sheets shall show elevations for top of frame, top of slab, bottom of slab and all inverts. The Drill Sheets shall show structure dimensions, pipe nominal diameters and pipe wall opening sizes.
2. Pipe opening locations shall comply with NYSDOT requirements and be clearly labeled on the Drill Sheets. Pipe opening sizes shall comply with the manufacturer of the pipe-to-manhole watertight connectors.
3. The size of the drainage structure shall be sized accordingly to accommodate the proposed pipes. Drainage structures that are too small for the proposed pipes will not be approved.

C. Catalog Cuts
1. Prior to deliveries, the Contractor shall submit six (6) copies of catalog cuts, certifications and shop drawings of the following items to the Engineer for approval:
   a. Drainage Pipe and Fittings
   b. Crushed Stone Bedding
   c. Pipe to Manhole Connectors
   d. Manufacturer's product data clearly marked to indicate item type and size.
   e. Manufacturer's recommended installation procedure for installing pipes.

PART 2 - PRODUCTS

2.1 MANHOLES, CATCH BASINS, FRAMES, COVERS AND GRATES

A. NYSDOT Standard Specification Material Requirements:
1. Section 604 Drainage Structures
2. Section 655 Frames and Grates
3. Section 701-04 Concrete Repair Material
4. Section 701-05 Concrete Grouting Material
5. Section 704-02 Concrete Brick
6. Section 704-13 Precast Concrete Driveway and Sidewalk Pavers
7. Section 705-07 Premolded Resilient Joint Filler
8. Section 705-21 Mortar for Concrete Masonry
9. Section 706-02 Reinforced Concrete Pipe Classes II, III, IV, V
10. Section 706-04 Precast Concrete Drainage Units
11. Section 709-01 Bar Reinforcement, Grade 420
12. Section 709-02 Wire Fabric for Concrete Reinforcement
13. Section 709-09 Cold Drawn Wire for Concrete Reinforcement
14. Section 725-02 Steps for Manholes

B. American Society for Testing and Materials (ASTM)
1. ASTM C55, Grade S-1 Concrete Brick
2. ASTM C139 Concrete Block

C. Drainage structures shall have a 1’ sump (below the lowest invert elevation).

D. All frames and covers shall accommodate HS-20 loading.

E. Bedding material shall be installed under all drainage structures and consist of a minimum of 12” of compacted crushed stone (NYSDOT No. 2). Bedding shall extend 18” horizontally beyond structure.

F. Nyloplast Drains as manufactured by ADS-Pipe or Engineer’s approved equal shall be used where indicated on the plans due to site constraints and limited space. Nyloplast drains shall have a grate size as indicated on the plans.

G. Casting for Cleanouts: Catalog No. R-7506, Neenah Foundry Company, Neenah Wisconsin, or Engineer’s approved equal. Lid cast with the designation “Clean Out”. Diameter of frame adequate to fit over outer diameter size of sewer pipe.

2.2 DRAINAGE PIPE

A. RCP Drainage Pipe shall meet the requirements of standard NYSDOT Reinforced Concrete Pipe Class III, and meet the requirements set forth in the NYSDOT Standard Specification Section 603 and 706 for Reinforced Concrete Pipe Class III.

B. HDPE Drainage Pipe and Fittings shall be N-12 WT IB pipe as manufactured by Advanced Drainage Systems, Inc. or Engineer’s approved equal and shall comply with the requirements of ASTM F 2306. Approved equals shall be selected from the NYSDOT Materials Bureau Approved List for Smooth Interior Corrugated Polyethylene Pipe (706-12).

C. Joint Performance: Pipe shall be joined with the N-12 WT IB joint meeting the requirements of ASTM F2306. Gaskets shall be oil resistant nitrile. Pipe shall be watertight according to the requirements of ASTM D3212. Nitrile gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and the bell during assembly

2.3 STORM DRAIN ACCESS COVER

A. Access cover shall be installed in accordance with NYSDOT Standard Specification, Section 655 “Frames, Grates and Covers.”

2.4 SPECIAL COMPONENTS

A. Insert-a-Tee or Engineer’s approved equal shall be used for connecting roof leaders into trunk lines. Roof leader connections will not be field leak tested.

B. For HDPE pipes, an A-LOK watertight nitrile pipe-to-manhole connectors shall be used at drainage structures, or Engineer’s approved equal. Models shall be as follows:
   1. Z-LOK STM Connector can be used for pipe diameters 36” or smaller
      a. In accordance with the manufacturer’s requirements, pipe entries shall be radial at round structures and within 15-degrees of perpendicular on rectangular structures.

