

MARCH 13, 2019

NEW HAVEN RAIL YARD FACILITY IMPROVEMENT

CITY OF NEW HAVEN

STATE PROJECT NO. 0300-0138

ADDENDUM NO. 2

This Addendum addresses the following questions and answers contained on the “CT DOT QUESTIONS AND ANSWERS WEBSITE FOR ADVERTISED CONSTRUCTION PROJECTS”:

Question and Answer Nos. 40, 51, 52, 55, 57, 58, 61, 65, 68, 72, 73, 74, 75, 78, 79, 82, 84, 86, 87, 89, 96, 98, 99, 100 and 107.

SPECIAL PROVISIONS

NEW SPECIAL PROVISION

The following Special Provision is hereby added to the Contract:

- NOTICE TO CONTRACTOR – POTENTIAL MODIFIED AWARD SCHEDULE

REVISED SPECIAL PROVISIONS

The following Special Provisions are hereby deleted in their entirety and replaced with the attached like-named Special Provisions:

- NOTICE TO CONTRACTOR – FTA BUY AMERICA
- ITEM #0090132A – STORAGE STRUCTURE
- ITEM #0090133A – STORAGE AND CART BUILDING
- ITEM #0202000A – EARTH EXCAVATION
- ITEM #0202528A – REMOVAL OF RAILROAD TRACKS
- ITEM #0999002A – DISPOSAL OF BUILDINGS
- ITEM #1403009A – MANHOLE-TYPE 2 (SANITARY SEWER)

DELETED SPECIAL PROVISION

The following Special Provision is hereby deleted in its entirety:

- ITEM #0000356A – 4” PVC DUCT BANKS – 18 DUCTS

CONTRACT ITEMS

NEW CONTRACT ITEMS

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>UNIT</u>	<u>QUANTITY</u>
0716000	TEMPORARY EARTH RETAINING SYSTEM	S.F.	41250
0717000	EARTH RETAINING SYSTEM LEFT IN PLACE	S.F.	600

REVISED CONTRACT ITEMS

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>ORIGINAL QUANTITY</u>	<u>REVISED QUANTITY</u>
1005423A	HIGHMAST LUMINAIRE - LED	50 EA.	70 EA.
1302207A	8” X 4” TAPPING SLEEVE + VALVE	2 EA.	1 EA.
1403011A	DROP MANHOLE (SANITARY SEWER)	18 EA.	13 EA.

DELETED CONTRACT ITEMS

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>ORIGINAL QUANTITY</u>	<u>REVISED QUANTITY</u>
0000356A	4” PVC DUCT BANKS – 18 DUCTS	174 L.F.	0 L.F.
0714050	TEMPORARY EARTH RETAINING SYSTEM	41250 S.F.	0 S.F.
0715050	EARTH RETAINING SYSTEM LEFT IN PLACE	600 S.F.	0 S.F.

PLANS

NEW PLANS

The following Plan Sheets are hereby added to the Contract:

Sheets: 20.01.A2, 20.02.A2, 20.03.A2, 20.04.A2, 20.05.A2, 20.06.A2, 20.07.A2, 20.08.A2, 20.09.A2, 20.10.A2, 20.11.A2, 20.12.A2, 20.13.A2, 20.14.A2, 20.15.A2, 20.16.A2, 20.17.A2, 20.18.A2, 20.19.A2, 20.20.A2, 20.21.A2, 20.22.A2, 20.23.A2, 20.24.A2, 20.25.A2, 20.26.A2, 20.27.A2, 20.28.A2, 20.29.A2, and 20.30.A2.

REVISED PLANS

The following Plan Sheets are hereby deleted and replaced with the like-numbered Plan Sheets:

Sheets: 02.001.A2, 05.050.A2, 05.050-2.A2, 08.02.A2, 08.20.A2, 09.022.A2, 10.024.A2, 10.026.A2, 11.018.A2, 12.23.A2, 15.013.A2, 15.024.A2, 15.033.A2, 15.037.A2, 15.041.A2, 15.047.A2, 15.069.A2, 15.070.A2, 15.071.A2, and 15.072.A2.

The Bid Proposal Form has been revised to reflect these changes.

There will be no change in the number of calendar days due to this Addendum.

The foregoing is hereby made a part of the contract.

**NOTICE TO CONTRACTOR – POTENTIAL MODIFIED AWARD
SCHEDULE**

The contractor is hereby given notice that this contract will not be awarded until all State and Federal funding approvals have been received. If funding approvals are not received, this Contract award may be delayed or the Contract may be withdrawn and re-advertised at the discretion of the Department, per section XIII of the Construction Contract Bidding and Award Manual. Any delay to the Contract award or failure to award shall not be the basis for any claims by any bidder.

NOTICE TO CONTRACTOR – FTA BUY AMERICA

The Contractor agrees to comply with 49 U.S.C. 5323(j) and 49 CFR Part 661, which provide that Federal funds may not be obligated unless steel, iron, and manufactured products used in FTA-funded projects are produced in the United States, unless a waiver has been granted by FTA or the product is subject to a general waiver. General waivers are listed in 49 CFR661.7.

The above provisions do not apply to the procurement of the following items listed below which have separate requirements for Rolling Stock as set out in 49 CFR 661.11. For Rolling Stock not subject to a general waiver, the Buy America domestic content requirements (i.e. more than 65% for fiscal years 2018 and 2019, and more than 70% for 2020 and beyond) will be based on the letting date of this contract. Therefore, throughout the term of this contract, the domestic content shall be at least 65%.

1. ITEM #0090042A - CATENARY SYSTEMS
2. ITEM #0090045A - AERIAL GROUND WIRE SYSTEMS
3. ITEM #0090050A - HIGH SPEED SECTION INSULATORS
4. ITEM #0090074A - TRACTION POWER DISTRIBUTION SYSTEM
5. ITEM #0090075A - GUY ASSEMBLIES
6. ITEM #0090079A - MODIFICATIONS AND ADDITIONS TO EXISTING CATENARY SYSTEMS
7. ITEM #0090130A - TRAPPED KEY INTERLOCK SYSTEM
8. ITEM # 0096062A - CONTROL PANEL AND INTERFACE
9. ITEM #0096084A - MOTOR OPERATED DISCONNECT SWITCH
10. ITEM #0096107A - SNOW MELTER DISTRIBUTION AND CONTROL CASES
11. ITEM #0096108A - DISCONNECT SWITCH AND SECTIONALIZING JUMPER TAPS
12. ITEM #0100082A - STANDBY POWER OUTLET STATION AND JUMPER ASSEMBLY
13. ITEM #0100500A - CONSTRUCTION COMMUNICATION EQUIPMENT (ESTIMATED COST)
14. ITEM #0104073A - SNOWMELTER UNIT SUBSTATIONS
15. ITEM #0104079A - SNOWMELTER SYSTEM 14 CONDUCTOR 10 AWG SIGNAL WIRE
16. ITEM #0104081A - SNOWMELTER SYSTEM LOADCENTER
17. ITEM #0165344A - 480V STANDBY POWER SUBSTATION
18. ITEM #0992033A - ELECTRICAL WORK
19. ITEM #1017228A - ELECTRIC LOAD CENTER
20. ITEM #1108798A - CENTRAL COMMUNICATIONS EQUIPMENT
21. ITEM #1108842A - FIBER OPTIC PATCH PANEL - 24 POSITION
22. ITEM #1108843A - 12 POSITION WALL MOUNTED FIBER OPTIC PATCH PANEL
23. ITEM #1113435A – COMMUNICATIONS CABLE NO. 22 AWG, 25 PAIR
24. ITEM #1113458A – #22 AWG, 200 PAIR COMMUNICATION CABLE
25. ITEM #1113459A – #22 AWG, 300 PAIR COMMUNICATION CABLE
26. ITEM #1113460A – 50 PAIR UNDERGROUND COMMUNICATION CABLE

- 27. ITEM #1113725A – #23 AWG, 4 TWISTED PAIR CATEGORY 6 CABLE
- 28. ITEM #1408802A – ELECTRICAL INSTALLATION AND EQUIPMENT

Bidders must submit the appropriate certificates, as included in the Bid Proposal Form, of either a completed Certificate of Compliance or a completed Certificate for Non-Compliance for the Iron, Steel and Manufactured Product and separate Certificates for Rolling Stock with their bid. The following forms are samples of the two certificates for your information. The actual certificates can be found in these documents in Exhibit A after Appendix E, page 35 and 36 of 58. Failure to complete and submit the referenced certificates for both Iron, Steel and Manufactured Products as well as Rolling Stock will result in rejection of the bid.

The Connecticut Department of Transportation (CTDOT) may seek a waiver from the Buy America Provisions if grounds for the waiver exist.

Exhibit A of FTA Requirements

Certification requirement for procurement of steel, iron, or manufactured products.

Certificate of Compliance with 49 U.S.C. 5323(j)(1)

The bidder or offeror hereby certifies that it will meet the requirements of 49 U.S.C. 5323(j)(1) and the applicable regulations in 49 C.F.R. Part 661.5.

Date _____

Signature _____

Company _____

Name _____

Title _____

Certificate of Non-Compliance with 49 U.S.C. 5323(j)(1)

The bidder or offeror hereby certifies that it cannot comply with the requirements of 49 U.S.C. 5323(j)(1) and 49 C.F.R. 661.5, but it may qualify for an exception pursuant to 49 U.S.C. 5323(j)(2)(A), 5323(j)(2)(B), or 5323(j)(2)(D), and 49 C.F.R. 661.7.

Date _____

Signature _____

Company _____

Name _____

Title _____

Exhibit A of FTA Requirements

§661.12 Certification requirement for procurement of buses, other rolling stock and associated equipment.

If buses or other rolling stock (including train control, communication, and traction power equipment) are being procured, the appropriate certificate as set forth below shall be completed and submitted by each bidder in accordance with the requirement contained in §661.13(b) of this part.

Certificate of Compliance with Buy America Rolling Stock Requirements

The bidder or offeror hereby certifies that it will comply with the requirements of 49 U.S.C. 5323(j), and the applicable regulations of 49 CFR 661.11.

Date _____

Signature _____

Company _____

Name _____

Title _____

Certificate of Non-Compliance with Buy America Rolling Stock Requirements

The bidder or offeror hereby certifies that it cannot comply with the requirements of 49 U.S.C. 5323(j), but may qualify for an exception to the requirement consistent with 49 U.S.C. 5323(j)(2)(C), and the applicable regulations in 49 CFR 661.7.

Date _____

Signature _____

Company _____

Name _____

Title _____

ITEM #0090132A – STORAGE STRUCTURE

Description

This work shall consist of the design, furnishing, and constructing a new pre-engineered 60 ft by 152 ft (minimum exterior dimensions, 9120 sq ft.) fabric structure that will be used for the storage of M8 Rail Car parts located east of the existing CCO at the north end of the existing parking lot in the New Haven Rail Yard as shown on the plans. The structure shall meet the minimum building envelope requirements as shown on the plans. A perimeter foundation wall on spread footings shall support the structure. The Foundation shall consist of a finished floor at grade and the lowest storage level at elevation 11.10 ft. The wall shall extend to 1 ft above grade to provide impact walls at the perimeter and to raise the fabric structure. A concrete slab on grade shall be provided as the interior surface.

This building will be constructed to accommodate the storage of the following items at minimum as shown on the plans:

- a. 30-HVAC units on wheeled carts stacked 3 high and supported by a double depth racks allowing HVAC units to be picked up by a forklift on the end.
- b. 21-Pantographs in support frames stacked 7 high and supported by double depth racks.
- c. 18-Truck frames stacked 3 high, not in racks but on stackable stands.
- d. 21-Wheelsets with gear boxes in cradles stacked 3 high in racks.

Design Requirements:

1. Design shall comply with the requirements of applicable codes and receive approval of Factory Mutual Research Corporation. The structure shall comply with all applicable codes including the latest Connecticut Fire Prevention Code, 2015 International Building Code, and Factory Mutual FM Standard 4880 Class 1 Guidelines.
2. Loadings: Design loads shall be developed using the procedures contained in Design Practices and Design Practice Commentary in the MBMA publications, Metal Building Systems Manual, the 2015 International Building Code, and current amendment to the State Building Code, Effective 10/01/2018. The following data shall be used in developing design loads, in addition to dead load including collateral load:
 - a. Roof live load: 30 PSF
 - b. Roof snow load: 30 PSF plus drift at roof level change
 - c. Wind Speed: 115 MPH
 - d. Auxiliary loads: Lighting and Fire Protection Systems
 - e. Uplift loads and collateral loads: Based on drawings and applicable codes.

3. The structural drawings are for bidding only and not for construction. All footing design has been based on the design criteria contained herein and on assumed loads and stiffness of pre-engineered structural members. Contractor shall not start foundation reinforcing shop drawings until he has submitted actual superstructure reactions to the Engineer and revised foundation detail drawings accommodating these reactions have been issued by the Engineer. Structural Contractor shall coordinate with Foundation Contractor.
4. Framing and Structural Members:
 - a. Structural steel members shall be designed in accordance with AISC publication. Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings.
 - b. Structural, cold-formed, steel framing members shall be designed in accordance with AISI publication. Specification for the Design of Cold-Formed Steel Structural Members.
 - c. Framed openings shall be designed to structurally replace the covering and framing displaced.
 - d. Welding of steel shall conform to the requirements of AWS D1.1 and D1.3.
 - e. Wind uplift ratings for standing seam roof system: Obtain from UL testing conducted in accordance with “Tests for Wind Uplift Resistance of Roof Assemblies”, UL580. Specific information shall be obtained in UL “Building Material Directory” and applicable state codes.
5. The following additional building requirements and standards shall be met:
 - a. An overhead rollup door (20 ft x 16 ft) with overhead electrical operator and a 36” wide personnel door on the southerly and westerly walls. All doors shall be equipped with MNR approved locks. See plans for details.
 - b. A two foot wide zone on all sides that allows for the building frame and fabric.
 - c. Positive drainage away from the structure to promote surface runoff as shown on the plans.
 - d. The Connecticut Building Code (paragraph 3102.3.1.2) requires that the fabric be flameproof.
 - e. Fabric membrane shall be water and mildew resistant, insect proof, withstand extreme climatic variations, and contain UV inhibitors to reduce degradation by the sun’s rays.
 - f. Interior warehouse lighting, exterior egress lighting and lighted exit signs must be provided to meet all relevant codes. Lighted exit signs shall be equipped with battery

- backup power and shall be installed on the building perimeter and be visible from all locations in the building, considering line of site restrictions due to the height of the part storage racks. Exterior egress lights shall be connected and powered by the interior lighted exit signs.
- g. 60A, 120/208V, 3 phase, 4 wire service and panelboard.
 - h. 2 electrical receptacles near each entrance, inside of structure.
 - i. Communication systems and CCTV systems are not required.
 - j. Passive fresh air wind driven ventilation must be provided with bug and bird screens for air movement inside of structure.
 - k. Automatic conventional fire alarm system must be provided and connected to New Haven Rail Yard's existing system using a digital alarm communicator transmitter (DACT) and two telephone lines. System includes weatherproof audible and visual alarm inside and outside of the building and heat detectors for property protection.
 - l. Building components and systems shall comply with all applicable codes including the latest Connecticut Fire Prevention Code, 2015 International Building Code, and Metro-North requirements.
 - m. American Institute of Steel Construction (AISC): Specification for the Design, Fabrication and Erection of Structural Steel for Buildings with Commentary.
 - n. Foundation and anchoring shall be engineered and approved by a CT licensed structural professional engineer.
 - o. Prior to commencing fabrication for the proposed site, verify if any modifications are required by the Engineer.
 - p. The design and depicted fabrication, erection, and foundation drawings are only valid for the exact design parameters and combinations of parameters documented. The design must be site adapted to the proposed location in the New Haven Rail Yard. Any use of the design and document for this specific site requires:
 - i. Design parameter verification by a CT registered professional engineer, experienced in structural engineering, verify that loading conditions and the requirements of the site are equal to or less than the documented design parameters and combination of the documented design parameters.
 - ii. Design parameters shall meet or exceed existing soil conditions. See Geotechnical Report for existing subsurface conditions.

