

MAINE DEPARTMENT OF INLAND FISHERY & WILDLIFE

DRY MILLS STORAGE BARN

BGS PROJECT NO: 3289

ADDENDUM NO. 1

DECEMBER 9, 2022

All bidders are hereby notified that the CONTRACT DOCUMENTS on DRY MILLS STORAGE BARN are amended only in respects set out below and all bids shall be submitted for the work described in the plans and specifications as amended by this ADDENDUM NO. 1.

GENERAL

N/A.

BIDDING DOCUMENTS

N/A.

TECHNICAL SPECIFICATIONS

1. Remove specification 08 11 16 Aluminum Doors and replace with specification 08 11 00 Hollow Metal Doors, attached.
2. Specification 08 51 13 – Aluminum Windows
 - a. Page 3 – Add “Construct Window Frames (Casement, Fixed and Projected)” under Section 2.4 Fabrication Paragraph H with the following:

Construct Window Frames (Casement, Fixed and Projected):

 1. Cope and mechanically fasten together at corners or mitre at corners and heliarc weld on nonexposed surfaces, leaving only hairline joinery.
 2. Seal weathertight.
 3. Do not use joinery methods which discolor finish.
 - b. Page 4 – Add “2. Projected” under Section 2.4 Fabrication Paragraph E Window Hardware with the following:

Projected:

 - a. Two balance arms with adjustable non-abrasive friction pivots or adjustable non-abrasive friction shoes to support sash in any open position.
 - b. Concealed, four-bar friction hinges meeting AAMA 904.
 - c. Two locks when sash are more than 4 FT wide.
 - d. Use incorporated stop within hinge in lieu of Life Safety hold open device when four-bar friction hinges are used.
 - c. Page 6 – Add the following paragraphs after paragraph 4. Uniform load structural test under Section 2.5 Source Quality Control Paragraph B Test Requirements with the following:
 5. Projected ventilator torsion:

- a. Remove ventilator, deglaze and support horizontally on fulcrums at diagonally opposite corners with other top corner secured in same plane between fulcrums clamped above and below.
 - b. Apply 15 LB load acting vertically downward at free corner of ventilator.
 - c. Deflection at free corner: $0.121A$ (A is area in square foot of ventilator being tested).
 - d. Measure deflection from original position of free corner.
6. Projected, latch rail horizontal load:
- a. Support unglazed ventilator by clamping stiles, 6 IN from latch rail to horizontal supports under jambs.
 - b. Apply 30 LB concentrated load to center of span of latch rail, perpendicular to plane of ventilator.
 - c. Deflection at point of load application: 0.062 IN, maximum.
7. Projected, latch rail vertical load:
- a. Clamp stiles of each unglazed ventilator to vertical supports 6 IN from latch rail.
 - b. Apply 30 LB concentrated load at center of span of latch rail, parallel to plane of ventilator.
 - c. Deflection at point of load application: 0.062 IN, maximum.
8. Projected, intermediate frame rail torsion:
- a. Place unglazed window frame in horizontal position.
 - b. Apply 40 LBF-IN (10 LB load on 4 IN lever arm measured from extremity of rail) to center of span of each intermediate horizontal rail.
 - c. Deflection at point of load application: 0.070 IN, maximum.
9. Projected, intermediate frame rail vertical load:
- a. Clamp jambs of unglazed unit to vertical support 6 IN from test rail.
 - b. Apply 30 LB concentrated load at center span of each intermediate rail parallel to plane of window.
 - c. Deflection at point of load application: 0.062 IN, maximum.
10. Projected balance arm test:
- a. Test all arms if two or more ventilators are in unit.
 - b. Support unglazed unit at 45-DEG angle to vertical and clamp frame its full height.
 - c. Open ventilator 45 DEG with balance arms in compression, and block in level position at both friction shoes.
 - d. Apply 60 LB vertical concentrated load at each free corner of ventilator for 1 minute.
 - e. After removal of loads, balance arms shall function normally with no apparent damage.
3. Add electrical Specifications
- a. 26 05 00 – Electrical – Basic Requirements.
 - b. 26 05 19 – Wire and Cable – 600 Volt and Below.
 - c. 26 05 26 – Grounding and Bonding.
 - d. 26 05 33 – Raceways and Boxes.
 - e. 26 27 26 – Wiring Devices.

PLAN SHEETS

Delete Plan Sheets C0.1 and E1.0 in their entirety and replace with the attached "Revised for Addendum 1" Plan Sheets C0.1 and E1.0.

End of Addendum No. 1.

SECTION 26 05 00
ELECTRICAL - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Basic requirements for electrical systems.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
 - 2. Section 26 05 33 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Aluminum Association (AA):
 - a. ADM, Aluminum Design Manual.
 - 2. American Institute of Steel Construction (AISC):
 - a. Steel Construction Manual.
 - 3. American National Standards Institute (ANSI).
 - 4. ASTM International (ASTM):
 - a. A36/A36M, Standard Specification for Carbon Structural Steel.
 - b. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - c. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. C2, National Electrical Safety Code (NESC).
 - 6. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 7. National Electrical Manufacturers Association (NEMA):
 - 8. Underwriters Laboratories, Inc. (UL).
- B. Products to be listed by a Nationally Recognized Testing Laboratory (NRTL) in accordance with applicable product standards.
 - 1. Applicable product standards including, but not limited to, ANSI, FM, IEEE, NEMA and UL.
 - 2. NRTL includes, but is not limited to, CSA Group Testing and Certification (CS), FM Approvals LLC (FM), Intertek Testing Services NA, Inc. (ETL), and Underwriters Laboratories, Inc. (UL).

1.3 DEFINITIONS

- A. For the purposes of providing materials and installing electrical work the following definitions shall be used.
 - 1. Outdoor area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.
 - 2. Architecturally finished interior area: Offices, laboratories, conference rooms, restrooms, corridors and other similar occupied spaces.
 - 3. Non-architecturally finished interior area: Pump, chemical, mechanical, electrical rooms and other similar process type rooms.
 - 4.
 - 5. Shop fabricated: Manufactured or assembled equipment for which a UL test procedure has not been established.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 61 03 and individual specification sections for submittal requirements for products defined as equipment.
 - 2. General requirements:
 - a. Provide manufacturer's technical information on products to be used, including product descriptive bulletin.
 - b. Include data sheets that include manufacturer's name and product model number.
 - 1) Clearly identify all optional accessories.
 - c. Acknowledgement that products are NRTL listed or are constructed utilizing NRTL recognized components.
 - d. Manufacturer's delivery, storage, handling and installation instructions.
 - e. Product installation details.
 - f. Short Circuit Current Rating (SCCR) nameplate marking per NFPA 70, include any required calculations.
 - g. See individual specification sections for any additional requirements.
- B. Operation and Maintenance Manuals:
 - 1. See Specification Section 01 78 23 for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content process of Operation and Maintenance Manuals.
- C. When a Specification Section includes products specified in another Specification Section, each Specification Section shall have the required Shop Drawing transmittal form per Specification Section 01 33 00 and all Specification Sections shall be submitted simultaneously.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect nameplates on electrical equipment to prevent defacing.

1.6 AREA DESIGNATIONS

- A. Designation of an area will determine the NEMA rating of the electrical equipment enclosures, types of conduits and installation methods to be used in that area.
 - 1. Outdoor areas:
 - a. Wet.
 - b. Also, corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.
 - 2. Indoor areas:
 - a. Dry.
 - b. Also, wet, corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, refer to specific Electrical Specification Sections and specific material paragraphs below for acceptable manufacturers.
- B. Provide all components of a similar type by one (1) manufacturer.

2.2 MATERIALS

- A. Electrical Equipment Support Pedestals and/or Racks:
 - 1. Manufacturers:
 - a. Modular strut:
 - 1) Unistrut Building Systems.
 - 2) B-Line by Eaton.
 - 3) Globe Strut.