2. A-LOK STM for pipe diameters 12" or larger.
   a. In accordance with the manufacturer's requirements, pipe entries shall be radial at round structures and perpendicular on rectangular structures.
   b. Final custom-length section of HDPE pipes shall have factory-installed smooth wall cylinder at pipe ends for structure entry to facilitate A-LOK STM watertight connection as per the manufacturer's requirements.

C. Z-806 6" wide trench drain system as manufactured by Zurn or Engineer's approved equal shall be used where indicated on the plans.

PART 3 - EXECUTION

3.1 PREPARATION

A. Transmit submittals required by this section.

B. Furnish products as indicated.

C. Store products on site so that they are not damaged. Replace or repair any damaged structures to the satisfaction of the Engineer.

3.2 PIPE INSTALLATION

A. General - The drainage pipe system shall be installed in the locations indicated on the Drawings. Pipe shall be of the type and sizes specified and shall be laid accurately to line and grade. Work shall comply with NYSDOT Standard Specification Sections 603-3 and 604-3 and be in accordance with the manufacturer's instructions.

B. Trench Excavation and Backfill – The requirements of Section 032300 – Excavation and Fill shall apply to the work to be done hereunder.

C. Storage and Handling – Storage of drainage materials and appurtenances on the job shall be in accordance with the manufacturer's recommendations. All drainage materials shall be protected against impact, shock, and free fall, and only equipment of sufficient capacity and proper design shall be used in handling the pipe and appurtenances.

D. Damage – Drainage materials that are defective from any cause, including damage caused by handling, will be unacceptable for installation and replaced. Pipe and/or appurtenances that are damaged or disturbed through any cause prior to acceptance of the Work, shall be repaired, realigned, or replaced.

E. Pipe Installation – Each length of Pipe shall be laid with firm, full, and even bearing throughout its entire length, in a trench prepared and maintained in accordance with Drawings and Section 032300 – Excavation and Fill of these Specifications. Pipe shall be laid upgrade.

F. Minimum Cover – All drainage pipes shall have a minimum cover as indicated on the Plans but in no case less than 24 inches unless encasement is provided. Consult pipe manufacturer for

required temporary cover for construction loads. Concrete encasement shall be required for ground cover less than 24 inches.

G. Pipe Lengths – Only full lengths of pipe shall be used in the installation except that partial lengths of custom-manufactured pipe shall be used at the entrance to structures to obtain a proper connection to the drainage structure.

H. Pipe Entries – All drainage pipe entering structures shall be cut in the first accessible corrugation valley inside the interior face of the structure, and the cut ends of the pipe and surface of the structure shall be properly rounded and finished so that there will be no protrusion, ragged edges, or imperfections that will impede the flow of water or affect the hydraulic characteristics of the installation.

I. Bedding and Backfill – The type of materials used as bedding and backfill and the method of placement shall conform to the requirements of Section 603 of the NYSDOT Specifications and the Contract Details.

J. Working Conditions – The installation shall be protected at all times during construction. At all times when pipe laying is not in progress, open ends of all pipes shall be closed with an ADS End Plug. If water is in the trench when work is resumed, the end plug shall not be removed until the trench has been pumped dry and all danger of water entering the pipe has been eliminated.

K. Clean Pipe Requirements – Every length of pipe shall be inspected and cleaned of all dirt and debris before being laid. Prior to the placing of a length of pipe, the end of the previously laid pipe shall be carefully and thoroughly wiped smooth and cleaned to obtain an even and close-fitting joint.

L. Tolerances – Allowable tolerances shall be one-half (1/2) inch on grade and one (1)-inch on line in any section of pipe between structures. The Engineer may request survey shots to confirm pipe line and grade. No adverse grades shall be allowed. See NYSDOT Section 603-3 for additional construction requirements and tolerances. Any line that has been rejected shall be rebuilt to the correct line and grade.

M. HDPE Pipe Joints – Pipes shall be watertight, oil resistant, and have bell/spigot joints with nitrile gaskets installed in compliance with the manufacturer's specifications.

N. Perforated HDPE pipe connections and Changes in Alignment – Pipe to pipe connections and changes in pipe alignment shall be made only with prefabricated fittings supplied by the manufacturer of the pipe (e.g. tees, wye branches, etc.).