- iii. Any site specific conditions failing the parameters listed above will require re-analysis of the structure and/or foundation by a CT registered professional engineer.

Submittals

1. Pre-Engineered Structure:

- a. Shop drawings consisting of catalog cuts: design and erection drawings: complete design analysis for lateral loads, uplift; instruction manuals; and other data to clearly describe design, materials, sizes, layouts, construction details, fasteners, and erection.
- b. Shop drawings shall be accompanied by engineering design calculations for structural framing and covering components, signed and sealed by a Professional Engineer licensed in the State of Connecticut stating the design criteria and procedures used, and attesting to the adequacy and accuracy of the design.
- c. Wiring Diagrams: Detail wiring for lighting and communication systems.

2. Electrical:

Shop drawings consisting of catalog cuts, including information on materials used, dimensions ratings of all equipment, etc. Shop drawings shall be provided for the following:

- a. Panelboard:
 - 1. All equipment ratings, materials used and equipment dimensions.
 - 2. All breakers included.
- b. Lighting fixtures and exits signs. Lighting calculations provide for interior.
- c. Wiring Diagrams: Detail wiring for lighting system.
- d. Fire Alarm System: Submittals shall be approved by the authorities having jurisdiction prior to submitting them to owner. Include complete riser diagram showing all devices. Provide voltage drop and battery sizing calculations.
- e. Galvanized Rigid Steel (GRS) conduit and conductor as proposed.

3. Storage Racks & Stackable Stands:

- a. All racks and stackable stands shall be structurally designed. Submit for engineer review structural design calculations indicating compliance with structural cited

standards and sealed by a registered Professional Engineer in the State of Connecticut.

4. Samples:

- b. Fabric Coverings: One piece, 12” x 12” sample for factory color finished covering shall be accompanied by certified laboratory test reports showing that the sheets are produced under a continuing quality control program and that a representative sample has been tested within the past 12 months and has met the quality standards specified.
 - i. Erection drawings, templates, and installation instructions for built-in or embedded anchor devices.
 - ii. Summary of forces and loads on walls and jambs.
- c. Fasteners: Two samples of each type to be used with statement regarding intended use.
- d. Sealant: One sample, approximately 1 pound, and descriptive data.

Materials

All materials shall conform to the following:

Pre-Engineered Building

1. Steel:

- a. All structural steel tubing shall be galvanized, min. yield strength 50 KSI. Section properties, design values, and galvanized protection shall meet or exceed standards as recommended by the Manufacturer.
- b. Steel plates shall comply with ASTM A572 Grade 50 or equal. Structural steel is to be shop prime coated with cold galvanizing compound. Apply shop prime coat to obtain a uniform dry film thickness of not less than 2-Mils.
- c. All Bolted connections shall use A325 bolts with compatible washers and nuts of diameters indicated on plans. Bolts need only be tightened to snug-tight condition. The snug-tight condition is defined as the tightness attained by a few impacts of an impact wrench, or the full effort of a person using an ordinary spud wrench.
- d. All structural steel is to be fabricated in accordance with the latest edition of AISC “Specification for the design, fabrication and erection of structural steel for building.”

2. Cables and Hardware:

- a. All cable shall be galvanized steel, multipurpose, 7 x 7 ($\leq 1/4$ " Dia.) or 7 x 19 (5/16" & 3/8" Dia.) or 6 x 26 (1/2" dia.) class strand core commercial grade, or diameter indicated, unless otherwise noted.
- b. Cable sleeves shall be installed per manufacturer's recommendations.
- c. Use thimbles with cable sleeves in all loop-end applications.
- d. Tension cables at turnbuckle to taut condition (straight and not slack or loose).
- e. Tighten cables sequentially to avoid twisting or deforming structural elements during erection. Recheck previously tightened cables until all cables achieve taut condition.

3. Electric Service:

- a. 60A, 120/208V, 3 phase, 4 wire electrical service shall be provided to the warehouse location from the location as shown on the plans. The contractor shall provide minimum (4) #2 & (1) #6 ground wire in 3" rigid galvanized steel conduit below ground. The service feeder indicated is a minimum required and will vary based on the determined origin of the electric service and voltage drop calculation. The engineer's approval will be required for final feeder sizing. (1) 60A, 3 pole breaker shall be provided in the selected origin panelboard. The type and rating of the circuit breaker shall match existing. (1) 100A bus, 30 pole panelboard shall be provided within the warehouse space. The panelboard shall be equipped with a 60A main circuit breaker, (22) 20A, single pole circuit breakers and (8) spare spaces. The short circuit rating shall match that of the feeder breaker.
- b. There shall be (4) 20A, 120V GFI, duplex receptacles provided with weatherproof covers. The receptacles shall be located on the inside of the building, 2 on either side of the building near the entryways.
- c. Electrical components and systems shall comply with all applicable codes including the Connecticut Fire Prevention and Building Codes, and Metro-North requirements for approval by Factory Mutual Research Corporation of specific building systems.
- d. Other applicable codes include but are not limited to the following:
 - NFPA 70 – National Electric Code
 - NFPA 72 – National Fire Alarm and Signaling code
 - NFPA 101 – Life Safety Code

4. Lighting:

- a. Interior lighting; High-bay LED style, rugged die-cast aluminum housing UL rated for wet location, low temperature use. Provide with 6'-0" cord, hook and 15A twist lock plug. Each fixture shall have an integral 360 degree motion sensor on/off wet location. Lighting levels provided shall be 25-30 foot candles with an average to

minimum ratio of 3:1. Source shall be 4000k with an 80 CRI. Optics, .375" thick borosilicate glass that is silicone rubber gasketed. 3/4" NPS threaded hub standard that is suitable for pendant, hook or loop mounting. An interior receptacle for fixture plug in controlled via toggle switch shall be provided for manual override and shall control all lighting fixtures.

- b. Emergency lighting drivers (batteries) shall be provided within a certain amount of interior high bay fixtures such that in the event of power failure 1fc average is provided at the floor level and no spot on the floor shall be less than .1fc (in accordance with NFPA 101).
- c. Exterior Egress Lighting: Located above each egress man door (2 total) on the exterior, an emergency wall mount style fixture shall be provided. The fixture shall be LED type rated for exterior, low temperature use. The fixture shall be equipped with an emergency battery. Source shall 4000k with an 80 CRI.

5. Exit Signage:

- a. Access to exits must be clearly marked by visible signs. At a minimum, emergency exit signage shall be provided above each egress man door (2 total) on the interior side. Additional exit signage and/or directional signage shall be provided as required when signage above doors is not visible due to location of storage racks and equipment stands. The fixture shall be LED type rated for exterior, low temperature use. The fixture shall be equipped with an emergency battery and shall meet the requirements of NFPA 101.

6. Fire Alarm System:

- a. A conventional fire alarm system meeting all requirements of NFPA 72 and listed for operation in an unheated building shall be provided. The system shall be connected to New Haven Rail Yard's existing system using form C contacts to transmit alarm, trouble and supervisory signals for remote monitoring. This specification includes wiring from this FACP to the FACP in the CCO building for remote monitoring. Provide surge suppression on each signal line between buildings. FACP shall also be supplied with DACT and internet monitoring modules for future connections if needed. The method of connection and monitoring of the new system shall be coordinated with the owner and must be compatible with the existing FACP in the CCO building. The existing FACP in the CCO building shall be programmed to monitor the signals from this FACP. At a minimum the design shall include (2) pull stations rated for the temperature range at each exit door, weatherproof horn strobe units to provide proper audio/visual coverage, and rate of rise type heat detectors for 100% detection coverage. Also included shall be a weatherproof audible and visual alarm inside and outside of the building. All wiring shall be class B. The FACP shall be housed in a NEMA 4 metal protective enclosure that provides heating and cooling to meet the operating range of the installed FACP, STI-7560AH or approved equal. Any monitor modules for addressable devices must also be housed in a separate

- NEMA 3R enclosure that provides heating and cooling to meet the operating range of the installed monitor modules.
- b. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work, include, but are not limited to, the following:
 - i. Fire Lite Alarms MS-5UD by Honeywell.
 - ii. Faraday by Siemens.
 - iii. Simplex Grinnell by Tyco.
 - iv. Or approved equal.
 - c. Heat Detectors: Single circuit fixed temperature with rate of rise detection, 135 deg F. Coverage shall be derated as specified for ceiling height per NFPA 72. System Sensor model 5601P or approved equal. Must be compatible with FACP.
 - d. Manual Pull Stations: Non-coded, red dual-action manually activated signaling boxes meeting ADA 5 lb. maximum pull-force. System Sensor BG-12 or approved equal.
 - e. Notification Appliances: Red Horn/strobes, synchronized on Class B circuits, Listed to UL 1971 and UL 464 and shall operate on a non-coded power supply with field selectable candela settings. System Sensor L-series P2RHK or approved equal.

Electrical Materials:

- 1. General materials and workmanship:
 - a. Materials and apparatus required for the work shall be new, of first-class quality, and shall be furnished, delivered, erected, connected, finished in every detail, and shall be so selected and arranged as to fit properly into the building spaces in compliance with all requirements.
 - b. Manufacturer's catalog numbers listed are not necessarily complete. Products provided shall be a standard product which has a history of successful installation and operation for a minimum period of two years. Prototype or custom made equipment is not acceptable unless so specified.
 - c. Manufacturer's instructions shall be obtained and used for the installation of all equipment and devices where such manufacturers' instructions are available.
- 2. Conductors and cables:
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- i. Alpha Wire Company.
 - ii. American Insulated Wire Corp.; a Leviton Company.
 - iii. Belden Inc.
 - iv. Cerro Wire LLC.
 - v. General Cable Corporation.
 - vi. Senator Wire & Cable Company.
 - vii. Southwire Company.
 - b. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
 - c. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-65 and type RHW-3.
 - d. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.
 - e. MC Metal Clad Cable: 90° C dry THHN copper conductors, maximum voltage 600V. Include green insulated grounding conductor. Steel or aluminum armor.
3. Connectors and splices:
 - a. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
 - b. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - i. AFC Cable Systems, Inc.
 - ii. Hubbell Power Systems, Inc.
 - iii. O-Z/Gedney; EGS Electrical Group LLC.
 - iv. 3M; Electrical Products Division.
 - v. Tyco Electronics Corp.
4. Conductor Material Applications:
 - a. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
 - b. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
5. Conductor insulation and multiconductor cable applications:
 - a. Service Entrance: Type THWN, single conductors in raceway.
 - b. Feeders: Type THHN-THWN, single conductors in raceway.

- c. Exposed Branch Circuits: Type THHN-THWN, single conductors in raceway.
 - d. Class 1 Control Circuits: Type THHN-THWN, in raceway.
 - e. Class 2 Control Circuits: Type THHN-THWN, in raceway.
 - f. Feeders and branch circuits underground in conduits or duct banks and outside the perimeter of the building: type RHW-2 single conductors in raceway.
6. Conductor identification materials:
- a. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
 - b. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
 - c. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
 - d. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
 - e. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
 - f. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - g. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
7. Equipment Identification Labels:
- a. Self-Adhesive, Engraved, Laminated Acrylic, or Melamine Label: Adhesive backed letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
 - b. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).
8. Cable Ties:

- a. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
 - i. Minimum Width: 3/16 inch (5 mm).
 - ii. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
 - iii. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - iv. Color: Black except where used for color-coding.

9. Miscellaneous Identification Products:

- a. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

Panelboards

1. Enclosures: Flush- and surface-mounted cabinets.

- a. Rated for environmental conditions at installed location.
 - i. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - ii. Outdoor Locations: NEMA 250, Type 3R.
- b. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
- c. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
- d. Skirt for Surface-Mounted Panelboards: Same gauge and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
- e. Gutter Extension and Barrier: Same gauge and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
- f. Finishes:
 - i. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - ii. Back Boxes: Galvanized steel.
- g. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.
- h. Incoming Mains Location: Top and bottom.

- i. Phase, Neutral, and Ground Buses:
 - i. Material: Copper.
 - ii. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - j. Conductor Connectors: Suitable for use with conductor material and sizes.
 - i. Material: Hard-drawn copper, 98 percent conductivity.
 - ii. Main and Neutral Lugs: Compression type.
 - iii. Ground Lugs and Bus-Configured Terminators: Compression type.
 - iv. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - v. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 - k. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
 - l. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
 - m. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.
2. Lighting and Appliance Branch-circuit Panelboards:
- a. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; a brand of Schneider Electric, or comparable product by one of the following:
 - i. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - ii. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - iii. Siemens Energy & Automation, Inc.
 - b. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
 - c. Mains: Circuit breaker or lugs only.
 - d. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
 - e. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

3. Disconnecting and Overcurrent Protective Devices:

- a. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - i. 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.
 - ii. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time pickup levels.
 - 3) Long- and short-time time adjustments.
 - 4) Ground-fault pickup level, time delay, and I^2t response.
 - iii. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - iv. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - v. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - vi. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - 1) Standard frame sizes, trip ratings, and number of poles.
 - 2) Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
 - 3) Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - 4) Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - 5) Shunt Trip: 120V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
 - 6) Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - 7) Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
 - 8) Multipole units enclosed in a single housing or factory assembled to operate as a single unit.