- 4) Superstrut by Thomas & Betts.
- 2. Material requirements:
 - a. Modular strut:
 - 1) Galvanized steel: ASTM A123/123M or ASTM A153/A153M.
 - 2) Stainless steel: AISI Type 316.
 - 3) PVC coated galvanized steel: ASTM A123/A123M or ASTM A153/A153M and 20 MIL PVC coating.
 - 4) Aluminum: AA Type 6063-T6.
 - b. Structural members (e.g., I beams, L and C channels):
 - 1) Galvanized steel: ASTM A36/A36M steel with galvanizing per ASTM A123/A123M.
 - 2) Aluminum: AA Type 6061-T6 or 6063-T6.
 - c. Mounting plates:
 - 1) Galvanized steel: ASTM A36/A36M steel with galvanizing per ASTM A123/A123M.
 - 2) Aluminum: AA Type 6063-T6.
 - d. Mounting hardware:
 - 1) Galvanized steel.
 - 2) Stainless steel.
- 3. .
- B. Field touch-up of galvanized surfaces.
 - 1. Zinc-rich primer.
 - a. One coat, 3.0 MILS, ZRC by ZRC Products.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install and wire all equipment, including prepurchased equipment, and perform all tests necessary to assure conformance to the Drawings and Specification Sections and ensure that equipment is ready and safe for energization.
- B. Install equipment in accordance with the requirements of:
 - 1. NFPA 70.
 - 2. IEEE C2.
 - 3. The manufacturer's instructions.
- C. In general, conduit routing is not shown on the Drawings.
 - 1. The Contractor is responsible for routing all conduits including those shown on one-line and control block diagrams and home runs shown on floor plans.
 - 2. Conduit routings and stub-up locations that are shown are approximate; exact routing to be as required for equipment furnished and field conditions.
- D. When complete branch circuiting is not shown on the Drawings:
 - 1. A homerun indicating panelboard name and circuit number will be shown and the circuit number will be shown adjacent to the additional devices (e.g., light fixture and receptacles) on the same circuit.
 - 2. The Contractor is to furnish and install all conduit and conductors required for proper operation of the circuit.
 - 3. The indicated home run conduit and conductor size shall be used for the entire branch circuit.
 - 4. See Specification Section 26 05 19 for combining multiple branch circuits in a common conduit.
- E. Do not use equipment that exceed dimensions or reduce clearances indicated on the Drawings or as required by the NFPA 70.
- F. Install equipment plumb, square and true with construction features and securely fastened.

- G. Install electrical equipment, including pull and junction boxes, minimum of 6 IN from process, gas, air and water piping and equipment.
- H. Install equipment so it is readily accessible for operation and maintenance, is not blocked or concealed and does not interfere with normal operation and maintenance requirements of other equipment.
- I. Device Mounting Schedule:
 - 1. Unless indicated otherwise on the Drawings, mounting heights are as indicated below:
 - a. Light switch (to center): 46 IN.
 - b. Receptacle on exterior wall of building (to center): 18 IN.
 - c. Receptacle in non-architecturally finished areas (to center): 46 IN.
 - d. Safety switch (to center of operating handle): 54 IN.
 - e. Separately mounted motor starter (to center of operating handle): 54 IN.
 - f. Pushbutton or selector switch control station (to center): 46 IN.
 - g. Panelboard (to top): 72 IN.
- J. Avoid interference of electrical equipment operation and maintenance with structural members, building features and equipment of other trades.
 - 1. When it is necessary to adjust the intended location of electrical equipment, unless specifically dimensioned or detailed, the Contractor may make adjustments of up to 6 IN in equipment location with the Engineer's approval.
- K. Provide electrical equipment support system per the following area designations:
 - 1. Dry areas:
 - a. Galvanized system consisting of galvanized steel channels and fittings, nuts and hardware.
 - b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.
 - 2. Wet areas:
 - a. Galvanized system consisting of galvanized steel channels and fittings, nuts and hardware.
 - b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.
- L. Provide all necessary anchoring devices and supports rated for the equipment load based on dimensions and weights verified from approved submittals, or as recommended by the manufacturer.
 - 1. Do not cut, or weld to, building structural members.
 - 2. Do not mount safety switches or other equipment to equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.
- M. Do not place equipment fabricated from aluminum in direct contact with earth or concrete.
- N. Screen or seal all openings into equipment mounted outdoors to prevent the entrance of rodents and insects.
- O. Do not use materials that may cause the walls or roof of a building to discolor or rust.
- P. Identify electrical equipment and components in accordance with Specification Section 10 14 00.
- Q. Provide field markings and/or documentation of available short-circuit current (available fault current) and related information for equipment as required by the NFPA 70 and other applicable codes.
- R. Provide equipment or control panels with Short Circuit Current Rating (SCCR) labeling as required by NFPA 70 and other applicable codes.
 - 1. Determine the SCCR rating by one of the following methods:
 - a. Method 1: SCCR rating meets or exceeds the available fault current of the source equipment when indicated on the Drawings.

- b. Method 2: SCCR rating meets or exceeds the source equipment's Amp Interrupting Current (AIC) rating as indicated on the Drawings.
- c. Method 3: SCCR rating meets or exceeds the calculated available short circuit current at the control panel.
2. The source equipment is the switchboard, panelboard, motor control center or similar equipment where the equipment or control panel circuit originates.
3. For Method 3, provide calculations justifying the SCCR rating. Utilize source equipment available fault current or AIC rating as indicated on the Drawings.

3.2 FIELD QUALITY CONTROL

- A. Verify exact rough-in location and dimensions for connection to electrified equipment, provided by others.
- B. Replace equipment and systems found inoperative or defective and re-test.
- C. The protective coating integrity of support structures and equipment enclosures shall be maintained.
 1. Repair galvanized components utilizing a zinc rich paint.
 2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
 3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the component.
 4. Repair surfaces which will be inaccessible after installation prior to installation.
 5. See Specification Section 26 05 33 for requirements for conduits and associated accessories.
- D. Replace nameplates damaged during installation.

END OF SECTION

SECTION 26 05 19
WIRE AND CABLE - 600 VOLT AND BELOW

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material and installation requirements for:
 - a. Building wire.
 - b. Wire connectors.
 - c. Insulating tape.
 - d. Pulling lubricant.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 26 05 00 - Electrical - Basic Requirements.
 - 2. QUALITY ASSURANCE
- C. Referenced Standards:
 - 1. Insulated Cable Engineers Association (ICEA):
 - a. S-58-679, Standard for Control Cable Conductor Identification.
 - 2. National Electrical Manufacturers Association (NEMA):
 - a. ICS 4, Industrial Control and Systems: Terminal Blocks.
 - 3. National Electrical Manufacturers Association/Insulated Cable Engineers Association (NEMA/ICEA):
 - a. WC 57/S-73-532, Standard for Control Cables.
 - b. WC 70/S-95-658, Non-Shielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
 - 4. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - b. 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
 - 5. Telecommunications Industry Association/Electronic Industries Alliance/American National Standards Institute (TIA/EIA/ANSI):
 - a. 568, Commercial Building Telecommunications Cabling Standard.
 - 6. Underwriters Laboratories, Inc. (UL):
 - a. 44, Standard for Safety Thermoset-Insulated Wires and Cables.
 - b. 83, Standard for Safety Thermoplastic-Insulated Wires and Cables.
 - c. 467, Standard for Safety Grounding and Bonding Equipment.
 - d. 486A, Standard for Safety Wire Connectors and Soldering Lugs for use with Copper Conductors.
 - e. 486C, Standard for Safety Splicing Wire Connections.
 - f. 510, Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
 - g. 1277, Standard for Safety Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
 - h. 1581, Standard for Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords.
 - i. 2250, Standard for Safety Instrumentation Tray Cable.

1.2 DEFINITIONS

- A. Building Wire: Single conductor, insulated, with or without outer jacket depending upon type.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data:

- a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
 - 1) Wire connectors.
 - 2) Insulating tape.
 - 3) Cable lubricant.
- b. See Specification Section 26 05 00 for additional requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. See Specification Section 26 05 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Building wire:
 - a. Aetna Insulated Wire.
 - b. Alphawire.
 - c. Cerrowire.
 - d. Encore Wire Corporation.
 - e. General Cable.
 - f. Okonite Company.
 - g. Southwire Company.
 - 2. Wire connectors:
 - a. Burndy Corporation.
 - b. Buchanan.
 - c. Ideal.
 - d. Ilsco.
 - e. 3M Co.
 - f. Teledyne Penn Union.
 - g. Thomas and Betts.
 - h. Phoenix Contact.
 - 3. Insulating and color coding tape:
 - a. 3M Co.
 - b. Plymouth Bishop Tapes.
 - c. Red Seal Electric Co.

2.2 MANUFACTURED UNITS

- A. Building Wire:
 - 1. Conductor shall be copper with 600 V rated insulation.
 - 2. Conductors shall be stranded, except for conductors used in lighting and receptacle circuits which may be stranded or solid.
 - 3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
 - 4. Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 for type THHN/THWN and THHN/THWN-2 insulation.
 - 5. Conform to NEMA/ICEA WC 70/S-95-658 and UL 44 for type XHHW-2 insulation.
- B. Wire Connectors:
 - 1. Twist/screw on type:
 - a. Insulated pressure or spring type solderless connector.
 - b. 600 V rated.
 - c. Ground conductors: Conform to UL 486C and/or UL 467 when required by local codes.
 - d. Phase and neutral conductors: Conform to UL 486C.