O. Upon completion of the installation and before final acceptance by the Engineer, the entire drainage system shall be subjected to survey of inverts in the presence of the Engineer.

3.3 LEAK TEST

A. Perform leakage tests on storm drain piping. Provide testing documentation to restrict requirements for leak proof construction and to avoid possible effluent violations due to groundwater infiltration.

B. Test sewer systems after backfilling has been completed and prior to placing any pavement.

C. Allowable Leakage: Leakage or infiltration for gravity sewer pipelines, encased or not encased, shall not exceed 200 gallons per inch diameter, per mile of sewer per day in accordance with ASTM F2487. No individual joint in any completed sewer under test shall leak an amount in excess of 1/8 gallon per hour per inch of inner diameter.

3.4 FINAL INSPECTION AND ACCEPTANCE

A. The Contractor shall clean the entire drainage system of all debris and obstructions. This shall include, but not be limited to, removal of all formwork from structures, concrete and mortar droppings, construction debris and dirt. The system shall be thoroughly flushed clean and the Contractor shall furnish all necessary fluid, hoses, pumps, pipe and other equipment that may be required for this purpose. No debris shall be flushed into existing storm drains or streams. All debris shall be removed from the system.

B. The work shall not be considered as complete until the Engineer has viewed the results of for line and grade survey, and the cleanliness and workmanship requirements have been met.

3.5 CLEANING CULVERTS AND CLOSED DRAINAGE SYSTEMS

A. No debris shall be flushed into existing storm drains or streams. All debris shall be removed from the system.

B. The work shall not be considered as complete until the Engineer has viewed the results of for line and grade survey, and the cleanliness and workmanship requirements have been met.

END OF SECTION

SECTION 33 71 19 - ELECTRICAL UNDERGROUND DUCTS AND MANHOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for underground electrical work, materials and products and raceway systems.

B. Related Sections:
1. Section 03 40 00 – Precast Concrete
2. Section 26 05 00 - Basic Electrical Materials and Methods
3. Section 26 05 26 – Grounding and Bonding
4. Section 26 05 63 - Acceptance Testing for Electrical Systems
5. Section 26 05 19 - Low Voltage Wire, Cable and Accessories
6. Section 26 05 33.13 - Conduit and Tubing
7. Section 31 23 00 – Excavation and Fill

1.2 REFERENCE STANDARDS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

B. American Society for Testing and Materials (ASTM):
1. ASTM A 36, Specification for Structural Steel.

C. Federal Specifications (Fed. Spec.):
1. Fed. Spec. FF-S-107C(2), Screws, Tapping and Drive.
2. Fed. Spec. A-A-1923, Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry) Group II (Shield, Expansion Bolt Anchor) Type 4 (Wedge expansion anchors).

1.3 QUALITY CONTROL

A. Equipment Manufacturer:
1. In cases where the Contractor contemplates using equipment not made by the first named manufacturer of these specifications, refer to Section 26 05 00 of these specifications for special requirements and/or substitution requirements.

1.4 GENERAL REQUIREMENTS

A. Section 26 05 00, Basic Electrical Materials and Methods, with the following additions and modifications.

B. Factory Tests:

1. Determine applicable soil-density relationships for underground electrical installation bedding per applicable soil tests as defined in Division 2 of the Specifications.
2. Determine soil-density relationships for compaction of backfill material as defined in Division 2 of the Specifications.

1.5 SUBMITTALS

A. Submit the following information for approval:
   1. Catalog Information:
      a. Conduit. (All Types)
      b. Handholes.
      c. Precast Concrete Manhole and Handhole.
      d. Manhole Frame and Cover.
      e. Handhole Frame and Cover.
      f. Sump Pumps.

1.6 CERTIFICATES

A. Material and Equipment: Provide manufacturer's statement certifying that the product supplied meets or exceeds contract requirements.
   1. Precast Concrete Manhole and Handhole and accessories.
   2. Manhole frame and cover.
   3. Precast Polymer Concrete Handhole

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Basic Electrical Materials: Those products such as building wire, connectors, fittings and similar devices as required for work of this Section are as specified in other Sections of these Specifications.