- 9) Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
- 10) Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

4. Panelboard Suppressors (spd):

- a. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; a brand of Schneider Electric, or comparable product by one of the following:
 - i. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - ii. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - iii. Siemens Energy & Automation, Inc.
- b. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, bolt-on, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:
 - i. Accessories:
 - 1) Fuses rated at 200-kA interrupting capacity.
 - 2) Fabrication using bolted compression lugs for internal wiring.
 - 3) Integral disconnect switch.
 - 4) Redundant suppression circuits.
 - 5) Redundant replaceable modules.
 - 6) Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 - 7) LED indicator lights for power and protection status.
 - 8) Audible alarm, with silencing switch, to indicate when protection has failed.
 - 9) Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 - 10) Six-digit, transient-event counter set to totalize transient surges.
 - ii. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase.
 - iii. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.

- 1) Line to Neutral: 70,000 A.
 - 2) Line to Ground: 70,000 A.
 - 3) Neutral to Ground: 50,000 A.
- iv. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
 - v. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 and 208Y/120-V, three-phase, four-wire circuits shall be as follows:
 - 1) Line to Neutral: 800 V for 480Y/277, 400 V for 208Y/120.
 - 2) Line to Ground: 800 V for 480Y/277, 400 V for 208Y/120.
 - 3) Neutral to Ground: 800 V for 480Y/277, 400 V for 208Y/120V.
- c. Accessory components and features:
 - i. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
 - ii. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

Wiring Devices

1. General:

- a. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- b. Comply with NFPA 70.
- c. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - i. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - ii. Devices shall comply with the requirements in this Section.

2. Straight-blade Receptacles:

- a. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD Configuration 5-20R, UL 498, and FS W-C-596.

- i. Products: Subject to compliance with requirements, provide one of the following:

- 1) Cooper; 5351 (single), CR5362 (duplex).
- 2) Hubbell; HBL5351 (single), HBL5352 (duplex).
- 3) Leviton; 5891 (single), 5352 (duplex).
- 4) Pass & Seymour; 5361 (single), 5362 (duplex).

3. GFCI Receptacles:

a. General Description:

- i. Straight blade, non-feed-through type.
- ii. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
- iii. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

b. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

- i. Products: Subject to compliance with requirements, provide one of the following:

- 1) Cooper; VGF20.
- 2) Hubbell; GFR5352L.
- 3) Pass & Seymour; 2095.
- 4) Leviton; 7590.

4. Twist-locking Receptacles:

a. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

- i. Products: Subject to compliance with requirements, provide one of the following:

- 1) Cooper; CWL520R.
- 2) Hubbell; HBL2310.
- 3) Leviton; 2310.
- 4) Pass & Seymour; L520-R.

5. Toggle switches:

a. Comply with NEMA WD 1, UL 20, and FS W-S-896.

b. Switches, 120/277 V, 20 A:

- i. Products: Subject to compliance with requirements, provide one of the following:

- 1) Single Pole:

- a) Cooper; AH1221.
- b) Hubbell; HBL1221.
- c) Leviton; 1221-2.
- d) Pass & Seymour; CSB20AC1.

- 2) Three Way:

- a) Cooper; AH1223.
- b) Hubbell; HBL1223.
- c) Leviton; 1223-2.
- d) Pass & Seymour; CSB20AC3.

- 3) Four Way:

- a) Cooper; AH1224.
- b) Hubbell; HBL1224.
- c) Leviton; 1224-2.
- d) Pass & Seymour; CSB20AC4.

6. Wall Plates:

- a. Single and combination types shall match corresponding wiring devices:

- i. Plate-Securing Screws: Metal with head color to match plate finish.
- ii. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished, Type 302 stainless steel.
- iii. Material for Unfinished Spaces: Galvanized steel.
- iv. Material for Damp Locations: Die cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- v. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover, labeled for use in wet locations.

7. Finishes:

- a. Device Color:

- i. Wiring Devices Connected to Normal Power System: Gray unless otherwise indicated or required by NFPA 70 or device listing.
- ii. Wiring Devices Connected to Emergency Power System: Red.

8. Disconnect switches:

- a. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; a brand of Schneider Electric, or comparable product by one of the following:
 - i. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - ii. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - iii. Siemens Energy & Automation, Inc.
- b. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- c. Accessories:
 - i. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - ii. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - iii. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - iv. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - v. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - vi. Hookstick Handle: Allows use of a hookstick to operate the handle.
 - vii. Lugs: Compression type, suitable for number, size, and conductor material.

9. Nonfusible switches:

- a. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; a brand of Schneider Electric, or comparable product by one of the following:
 - i. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - ii. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - iii. Siemens Energy & Automation, Inc.
- b. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- c. Accessories:

- i. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
- ii. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
- iii. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
- iv. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
- v. Hookstick Handle: Allows use of a hookstick to operate the handle.
- vi. Lugs: Compression type, suitable for number, size, and conductor material.

10. Molded-case circuit breakers:

- a. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; a brand of Schneider Electric, or comparable product by one of the following:
 - i. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - ii. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - iii. Siemens Energy & Automation, Inc.
- b. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- c. 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.
- d. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- e. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- f. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- g. Features and Accessories:
 - i. Standard frame sizes, trip ratings, and number of poles.
 - ii. Lugs: Compression type, suitable for number, size, trip ratings, and conductor material.
 - iii. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

- iv. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
- v. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
- vi. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
- vii. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

11. Molded-case Switches:

- a. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; a brand of Schneider Electric, or comparable product by one of the following:
 - i. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - ii. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - iii. Siemens Energy & Automation, Inc.
- b. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- c. Features and Accessories:
 - i. Standard frame sizes and number of poles.
 - ii. Lugs: Compression type, suitable for number, size, trip ratings, and conductor material.
 - iii. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 - iv. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - v. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - vi. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.

12. Enclosures:

- a. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

- i. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
- ii. Outdoor Locations: NEMA 250, Type 3R.
- iii. Wet or Damp, Indoor Locations: NEMA 250, Type 3R

Storage Racks

1. General:

- a. The material storage equipment shall conform to the design indicated and shall be placed in accordance with the general arrangement as shown on the Contract Drawings. The general arrangement may be modified to improve operating efficiency. Any modifications required to the building design to accommodate the equipment shall be the responsibility of the Contractor and shall be provided by the Contractor at no additional cost to CTDOT. Changes shall be specifically approved by the Engineer.

2. Design Requirements:

- a. Provide products of one of the following manufacturers or engineer approved equal:

- i. Speedrack Products Group, Ltd
7903 Venture Avenue
Sparta, MI 49345
800-752-7352
www.speedrack.net
- ii. Equipto Consolidated Storage Companies, Inc.
225 Main Street
Tatamy, PA 18085
800-323-0801
www.equipto.com
- iii. Lyon
420 North Main Street
Montgomery, IL 60538
800-433-8488
www.lyonworkspace.com

- 3. All pallet racks within this facility shall be provided by the same manufacturer to ensure compatibility and interchangeability.

4. Each beam shall be adjustable at approximately 1½ inch intervals.
5. All pallet rack beams shall be designed to carry a minimum 8,000 pound evenly distributed load per rack per shelf, unless otherwise noted. Support beams shall positively lock into the uprights.
6. Provide additional rack end frames per the layout as shown on Contract Drawing.
7. Each beam shall be adjustable at approximately 1½ inch intervals.
8. All pallet rack beams shall be designed to carry a minimum 8,000 pound evenly distributed load per rack per shelf, unless otherwise noted. Support beams shall positively lock into the uprights.
9. Provide additional rack end frames per the layout as shown on Contract Drawing.
10. Provide corner post protection, minimum 24” high, on all frame posts at the end of aisle ways exposed to forklift travel.
11. Provide back to back ties per the layout as shown on the Contract Drawings.
12. Provide footplates at bottom of each rack upright leg.
13. Shims shall be provided as required to level the pallet racks and anchors shall be provided at each rack leg to properly anchor each leg to the floor.
14. HVAC Unit Pallet Racks:
 - a. The HVAC Unit pallet racks shall each store 2 HVAC units mounted on their carts on structural channels attached to the racks and one cart at the floor level between the uprights. The HVAC unit carts are approximately 15’-4” long x 7’-0” wide x 4’-10” high with the HVAC unit.
 - b. Provide 10 double depth pallet racks each consisting of two pallet rack systems, each with an 48 inch upright depth and a height of 12’-0” welded together with two (2) - 14’-0” long C8 channels as shown on contract drawings. The C8 structural channels shall be spaced 5’-10” center to center to correspond to the distance between wheels of the HVAC transport cart, contractor to verify the dimensions in the field. Each upright shall be placed so that the distance between the front and rear racks is 6’-0” as shown on contract drawing.
 - c. Beam lengths shall provide 108 inches between centerlines of uprights. Each rack shall have two (2) beams with their tops 6’-0” and 12’-0” above the finished floor. There shall be no beams at the floor level.

- d. Eight inch wide structural steel channels shall be laid on their web, with legs upright, welded to all beams of each pallet rack. There shall be ½ inch thick plates welded to the channels on both ends, to cap the end to prevent carts rolling off racks.

15. Pantograph Pallet Racks:

- a. The pantographs are mounted to frames that consist of various sized structural tubing. The structural steel tubing will support the pantographs in storage. Pantographs to be stored seven (7) high on the rack system.
- b. Provide 3 pallet racks, each shall be double depth, having two pallet rack systems each with an upright depth of each 42 inches and a height of 14'-0" tied together with 12 inch long row spacers. Beams shall provide 120 inches between centerlines of uprights. Each rack shall have six (6) beams spaced 2'-4" between their tops. There shall be no beams at the floor level. The tops of the bottom beams shall be 2'-4" above the floor level.
- c. Pantograph pallet rack beams shall be designed to carry a minimum 4,000 pound evenly distributed load per rack per shelf. Support beams shall positively lock into the uprights.
- d. Minimum upright column size shall be 3 inches by 3 inches.

16. Wheelset Pallet Racks:

- a. Provide 7 pallet rack systems each with an upright depth of each 42 inches and a height of 10'-0". Beams shall provide 108 inches between centerlines of uprights. Each rack shall have two (2) beams spaced 4'-3" between their tops. There shall be no beams at the floor level. The tops of the bottom beams shall be 4'-3" above the floor level.
- b. Wheelsets with gearboxes but without motors shall be mounted in Metro-North standard wheelset cradles for storage on the rack system. Contractor shall verify dimension in field. Wheelsets with gear boxes in cradles shall be stored three (3) high on the rack system.

Truck Frame Stackable Stands

1. Provide 36 truck frame stands, each shall be a structural steel welded frame, fabricated from minimum 4" x 4" x 1/2" structural square tubing.
2. Two (2) stands shall be required to support each stored truck frame.
3. Provide cross bracing as necessary to be structurally capable of stacking 6,000# truck frames, 3 high on these stands.
4. Submit for engineer review structural design calculations indicating compliance with structural cited standards and sealed by a registered Professional Engineer in the State of Connecticut.
5. Each stand shall consist of a hyper rectangular frame with outside dimensions of approximately 18 inches wide by 24 inches high by 86 inches deep.
6. Provide a single forklift sleeve 8 inches by 4 inches on the ends inside the top of each stand the full depth of the stand.
7. Each stand shall have at least two (2) protruding alignment pins on top and bottom face, at least 1 inch in diameter and 1 inch long, that key into holes or depressions in the truck frame on corners of the fabricated stands.
8. Provide all truck stands with clearly marked, at each end, on the top frame with 3 inch high letters, "UP" with built up weld material that is painted a contrasting color to the balance of the stands.
9. Provide 12 truck stands without protruding pins on the bottom of the frame to be used on the concrete floor slab. Each of these stands shall be clearly marked, on the bottom frame, at each end, with 3 inch high letters, "BOT" with built up weld material, that is painted a contrasting color to the balance of the stands.
10. The contractor shall be required to measure the truck frames on site at the New Haven Yard to determine the exact dimensions required for the stands and configuration of outstanding alignment pins.

Painting

11. Non-stainless steel equipment shall be given a primer coat of factory applied rust inhibiting paint to dry film thickness of 1.5 mils. Provide two finish coats of the manufacturer's standard enamel paint that shall be factory applied over the primer coat. Colors shall be manufacturer standard colors.
12. Surfaces shall be free of rust, scale dirt, and oil before painting. Matching touch-up paint shall be provided in the amount of one quart of each color used to permit retouching.

Floor Finish

1. The Storage Structure floor shall be prepared and finished to have a non-slip coating applied as recommended by the manufacturer.
2. Contractor shall prepare concrete floors according to the manufacturer's requirements. Concrete floor surface must be clean, sound, and dry. Contractor shall perform moisture testing in accordance with ASTM F2170 and submit results to the Engineer to obtain approval prior to applying the coatings to ensure concrete meets the manufacturer's requirements.
3. Primer: Sika Floor 90 as manufactured by the Sika Corporation or approved equal, with an appropriate coverage of 150 sq. ft/gal.
4. Two component, high solids, non-slip, textured, epoxy coating. Sika Floor 7530 as manufactured by the Sika Corporation or approved equal. Two coats of Sika Floor 7530 with an approximate coverage of 100 sq. ft/gal at 17 mils wet. Finish color to be determined as directed by the Engineer.
5. Effective thickness of wearing course approximately 31 mils with 2 coats.
6. One coat of primer and two coats of epoxy finish shall be required.
7. Provide skid-resistant surface by adding 10% by weight of an oven-dried sand, 50-140 (0.1-0.3 mm) gradation, to the top coat mix.

Construction Methods

1. General:
 - a. The erector is responsible for designing and furnishing all temporary bracing, shoring, and/or sequences. The structure is designed to function as a unit upon completion. The structural engineer assumes no liability for the structure during erection.
 - b. No opening (other than those shown on the drawings) shall be made in any structural member, and no modification or alteration shall be made to any structural member or connection without the written approval of the design engineer.
 - c. All methods of construction shall conform to the requirements as stipulated in the Manufacturer's Specifications. A representative of the supplier should verify installation of trusses, connection points, and fabric material.
 - d. All electrical conduit feeding lighting fixtures and devices above grade shall be run exposed on the steel warehouse frame. Junction boxes and device boxes shall be provided as required.