2. Compression and mechanical screw type:
 - a. 600 V rated.
 - b. Ground conductors: Conform to UL 467.
 - c. Phase and neutral conductors: Conform to UL 486A.
 3. Terminal block type:
 - a. High density, screw-post barrier-type with white center marker strip.
 - b. 600 V and ampere rating as required, for power circuits.
 - c. 600 V, 20 ampere rated for control circuits.
 - d. 300 V, 15 ampere rated for instrumentation circuits.
 - e. Conform to NEMA ICS 4 and UL 486A.
- C. Insulating and Color Coding Tape:
1. Pressure sensitive vinyl.
 2. Premium grade.
 3. Heat, cold, moisture, and sunlight resistant.
 4. Thickness, depending on use conditions: 7, 8.5, or 10 MIL.
 5. For cold weather or outdoor location, tape must also be all-weather.
 6. Color:
 - a. Insulating tape: Black.
 - b. Color coding tape: Fade-resistant color as specified herein.
 7. Comply with UL 510.
- D. Pulling Lubricant: Cable manufacturer's standard containing no petroleum or other products which will deteriorate insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Permitted Usage of Insulation Types:
1. Type XHHW-2:
 - a. Building wire and power and control cable in architectural and non-architectural finished areas.
 - b. Building wire in conduit in outdoor areas and below grade.
 - c. Building wire in cable tray in outdoor areas.
 2. Type THHN/THWN and THHN/THWN-2:
 - a. Building wire No. 8 AWG and smaller in architectural and non-architectural finished areas.
- B. Conductor Size Limitations:
1. Feeder and branch power conductors shall not be smaller than No. 12 AWG unless otherwise indicated on the Drawings.
 2. Control conductors shall not be smaller than No. 14 AWG unless otherwise indicated on the Drawings.
 3. Instrumentation conductors shall not be smaller than No. 18 AWG unless otherwise indicated on the Drawings.
- C. Color Code All Wiring as Follows:
1. Building wire:

	240 V, 208 V, 240/120 V, 208/120 V	480 V, 480/277 V
Phase 1	Black	Brown
Phase 2	Red *	Orange
Phase 3	Blue	Yellow
Neutral	White	White or Gray

Ground	Green	Green
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* Orange when it is a high leg of a 120/240 V Delta system.

- a. Conductors No. 6 AWG and smaller: Insulated phase, neutral and ground conductors shall be identified by a continuous colored outer finish along its entire length.
 - b. Conductors larger than No. 6 AWG:
 - 1) Insulated phase and neutral conductors shall be identified by one of the following methods:
 - a) Continuous colored outer finish along its entire length.
 - b) 3 IN of colored tape applied at the termination.
 - 2) Insulated grounding conductor shall be identified by one of the following methods:
 - a) Continuous green outer finish along its entire length.
 - b) Stripping the insulation from the entire exposed length.
 - c) Using green tape to cover the entire exposed length.
 - 3) The color coding shall be applied at all accessible locations, including but not limited to: Junction and pull boxes, wireways, manholes and handholes.
- D. Install all wiring in raceway unless otherwise indicated on the Drawings.
- 1. Multiple branch circuits for similar loads may be combined in a common raceway, such as multiple lighting circuits or multiple receptacle circuits or other 120Vac circuits. Do not combine lighting and receptacle circuits.
 - a. Do not combine control device circuits with lighting or receptacle circuits.
 - b. Contractor is responsible for making the required adjustments in conductor and raceway size, in accordance with all requirements of the NFPA 70, including but not limited to:
 - 1) Up sizing conductor size for required ampacity de-ratings for the number of current carrying conductors in the raceway.
 - 2) The neutral conductors may not be shared.
 - 3) Up sizing raceway size for the size and quantity of conductors.
- E. Splices and terminations for the following circuit types shall be made in the indicated enclosure type using the indicated method.
- 1. Feeder and branch power circuits:
 - a. Device outlet boxes:
 - 1) Twist/screw on type connectors.
 - b. Junction and pull boxes and wireways:
 - 1) Twist/screw on type connectors for use on No. 8 and smaller wire.
 - 2) Compression, mechanical screw or terminal block or terminal strip type connectors for use on No. 6 AWG and larger wire.
 - c. Motor terminal boxes:
 - 1) Twist/screw on type connectors for use on No. 10 AWG and smaller wire.
 - 2) Insulated mechanical screw type connectors for use on No. 8 AWG and larger wire.
- F. Insulating Tape Usage:
- 1. For insulating connections of No. 8 AWG wire and smaller: 7 MIL vinyl tape.
 - 2. For insulating splices and taps of No. 6 AWG wire or larger: 10 MIL vinyl tape.
 - 3. For insulating connections made in cold weather or in outdoor locations: 8.5 MIL, all weather vinyl tape.
- G. Color Coding Tape Usage: For color coding of conductors.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material and installation requirements for grounding and bonding system(s).
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 26 05 00 - Electrical - Basic Requirements.
 - 2. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
 - 3. Section 26 05 33 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
 - 2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. 837, Standard for Qualifying Permanent Connections Used in Substation Grounding.
 - 3. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 4. Underwriters Laboratories, Inc. (UL):
 - a. 467, Grounding and Bonding Equipment.
- B. Assure ground continuity is continuous throughout the entire Project.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data.
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
 - 1) Grounding clamps, terminals and connectors.
 - 2) Exothermic welding system.
 - b. See Specification Section 26 05 00 for additional requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Ground rods and bars and grounding clamps, connectors and terminals:
 - a. ERICO by Pentair.
 - b. Harger Lightning & Grounding.
 - c. Heary Bros. Lightning Protection Co. Inc..
 - d. Burndy by Hubbell.
 - e. Robbins Lightning, Inc.
 - f. Blackburn by Thomas & Betts.
 - g. Thompson Lightning Protection, Inc.
 - 2. Exothermic weld connections:
 - a. ERICO by Pentair - Cadweld.
 - b. Harger Lightning & Grounding - Ultraweld.

- c. Burndy by Hubbell - Thermoweld.
- d. FurseWELD by Thomas & Betts.

2.2 COMPONENTS

- A. Wire and Cable:
 - 1. Bare conductors: Soft drawn stranded copper meeting ASTM B8.
 - 2. Insulated conductors: Color coded green, per Specification Section 26 05 19.
- B. Conduit: As specified in Specification Section 26 05 33.
- C. Ground Rods:
 - 1. 5/8 IN x 10 FT .
 - 2. Copper-clad:
 - a. 10 MIL minimum uniform coating of electrolytic copper molecularly bonded to a rigid steel core.
 - b. Corrosion resistant bond between the copper and steel.
 - c. Hard drawn for a scar-resistant surface.
- D. Grounding Clamps, Connectors and Terminals:
 - 1. Mechanical type:
 - a. Standards: UL 467.
 - b. High copper alloy content.
 - 2. Compression type for interior locations:
 - a. Standards: UL 467.
 - b. High copper alloy content.
 - c. Non-reversible.
 - d. Terminals for connection to bus bars shall have two bolt holes.
 - 3. Compression type suitable for direct burial in earth or concrete:
 - a. Standards: UL 467, IEEE 837.
 - b. High copper alloy content.
 - c. Non-reversible.
 - d. Factory filled with oxide inhibiting compound.
- E. Exothermic Weld Connections:
 - 1. Copper oxide reduction by aluminum process.
 - 2. Molds properly sized for each application.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Install products in accordance with manufacturer's instructions.
 - 2. Size grounding conductors and bonding jumpers in accordance with NFPA 70, Article 250, except where larger sizes are indicated on the Drawings.
 - 3. Remove paint, rust, or other non-conducting material from contact surfaces before making ground connections. After connection, apply manufacturers approved touch-up paint to protect metallic surface from corrosion.
 - 4. Where ground conductors pass through floor slabs or building walls provide nonmetallic sleeves and install sleeve per Specification Section 01 73 20.
 - a. Seal the sleeve interior to stop water penetration.
 - 5. Do not splice grounding electrode conductors except at ground rods.
 - 6. Install ground rods and grounding electrode conductors in undisturbed, firm soil.
 - a. Provide excavation required for installation of ground rods and conductors.
 - b. Use driving studs or other suitable means to prevent damage to threaded ends of sectional rods.
 - c. Unless otherwise specified, connect conductors to ground rods with compression type connectors or exothermic weld.