B. Provide materials and equipment listed by UL, when such equipment is listed or approved.

C. Conduit and Conduit Spacers: Conform to Section 26 05 33.13.

D. Wire and Cable: Conform to Section 26 05 19.

E. Grounding Material: Conform to Section 26 05 26.

2.2 WATERPROOFING OF CONDUIT JOINTS

A. General: Ensure that equipment and materials for waterproofing conduit joints complies with the following manufacturers for quality, installation procedures and guaranteed end results.
   1. Rigid Metal Conduit:
      a. Thread sealant: As recommended and approved by the conduit manufacturer.

b. Cleaning solvent: As recommended and approved by the conduit manufacturer.

2. Non-Metallic Conduit:
   a. All weather, quick-set joint cement: Approved by the conduit manufacturer.
   b. Cleaning solvent: As recommended and approved by the conduit manufacturer.

2.3 CAST JUNCTION BOXES

A. Provide weatherproof and watertight junction boxes for flush in-ground installation where indicated on the Contract Drawings.
   1. Construction: Cast iron type with necessary boxes, checkered cover and neoprene gasket for flush mounting.
   2. Install junction box in concrete pad as detailed on the Contract Drawings.
   3. Provide box of minimum size of 8-inches x 8-inches; larger as required by the
   4. National Electrical Code, or as indicated on the Contract Drawings and/or required by the field conditions.
   5. Acceptable Manufacturers:
      a. Appleton.
      b. Crouse Hinds.
      c. Killark.

2.4 PRECAST CONCRETE MANHOLES & HANDHOLES

A. Provide precast concrete, watertight manholes/handholes as indicated on the Contract Drawings. Provide manholes/handholes complete with necessary, required and specified appurtenances such as watertight locking type covers, cable racks, pulling-in irons, ground rods and ladder and water drainage provisions.

B. Acceptable manholes/handholes manufactures as indicated on Contract Drawings or as approved equal.

2.5 PRECAST POLYMER CONCRETE HANDHOLES

A. Provide precast polymer concrete, handholes as indicated on the Contract Drawings. Provide handholes complete with necessary, required and specified appurtenances such as watertight locking type covers, cable racks, ground rods and water drainage provisions.

B. Provide precast polymer concrete handholes constructed of sand-gravel aggregate bonded together with a matted fiberglass-reinforced polymer concrete. In no assembly can the cover design load exceed the design load of the box. All covers are required to have a minimum coefficient of friction of .50 in accordance with ASTM C 1028 and the corresponding Tier Level embossed on the top surface.

C. Provide handhole with a standard cover suitable for sidewalk application with occasional non-deliberate light vehicular traffic and a service load of 2270 kg over a 250 mm (5000 pounds over a 10-inch) square and a heavy duty cover suitable for driveway and parking lot application with occasional non-deliberate heavy vehicular traffic and a service load of 6800 kg over a (15,000 pounds over a 10-inch) square, wherever needed.

D. Provide enclosures, boxes and covers to conform to all test provisions of the latest version of the ANSI/SCTE 77 “Specification For Underground Enclosure Integrity” for Tier 22.

E. Provide handhole with the following identification cast into the cover as appropriate for the service: "Electric” and "Communications".

F. Acceptable Manufactures
1. Quazite
2. CDR Systems
3. Strongwell
4. Hubbell Enclosures

2.6 WATERPROOFING PRECAST CONCRETE MANHOLES

A. Provide asphalt compound coating of either the solvent type or the emulsion type. However, mixtures of the two types in the Project is not permitted.
1. Solvent Type: Brush or spray-on asphalt compound, cold-applied.
2. Emulsion-Type: Brush or spray-on asphalt-base, clay emulsion with fibers, cold- applied.
3. Acceptable Manufacturers:
   a. W. R. Meadows, Inc.; SEALMASTIC.
   b. Coopers Creek; Coopers Black.
   c. Tnemec; 46-465.
   d. Or Approved Equal.

2.7 SUPPORTS AND FASTENERS

A. Supporting Devices: Carbon steel angles, channels, and bars meeting material requirements of ASTM A36. Pre-engineered UL Listed supporting systems of electrogalvanized steel or electrogalvanized steel PVC coated products may be used in lieu of field fabricated support systems.

B. Fasteners: Provide anchoring devices to anchor conduit or raceway, and supporting devices or pre-engineered supporting systems, to the structure, of the type designed for the specific purpose of anchoring into structure materials at intended point of installation. RAWL PLUGS NOT PERMITTED.
1. Toggle and Expansion Bolts: Fed. Spec. FF-B-588C.
2. Self-Tapping Screws: Fed. Spec. FF-S-107C(2).
3. Conform anchoring devices for fastening into solid masonry or concrete to Fed Spec. FF-S-325 Group II, Type 4, Class 1 for expansion type anchors.