- e. Coordinate additional mounting requirements/restrictions with selected manufacturer.
 - f. Except for specified components and accessories including, but not limited to: prefabricated building components and systems shall be the products of fabric building manufacturer. The responsibility for weather-tight construction and warranties for wall and roof systems and associated accessories shall be the manufacturers and its approved erector.
 - g. The fabric building manufacturer and its approved erector shall accept full responsibility for compliance with the Connecticut Fire Prevention and Building Code, other applicable codes for wall and roof assemblies in their entirety and shall ensure that all components are compatible and weather-tight.
 - h. The building erector shall ensure the connection between the fabric structure and the foundation are water-tight. Also, the erector shall ensure the connection between the main fabric structure and fabric end walls is water-tight.
 - i. Perform quality control inspection, testing and reporting. Provide written Certification that the building conforms to specifications and applicable codes.
 - j. The fabric building manufacturer shall approve the erection contractor.
 - k. Fabrication shall be in accordance with all specifications and approved shop drawings.
 - l. The Contractor shall install the material storage equipment in accordance with the manufacturer's instructions.
 - m. It shall be the Contractor's responsibility to assure that all information regarding the scheduling, delivery, and preparations necessary for setting up the shelving to be supplied under this specification to be verified with the equipment manufacturer and reviewed by the Engineer prior to commencement of the Work.
 - n. Coordinate rack layout, details and installation with the Engineer and Metro-North, and provide access between and behind racks as necessary.
 - o. Shims and anchors shall be provided as required to level the pallet racks and properly anchor them to the floor.
2. Fire Alarm installation:
- a. Heat detector spacing shall comply with NFPA 72 Appendix A for irregular ceiling construction. Detectors shall not be located closer than 36 inches from any part of lighting fixtures. FACP shall be located not more than 72" above finished floor. All wiring for the fire alarm system shall be in complete separate conduit and wiring color codes shall be maintained and identified throughout the installation. System

testing shall comply with “Testing” section of NFPA 72 and reported on the forms provided in NFPA 72. Installation of conductors and cables

- b. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
 - c. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
 - d. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
 - e. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
 - f. Identify and color-code conductors and cables with the requirements listed herein.
3. Connections:
- a. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
 - b. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - c. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
 - d. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.
 - e. Sleeve and sleeve-seal installation for electrical penetrations.
 - f. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.
 - g. Comply with all requirements listed herein.
4. Firestopping:
- a. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.
5. Panelboards:

- a. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
 - b. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
 - c. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
 - d. Proceed with installation only after unsatisfactory conditions have been corrected.
 - e. Install panelboards and accessories according to NEMA PB 1.1.
 - f. Attach panelboard to the vertical finished or structural surface behind the panelboard.
 - g. Comply with mounting and anchoring requirements as required.
 - h. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
 - i. Install overcurrent protective devices and controllers not already factory installed.
 - j. Install filler plates in unused spaces. Arrange conductors in gutters into groups and bundle and wrap with wire ties. Comply with NECA 1.
 - k. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding critical equipment and services for compliance with requirements.
 - l. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - m. Remove and replace malfunctioning units and retest as specified above.
 - n. Test Reports: Prepare a written report to record the following: Test procedures used, test results that comply with requirements. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements
6. Identification:
- a. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs in accordance with electrical codes and regulations.

- b. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
 - c. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification.
 - d. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification.
 - e. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - f. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit. Test continuity of each circuit.
 - g. Trade malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest. Panelboards will be considered defective if they do not pass tests and inspections.
 - h. Prepare test and inspection reports, including a certified report that identifies panelboards included. Include notation of deficiencies detected, remedial action taken and observations after remedial action.
 - i. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
 - j. Set field-adjustable circuit-breaker trip ranges as specified as required.
 - k. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
7. Coordination with Other Trades:
- a. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - b. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - c. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

d. Install wiring devices after all wall preparation, including painting, is complete.

8. Conductors:

- a. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
- b. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
- c. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
- d. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
- e. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
- f. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
- g. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
- h. Use a torque screwdriver when a torque is recommended or required by manufacturer.
- i. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
- j. Tighten unused terminal screws on the device.
- k. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

9. Receptacle Orientation:

- a. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
- b. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

- c. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- d. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

10. GFCI Receptacles:

- a. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.
- b. Use instruments that comply with UL 1436.

11. Tests for Convenience Receptacles:

- a. Line Voltage: Acceptable range is 105 to 132 V. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
- b. Ground Impedance: Values of up to 2 ohms are acceptable.
- c. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
- d. Using the test plug, verify that the device and its outlet box are securely mounted.
- e. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- f. Wiring device will be considered defective if it does not pass tests and inspections.
- g. Prepare test and inspection reports.

12. Enclosures:

- a. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- b. Proceed with installation only after unsatisfactory conditions have been corrected.
- c. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

- d. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- e. Install fuses in fusible devices.
- f. Comply with NECA 1.
- g. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
- h. Label each enclosure with engraved metal or laminated-plastic nameplate.

13. Perform tests and inspections:

- a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- b. Acceptance Testing Preparation:
 - i. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - ii. Test continuity of each circuit.
 - iii. Tests and Inspections:
 - 1) Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2) Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3) Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
 - 4) Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

14. Adjusting:

Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

15. Installation:

- a. Verify identity of each item before installing identification products.
- b. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

- c. Apply identification devices to surfaces that require finish after completing finish work.
- d. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- e. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- f. Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- g. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - i. Outdoors: UV-stabilized nylon.
 - ii. In Spaces Handling Environmental Air: Plenum rated.
- h. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

16. Identification schedule

- a. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - i. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
- b. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - i. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - ii. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.

- c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
 - i. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
 - ii. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
 - iii. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1) Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation. Control wire shall include “to” or “from”.
 - 2) Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3) Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- d. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- e. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
 - i. Comply with 29 CFR 1910.145.
 - ii. Identify system voltage with black letters on an orange background.
 - iii. Apply to exterior of door, cover, or other access.
 - iv. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - 1) Power transfer switches.
 - 2) Controls with external control power connections.
- f. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- g. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

- h. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

17. Labeling Instructions:

- a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
- b. Outdoor Equipment: Stenciled legend 4 inches (100 mm) high.
- c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
- d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

18. Equipment to Be Labeled:

- a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
 - i. Enclosures and electrical cabinets.
 - ii. Enclosed switches.

Warranty and Certifications

- 1. Membrane - Provide a twenty (20) year warranty to include coverage for exterior surfaces, including main structure fabric and end wall fabric, against ripping, tearing, or puncturing. Include coverage for weather tightness of building enclosure elements after installation. Warranty to include equipment, labor, and all associated costs.

2. Structure - Manufacturer's written weather tightness warranty for a period of fifty (50) years against defects in workmanship and leaks in roof panels arising out of or caused by ordinary wear and tear under normal weather and atmospheric conditions. Warranty to include all metal components, including main frame and end wall framing, bracing, and connections to foundation, to cover corrosion resistance.
3. Inspection and Report Services: Fabric manufacturer or his authorized agent shall perform an inspection of the entire system and submit a written report to the Engineer detailing all conditions requiring maintenance and repair by parties under the above warranties. Inspections and reports shall be performed once every other year over the weathertight warranty period.
4. Manufacturer's Certification: Submit written certification signed by the manufacturer stating that the fabric structure system manufacturer will provide warranties and inspections specified herein. Also include certification of the manufacturer's compliance with AISC-MB category.
5. All electrical lighting fixtures and devices shall have a minimum manufacturers 5 year general warranty. Warranty to include equipment, labor, and all associated costs.

Method of Measurement

The "Storage Structure" will be paid on a lump sum basis and will not be measured for payment. The limits of all above and underground utilities, to be included in the lump sum price for "Storage Structure", shall be 5 feet from the outside faces of the foundation walls. All electrical, lighting, fire alarm system, storage racks, ventilation devices, roll up doors, entry doors, finishes, and all items to complete the structure are included in this item and will not be measured for payment. Foundation, concrete slab work, structure excavation, sawcutting, deformed steel bars – epoxy coated, welded wire fabric – epoxy coated, and bituminous pavement are not included in this item and will be measured separately under their individual contract items.

Basis of Payment

Payment for this work will be at the contract lump sum price for "Storage Structure" complete in place which shall include all work necessary and incidental to fabricate, deliver and install the pre-engineered fabric and truss frame structure. Foundation and Concrete slab work shall be paid under "Structure Excavation – Earth (Complete)", "Granular Fill", "Class "F" Concrete", "Cut Bituminous Concrete Pavement", "Bituminous Concrete Pavement", "Deformed Steel Bars – Epoxy Coated", and "Welded Wire Fabric – Epoxy Coated" items.

<u>Pay Item</u>	<u>Pay Unit</u>
Storage Structure	L.S.

ITEM #0090133A – STORAGE AND CART BUILDING**Description:**

Fabricate, deliver and install a pre-engineered rigid steel frame building over foundation by the Contractor as shown on the plans. Provide all utility and electric connections. Foundation and slab work will not be included in this item.

Building dimensions and floor layouts are as shown on the plans. The roof shall monoslope of 1/4" per foot, sloping away from the 12' roll up doors. The minimum eaves height is 13'-8".

The building shall incorporate the following:

The building shall be painted white.

Building shall have insulation R rating: Walls R-21, Ceiling R-38

Qty. Description

- 2- 3'-0" x 7'-0", 16 gauge, single door, dead bolt, hydraulic closer, weather stripping, door sweep, open and close latch and 3" drip cap
- 2- 12' OW x 10' OH roll up garage type doors with locks and OHD electrical operators with interior pushbutton operator controls. R value of 8.0 minimum.
- 1- 6' W x 10' OH roll up garage type door with lock and OHD electrical operator, with interior pushbutton operator controls. R value of 8.0 minimum.
- 1- 3' W x 3' H window with anodized aluminum frame and inserts of industrial quality with active window panel to slide horizontally on stainless steel ball bearing rollers. Windows to include inside positive locking device. Windows to be glazed with 1/4" clear tempered safety glass. R value Of 8.0 minimum.
- 1- 2" (R- 4.4) insulation on refrigerant piping minimum.
- 1- 24" x 24" Acoustical Ceiling Tiles, square edge, white mineral fiber, Class A, CAC range 35-39, NRC range 0.65 – 0.7, with Grid suspension system
- 1- Ceiling mounted unit heater with wall thermostat, 8kW heat for Plumbing Storage Room and Cart garage
- 1 - Forced hot and cold air, vertical cabinet style, Heat Pump; 40K BTU of heat, 3.0 ton of AC and

1100 CFM min; motorized outside air damper via HRV, thermostat controlled, fan motor with 208 volt three phase, 60 hertz operation, typical, or equals; Mitsubishi Models: MXZ-8C36NHZ & MVZ-A36AA4, LG Model: LVN360HV4/ LUU368HV & Model: ANEH033B1 or Samsung Models AC036KNZDCH/AA AC036JXSCCH/AA

- 1- 208V AC, 400 amp, Three phase electrical distribution system
- 1- 400 amp main breaker
- 12- 120Volt duplex power outlets
- 16- 2 bulb 4' LED interior lights and lens, support these pendant hung fixtures from approved and listed for use Unistrut or B-line type channel, spanning and secured to structural roof framing. Fixtures would then be hung from the channel in locations as shown on the lighting plan on an approved and listed for use chain or cable system to a mounting height of 9' AFF.
- 7- 2'X2' LED Troffer, support fixtures by laying in the ceiling grid, then per code requirements provide approved grid attachments listed for use at two points to secured each fixture in the grid and per manufacturer's instructions. Where independent annealed support wires are used for safety per NEC 300.11(B), they must be attached at two points securely at each end of the fixture and then to the structural roof framing. The fixtures will be mounted in the grid to a height of 9' AFF.
- 1- Photo electric smoke detectors, 1 each in Garage, Soap storage and Plumbing storage
- 1- Horn and strobe fire protection system with pull stations, FACP and annunciator
- 1- Fire alarm control system, digital addressable system with interface to master FA system
- 2- Sump and grate
- 1- Floor mounted water closet
- 2- Wall mounted toilet lavatory, ADA compliant in Accessible Unisex Toilet
- 2- 6", 150CFM exhaust fan (Toilet), Call for Aid in (ADA) Accessible Unisex Toilet
- 1- 42", ADA compliant Grab bar in Accessible Unisex Toilet

- 2- GFCI outlets (Toilet)
- 2- 26 watt LED exterior light with photo cell operator or programmable timer at or over each door
- 2- 18" x 30" stainless steel angle frame and shelf mirror
- 2- Surface mounted, roll type towel dispenser
- 1- 19 gallon minimum capacity floor model slop sink, fiberglass reinforced polyester resin
- 1- 20 gallon electric Hot water heater, 208V, 2P. Water Heater to drain to Janitor's sink

Design Loads:

Snow Loads

- Ground Snow Load P_g = 30 PSF
- Snow Importance Factor, I_s 1.0
- Thermal Coefficient factor, C_t 1.0
- Snow Exposure Factor, C_e 1.1

Wind

- Basic Wind Speed (3 second gust) 115 MPH
- Wind Importance Factor, I_w 1.15
- Wind Exposure Category C

Seismic

- Occupancy Category II
- Seismic Importance Factor 1.5
- Site Class E
- Seismic Design Category D
- Short Period Spectral Acceleration, S_s 0.186
- 1-Second Period Spectral Acceleration, S₁ 0.062

The structure shall be designed to conform, but not limited to the following codes:

- Connecticut State Building Code 2016 or Latest Edition with supplements
- ASCE 7, American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures, Latest Edition
- AISC 360, American Institute of Steel Construction Specification for Structural Steel Buildings, Latest Edition

- AISC 341, American Institute of Steel Construction Seismic Provisions for Structural Steel Buildings including Supplement No. 1 dated 2006.
- ACI 318, American Concrete Institute Building Code Requirements for Structural Concrete 2014 or Latest Edition
- ACI 530/530.1, American Concrete Institute Building Code Requirements & Specifications for Masonry Structures 2013 or Latest Edition
- AWS D1.1-04 American Welding Society Structures Welding Code – Steel
- 2015 International Building Code
- 2015 International Energy Conservation Code
- 2015 International Fire Code (Part III)
- 2015 International Plumbing Code
- 2012 International Mechanical Code
- 2015 NFPA 101, Life Safety Code (Part IV)
- 2015 NFPA 1 – Fire Code
- 2017 NFPA 70, National Electrical Code

Certification:

Submit written certification and design calculations prepared and signed by a Professional Engineer, registered to practice in the State of Connecticut verifying that the building design and metal roof system (including panel, clips and support system components) meet indicated loading requirements and codes of authorities having jurisdiction. The certification must reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end use categories, governing code bodies including year and load applications.