- d. Provide sufficient slack in conductor to prevent conductor breakage during backfill or due to ground movement.
 - e. Backfill excavation completely, thoroughly tamping to provide good contact between backfill materials and ground rods and conductors.
7. Do not use exothermic welding if it will damage the structure the grounding conductor is being welded to.
- B. Grounding Electrode System:
- 1. Provide a grounding electrode system in accordance with NFPA 70, Article 250 and as indicated on the Drawings.
 - a. All grounding electrode conductors terminate on a main ground bar located adjacent to the service entrance equipment.
 - 2. Grounding electrode conductor terminations:
 - a. Ground bars mounted on wall: Use a two-hole compression type conductor terminal and bolt it to the ground bar with two bolts.
 - b. Ground bars in electrical equipment: Use compression type conductor terminal and bolt it to the ground bar or manufacturer's provided mechanical type termination device.
 - c. Piping systems: Use mechanical type connections.
 - d. Building steel, below grade and encased in concrete: Use compression type connector or exothermic weld.
 - e. Building steel, above grade: Use a two-hole compression type conductor terminal and bolt to the steel with two bolts or exothermic weld.
 - f. Ground rod: Compression type or exothermic weld, unless otherwise specified.
 - g. At all above grade terminations, the conductors shall be labeled per Specification Section 10 14 00.
 - 3. Triad grounding system:
 - a. Triad consists of three ground rods arranged in a triangle separated by 20 FT and a conductor interconnecting each ground rod.
 - b. Place first ground rod a minimum of 10 FT from the structure foundation and 2 FT-6 IN below grade.
 - c. Grounding conductor: Bare conductor, size as indicated on the Drawings.
- C. Supplemental Grounding Electrode:
- 1. Provide the following grounding in addition to the equipment ground conductor supplied with the feeder conductors whether or not shown on the Drawings.
 - a. See Grounding Electrode System paragraph for conductor termination requirements.
 - 2. Metal light poles:
 - a. Connect metal pole and pole base reinforcing steel to a ground rod.
 - b. Grounding conductor: Bare #6 AWG minimum.
 - 3. Equipment support rack and pedestals mounted outdoors:
 - a. Connect metallic structure to a ground rod.
 - b. Grounding conductor: #6 AWG minimum.
- D. Raceway Bonding/Grounding:
- 1. Install all metallic raceway so that it is electrically continuous.
 - 2. Provide an equipment grounding conductor in all raceways with insulation identical to the phase conductors, unless otherwise indicated on the Drawings.
 - 3. NFPA 70 required grounding bushings shall be of the insulating type.
 - 4. Provide double locknuts at all panels.
 - 5. Bond all conduits, at entrance and exit of equipment, to the equipment ground bus or lug.
 - 6. Provide bonding jumpers if conduits are installed in concentric knockouts.
 - 7. Make all metallic raceway fittings and grounding clamps tight to ensure equipment grounding system will operate continuously at ground potential to provide low impedance current path for proper operation of overcurrent devices during possible ground fault conditions.
- E. Equipment Grounding:

1. Ground all utilization equipment with an equipment grounding conductor.

3.2 FIELD QUALITY CONTROL

- A. Leave grounding system uncovered until observed by Owner.

END OF SECTION

SECTION 26 05 33
RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material and installation requirements for:
 - a. Conduits.
 - b. Conduit fittings.
 - c. Conduit supports.
 - d. Wireways.
 - e. Outlet boxes.
 - f. Pull and junction boxes.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 26 05 00 - Electrical - Basic Requirements.
 - 2.
 - 3. Section 26 27 26 - Wiring Devices.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Aluminum Association (AA).
 - 2. American Iron and Steel Institute (AISI).
 - 3. ASTM International (ASTM):
 - a. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - b. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - c. D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
 - 4. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. RN 1, Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - c. TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
 - d. TC 3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
 - e. TC 14.AG, Aboveground Reinforced Thermosetting Resin Conduit and Fittings.
 - f. TC 14.BG, Belowground Reinforced Thermosetting Resin Conduit and Fittings.
 - 5. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
 - a. C80.1, Electric Rigid Steel Conduit (ERSC).
 - b. C80.3, Steel Electrical Metallic Tubing (EMT).
 - c. C80.5, Electrical Aluminum Rigid Conduit (ERAC).
 - d. OS 1, Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 6. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 7. Underwriters Laboratories, Inc. (UL):
 - a. 1, Standard for Flexible Metal Conduit.
 - b. 6, Electrical Rigid Metal Conduit - Steel.
 - c. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.
 - d. 360, Standard for Liquid-Tight Flexible Metal Conduit.
 - e. 467, Grounding and Bonding Equipment.
 - f. 514A, Metallic Outlet Boxes.

- g. 514B, Conduit, Tubing, and Cable Fittings.
- h. 651, Standard for Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.
- i. 797, Electrical Metallic Tubing - Steel.
- j. 870, Standard for Wireways, Auxiliary Gutters, and Associated Fittings.
- k. 1203, Standard for Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations.
- l. 2420, Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
- m. 2515, Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
 - 1) Conduit fittings.
 - 2) Support systems.
 - b. See Specification Section 26 05 00 for additional requirements.
 - 2. Fabrication and/or layout drawings:
 - a. Identify dimensional size of pull and junction boxes to be used.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. See Specification Section 26 05 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Rigid metal conduits and electrical metallic tubing:
 - a. Allied Tube and Conduit.
 - b. Western Tube and Conduit Corporation.
 - c. Wheatland Tube.
 - d. Patriot Aluminum Products, LLC.
 - 2. Rigid nonmetallic conduit:
 - a. Prime Conduit.
 - b. Cantex, Inc.
 - c. Osburn Associates, Inc.
 - 3. Flexible conduit:
 - a. AFC Cable Systems.
 - b. Anamet, Inc.
 - c. Electri-Flex Company.
 - d. International Metal Hose Company.
 - e. Southwire Company, LLC.
 - 4. Conduit fittings and accessories:
 - a. Appleton by Emerson Electric Co.
 - b. Carlon by Thomas & Betts.
 - c. Cantex, Inc.
 - d. Crouse-Hinds by Eaton.
 - e. Killark by Hubbell.
 - f. Osburn Associates, Inc.
 - g. O-Z/Gedney by Emerson Electric Co.
 - h. Raco by Hubbell.
 - i. Steel City by Thomas & Betts.
 - j. Thomas & Betts.
 - 5. Support systems:

- a. Unistrut by Atkore International, Inc.
 - b. B-Line by Eaton.
 - c. Kindorf by Thomas & Betts.
 - d. Minerallac Company.
 - e. CADDY by Pentair.
 - f. Superstrut by Thomas & Betts.
6. Outlet, pull and junction boxes:
- a. Appleton by Emerson Electric Co.
 - b. Crouse-Hinds by Eaton
 - c. Killark by Hubbell.
 - d. O-Z/Gedney by Emerson Electric Co.
 - e. Steel City by Thomas & Betts.
 - f. Raco by Hubbell
 - g. Bell by Hubbell.
 - h. Hoffman Engineering.
 - i. Wiegmann by Hubbell.
 - j. B-Line by Eaton.
 - k. Adalet.
 - l. RITTAL North America LLC.
 - m. Stahlin by Robroy Enclosures.

2.2 RIGID METAL CONDUITS

- A. Rigid Galvanized Steel Conduit (RGS):
- 1. Mild steel with continuous welded seam.
 - 2. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.
 - 3. Threads galvanized after cutting.
 - 4. Internal coating: Baked lacquer, varnish or enamel for a smooth surface.
 - 5. Standards: NFPA 70 Type RMC, NEMA/ANSI C80.1, UL 6.

2.3 ELECTRICAL METALLIC TUBING (EMT)

- A. Mild steel with continuous welded seam.
- B. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.
- C. Internal coating: Baked lacquer, varnish, or enamel for a smooth surface.
- D. Standards: NFPA 70 Type EMT, NEMA/ANSI C80.3, UL 797.

2.4 RIGID NONMETALLIC CONDUIT

- A. Schedules 40 (PVC-40) and 80 (PVC-80):
- 1. Polyvinyl-chloride (PVC) plastic compound which includes inert modifiers to improve weatherability and heat distribution.
 - 2. Rated for direct sunlight exposure.
 - 3. Fire retardant and low smoke emission.
 - 4. Shall be suitable for use with 90 DEGC wire and shall be marked "maximum 90 DEGC".
 - 5. Standards: NFPA 70 Type PVC, NEMA TC 2, UL 651.

2.5 FLEXIBLE CONDUIT

- A. Flexible Galvanized Steel Conduit (FLEX):
- 1. Formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.
 - 2. Standard: NFPA 70 Type FMC, UL 1.
- B. PVC-Coated Flexible Galvanized Steel (liquid-tight) Conduit (FLEX-LT):
- 1. Core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.
 - 2. Extruded PVC outer jacket positively locked to the steel core.

3. Liquid and vaportight.
4. Standard: NFPA 70 Type LFMC, UL 360.

2.6 CONDUIT FITTINGS AND ACCESSORIES

A. Fittings for Use with RGS:

1. General:
 - a. In hazardous locations listed for use in Class I, Groups C and D locations.
2. Locknuts:
 - a. Threaded steel or malleable iron.
 - b. Gasketed or non-gasketed.
 - c. Grounding or non-grounding type.
3. Bushings:
 - a. Threaded, insulated metallic.
 - b. Grounding or non-grounding type.
4. Hubs: Threaded, insulated and gasketed metallic for raintight connection.
5. Couplings:
 - a. Threaded straight type: Same material and finish as the conduit with which they are used on.
 - b. Threadless type: Gland compression or self-threading type, concrete tight.
6. Unions: Threaded galvanized steel or zinc plated malleable iron.
7. Conduit bodies (ells and tees):
 - a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
 - b. Standard and mogul size.
 - c. Cover:
 - 1) Clip-on type with stainless steel screws.
 - 2) Gasketed or non-gasketed galvanized steel, zinc plated cast iron or cast copper free aluminum.
8. Conduit bodies (round):
 - a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
 - b. Cover: Threaded screw on type, gasketed, galvanized steel, zinc plated cast iron or cast copper free aluminum.
9. Sealing fittings:
 - a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
 - b. Standard and mogul size.
 - c. With or without drain and breather.
 - d. Fiber and sealing compound: UL listed for use with the sealing fitting.
10. Service entrance head:
 - a. Malleable iron, galvanized steel or copper free aluminum.
 - b. Insulated knockout cover for use with a variety of sizes and number of conductors.
11. Expansion couplings:
 - a. 2 IN nominal straight-line conduit movement in either direction.
 - b. Galvanized steel with insulated bushing.
 - c. Gasketed for wet locations.
 - d. Internally or externally grounded.
12. Expansion/deflection couplings:
 - a. 3/4 IN nominal straight-line conduit movement in either direction.
 - b. 30 DEG nominal deflection from the normal in all directions.
 - c. Metallic hubs, neoprene outer jacket and stainless steel jacket clamps.
 - d. Internally or externally grounded.
 - e. Watertight, raintight and concrete tight.
13. Standards: UL 467, UL 514B, UL 1203.
- 14.