2.8 UNDERGROUND WARNING TAPE

A. Metal detectable polyester material, with minimum one-inch high lettering. Overcoated graphics to read, "CAUTION-BURIED ELECTRIC LINE" for electric lines and/or “CAUTION - BURIED TELEPHONE” for telephone lines. APWA color to be red for electric lines and orange for telecommunication or fiber-optic lines.

B. Acceptable Manufacturers:

1. Brady #91600 Series
2. Presco
3. Seton
4. Or Approved Equal

2.9 GROUNDING

A. Ground rods are to be copper clad steel with diameter adequate to permit driving full length of the rod minus 6 inches, which extends above the finished concrete slab. Conform to Section 26 05 26 of these Specifications.

B. Ground Wires: 600Volt, size as indicated or required by code minimum #6.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Incoming Service Requirements:
   1. Coordinate work and work requirements with Servicing Utility Company and the Owner prior to installation.
   2. Contact the following representative of the Serving Utility Company for electrical service installation requirements and to verify exactly the work required by the utility company to perform under this Contract.
      a. Contact information at ConEd will be provided upon award of contract.

B. General Requirements: (For Underground Work)
   1. Install underground conduit systems in accordance with Article 300-5 of the NEC, in accordance with previous requirements of this Section, and the following requirements exceeding NEC:
      a. Perform earthwork for buried conduit as specified previously for electrical work under Trenching: Section 31 23 00.
      b. Install Concrete Encasement as indicated and detailed. Concrete as previously specified in Section 03 40 00.
      c. Where detailed on the Contract Drawings, underground conduits, both single and banked, concrete encase and reinforce using steel reinforcing rods as indicated on the Contract Drawings.
      d. Bank conduits to the extent indicated and secure same in place with install separators at 5-foot intervals. Provide separators with sufficient strength to prevent displacement of conduits when placing backfill or pouring concrete encasement.
      e. Lay conduit lines to grade a minimum of three inches per 100 feet. Grade conduit lines away from buildings, except conduit lines running between buildings, without intervening handholes or manholes shall be level.
      f. Where conduit lines run to manholes, handholes or similar underground structures, grade conduits to drain to such.
      g. Construct underground conduit lines to be watertight. Stagger conduit couplings in banks of conduits.

h. Unless otherwise indicated on drawing or details, where conduits change direction or turn up at equipment, transformers, buildings, terminal poles, etc., use long sweep PVC coated rigid galvanized steel conduit elbows.

i. Provide two feet minimum cover over conduits and over concrete encasement of conduit, unless indicated otherwise or specified.

j. Where conduits are to be turned up into equipment or transformer pads, extend the concrete encasement for the conduits up to the top of the concrete pad and provide a 3/4" chamfer around exposed top edges. Isolate the concrete encasement for the conduits from the concrete pad for the

k. equipment or transformer pad. Provide 2" high crushable fiber materials around duct bank encasement.

l. Extend conduits 6 inches above concrete slab surface. Install insulating grounding bushing on all conduits. Perform concrete work as specified in Division 3 "Cast-In-Place Concrete".

m. Where conduits are to be turned up at terminal poles, extend the concrete encasement for the conduits up pole to a height of 24 inches above finished grade and be provided with a 3/4" chamfer around all exposed top edges. Perform concrete work as specified in Division 3 "Cast-In-Place-Concrete".

C. Underground Duct Bank with Concrete Encasement: Construct underground duct bank lines of individual conduits encased in concrete as indicated. Except where rigid galvanized steel conduit is indicated or specified, use only one kind of conduit in any one duct bank. Use ducts no smaller than 4 inches in diameter unless otherwise indicated. Provide concrete encasement rectangular in cross-section surrounding the bank and provide at least 3 inches of concrete cover for ducts. Separate conduit by a minimum concrete thickness of 2-inches, and maintain a separation, between conduit centerlines, of seven and one-half inches. Separate power conduits from telephone, communication and/or data highway conduits a minimum of 24 inches of earth or concrete thickness of 8 inches, unless otherwise indicated.