Material Testing:

In addition to mill certifications of structural steel, the manufacturer shall provide, upon request, evidence of compliance with specifications through testing independent of the manufacturer's suppliers. The quality assurance testing to include structural bolts, nuts, screw fasteners, mastic and metal coatings (primary, metallic coated products and painted coil products).

Warranties:

1. Provide manufacturer's written weather tightness warranty for a maximum of twenty (20) years against leaks in roof panels arising out of or caused by ordinary wear and tear under normal weather and atmospheric conditions. Warranty shall be signed by both the metal roofing system manufacturer and metal roofing system contractor. Maximum liability of warranty shall be no less than \$ 1.00 per square foot of roof area.
2. Provide manufacturer's standard written warranty for twenty (20) years against perforation of metal roof panels due to corrosion under normal weather and atmospheric conditions. Warranty shall be signed by metal roofing system manufacturer.

3. Provide manufacturer's standard paint film written warranty for twenty (20) years against cracking, peeling, chalking and fading of the coating on painted wall panels, painted roof panels and soffit panels. Warranty shall be signed by the building system or roof system manufacturer. Manufacturer warrants that coating shall not blister, peel, crack, chip or experience material rust through for 20 years. For a period of 20 years chalking shall not exceed #8 – ASTM and fading shall be 5ΔE Hunter units or less.
4. Inspection and Report Services: Metal roof system manufacturer or his authorized agent shall perform inspection of the entire roof system and shall submit a written report to the Owner detailing all conditions requiring maintenance and repair by parties under the above warranties. Inspections and reports shall be performed once every other year over the twenty (20) year weather tightness warranty period. Cost of inspection and Report services shall be included in the contract amount.
5. Manufacturer's Certification: Submit written Certification, by the signed manufacturer one week prior to bid date stating that the metal roof system manufacturer will provide warranties and Inspection and Report service specified herein. NOTE: Warranty terms shall be submitted with the bid. Also included in this submittal will be certification of the manufacturer's compliance with AISC-MB category.

Submittals:

1. Product Data: Submit manufacturer's product information, specifications and installation instructions for building components, accessories, and finishes.
2. Erection Drawings: Submit complete erection drawings showing roof framing, transverse cross sections, covering and trim details and accessory installation details to clearly indicate proper assembly of building components.
3. Submit certification verifying that the metal roofing system has been tested and approved by Underwriter's Laboratory as Class 90. Submit certification that the metal roofing system, has been tested and approved by the US Army Corps of Engineers Guide Specification 07146 (Test Method for Structural Performance of Standing Seam Metal Roof Systems by Uniform Static Air Pressure) (MR-24®, CMR-24® and VSR™).
4. Dealers Certification: Submit certification that the building component system supplier and/or the metal roofing system supplier is a manufacturer's authorized and franchised dealer of the system to be furnished. Certification shall state date on which authorization was granted.
5. Installer Certification: Submit certificate that the building roof system installer has regularly engaged in the installation of building systems of the same or equal construction of the system specified.
6. Samples: Submit samples, two (2) each of the following for Engineer's review. Samples will be used as basis for evaluating quality of finished roof and wall systems.
 - a. Twelve inch long by actual width of roofing, liner panel and sliding panels with required finishes.
 - b. Fasteners (including standing seam roof clips) for application of roofing, sliding and soffit panels.

- c. Twelve (12) inch long (min.) x twelve (12) inch wide (min.) of actual standing seam side lap seams for both sides of a typical panel including sealants and closures.

Materials:

Structural Steel Design:

All structural mill sections or welded plate sections shall be designed in accordance with the latest edition of ASIC “Specifications for Design, Fabrication and Erection of Structural Steel Buildings,” and all cold formed steel members shall be designed in accordance with the latest edition of AISI “Specification for the Design of Cold-Formed Steel Structural Members.”

Primary Framing:

Rigid Frames: Frame shall consist of welded-up plate section or rolled section columns and roof beams complete with necessary splice plates for bolted field assembly. All bolts for field assembly of frame members shall be high strength bolts as indicated on the erection drawings.

Endwall Structural: The endwall structural shall be cold-formed channel members designed in accordance with the latest edition of AISI Specifications or welded-up plates sections designed in accordance with the latest edition AISC Specifications. Endwall frames shall consist of endwall corner posts, endwall roof beams and endwall posts as required by design criteria.

Secondary Structural Members:

Purlins and Girts: Purlins and Girts shall be “Z” shaped, precision roll formed.

Eave Strut: Eave Struts shall be factory pre-punched “C” sections.

Bracing: Bracing shall be located as indicated on the drawings.

Structural Painting:

1. Prior to painting all steel shall be cleaned of loose rust, loose mill scale, dirt and other foreign material. Unless otherwise specified, the fabricator shall not sand blast, flame clean or pickle prior to painting.
2. Factory cover all steel with one coat of red oxide primer paint formulated to equal or exceed the performance of Federal Specification TT-P-636D, TT-P-664C and SSPC Paint-25.

Primary Frames:

1. Clean all steel per SSPC-SP2.
2. Apply one coat of water reducible alkyd primer by spray or dip method to a minimum coating thickness of 1.0 mil.

Secondary Structural:

1. Clean all steel per SSPC-SP8.

2. Apply one coat of coil applied polyester primer to a minimum coating thickness of 0.5 mil (Purlins and Girts).

Roof:

The roof shall be covered with a roof system furnished by the manufacturer and installed in accordance with the manufacturer’s instructions.

Component Description:

Roof Panels:

Roof panels shall be roll formed panels 24” wide, with 2 major corrugation, 2” high (2-3/4” including seam) 24” on center. The flat of the panel shall contain cross flutes 6” on center perpendicular to the major corrugations the entire length of the panel to reduce wind noise and improve workability.

Panel material as specified shall be 24 gauge steel coated both sides with a layer of aluminum zinc alloy (approximately 55% aluminum and 45% zinc) applied by the continuous hot dip method. Minimum 0.55 ounce coated weight per square foot as determined by the triple spot test per ASTM Specification A792.

System Design:

All components for the roof paneling system shall be designed in accordance with sound engineering methods and practices.

Roof panels shall be designed in accordance with the latest edition of AISI “Specifications for the Design of Light-Gage, Cold Formed Steel Structural Members.”

Paneling system shall be designed to support design live loads.

All endwall trims and roof transition flashings shall allow the roof panel to move relative to the wall panels and/or parapets as the roof expands and contracts with temperature change.

Roof Panel Fasteners:

All connections of panels to structural members, except at eaves, shall be made with clips with moveable tabs that are seamed into the standing seam sidelap.

Panel clips shall be fastened to structural members with fasteners as per manufacturer’s erection drawings, using factory pre-punched holes in structural members. Scrubolts™ or approved equal, shall contain a metal backed rubber washer which serves as a torque indicator.

Panel to panel connections shall be made with a positive, field formed standing double lock seam, formed by a special seaming machine. The machine field forms the final 180° of a 360° Pittsburgh double-lock standing seam; all sidelap sealant shall be factory applied.

Fasteners penetrating the metal membrane at the following locations must not exceed the frequency listed:

Basic Panel System	0 per sq. ft.	High Eave (no parapet)	2 per lin. Ft.
Exterior Eave Gutter	2 per sq. ft.	Panel Splices	2 per lin. Ft.

Gable Trim (no parapet)	2 per lin. ft.	High Side Transition	1 per lin. Ft.
Ridge	1 per lin. Ft.		

In lieu of pre-punched secondaries and panels, pre-drilling of the structural members is mandatory in order to maintain proper alignment of the roof system.

Accessories:

The building shall have ventilators, gutters. Downspouts, gable trim and eave trim.

Performance Testing:

Underwriters Laboratories – UL Class 90 Rating (UL Test 580)

The roof system shall carry a UL wind uplift classification Class 90 rating to ensure structural integrity.

Provision for Expansion/Contraction:

Provision for thermal expansion movement of the panels shall be accomplished by the use of clips with a moveable tab. The stainless steel tab shall be factory centered on the roof clip when installed to assure full movement in either direction. A force of no more than 8 pounds will be required to initiate tab movement. Each clip shall accommodate a minimum of 1¼” in either direction.

Exterior Wall:

Exterior walls shall be covered with precision roll-formed panels.

Panel Description:

Panel shall be 3’ wide with four major corrugations, 1½” high, and 12” on center with two minor corrugations between each of the major corrugations the entire length of the panel.

Panels shall be one piece from base to building eave.

The upper end of panels shall be fabricated with mitered cut to match corrugations of roof panels.

The bottom end of panels shall be straight cut.

Panel Design:

Panel design shall be in accordance with the latest edition of AISI “Specifications for the Design of Light-Gage, Cold-Formed Steel Structural Members,” and in accordance with sound engineering methods and practices.

Panel Material and Finish:

26 gage galvanized, per ASTM A525 and painted with exterior color of the manufacturer’s finish system, a full strength fluoropolymer coating. Manufacturer warrants that coating shall not blister, peel, crack, chip or experience material rust through for 20 years. For a period of 20 years chalking shall not exceed #8 – ASTM and fading shall be 5ΔE Hunter units or less.

Panels shall be sealed at the base with foam or rubber closures.

Trim material shall be as follow:

All exterior trim shall be of the same finish as the exterior color of the wall panel except the following:

1. All gutters, downspouts, eave trim, gable trim, door side flashings to be pre-painted galvanized steel with fluoropolymer coating.
2. All gutter, downspouts, eave trim and gable trim shall be Charcoal.
3. Door side flashing and door header flashing shall be in Charcoal.

All interior trim shall be painted.

All flashings, trims, closures and similar items shall be detailed on drawings as supplied by the manufacturer of the panel.

Wall Panel Fasteners:

Wall panel to structural connections shall be made with Torx® head fasteners, Torx® head self-drilling screws or Lock-Rivet™ fasteners or approved equal. Panel to Panel connections shall be made with Torx® heads self-drilling screws, or Lock-Rivet™ fasteners or approved equal.

All exposed fasteners shall be pre-painted to match wall color or shall be covered with plastic color caps to match wall color.

Insulation:

The roof and exterior walls shall be made with faced fiberglass insulation blanket with a minimum R-value of 38 and 21 respectively. The insulation facing shall be foil reinforced kraft, 0.00035” minimum thick aluminum foil laminated to kraft paper, reinforced with fiberglass scrim, which is adhered to the blanket insulation. The assembly of blanket and facing shall have a flame spread rating of 25 and U/L label shall be furnished upon request.

Deadbolt Lock:

The door hardware shall have a removable core. Metro-North shall determine the exact brand and model that will be used.

Interior Walls:

All interior walls shall be made of Laminated FRP panels (Minimum 3/8” thick). Exterior walls shall be covered with precision roll-formed panels.

Floor Finish:

All rooms shall have Vinyl flooring and Vinyl Cove base, excluding the Soap Storage/Cleaning Supply room,

Plumbing Storage room, Cart Storage area and the passage.

The Soap Storage/Cleaning Supply Room, Plumbing Storage Room, Cart Storage Area, and the Passage shall be prepared and finished to have a non-slip coating applied as recommended by the manufacturer. Contractor shall prepare concrete floors according to the manufacturer's requirements. Concrete floor surface must be clean, sound, and dry. Contractor shall perform moisture testing in each room in accordance with ASTM F2170 and submit results to the Engineer to obtain approval prior to applying the coatings to ensure concrete meets the manufacturer's requirements.

Primer: Sika Floor 90 as manufactured by the Sika Corporation or approved equal, with an appropriate coverage of 150 sq. ft/gal.

Two component, high solids, non-slip, textured, epoxy coating. Sika Floor 7530 as manufactured by the Sika Corporation or approved equal. Two coats of Sika Floor 7530 with an approximate coverage of 100 sq. ft/gal at 17 mils wet. Finish color to be determined as directed by the Engineer.

Effective thickness of wearing course approximately 31 mils with 2 coats.

One coat of primer and two coats of epoxy finish shall be required.

Provide skid-resistant surface by adding 10% by weight of an oven-dried sand, 50-140 (0.1-0.3 mm) gradation, to the top coat mix.

Mechanical:

- All ducts shall be fabricated in accordance with the latest edition on SMACNA standards and International Mechanical Code.
- Dust tape shall not be permitted as sealant.
- Fiberglass duct system is not permitted.
- Duct sizes indicated on the drawings are inner clear dimensions.
- Diffuser neck size shall be same as flexible duct size, unless noted otherwise.
- Unless noted otherwise, all changes in direction shall be made with radius elbows with radius to centerline equal to 1.5 times the duct diameter.

Accessories:

- Volume dampers shall comply with SMACNA. Provide damper on each branch runout and where required for adequate balancing. Where volume dampers are not readily accessible, provide remote operator.
- Flexible ducts shall be acoustical type with CPE inner fabric inner liner similar to Flexmaster SM. Length of flexible duct shall not exceed 6feet in length to diffusers. Special conditions must be approved by the engineer to limit flexible duct more than 6feet and less than 14feet in length. Flexible ducts shall not be installed above inaccessible ceilings.
- Flexible faced fiberglass ductwork insulation shall be John-Manville Microtite with FSK factory applied foil scrim kraft facing or approved equal.
- Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by the insulation manufacturer for the application indicated.
- Supply ductwork shall be 1-1/2" thick flexible faced fiberglass.