B. Fittings for Use with EMT:

1. Connectors:
 - a. Straight, angle and offset types furnished with locknuts.

- b. Zinc plated steel.
 - c. Insulated gland compression type.
 - d. Concrete and raintight.
 - 2. Couplings:
 - a. Zinc plated steel.
 - b. Gland compression type.
 - c. Concrete and raintight.
 - 3. Conduit bodies (ells and tees):
 - a. Body: Copper free aluminum with threaded hubs.
 - b. Standard and mogul size.
 - c. Cover:
 - 1) Screw down type with steel screws.
 - 2) Gasketed or non-gasketed galvanized steel or copper free aluminum.
 - 4. Standard: UL 514B.
- C. Fittings for Use with FLEX:
- 1. Connector:
 - a. Zinc plated malleable iron.
 - b. Squeeze or clamp-type.
 - 2. Standard: UL 514B.
- D. Fittings for Use with FLEX-LT:
- 1. Connector:
 - a. Straight or angle type.
 - b. Metal construction, insulated and gasketed.
 - c. Composed of locknut, grounding ferrule and gland compression nut.
 - d. Liquid tight.
 - 2. Standards: UL 467, UL 514B.
- E. Fittings for Use with Rigid Nonmetallic PVC Conduit:
- 1. Coupling, adapters and conduit bodies:
 - a. Same material, thickness, and construction as the conduits with which they are used.
 - b. Homogeneous plastic free from visible cracks, holes or foreign inclusions.
 - c. Bore smooth and free of blisters, nicks or other imperfections which could damage the conductor.
 - 2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.
 - 3. Standards: ASTM D2564, NEMA TC 3, UL 651, UL 514B.
- F.

2.7 ALL RACEWAY AND FITTINGS

- A. Mark Products:
- 1. Identify the nominal trade size on the product.
 - 2. Stamp with the name or trademark of the manufacturer.

2.8 OUTLET BOXES

- A. Metallic Outlet Boxes:
- 1. Hot-dip galvanized steel.
 - 2. Conduit knockouts and grounding pigtail.
 - 3. Styles:
 - a. 2 IN x 3 IN rectangle.
 - b. 4 IN square.
 - c. 4 IN octagon.
 - d. Masonry/tile.
 - 4. Accessories:
 - a. Flat blank cover plates.

- b. Barriers.
 - c. Extension, plaster or tile rings.
 - d. Box supporting brackets in stud walls.
 - e. Adjustable bar hangers.
 - 5. Standards: NEMA/ANSI OS 1, UL 514A.
- B. Cast Outlet Boxes:
- 1. Zinc plated cast iron or die-cast copper free aluminum with manufacturer's standard finish.
 - 2. Threaded hubs and grounding screw.
 - 3. Styles:
 - a. "FS" or "FD".
 - b. "Bell".
 - c. Single or multiple gang and tandem.
 - d. "EDS" or "EFS" for hazardous locations.
 - 4. Accessories: 40 MIL PVC exterior coating and 2 MIL urethane interior coating.
 - 5. Standards: UL 514A, UL 1203.
- C. See Specification Section 26 27 26 for wiring devices, wallplates and coverplates.

2.9 PULL AND JUNCTION BOXES

- A. NEMA 1 Rated:
- 1. Body and cover: 14 GA minimum, galvanized steel or 14 GA minimum, steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
 - 2. With or without concentric knockouts on four sides.
 - 3. Flat cover fastened with screws.
- B. Miscellaneous Accessories:
- 1. Rigid handles for covers larger than 9 SQFT or heavier than 25 LBS.
 - 2. Split covers when heavier than 25 LBS.
 - 3. Weldnuts for mounting optional panels and terminal kits.
 - 4. Terminal blocks: Screw-post barrier-type, rated 600 volt and 20 ampere minimum.
- C. Standards: NEMA 250, UL 50.

2.10 SUPPORT SYSTEMS

- A. Multi-conduit Surface or Trapeze Type Support and Pull or Junction Box Supports:
- 1. Material requirements:
 - a. Galvanized steel: ASTM A123/A123M or ASTM A153/A153M.
 - b. Stainless steel: AISI Type 316.
 - c. PVC coat galvanized steel: ASTM A123/A123M or ASTM A153/A153M and 20 MIL PVC coating.
- B. Single Conduit and Outlet Box Support Fasteners:
- 1. Material requirements:
 - a. Zinc plated steel.
 - b. Stainless steel.
 - c. Malleable iron.
 - d. PVC coat malleable iron or steel: 20 MIL PVC coating.
 - e. Steel protected with zinc phosphate and oil finish.

2.11 OPENINGS AND PENETRATIONS IN WALLS AND FLOORS

- A. Sleeves, smoke and fire stop fitting through walls and floors:

PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION - GENERAL

- A. Shall be in accordance with the requirements of:

1. NFPA 70.
 2. Manufacturer instructions.
- B. Size of Raceways:
1. Raceway sizes are shown on the Drawings, if not shown on the Drawings, then size in accordance with NFPA 70.
 2. Unless specifically indicated otherwise, the minimum raceway size shall be:
 - a. Conduit: 1/2 IN.
- C. Field Bending and Cutting of Conduits:
1. Utilize tools and equipment recommended by the manufacturer of the conduit, designed for the purpose and the conduit material to make all field bends and cuts.
 2. Do not reduce the internal diameter of the conduit when making conduit bends.
 3. Prepare tools and equipment to prevent damage to the PVC coating.
 4. Degrease threads after threading and apply a zinc rich paint.
 5. Debur interior and exterior after cutting.
- D. Male threads of conduit systems shall be coated with an electrically conductive anti-seize compound.
- E. The protective coating integrity of conduits, fittings, outlet, pull and junction boxes and accessories shall be maintained.
1. Repair galvanized components utilizing a zinc rich paint.
 2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
 3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the conduit; or a self-adhesive, highly conformable, cross-linked silicone composition strip, followed by a protective coating of vinyl tape.
 - a. Total nominal thickness: 40 MIL.
 4. Repair surfaces which will be inaccessible after installation prior to installation.
- F. Remove moisture and debris from conduit before wire is pulled into place.
1. Pull mandrel with diameter nominally 1/4 IN smaller than the interior of the conduit, to remove obstructions.
 2. Swab conduit by pulling a clean, tight-fitting rag through the conduit.
 3. Tightly plug ends of conduit with tapered wood plugs or plastic inserts until wire is pulled.
- G. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.
- H. Where portions of a raceway are subject to different temperatures and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway shall be sealed to prevent circulation of warm air to colder section of the raceway.
- I. Fill openings in walls, floors, and ceilings and finish flush with surface.
1. See Specification Section 01 73 20.

3.2 RACEWAY ROUTING

- A. Raceways shall be routed in the field unless otherwise indicated.
1. Conduit and fittings shall be installed, as required, for a complete system that has a neat appearance and is in compliance with all applicable codes.
 2. Run in straight lines parallel to or at right angles to building lines.
 3. Do not route conduits:
 - a. Through areas of high ambient temperature or radiant heat.
 - b. In suspended concrete slabs.
 - c. In concrete members including slabs, slabs on grade, beams, walls, and columns unless specifically located and detailed on structural Drawings..

4. Locate sleeves or conduits penetrating floors, walls, and beams so as not to significantly impair the strength of the construction. Do not place conduit penetrations in columns.
 5. Conduit shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.
 6. Provide pull boxes or conduit bodies as needed so that there is a maximum of 360 DEG of bends in the conduit run or in long straight runs to limit pulling tensions.
- B. All conduits within a structure shall be installed exposed.
- C. Conduits shall be installed to eliminate moisture pockets.
1. Where water cannot drain to openings, provide drain fittings in the low spots of the conduit run.
- D. Conduit shall not be routed on the exterior of structures except as specifically indicated on the Drawings.
- E. Where sufficient room exists within the housing of roof-mounted equipment, the conduit shall be stubbed up inside the housing.