D. Place duct bank lines with a continuous slope downward toward manholes, handholes and away from buildings with a pitch of not less than 3 inches in 100 feet. Except at conduit risers, change direction of bends in runs exceeding a total of 10 degrees, either vertical or horizontal, by long sweep bends having a minimum radius of curvature of 25 feet. Sweep bends may be made up of one or more curved or straight sections or combinations thereof. Use only manufactured bends with a minimum radius of 18 inches for use with conduits of less than 3 inches in diameter and a minimum radius of 36 inches for conduits of 3 inches in diameter and larger. Terminate conduits in end-bells where duct bank lines enter manholes and handholes as indicated on the Contract Drawings.

E. Provide separators compatible with the conduit utilized and conforming to those specified in other Sections of these Specifications. Stagger the joints of the conduits by rows and layers so as to provide a duct bank line having the maximum strength. During construction, protect partially completed duct bank lines from the entrance of debris such as mud, sand, and dirt by means of suitable conduit plugs. As each section of a duct bank line is completed from manhole to manhole, from manhole to building or structure and/or from handhole to handhole, draw a testing mandrel not less than 12 inches long with a diameter 1/4 inch less than the size of the conduit, through each conduit, after which draw a brush having the diameter of the duct bank and stiff bristles through until the conduit is clear of particles of earth, sand, and/or gravel; immediately install conduit plugs. Provide a plastic pull rope, having a minimum of 3 additional feet at each end, in telephone and spare duct banks.

F. Underground Conduit for Service Feeders: Indicate underground conduit for service feeders into buildings on the Contract Drawings. Where rigid steel conduit bank is utilized, protect the ends of the conduit by threaded metal caps or brushings; coat the threads with graphite grease or other suitable coating. Clean and plug conduit before conductors are installed.

G. Conform concrete to that specified in Division 3 of this Specification.

H. Backfilling: Provide a continuous plastic warning tape centered about 12 inches above the top of the underground duct bank. Conform concrete to that specified in Division 3 of this Contract. Progress backfilling as rapidly as the construction, testing and acceptance of the work permits. Ensure backfill is free from roots, wood, scrap material, and other vegetable matter and refuse. Install and compact backfill as specified in Section 31 23 00.

3.2 CONDUIT WATERPROOFING

A. Non-Metallic Conduit:
   1. Plastic PVC Conduit (Schedule 40): Liberally coat the end of the conduit with an approved all weather, quick-set clear cement before joining. Insert joint into the coupling, pushing firmly and rotating conduit until it reaches the pre-formed stopping ridge within the coupling.

3.3 PRECAST CONCRETE MANHOLES & HANDHOLES

A. Provide steel bar pulling-in irons bent in the configuration of a deformed "Z" and cast in the walls and floors. Pocket pulling-in irons in the floor and center directly under the manhole cover. Locate pulling-in irons in the wall not less than 6 inches above or below, and opposite the conduits entering the manhole. Locate the pulling-in-irons such as not to interfere with the cable distribution racks. Project pulling-in-irons into the manhole approximately 4 inches. Zinc-coat irons after fabrication.

B. Ensure cable racks, including hooks and insulators, are sufficient to accommodate the cables and spaced not more than 24 inches horizontally. Provide wall bracket of glass reinforced nylon channel. Provide support brackets of glass reinforced nylon and of the removable type. Provide insulators of dry-process glazed porcelain.

C. Provide aluminum step: aluminum alloy AA designation 6061-T6. Coat that portion of aluminum step being embedded in concrete with heavy bodied bituminous paint.

3.4 MANHOLE/HANDHOLE INSTALLATIONS

A. Where openings into manholes are below final finished grade, extend openings to the required elevation with either concrete or brick suitably arranged to support or anchor the frames and covers. Obtain engineer approval of the construction method and procedure before any work is done.

B. Where required for pulling cables, furnish and install in the walls of the manholes and handholes, a sufficient number of inserts for the proper attachment of cable supports.

C. In general, properly dress and rack cable/or wire on the support arms and insulators around the walls of the manholes and handholes, providing slack where required for future rearrangements. Install cable support brackets, along with the support arms and porcelain insulators, on each wall of the manhole and handhole. Secure cables within manholes and handholes to the insulators by marlin rope. Use proper regard for neat and orderly appearance and location, and provide accessibility for future connections. Take care not to damage the walls of the manholes and handholes during cable pulling.

D. Provide each manhole with a 1 inch diameter hole in the floor for a ground rod. Provide a 3/4 inch diameter by 10 foot long copper clad ground rod installed in one corner with 6 inches of the ground rod left extended above finished floor. Ground metal work to the ground rod.