Electrical:

- All materials and equipment provided under this section shall be new, first grade, best of their section and shall meet the requirements of all standards set up to govern the manufacture of electrical materials and comply with all applicable codes and standards.
- All equipment and materials shall be specification grade and bear underwriter's (U.L.) label.
- Conductors shall be U.L. listed, 600 Volts, 90 Deg. C. Single Conductor type THWN/THHN. 98% conductivity annealed uncoated cooper with PVC insulation covered with nylon sheath jacket. Tested in accordance with the requirements of the underwriter's laboratories standard 83. Wire shall be identified by surface marking indicating manufacturer's identification, conductor size and metal, voltage rating, UL symbol and type designation. Conductors shall be stranded. Minimum size shall be #12awg unless otherwise indicated as manufactured by Essex, Rome cable, Triangle cable or General cable.
- Electric metallic tubing (EMT) shall be zinc coated steel.
- Armored cable shall be of galvanized steel interlocking armor construction, color coded thermoplastic insulated copper conductors, 9 deg. C, 600 volts. Conductor sizes shall be as indicated on the drawings. If not indicated, the sizes of power and lighting conductors shall not be less than size #12awg as manufactured by American flexible conduit, Triangle or Southwire. Connectors shall be squeeze type, die cast zinc, or malleable iron - cadmium plated as manufactured by Z Gedney, Appleton or Thomas-Betts.
- Conduit straps shall be snap-type, double ribbed steel - zinc plated. Metal clad cable and flexible metallic conduit connectors shall be malleable iron-zinc plated, male hub threads with locknut.
- Recessed outlet boxes shall be drawn steel, galvanized with a minimum depth of 1-1/2inches. Minimum size shall be 4 inch x 4 inch square. Provide and install plaster rings as required.
- Outlet boxes for surface mounted switches and receptacles shall be type FD, cast ferroalloy with threaded hubs. Provide gasketed cover as required.
- Switches shall be 120-277VAC 20 amp, single pole. Color shall be Ivory.
- Receptacle and switch cover plates shall be smooth thermoplastic Ivory.
- Panelboards shall be NEMA PB 1, circuit breaker type.
- Provide and install markers for all conduits. Markers shall be "Brady" type adhesive-backed, plastic-faced of suitable color. Marker shall identify system and electrical

characteristics. Install markers at point of origin, termination, adjacent to each intermediate splice, and all boxes in run.

- Identify all conductors at origin, termination and at intermediate boxes by means of “Brady” type, pressure sensitive, plastic coated face, stick-on labels except feeders shall have phenolic tags engraved with circuit designations and attached with plastic tie-wraps.

Plumbing:

- Soil, waste and vent piping below grade or floor slab shall be cast iron pipe, ASTM A74 Service weight, fitting: Cast iron, Joints: Hub-and-Spigot, CISPI HSN compression type with ASTM C564 Neoprene gaskets or Plastic pipe: ASTM D2665 Polyvinyl chloride (PVC), schedule 40, Fitting: PVC. Joints: ASTM D2855, Solvent weld.
- Soil waste and Vent piping above grade or floor slab shall be Cast iron pipe: CISPS 301, Hubless, Service weight. Fittings: Cast iron. Joints: Neoprene gaskets and stainless steel clamp and shield assemblies. OR Copper pipe: ASTM B306, DMW, Fittings: ANSI/ASME B16.3, Cast Bronze, or ANSI/ASME Bb16.29, Wrought Copper. Joints: ANSI/ASTM B32, Solder Grade 50B, or Plastic pipe: ASTM D2665, Polyvinyl chloride (PVC) Schedule 40, Fittings: PVC joints: ASTM D2855, Solvent weld.
- Domestic water piping above grade shall be Type I hard copper tubing with Wrought Copper solder joint fittings, made with Lead free (95% Tin - 5% Antimony) or Propress mechanical fittings, as approved by the engineer.
- Domestic water system valves shall be Milwaukee, Nibco, or Hammond, 125 #Ball, Gate, Globe and check types selected for the intended service per manufacturer's standards. Provide individual shutoff valves for each fixture or piece of equipment.
- Secure all piping to structure using clevis or split ring type except where a t bar is used to support pipe groups. Hanger rods shall be steel except hangers supporting copper pipe shall be brass, bronze, or cooper plated steel. Minimum hanger rod sizes and spacing as follows:

PIPE SIZE	MIN SPACING, FEET			MIN DIAMETER ROD HANGER
	COPPER	STEEL	CPVC	
½,¾	5	7	4	3/8"
1	6	7	4-1/2	3/8"
1-1/4	7	7	5	3/8"
1-1/2	8	9	5	3/8"
1-1/2	8	10	6	3/8"
2	8	10	6	½"
2-1/2	8	10	6	½"
3	8	10	6	½"
4	8	10	6	½"

- Piping insulation shall be Preformed Fiberglass, 0.25 K-factor at 75deg.F. Mean temperature; Schuller Micro-Lok w/ all service jacket (ASJ), and Zeston PVC fitting covers. Insulate piping subject to heat loss, heat gain and condensation, as follows:

<u>PIPE SIZE</u>	<u>INSULATION THICKNESS</u>
1-1/2" & BELOW	1-1/2"
ABOVE 1-1/2"	2"

- All exposed pipe and fittings in mechanical equipment rooms shall be additionally covered with a PVC jacket.
- Wall Cleanouts: Wade #W-8550-S Cleanout ferrule with countersunk plugs and W-8480-S Access frame and cover. Equals by Zurn or Jasam accepted.
- Individual fixture stop valves: Chicago Faucet Company #441 for 3/8" supply, # 442 for 1/2" supply, angle stops, slow compression type with cross handle, polished chrome finish.
- Flow control devices: Dole flow regulators, Eaton Corp, Controls division: Lavatories #FMA-0.5 GPM; Kitchen Sink: #FMC-2.0 GPM, Hose Bibbs: #GC-3.0 GPM.
- Vacuum relief valve (on Cold water supply to water heater): Watts #36A or equal, complying with ANSI Z21.22 and Connecticut Plumbing Code. Valve shall have a cross sectional area equal to one pipe size smaller than the supply pipe in which it is to be installed.
- Water pressure reducing valves: Watts regulator Co. No. 2238, adjustable 25PSI to 75PSI range, Bronze construction with thermal expansion bypass feature.

Construction Methods:

The Contractor shall erect the structure, seal the building after installation of electrical, mechanical and plumbing systems, to form a weather tight enclosure.

Method of Measurement:

“Storage and Cart Building” will be paid on a lump sum basis and will not be measured for payment. The limits of all underground utilities, to be included in the lump sum price for “Storage and Cart Building”, shall be 5’ from the outside faces of the foundation walls. Foundation and Concrete slab work will not be included in this item.

Basis of Payment:

Payment for this work will be at the contract lump sum price for “Storage and Cart Building” complete in place which shall include all work necessary and incidental to fabricate and install the building including all Plumbing, Electrical, Mechanical and Fire protection system and all appurtenances and finishes mentioned in these specifications and drawings and or as needed per building code requirements. Foundation and Concrete slab work shall be paid under “Structure Excavation – Earth (Complete)”, “Class “F” Concrete”, “Deformed Steel Bars- Epoxy Coated” and “Welded Wire Fabric – Epoxy Coated” items.

<u>Pay Item</u>	<u>Pay Unit</u>
Storage and Cart Building	Lump Sum

ITEM #0202000A - EARTH EXCAVATION

Earth Excavation shall be performed in accordance with Section 2.02, supplemented and amended as follows:

Article 2.03.01 – Description:

Add the following

Earth Excavation shall include the ballast and tie removal required under “Removal of Railroad Tracks” and “Railroad Track Work.”

All railroad ties from this project shall be treated as contaminated and be disposed as described under the Disposal of Contaminated Railroad Ties item.

Article 2.02.04 – Method of Measurement:

Add the following:

Earth Excavation for ballast and tie removal shall be measured from a plane at the base of the tie to the top of tie and extend one (1) foot out from each end of tie.

Excavations beyond the payment limits will be considered “Unauthorized Excavation” and will not be paid for. Any soil generated by unauthorized excavations will be stockpiled separately and the Contractor shall assume the additional costs of environmental testing, stockpiling, off-site disposal of controlled and/or clean soils, and placement and compaction of suitable backfill.

Article 02.02.05 – Basis of Payment:

Add the following:

Ballast and tie removal shall be paid as Earth Excavation. The New Haven Rail Yard is considered an area of environmental concern. For additional information refer to “Dewatering”, “Controlled Materials Handling”, and “Disposal of Controlled Materials” Specifications. Ballast material shall be tested for contamination at the WSA to determine proper disposition.

ITEM #0202528A – REMOVAL OF RAILROAD TRACKS

Description:

Work for this item shall include removing turnouts, rail, rail guard rail, and all appurtenances beyond installation limits and new work limits shown on the Contract Drawings in order to meet minimum rail length requirements for both track and turnouts, and all other track materials and appurtenances; all power and signal materials and appurtenances, (cable, wire, conduit, trunking, track connections, rail bonding, and other appurtenances secured to the ties or rails) that are in the trackway which will be required to be removed in order to provide for the changes in the tracks within the limits shown on the Contract Drawings and as determined by the Engineer; also all cleaning up, including the removal and disposal of all debris and incidental work. Ballast and railroad ties shall be removed under the Earth Excavation item. Concrete shall be removed under the Rock Excavation item. All railroad ties from this project shall be treated as contaminated and be disposed as described under the Disposal of Contaminated Railroad Ties item.

Materials:

The Contractor shall comply with provisions of Codes, Specifications, Standards and recommended practices of the most recent edition and addenda thereto of:

AREMA Manual: American Railway Engineering and Maintenance–Of-Way Association, Manual for Railway Engineering.

MNRR: Metro North Railroad.

Construction Methods:

The Contractor's attention is called to the fact that the tracks to be removed are now under operations. The Contractor shall remove tracks at such time and under such conditions as has been approved by the Engineer prior to the start of such work.

Rails shall be cut at the limit of removal using a rail saw and not with a torch. Demolition and removal of work shall be carried out in a systematic manner, with the least possible disturbance to existing traffic on adjacent tracks. Trackwork removal shall include all rails, ties, concrete and hardware.

The Contractor shall remove and collect certain track materials not required for reinstallation, from existing track shown on the Contract Drawings. These Materials shall remain the property of CTDOT unless specifically released to the Contractor through written direction from the

Engineer. All CTDOT retained material shall be delivered by the Contractor to the CTDOT material storage yard as directed by the Engineer.

Except where otherwise shown on the Contract Drawings or directed by the Engineer, materials to be removed and collected by the Contractor for return to CTDOT shall include:

1. All in-service rails, frogs, switch points and stock rails in good condition as determined by the Engineer.
2. All hand thrown switch stands.

All cross ties and switch ties to be removed by the Contractor shall be treated as contaminated and be disposed of at a facility contained on the Approved DOT Disposal Facilities list under the item Disposal of Contaminated Railroad Ties.

Method of Measurement:

This item shall be measured for payment by the actual number of linear feet of railroad tracks removed and measured along the centerline of tracks, including disposal of all trackwork materials.

Basis of Payment:

This work will be paid for at the contract unit price per linear foot for “Removal of Railroad Tracks”, which price shall include the removal of track and hardware, disposal of materials, and for all labor, tools, equipment and incidentals necessary to complete the work.

Railroad tie and ballast removal shall be paid as Earth Excavation.

Concrete Excavation shall be paid as Rock Excavation.

<u>Pay Item</u>	<u>Pay Unit</u>
Removal of Railroad Tracks	LF

ITEM NO. 0999002A – DISPOSAL OF BUILDINGS

This item shall conform to the requirements of Section 9.99 of the standard specifications Form 817, supplemental and amended as follows:

Article 9.99.01 - Description:

Delete and replace with the following:

Work under this item shall include the demolition and disposal of the former dewatering treatment plant (Building 10A) and six existing trailers from the west end of the New Haven Railyard (NHR Y) as identified on the plans. Also included in this item is the relocation of one existing trailer, to be determined by MNR, to an area near Building 23.

The Contractor shall not commence demolition and/or relocation activities until such time that all applicable hazardous material abatement has been completed. Refer to Environmental specifications. Final release of items shall be provided by the Owner in coordination with MNR.

Items released to the Contractor shall be immediately removed and properly disposed of off-site. Items not released to the Contractor shall remain the property of the Owner.

The Contractor must obtain a Municipal Demolition Permit from the City of New Haven for all demolition work associated with this project. The work shall be performed by an experienced firm that has successfully completed demolition work similar to that indicated herein. Such firm shall be Registered for Demolition Business by the Department of Public Safety (CTDPS) in accordance with CGS 29-402, and shall perform work under the supervision of a competent person as defined under OSHA 29 CFR 1926.850-Demolition. In addition, employees performing on-site demolition related activity shall have attended an OSHA 10-hour Occupational Safety and Health Training Course in Construction Safety & Health, or equivalent.

Article 9.99.03 - Construction Methods:

Replace section with the following:

(1) Pre-demolition Submittals and Permits:

- (a) Follow all requirements set forth in Section 1.20-1.08.03.5.B, APPROVAL PROCESS.
- (b) The Contractor shall, in accordance with CGS 29-406, apply for and obtain from the local building department, demolition permits for each structure to be demolished/disposed of. The Contractor shall pay all associated fees. The Contractor is also hereby notified that the local authority may impose a waiting period of up to ninety (90) days before granting

any demolition permit. It is the Contractor's responsibility to schedule activities to accommodate for such waiting periods and these waiting periods will not be allowed as the basis of delay claims by the Contractor.

- (c) For each structure to be demolished, if an Asbestos Abatement Notification Form was not submitted to the CTDPH, the Contractor shall submit the Demolition/Notification Form to the CTDPH not less than 10 working days prior to the commencement of demolition activities in accordance with CTDPH 19a-332a-3. The Contractor shall pay all associated fees.
- (d) In accordance with CGS 29-407, prior to commencing demolition activity, Contractor shall notify each adjoining property owner by certified mail that such demolition operations are planned.
- (e) At least fifteen (15) working days prior to the start of any demolition work, the Contractor shall submit the following to the Engineer for review and approval:
 - 1. A copy of the Contractors CTDPH Registration for Demolition Business.
 - 2. A copy of the approved demolition permit(s)
 - 3. A copy of the CTDPH Demolition/Notification Form(s) (as applicable)
 - 4. A copy of the letters to adjoining property owners
 - 5. Documentation that signs conforming to CGS 4b-64 have been posted (as applicable)
 - 6. Copies of utility disconnect letters
 - 7. A project time schedule for each phase of work, including demolition, utility service/sewer abandonment, etc.
 - 8. Proposed demolition procedures to be utilized, as developed by a competent person in accordance with OSHA 29 CFR 1926.850, and waste management plan
 - 9. Proposed protective/safety measures to be implemented.
 - 10. Proposed dust control measures.
 - 11. Proposed demolition C&D bulky waste disposal facility.
 - 12. Proposed steel/scrap metal recycling facility.
 - 13. Proposed concrete, brick, stone batch processing/recycling facility.
 - 14. Proposed bituminous disposal/recycling facility.
 - 15. A copy of the CTDEP Nuisance Wildlife Control Operator license (as applicable)
 - 16. Copies of the Site Postings and Legal Notices Published pursuant to CGS 4b-64 (as applicable).
 - 17. Copies of on-site employee OSHA 10-hour Construction Safety & Health training certificates, or equivalent.