3.3 RACEWAY APPLICATIONS

- A. Permitted Raceway Types Per Wire or Cable Types:
1. Power wire or cables: All raceway types.
 2. Control wire or cables: All raceway types.
 3. Instrumentation cables: Metallic raceway except nonmetallic may be used underground.
 4. Motor leads from a VFD: RGS, RAC or shielded VFD cables in all other raceways.
 5. Telecommunication cables: All raceway types.
- B. Permitted Raceway Types Per Area Designations:
1. Dry areas:
 - a. RGS.
 - b. RAC.
 - c. EMT
 2. Wet areas:
 - a. RGS.
 - b. RAC.
 3. Direct buried conduits:
 - a. PVC-40.
- C. FLEX conduits shall be installed for connections to light fixtures, HVAC equipment and other similar devices above the ceilings.
1. The maximum length shall not exceed:
 - a. 6 FT to light fixtures.
 - b. 3 FT to all other equipment.
- D. FLEX-LT conduits shall be installed as the final conduit connection to light fixtures, dry type transformers, motors, electrically operated valves, instrumentation primary elements, and other electrical equipment that is liable to vibrate.
1. The maximum length shall not exceed:
 - a. 6 FT to light fixtures.
 - b. 3 FT to motors.
 - c. 2 FT to all other equipment.

3.4 CONDUIT FITTINGS AND ACCESSORIES

- A. Threaded connections shall be made wrench-tight.
- B. Conduit joints shall be watertight:
1. Where subjected to possible submersion.
 2. In areas classified as wet.
 3. Underground.

- C. Terminate Conduits:
 - 1. In metallic outlet boxes:
 - a. RGS :
 - 1) Conduit hub and locknut.
 - 2) Insulated bushing and two locknuts.
 - 3) Use grounding type locknut or bushing when required by NFPA 70.
 - b. EMT: Compression type connector and locknut.
 - 2. In NEMA 1 rated enclosures:
 - a. RGS:
 - 1) Conduit hub and locknut.
 - 2) Insulated bushing and two locknuts.
 - 3) Use grounding type locknut or bushing when required by NFPA 70.
 - b. EMT: Compression type connector and locknut.
- D. Threadless couplings shall only be used to join new conduit to existing conduit when the existing conduit end is not threaded and it is not practical or possible to cut threads on the existing conduit with a pipe threader.

3.5 CONDUIT SUPPORT

- A. Permitted multi-conduit surface or trapeze type support system per area designations and conduit types:
 - 1. Dry or wet areas:
 - a. Galvanized system consisting of: Galvanized steel channels and fittings, nuts and hardware and conduit clamps.
 - b. Aluminum system consisting of: Aluminum channels, fittings and conduit clamps with stainless steel nuts and hardware.
 - 2. Conduit type shall be compatible with the support system material.
 - a. Galvanized steel system may be used with RGS.
- B. Permitted single conduit support fasteners per area designations and conduit types:
 - 1. Architecturally finished areas:
 - a. Material: Zinc plated steel, or steel protected with zinc phosphate and oil finish.
 - b. Types of fasteners: Spring type hangers and clips, straps, hangers with bolts, clamps with bolts and bolt on beam clamps.
 - c. Provide anti-rattle conduit supports when conduits are routed through metal studs.
 - 2. Dry or wet and/or hazardous areas:
 - a. Material: Zinc plated steel, stainless steel and malleable iron.
 - b. Types of fasteners: Straps, hangers with bolts, clamps with bolts and bolt on beam clamps.
 - 3. Conduit type shall be compatible with the support fastener material.
 - a. Zinc plated steel, steel protected with zinc phosphate and oil finish and malleable iron fasteners may be used with RGS.
- C. Conduit Support General Requirements:
 - 1. Maximum spacing between conduit supports per NFPA 70.
 - 2. Support conduit from the building structure.
 - 3. Do not support conduit from process, gas, air or water piping; or from other conduits.
 - 4. Provide hangers and brackets to limit the maximum uniform load on a single support to 25 LBS or to the maximum uniform load recommended by the manufacturer if the support is rated less than 25 LBS.
 - a. Do not exceed maximum concentrated load recommended by the manufacturer on any support.
 - b. Conduit hangers:
 - 1) Continuous threaded rods combined with struts or conduit clamps: Do not use perforated strap hangers and iron bailing wire.
 - c. Do not use suspended ceiling support systems to support raceways.
 - d. Hangers in metal roof decks:

- 1) Utilize fender washers.
 - 2) Not extend above top of ribs.
 - 3) Not interfere with vapor barrier, insulation, or roofing.
5. Conduit support system fasteners:
- a. Use sleeve-type expansion anchors as fasteners in masonry wall construction.
 - b. Do not use concrete nails and powder-driven fasteners.

3.6 OUTLET, PULL AND JUNCTION BOX INSTALLATION

A. General:

1. Install products in accordance with manufacturer's instructions.
2. See Specification Section 26 05 00 and the Drawings for area classifications.
3. Fill unused punched-out, tapped, or threaded hub openings with insert plugs.
4. Size boxes to accommodate quantity of conductors enclosed and quantity of conduits connected to the box.
5. Mount device outlet boxes where indicated on the Drawings and at heights as scheduled in Specification Section 26 05 00.
6. Set device outlet boxes plumb and vertical to the floor.

B. Pull and Junction Boxes:

1. Install pull or junction boxes in conduit runs where indicated or required to facilitate pulling of wires or making connections.
 - a. Make covers of boxes accessible.
2. Permitted uses of NEMA 1 enclosure:
 - a. Pull or junction box surface mounted above removable ceiling tiles of an architecturally finished area.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material and installation requirements for:
 - a. Wall switches.
 - b. Receptacles.
 - c. Device wallplates and coverplates.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 26 05 00 - Electrical - Basic Requirements.
 - 2. Section 26 05 33 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. WD 1, General Color Requirements for Wiring Devices.
 - c. WD 6, Wiring Devices - Dimensional Requirements.
 - 2. Underwriters Laboratories, Inc. (UL):
 - a. 20, General-Use Snap Switches.
 - b. 498, Standard for Attachment Plugs and Receptacles.
 - c. 514A, Metallic Outlet Boxes.
 - d. 894, Standard for Switches for Use in Hazardous (Classified) Locations.
 - e. 943, Ground-Fault Circuit-Interrupters.
 - f. 1010, Standard for Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations.
 - g. 1310, Standard for Class 2 Power Units.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section.
 - b. See Specification Section 26 05 00 for additional requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Wall switches and receptacles:
 - a. Bryant Electric.
 - b. Cooper Wiring Devices by Eaton.
 - c. Hubbell Incorporated Wiring Device-Kellems.
 - d. Leviton Manufacturing Company.
 - e. Legrand/Pass & Seymour.
 - f. Eaton Crouse-Hinds.
 - g. Appleton Electric Co.
 - h. Hubbell Killark.

2.2 WALL SWITCHES

- A. Basic requirements unless modified in specific requirements paragraph of switches per designated areas or types:
 - 1. Industrial Specification Grade.
 - 2. Quiet action, snap switch.
 - 3. Self-grounding with grounding terminal.
 - 4. Back and side wired.
 - 5. Solid silver cadmium oxide contacts.
 - 6. Rugged thermoplastic and/or nylon housing and one-piece switch arm.
 - 7. Ratings: 20 A, 120/277 VAC.
 - 8. Switch handle type: Toggle.
 - 9. Switch handle color: Gray.
 - 10. Types as indicated on the Drawings:
 - a. Single-pole.
 - b. Double-pole.
 - c. 3-way.
 - d. 4-way.
 - 11. Standards: UL 20, UL 514A, NEMA WD 1, NEMA WD 6.
- B. Dry Non-architecturally Finished Area Specific Requirements:
 - 1. Coverplate for use on surface mounted outlet boxes:
 - a. Raised steel, galvanized.
 - b. Single or multiple gang as required.

2.3 RECEPTACLES

- A. Basic requirements unless modified in specific requirements paragraph of receptacles and per designated areas:
 - 1. Industrial Specification Grade.
 - 2. Straight blade.
 - 3. Brass triple wipe line contacts.
 - 4. One-piece grounding system with double wipe brass grounding contacts and self-grounding strap with grounding terminal.
 - 5. Back and side wired.
 - 6. Rating: 20 A, 125 VAC.
 - 7. High impact nylon body.
 - 8. Receptacle body color:
 - a. Normal power: Gray.
 - 9. Duplex or simplex as indicated on the Drawings.
 - 10. Configuration: NEMA 5-20R.
 - 11. Standards: UL 498, UL 514A, NEMA WD 1, NEMA WD 6.
- B. Receptacle Type Specific Requirements:
 - 1. Basic receptacles:
 - a. Weather-resistant when located in exterior locations or interior damp or wet areas as indicated on the Drawings.
 - 1) Identification: Letters “WR” on face of receptacle.
 - 2. Ground Fault Circuit Interrupter (GFCI):
 - a. Specification Grade.
 - b. Class A protection.
 - c. Feed through type.
 - d. Test and reset buttons.
 - e. Self-testing.
 - f. Visual indicator light.
 - g. Weather-resistant when located in exterior locations or interior damp or wet areas as indicated on the Drawings.
 - 1) Identification: Letters “WR” on face of receptacle.