E. Conform manhole frames and covers to requirements as outlined above in these Specifications; and ensure Engineer approval.

F. Provide a manhole drainage system as indicated on the Contract Drawings.

3.5 PRECAST CONCRETE MANHOLE & HANDHOLE FRAME AND COVER INSTALLATION

A. Where required, make final adjustment of frame to elevation using materials grade rings.
   1. Set precast grade rings in Waterproof Mortar. Do not exceed 3/4-inch maximum and 3/8-inch minimum mortar thickness. Wet, but do not saturate precast grade rings immediately before laying.
   2. Precast grade ring: Pre-set to proper plane and elevation using wedges or blocks of cementation material not exceeding one spare inch wide on each side. Permit no more than four wedges or blocks per grade ring. Incorporate wedges or blocks in fresh mortar in a manner to completely encase each. Crown fresh mortar to produce squeeze-out between grade rings. Tool exposed joints with appropriately shaped tool and compact mortar edge into joints. Clean off excess mortar prior to initial mortar set.
   3. Bolt manhole frames in place on manhole top section, or on leveling units if required, after installing 2 inch thick preformed plastic sealing compound on bearing surface of manhole frame. Remove excess sealing compound squeeze- out after manhole frame is bolted in place.
   4. Use bolts of sufficient length to properly pass through leveling units, if used, engage full depth of manhole top section inserts and allow enough threaded end to pass through manhole frame to properly tighten nut and washer. Tighten manhole frame bolts after mortar has cured.

3.6 PRECAST CONCRETE HANDHOLES & MANHOLES FIELD COATING

A. Clean cast-iron or steel frames, covers and gratings not buried in masonry of mortar, rust, grease, dirt and other deleterious materials by an approved blasting process, and give a coat of bituminous coating material. Clean surfaces that cannot be cleaned satisfactorily by blasting to bare metal, by wire brushing, or other mechanical means. Wash surfaces contaminated with rust, dirt, oil, grease or other contaminants with solvents until thoroughly cleaned. Immediately after cleaning, coat surface with a pretreatment coating or give a crystalline phosphate coating. As soon as practicable after the pretreatment coating has dried, prime treated surfaces with a coat of zinc chromate primer and coat with synthetic exterior gloss enamel.

3.7 WATERPROOFING PRECAST CONCRETE HANDHOLES & MANHOLES

A. Apply a specified protective coal-tar-based coating of two applied coats, minimum, to surfaces in direct contact with in ground cover to obtain a minimum 12.0 dry mil total applied surface thickness. Apply coating in strict conformance with manufacturer's requirements.

B. Application: The coating may be either shop or field applied. Apply coating to the exterior of manhole components.

3.8 CONNECTIONS TO MANHOLES/HANDHOLES

A. Construct concrete encased duct bank lines connecting to manholes or handholes to have a tapered section adjacent to the manhole or handhole to provide shear strength. Construct manholes and handholes to provide for keying the concrete envelope of the duct bank line into the wall of the manhole or handhole. Use vibrators when this portion of the envelope is poured to assure a seal between the envelope and the wall of the manhole or handhole.

3.9 CABLE DUCT BANK SHIELDS

A. Provide shields of a suitable type manufactured for the purpose where cables enter and leave manholes and handholes and other duct bank entrances.

3.10 EARTHWORK

A. Excavate to depths as required for manholes and handholes. Excavation for manholes and handholes shall conform to the requirements stipulated in Division 2 - Site Work.

B. Remove waste excavated materials not required or suitable for backfill on the project from the site as directed. Provide sheeting and shoring as necessary for protection of work and safety of personnel. Remove water from excavation by pumping or other approved method.

3.11 GROUNDING

A. Provide non-current carrying metallic parts associated with electrical equipment with a maximum resistance to solid "earth" ground not exceeding the values indicated in Section 26 05 63 of these Specifications.

3.12 DISSIMILAR SURFACES ISOLATION

A. Paint aluminum surfaces at point of contact with wood, concrete or masonry construction with one coat (minimum dry mil thickness - 5.0 mils) of bituminous paint.

B. Clean away excess or misplaced paint materials from aluminum surfaces and adjoining construction materials.

3.13 TEST

A. Field Tests: Field test of electrical equipment and conform systems to those specified in Section 26 05 63 of these Specifications.

END OF SECTION