(2) Disposal of Buildings Provisions:

The Contractor shall dispose of Building 10A and trailers, unless otherwise ordered by the Engineer. The Contractor shall completely demolish the structure and associated items, remove and dispose of the demolition debris, and abandon utilities as identified in the plans and/or specifications, listed in the proposal, or as directed by the Engineer. The Contractor shall also relocate one existing trailer, to be determined by MNR, to an area near Building 23.

The Contractor shall provide adequate safety measures and suitable protection for the public, State of Connecticut and Metro-North personnel.

The Contractor shall prevent damage to any existing utilities that are to remain in service during demolition. The Contractor shall not interrupt existing utilities serving adjacent facilities, except when authorized in writing by authorities having jurisdiction and the Engineer.

Use of explosives or blasting for demolition purposes will not be permitted.

No burning or flame/torch cutting will be permitted unless approved in advance by the Engineer.

Any items not designated for salvage in the documents that are of salvageable value to the Contractor may be removed as work progresses. The Contractor shall transport its salvaged items from site as they are removed. Storage or sale of such items will not be permitted on site. No requests for additional time will be considered based on delays caused by the Contractor's salvage work.

The Contractor shall use the methods of demolition required to complete the work in accordance with all codes, ordinances and requirements of governing authorities. Demolition practices shall be acceptable to the Engineer, shall assure the safety of persons, equipment and structures which are to remain, and shall provide adequate protection of the environment. The Contractor shall schedule demolition activities to minimize delays, storage of debris, and construction traffic on-site.

Demolition shall proceed in a systematic manner, from top of structure to ground. No storage of rubble on the site shall be allowed.

Contractor shall adhere to the requirements set forth in Section 1.20-1.08.03.5.G, POLLUTION CONTROLS.

If hazardous materials are encountered during demolition operations, the Contractor shall immediately notify the Engineer. The Contractor shall also comply with applicable laws and regulations regarding removal, handling, disposal, and protection against exposure and environmental pollution.

Demolition operations and removal of debris shall not interfere with roads, streets, walks, and other adjacent occupied and used facilities. Shoring, bracing, barricades, fencing and other

devices shall be used as necessary to protect adjacent properties and the public. Damage to adjacent facilities caused by demolition operations shall be promptly repaired. The Contractor shall not close or obstruct streets, access drives, walks, or other occupied or used facilities without permission from the Engineer and local authorities.

The Contractor shall implement a fugitive dust suppression program in accordance with the Contract to prevent the off-site migration of particulate matter and/or dust resulting from demolition activities. It shall be the Contractor's responsibility to supervise fugitive dust control measures and to monitor airborne particulate matter. The Contractor shall employ reasonable fugitive dust suppression techniques and shall visually observe the amounts of particulate and/or fugitive dust generated.

If the control of fugitive dust and/or particulate matter is not acceptable to the Engineer, the Contractor shall implement corrective measures, including using water or calcium chloride for dust control, temporary enclosures, and other methods to limit and control dust and dirt migration. The contractor shall not create hazardous or objectionable conditions, such as ice, flooding, water runoff and pollution when using water for dust control. Calcium Chloride for dust control shall conform to the requirements of Article 9.42. Water for dust control shall conform to the requirements of Article 9.43.

The Engineer will conduct ambient air monitoring for contaminants such as total lead, total dust, total fibers, silica, microbial spores, etc. for comparison to applicable standards. If any standard is exceeded, Contractor shall immediately cease operations and modify the engineering controls being used to maintain levels below the applicable standard.

Except as otherwise specified, the Contractor shall break up, demolish and remove existing Building 10A from site for disposal/recycling to include:

1. The entire 83' x 80' truss house type structure, fabric covering, overhead doors, and utility door.
2. All interior electric panelboards, overhead heaters, lights, and associated conduits.
3. All interior surface debris, and concrete pads.
4. All interior bituminous type pavement.
5. All footings and foundations to a minimum depth of 48 inches below existing grade.
6. All interior drainage structures and pipes to limit of building footprint, including plugging of all pipes.

For additional information, see Figure 1 - Existing Floor Plan and Figures 2 thru 6 – Interior Photographs circa August 2017.

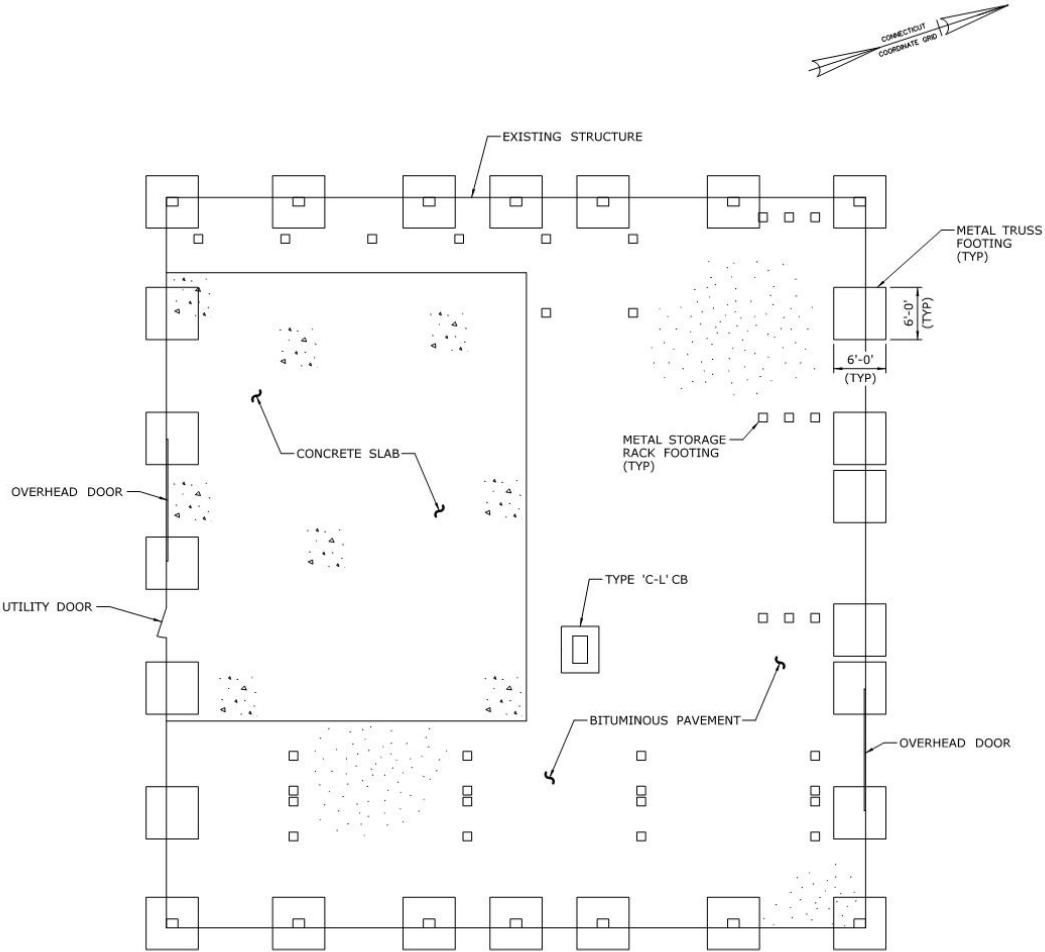


Figure 1 - Existing Floor Plan



Figure 2 - Interior Photograph



Figure 3 - Interior Photograph



Figure 4 - Interior Photograph



Figure 5 - Interior Photograph



Figure 6 - Interior Photograph

Accumulated debris, rubbish, wood, plaster, roofing, wallboard, and other materials resulting from demolition and related operations shall be removed from the site daily as generated. Steel and scrap metal generated during the demolition process shall be recycled as scrap metal at an approved scrap metal recycling facility.

Demolition materials that have not been characterized as hazardous shall be recycled off site or disposed of at a landfill. Transport non-hazardous materials removed from the demolished structure and dispose/recycle off site as C&D bulky waste in accordance with the DEP solid waste management standards. The Contractor shall recycle as much C&D bulky waste as practical, following waste management guidelines such as the US Green Building Council (USGBC) Leadership in Energy & Environmental Design (LEED) Green Building Rating System, in cases where it reduces the overall project costs and does not violate applicable regulations or restrictions. Burning of combustible materials from the demolished structure shall not be permitted on site.

The Contractor shall dispose or recycle materials off-site in accordance with the Specifications and all Federal, State and local regulations. A copy of the shipping paper for each load of material shipped off-site for disposal/recycling, including the weight of the load as measured at the disposal/recycling facility, shall be returned to the Engineer.

The foundation and subgrade areas shall be backfilled. Any additional material required to bring the subsurface area to grade shall be granular fill in accordance with Article 2.13. Prior to placement of fill materials, areas to be filled shall be free of standing water, frost, frozen

material, trash and debris. Construction debris shall not be used as fill within the project limits and shall be properly disposed of in accordance with all regulations. After fill placement and compaction, the Contractor shall grade surface to meet adjacent contours and provide flow to surface drainage structures. Grading shall not create any depressions that can retain water, create any diversions to surface flow, or block the intended flow of surface water.

(3) Salvage and Relocation of Equipment/Materials:

At the pre-demolition coordination meeting, the Contractor, Engineer, the Department, and MNR will determine any elements within the former dewatering treatment plant and existing trailers which will be salvaged and delivered to a location within 25 miles of the NHRY. All salvaged items shall be packaged and transported in a manner to preserve the existing operational and cosmetic condition. Packaging shall be weather tight, unless otherwise directed by the Engineer. All salvaged elements shall be clearly tagged and labeled in a weather resistant manner with the owner's name (MNR or CTDOT), schedule of contents, date of salvage, source location, storage destination, and the text, "Salvaged by WEY Project No. 0300-0138".

MNR will remove all existing train components and metal rack systems within Building 10A prior to start of demolition. If directed by the Engineer, the Contractor shall remove the remaining existing train components and metal rack systems not removed by MNR. This work shall be paid as provided for under Article 1.20-1.09.04 – "Extra and Cost-Plus Work."

(4) Post-demolition Submittals:

The Contractor shall provide the Engineer, within 30 days of completion of the demolition work, a compliance package; which shall include, but not be limited to, the following:

1. Site sketches indicating the locations of capped utilities (water, sewer, etc) and/or other subsurface structural, electrical or mechanical conditions.
2. Shipping papers from the CTDEP solid waste bulky waste disposal facility indicating receipt and acceptance of C&D bulky waste demolition debris.
3. Shipping papers from the approved scrap metal recycling facility indicating receipt and acceptance of scrap metal debris.
4. Shipping papers from the approved concrete, brick, stone batch processing/recycling facility indicating receipt and acceptance of the recycled debris.

Article 9.99.04 – Method of Measurement:

Remove and replace with the following:

The Contractor shall submit a lump sum bid price for the disposal of Building 10A and six existing trailers from the west end of the New Haven Railyard (NHRY) as identified on the plans, which shall include the removal of the structure, fabric covering, doors, interior electric

components and conduits, interior surface debris, concrete pad, interior bituminous type pavement, footings and foundations to a minimum depth of 48 inches below existing grade, and interior drainage structures and pipes.

Plugging of existing drainage outlet shall not be measured for payment and shall be considered incidental to the work.

Backfilling of the foundation and subgrade areas with granular fill to bring the subsurface area to grade shall not be measured for payment and shall be considered incidental to the work.

Relocation of one existing trailer, to be determined by MNR, to an area near Building 23 shall not be measured for payment and shall be considered incidental to the work.

No separate payment shall be made for the salvage and relocation of elements and is considered incidental work.

Article 9.99.05 – Basis of Payment:

Remove and replace with the following:

This work will be paid for at the Contract lump sum for the “Disposal of Buildings” as adjusted in accordance with the provisions of the above paragraph, which price shall include all materials, equipment, tools, labor and work incidental thereto.

Pay Item	Pay Unit
Disposal of Buildings	l.s.

ITEM #1403009A – MANHOLE-TYPE 2 (SANITARY SEWER)

Description:

Scope

This item shall consist of furnishing and installing a channel flow sanitary sewer grinder for the discharge from the WEY sanitary sewage collection system. The work shall include the control & alarm system, associated wire from the controller to grinder, manhole, and concrete shelf within the manhole. The manhole is a Class 1, Division 1 location and all fittings, junction boxes, and enclosures shall be rated for use in this environment.

Related Work

Related requirements are included in, but not limited to, the following:

1. 600 Volt Copper Wire Items
2. Duct Bank and Direct Buried Items
3. Manhole Over 10' Deep (Sanitary Sewer)

Submittals

Submit the following in accordance with the Standard Specifications Article 1.20-1.05.02:

The Contractor shall prepare detailed designs for each of the required assemblies based on the information specified on the Contract Documents, including, grinder & enclosures indicating all the components included, including power connection, control & alarm system, mounting details, enclosure operating mechanisms, other related assemblies on the structure, including details and dimensions of the parts and their relationship to each other, and describing the material composing the various parts, together with technical, mechanical and electrical characteristics including but not limited to the following:

1. Sufficient information, clearly presented, shall be included to determine compliance with Plans and Specifications.
2. Include electrical ratings, nameplate data, impedance, dimensions, weight, mounting details, decibel rating, termination information, temperature rise, no load and full load losses, regulation, over current protection, connection diagrams, and accessories.
3. Complete nameplate data including manufacturer's name and catalog number.

Provide manufacturer's installation manual.

Provide grinder parts list.

Provide copies of manufacturer's Operation and Maintenance Data: To include in emergency, operation, and maintenance manuals as specified in NOTICE TO CONTRACTOR CLOSE OUT DOCUMENTS.

Provide copies of manufacturer's guarantee for sanitary grinder.

As-Built drawings shall be submitted prior to the close out of the project.

Training syllabus with training material shall be submitted for approval to MNR. Once approval is obtained, the contractor shall schedule a one day training sessions for MNR staff.

Provide Spare Parts

Provide one spare grinder assembly.

Quality Control

The manufacturer of the sewage grinder pumps and enclosures shall have manufactured grinder pump units for a minimum of five (5) years.