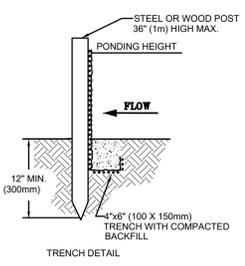
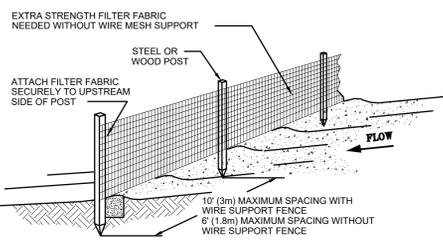
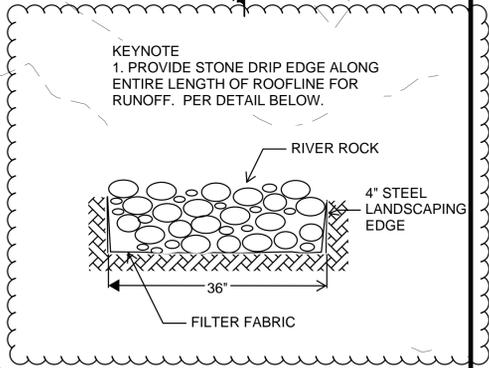
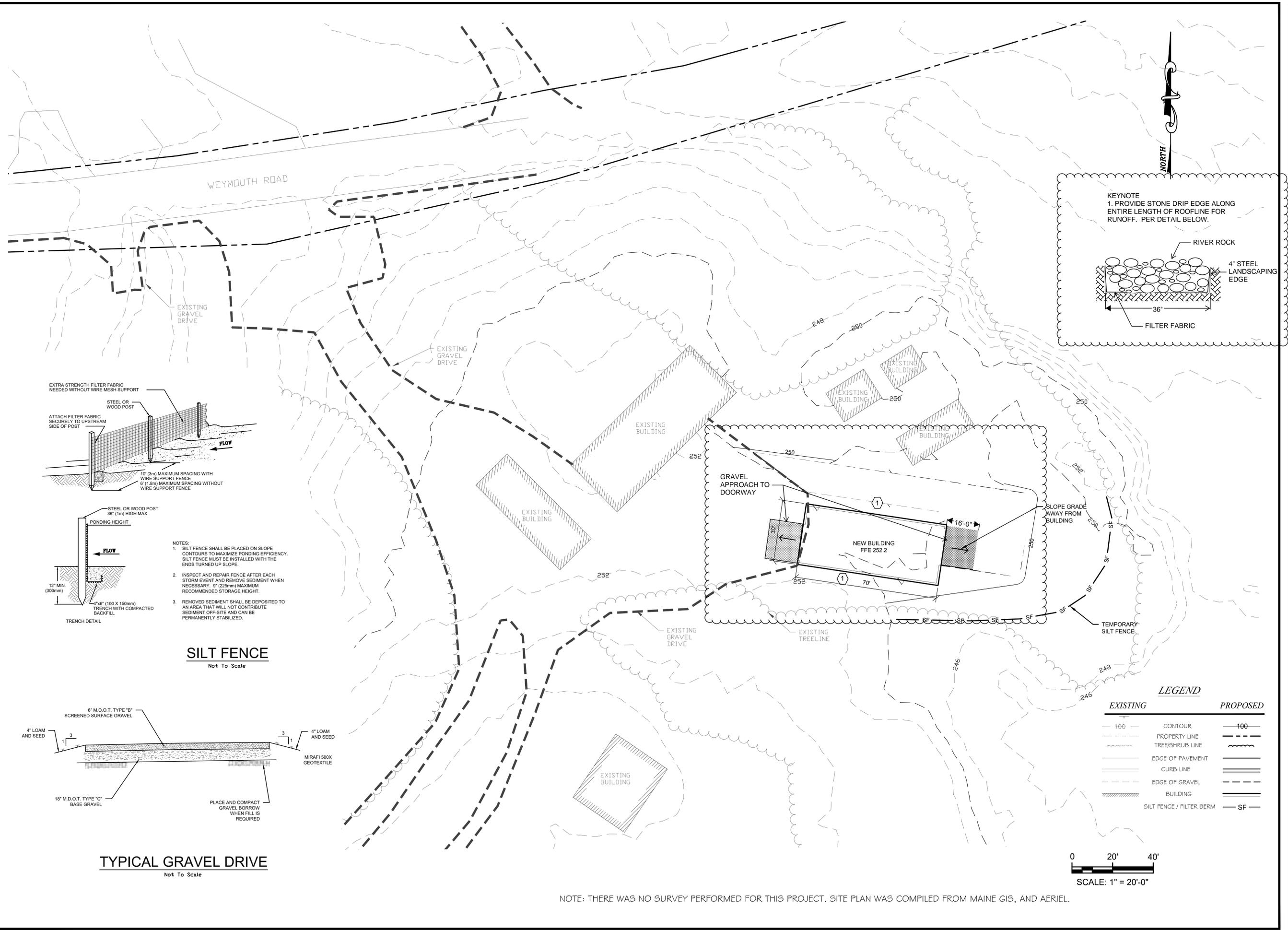
- C. Dry Non-Architecturally Finished Areas Specific Requirements:
 - 1. Coverplate for use on surface mounted outlet boxes:
 - a. Raised steel, galvanized.
 - b. Single or multiple gang as required.

PART 3 - EXECUTION

3.1 INSTALLATION

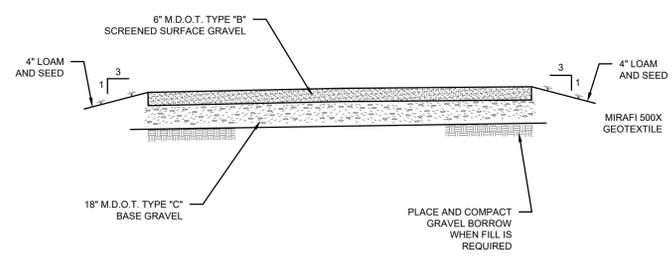
- A. Install products in accordance with manufacturer's instructions.
- B. Mount devices where indicated on the Drawings and as scheduled in Specification Section 26 05 00.
- C. See Specification Section 26 05 33 for device outlet box requirements.

END OF SECTION



- NOTES:**
1. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY. SILT FENCE MUST BE INSTALLED WITH THE ENDS TURNED UP SLOPE.
 2. INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN NECESSARY. 9" (225mm) MAXIMUM RECOMMENDED STORAGE HEIGHT.
 3. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.