Materials:

Manhole

Manhole structure, frame and cover, steps, waterproofing, aggregate base, grout, and backfill, shall be constructed to the same materials and requirements as item "MANHOLE OVER 10' DEEP (SANITARY SEWER)". Includes the design of the structure approved and signed by a Civil or Structural Engineer in the State of Connecticut meeting the design requirements provided in the referenced item such as Cooper E80 loading applied at 4'-3" from the centerline of track and associated design load requirements.

Grinder

- A. Provide an open channel twin-shaft grinder designed for below-ground installation and rated for residential and light commercial service consisting of the following main components:
 1. Grinder assembly (lower works)
 2. Drive assembly
 3. Grinder assembly guide
- B. Grinders and motors shall be specifically designed and manufactured to operate in a completely submerged environment in the liquid being pumped.

C. Operating & Performance Criteria:

1. The grinder shall employ counter rotating cutter stacks with intermeshing cutters driven by a common drive.
2. The shafts shall counter-rotate with the driven cutter peripheral linear speed operating at approximately two-thirds (2/3) that of the drive cutter peripheral linear speed.
3. The twin-shaft grinder shall employ a design wherein cutters fill 90% of the cutting chamber. Units with passive style diverter screens or diverter disks shall not be accepted.
4. The Grinder shall be controlled via a reversing motor starter that will normally operate in the forward direction with momentary reversing operation.
5. Normal Cycle: Placing the selector switch in the Hand or (when a remote run signal is received, if in the Auto position), shall energize the Reverse motor starter and the equipment rotates in that direction for two seconds (adjustable) before the reverse starter coil is de-energized.
 - a. After a delay of five seconds (adjustable) to allow the equipment to coast to a stop, the equipment shall run continuously in the Forward direction of rotation.
 - b. It shall continue to run in this direction until the motor starter is de-energized by interrupting the remote-run signal, or by turning the selector switch to the 'Off' position, or if the equipment experiences a jam condition.
6. Auto Clear Cycle: If the phase current reaches an adjustable set point (factory-set), the motor starter shall be de-energized.
 - a. After a delay of five (adjustable) seconds to allow the equipment to coast to a stop, the sequence described above for a normal starting cycle shall be initiated in an attempt to clear the Jam condition.
 - b. This automatic auto-clear cycle shall repeat a total of four times.
 - c. If at any time the equipment runs for more than 30 seconds continuously in the forward direction during the four attempts, the reversal counter shall be reset.
 - d. Alarm Condition: If after four tries, however, the Jam condition still exists, the forward starter coil shall be de-energized. An Alarm Condition lockout circuit shall then be established and remain in the alarm state (even if power is lost) until it is reset.
 - e. The lockout circuit shall disable the automatic cycle.

D. Manufacturer: The pumping equipment shall be supplied as a complete unit, and all items furnished by the manufacturer:

1. Franklin Miller Incorporated
2. JWC Enviromental
3. Or approved equal

E. Grinder Housing

1. The main grinder housing components shall be constructed of Ductile Iron, shall not be subject to wear from the seal, and shall not constitute a seal wear element.

F. Cutters

1. The cutters shall be a monolithic type comprising a plurality of cam shaped cutter elements. The cartridges shall be designed to eliminate individual cutter and spacer disks for improved strength and transmission of power from the shaft. Units using individual cutters and spacers shall not be accepted.
2. No cutter stack re-tightening shall be required with this system for regular maintenance.

G. Shafts

1. The shafts shall minimally 2 inch in diameter
2. Two-shaft design shall consist of two parallel shafts stacked with intermeshing cutters.
3. The shafts shall counter-rotate with the driven cutter peripheral linear speed operating at approximately two-thirds (2/3) that of the drive cutter peripheral linear speed.

H. Side Frames

1. Side frames shall have a high flow design with a series of parallel comb tines designed to enhance liquid flow capacity.

I. Bearings and Seals

1. The bearings and seals shall be housed in replaceable cartridges that support and align the bearings and seals. The cartridge housings shall be constructed of hardened AISI 17-4 PH Stainless Steel for superior resistance to corrosive and abrasive contaminants.
2. The cutter shaft's radial and axial loads shall be borne by a sealed oversize deep-groove ball bearing at each end. C_E Units without bearings on both ends shall not be accepted.
3. The bearings shall be protected by a combination of a replaceable and tortuous path device and end face mechanical seals.
4. Face materials shall be tungsten carbide vs. tungsten carbide and shall not require an external flush.
5. The seals shall employ elastomeric members operating as opposing disk springs when compressed and, at the same time, maintain a positive seal face pressure to ensure positive sealing. No metal springs shall be employed.
6. The contact-less labyrinth rings shall be supplied to further protect from coarse and fine granular contaminants.
7. Components subject to wear shall be designed as replaceable elements and shall not be a part of the ductile iron unit main housing.

J. Painting Specifications

1. All steel or iron structural components shall be prepared and painted in accordance with the following procedures:
 - a. The surfaces shall be properly prepared as defined by (SSPC) Steel Structures Paint Council.
 - b. The metal surfaces shall be blast cleaned to near-white in preparation for painting to substantially remove mill scale, rust, paint or foreign matter including oil, grease, dirt or oxides.
2. The cleaned surfaces shall be primed the same day as cleaned.

3. The parts shall be minimally painted with 2 coats of Polyamide Epoxy.
 - a. One (1) coat primer
 - b. One (1) Top coat
4. The dry film thickness shall be 3 to 5 mil per coat.
5. Available colors shall be submitted for Engineers selection.
6. All stainless steel parts, if used, shall not be painted.

K. Reducer

1. The speed reducer shall be a grease-filled cycloidal type reducer with "Heavy-Shock" load classification.
2. Helical gear drives shall not be acceptable.
3. The high-speed shaft of the grinder shall be coupled with the reducer via a coupling.
4. The two-piece, three-lobed coupling shall have jaws that intermesh by at least $\frac{3}{4}$ inch.
5. The reducer shall have a rigid input shaft supported by heavy bearings capable of handling thrust and radial loads and shock conditions.

L. Motor

1. The minimum motor shall be: 3 HP (2.2 kW),
2. Power requirements: 208 Volt, 3-phase, 60 Hz.
3. Motor service factor shall be 1.15 with NEMA premium efficiency standards.
4. Motor shall be explosion proof.

M. Grinder Pump Guide

1. The channel frame shall support the unit and provide for convenient unit removal and installation without bolting of grinder to the channel walls or floor.
2. The channel frame shall be constructed of AISI 304 stainless steel.
3. The unit shall slide vertically into a channel frame slot.
4. The grinder pump guide shall be secured to the channel floor/ wall with anchor bolts.

Alarm and Control System

Provide manufacturer's alarm and control system designed to sequence the operation of the equipment and indicate motor overload or stoppage:

- A. Alarm conditions: pump seal failure, or thermal overload.
- B. enclosure mounted, visual rotating red beacon, with electric bell; 208-V ac, with transformer and contacts for remote alarm bell.alarm silence switch.
- C. Control panel with test switch for alarm and light.
- D. Control-Interface Features:
 1. Remote Alarm Contacts: For remote alarm interface.
 2. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

- a. On-off status of pump.
 - b. Alarm status.
- E. UL listed.
- F. Stanchion mounted NEMA 4X enclosure with factory installed viewing window to contain the grinder control panel.
- G. Signage: below the Control cabinet, provide signage with 3-inch high red lettering indicating “Storage Yard Sanitary Grinder Failure Alarm” on a white background.
- H. Motor starter: A reversing starter shall be based on IEC requirements for the motor horsepower, rated 18A minimum. Motor starter shall be a full voltage reversing type. Forward and reverse contactors shall have both mechanical and electric interlocks.
 - 1. A motor protection relay shall be furnished as part of the starting equipment. The motor protector shall be adjustable so that the range selected includes the motor nameplate listed FLA (full load amps) rating and the service factor.
 - 2. Repeated unsuccessful attempts to start the motor or a short circuit shall cause the motor protector to trip.
 - 3. Tripping of the motor protector shall stop the motor and flash the trip light. Resetting the relay shall allow the alarm circuitry to be reset.
- I. Operator Controls: A three-position “HAND-OFF/RESET- AUTO” selector switch shall be provided for the Grinder. Its function is as follows:
 - 1. Hand: When in this position, the equipment shall run under the control of the PLC until the switch is placed in Off/Reset.
 - 2. Off/Reset: When in this position, the motor shall be prevented from starting (in both the forward and reverse directions); the remote-start signal shall be disabled; and the established Alarm Condition lockout circuitry reset.
 - 3. Auto: In this position, when a remote Run signal is received, the motor shall cycle under the control of the PLC. The cycle shall be terminated if the run signal is interrupted, or the selector switch is placed in the Off/Reset position or if the equipment experiences an Alarm Condition.
- J. PLC: Provide a programmable logic controller with Ethernet port capable of Modbus/TCP communications, USB programming port, and SD slot for uploading and downloading programming without requirement of a PC.
- K. Instrumentation shall be provided as required by manufacturer to meet the specified performance criteria to ensure safe and reliable extended operation.

Power Disconnect

A motor power disconnect shall be provided adjacent to the alarm and control system and sized as indicated on the plans.

A. Manufacturer:

1. Eaton/Cutler-Hammer.
2. General Electric.
3. Siemens Energy & Automation, Inc.
4. Or approved equal.

B. Construction:

1. Switch blades and jaws shall be visible and plated copper.
2. Switches shall have a handle that is easily pad-lockable with three 3/8-inch shank locks in the OFF position.
3. Switches shall have defeatable door interlocks that prevent the door from opening when the handle is in the ON position (except for double-throw switches). Defeater mechanism shall be front accessible.
4. Switches shall have deionizing arc chutes.
5. Switch assembly and operating handle shall be an integral part of the enclosure base.
6. Switches rated 30 A to 600 A shall have reinforced fuse clips.
7. Switch blades shall be readily visible in the "ON" and "OFF" position.
8. Switch operating mechanism shall be non-teasable, positive quick-make/quick-break type. Bail type mechanisms are not acceptable.
9. Embossed or engraved ON-OFF indication shall be provided.
10. Double-make, double-break switch blade feature shall be provided.
11. Renewal parts data shall be shown on the inside of the door.

C. Enclosures: All enclosures shall be NEMA 4x:

1. 30 A to 200 A –316 stainless steel.
2. Factory installed ground terminal block.
3. Nameplate shall be front cover mounted, containing a permanent record of switch type, ampere rating, and maximum voltage rating.

Explosion Proof Fittings

Explosion proof fittings and conduit seals shall be installed in accordance with NEC 501.

A. Manufacturer:

1. Thomas and Betts
2. Cooper
3. Calbrite
4. Or approved equal

- B. Construction
 - 1. Type: EYS
 - 2. Material: Rigid Galvanized Steel
 - 3. Provided with manufacturer's UL listed sealing compound.

Explosion Proof Enclosures

All junction boxes and enclosures located within the manhole shall be rated for installation in Class 1, Division locations.

- A. Manufacturer:
 - 1. Cooper
 - 2. Hoffman
 - 3. Thomas and Betts
 - 4. Or approved equal

- B. Construction:
 - 1. NEMA 7 Enclosure
 - 2. UL 1203 Listed
 - 3. Stainless steel

Conductors and Cables

Conductors and cables shall be provided as required on the plans and per the manufacturers requirements. Wires and cables shall meet the same requirements as set forth in respective items in the contract.

Wire Splices

Wire & cable splices (at pipe tees, crosses and laterals) shall be accomplished using a direct bury type, 600V rated, silicone-filled capsule tube with standard wire nut or silicone-filled wire nut connectors of the appropriate size.

Construction Methods:

General

Shall be located as indicated on the Plans.

Excavation, support of excavation, and dewatering shall be in accordance with contract requirements.

Installation of the sanitary sewer grinder shall be in accordance with written instructions provided by the manufacturer. Installation shall be performed by an installer experienced in the installation of similar pump systems.

Manhole

Manhole shall be constructed to the same requirements as item “MANHOLE OVER 10’ DEEP (SANITARY SEWER)”. Concrete shelf may be cast-in-place once the manhole has been installed or precast into the manhole base. Reinforcing shall be coordinated with the grinder pump guide to ensure rebar is not broken or cut when installed.

Alarm and Control Panel

Install at the location indicated on the plans or as determined in the field by the Designer.

Pipe Connection

Provide sealed connections for 10-inch SDR35 waste line.

Splices

Resin-filled splice shall be covered with two, half-lapped layers of vinyl tape and two coats of sealer or shrinkable tubing. Splices shall be completed in NEC approved spliced locations.

Operation and Maintenance Manuals

The manufacturer shall also provide copies the operation and maintenance manual covering general operating procedures, operation, maintenance, and servicing procedures of the major individual components, and a trouble-shooting guide as required in the NTC provisions.

Manufacturer’s Representative on Site

The Contractor shall provide the services of a technical representative of the equipment manufacturer to supervise the final adjustments of the system, perform such operating tests as will assure the Designer that the equipment is in proper adjustment and satisfactory operating condition.

Factory-authorized service representative shall perform the following startup services:

- Complete installation and startup checks per manufacturer's written instructions.
- Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.
- Adjust control set points.

The complete sanitary sewer grinder shall be in good working order, and spare parts provided before it is turned over to the Department for acceptance and operation.

Vendor Training

The Contractor shall provide the services of a technical representative of the equipment manufacturer to instruct and train the operating personnel from Metro North Railroad and the Department in the use of the equipment for a minimum of one (1) day.

Method of Measurement:

Sanitary sewer grinder shall be measured on a per “each” basis, completely installed under item “MANHOLE-TYPE 2 (SANITARY SEWER)”. This work includes all materials, motors, grinders, manhole structures, electrical components, controls and alarm devices defined herein, disconnects defined herein, electrical junction boxes, grounding conductor, grounding rods, grout, concrete, and reinforcing.

Basis of Payment:

This work will be paid for at the contract unit price per each Manhole-Type 2 (Sanitary Sewer) installed and accepted, in place, including all materials, equipment, testing, tools and labor incidental thereto. Payment shall also include for providing and connecting to the specified power source.

Trench Excavation, Rock-in-Trench Excavation, No. 6 Crushed Stone, and Granular Fill shall be paid separately under the applicable items.

Wiring and conduit shall be paid separately under the respective direct buried conduit, 600V cable, and/or duct bank items.

Pay Item

Pay Unit

Manhole-Type 2 (Sanitary Sewer)

EA