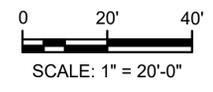
SILT FENCE
Not To Scale



TYPICAL GRAVEL DRIVE
Not To Scale

LEGEND

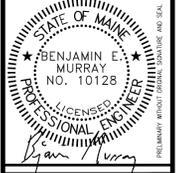
EXISTING		PROPOSED
--- 100 ---	CONTOUR	--- 100 ---
---	PROPERTY LINE	---
~~~~~	TREE/SHRUB LINE	~~~~~
=====	EDGE OF PAVEMENT	=====
-----	CURB LINE	-----
-----	EDGE OF GRAVEL	-----
	BUILDING	
- - - - -	SILT FENCE / FILTER BERM	- - - - - SF - - - - -



NOTE: THERE WAS NO SURVEY PERFORMED FOR THIS PROJECT. SITE PLAN WAS COMPILED FROM MAINE GIS, AND AERIAL.

REV.	APPD	DATE	STATUS
3	JMC	12-9-2022	ADDENDUM 1
2	BEM	10-25-2022	REVISED PER COMMENTS
1	BEM	08-26-2022	ISSUED FOR BID

THIS PLAN SHALL NOT BE MODIFIED WITHOUT WRITTEN PERMISSION FROM A.E. HODSDON CONSULTING ENGINEERS. ANY ALTERATIONS AUTHORIZED OR OTHERWISE SHALL BE AT THE USER'S RISK AND WITHOUT LIABILITY TO A.E. HODSDON CONSULTING ENGINEERS.

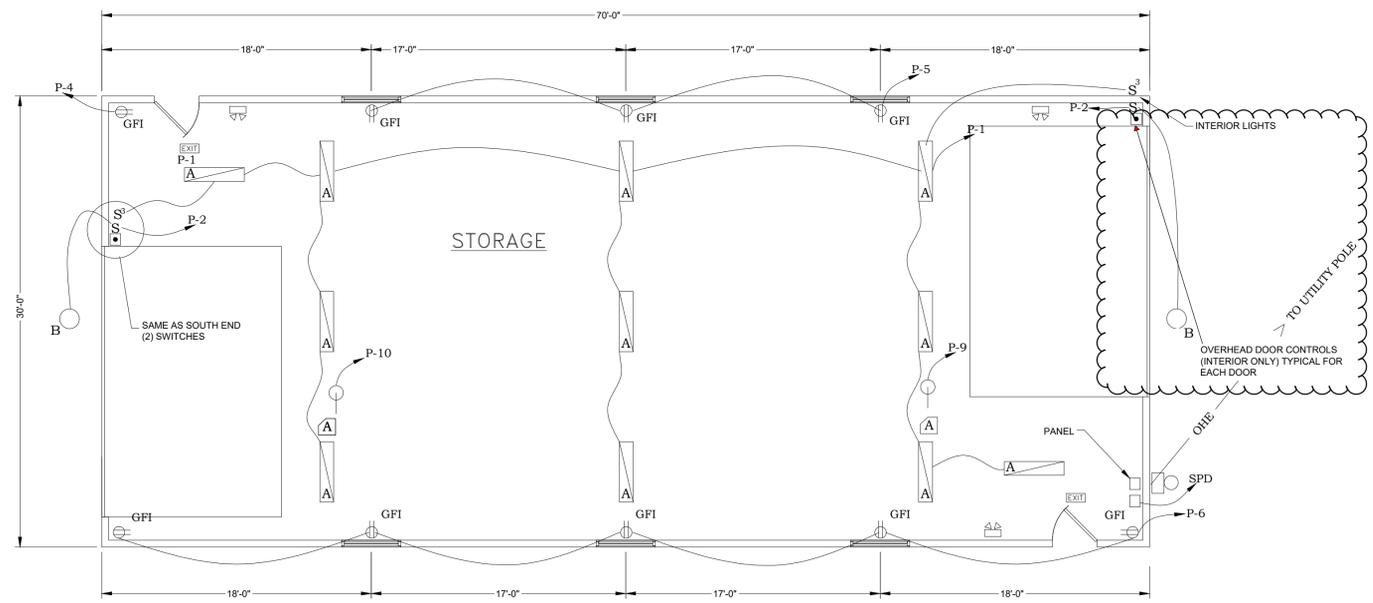


**SITE PLAN**

OF  
**MDIFW DRY MILLS STORAGE BARN**  
158 WEYMOUTH ROAD  
GRAY, MAINE

FOR:  
**HDR ENGINEERING, INC.**  
8450 W. BRYN MAWR AVE.  
ROSEMONT, IL

DRAWN	CHECKED
PLS	BEM
SCALE	DATE
AS NOTED	06-30-2022



**LEGEND**

- LED LIGHTING FIXTURE; LETTER INDICATES TYPE
- DUPLEX 20A RECEPTACLE 48" AFF
- SINGLE POLE SWITCH 48" AFF
- 3-WAY SWITCH 48" AFF
- UTILITY METER
- OVERHEAD ELECTRICAL WIRES
- OVERHEAD DOOR OPERATOR CONTROL
- PANEL OR AS LABELED
- AFF ABOVE FINISHED FLOOR
- AFG ABOVE FINISHED GRADE
- GFI GROUND FAULT CIRCUIT PROTECTOR
- SPD SURGE PROTECTIVE DEVICE
- OHD OVERHEAD DOOR

NOTE: CONTRACTOR SHALL PERFORM VOLTAGE DROP CALCULATIONS FOR INTERIOR LIGHTING CIRCUIT AND RECEPTACLE CIRCUITS AND PROVIDE CONDUCTORS THAT LIMIT THE VOLTAGE DROP TO A MAXIMUM OF 3%. CALCULATIONS SHALL BE SUBMITTED WITH SHOP DRAWINGS FOR ENGINEER'S APPROVAL.

**ELECTRICAL PLAN**  
SCALE 3/16" = 1'-0"

**A** FIELD COORDINATE MOUNTING FOR POWER TO OVERHEAD DOOR

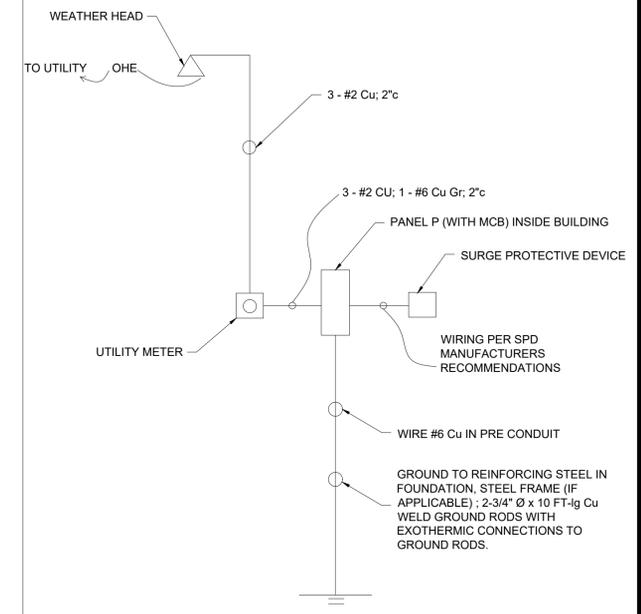
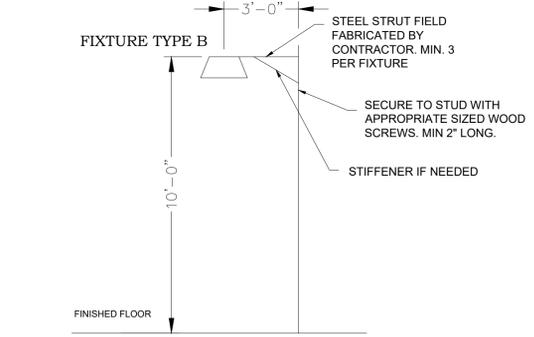
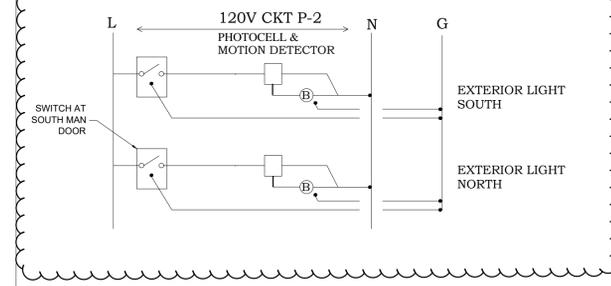
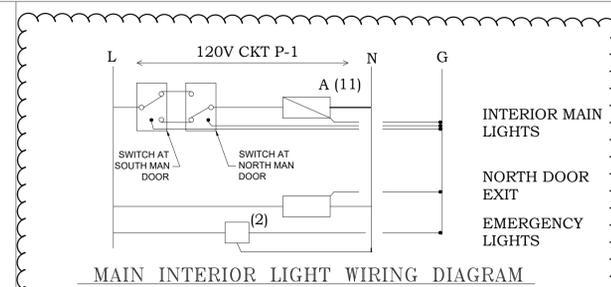
**FIXTURE SCHEDULE**

TYPE	FIXTURE MAKE	FIXTURE MODEL	MOUNTING	LAMPING
A	LITHONIA	ZLIN L48 5000LM FST MVOLT 50K 80 CRI WH WITH LSXR-LT OCCUPANCY SENSOR	SURFACE ON BOTTOM OF TRUSS	21.7W/LED
B	RAB	WPLED 4T 78 NPC WITH SMS 800 MOTION CONTROLLER AND PHOTOCELL	WALL 18 FT AFG	78W/LED
EXIT	LITHONIA	WLTE W 1 R EL SD	WALL ABOVE DOOR	2.3W/LED
EMRG	LITHONIA	INDL SP640L UVOLT LTP SDRT CW	WALL 10 FT AFG	LED

**PANEL SCHEDULE - A SURFACE MOUNTED**  
100 AMP MCB, 240/120 VOLT, 1 PHASE, 3 WIRE, 60 HZ

CIRCUIT NO.	DESCRIPTION	NO. POLES	RATING	LOAD
1	INTERIOR LIGHTS	1	20*	1.9
2	EXTERIOR LIGHTS	1	20*	0.3
3	RECEPT - M	1	20	0.4
4	RECEPT - E	1	20	0.6
5	RECEPT - E	1	20	1.0
6	RECEPT - W	1	20	0.4
7	RECEPT - S	1	20	0.4
8	RECEPT - S	1	20	0.5
9	OH DOORS	1	20	0.5
10	OH DOOR N	1	20	
11,13	SPD	2	**	
12-14	SPARE	1	20	
15,16	SPARE	1	20	
17-24	SPARE	-	20	

* PROVIDE HANDLE LOCK ON CIRCUITS  
** RATING PER SPD MANUFACTURER RECOMMENDATION



NO.	DATE	DESCRIPTION
4	12-09-2022	ADDENDUM 1
3	08-26-2022	ISSUED FOR BID
2	07-11-2022	REVISED OHD LOCATION
1	06-08-2022	80% SUBMITTAL

REV: APPD DATE: STATUS:  
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