



**SPECIAL PROVISIONS  
FOR  
GENERAL ELECTRICAL (IOWA INTERSTATE RAILROAD)**

**Pottawattamie County  
ESL-000R (1)--7S-78**

**Effective Date  
November 17, 2009**

**THE STANDARD SPECIFICATIONS, SERIES OF 2009, ARE AMENDED BY THE FOLLOWING ADDITIONS AND MODIFICATIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.**

**090019.01 GENERAL ELECTRICAL PROVISIONS**

The work covered by this Section of the Specifications consists of furnishing all labor and materials (unless otherwise specified) and in performing all operations necessary for the installation of the complete electronic and electrical system as required by terms and conditions of the Contract. The work shall also include the completion of such details of electrical work not mentioned or shown which are necessary for the successful operation of all electrical and electronic systems described on the drawings or required by these Specifications.

The work in this Contract involves the installation of new work and the alteration of existing work on an existing site. It shall be this Contractor's responsibility to visit the site so that he may ascertain all existing conditions which may affect the work under his Contract. No additional compensation will be granted for additional work required by this Contractor for his failure to visit the jobsite and determine existing conditions. This Contractor shall provide all labor and materials required to complete the Plans and Specifications for a ready to operate installation.

**090019.02 PERMITS.**

The Contractor shall, before entering upon Iowa Interstate Railroad (Railroad) property for the performance of work secure permission from the Railroad's Vice President of Engineering for the occupancy and use of the Railroad's property and shall confer with the Railroad relative to requirements for railroad clearances, operation and general safety regulations. (In this specification, references to the Railroad's Vice President of Engineering is intended to mean the following: Railroad's Vice President of Engineering or authorized representative)

The Contractor shall conduct work in a manner satisfactory to the Railroad's Vice President of Engineering and shall not damage Railroad property or interfere with their operations.

The Railroad's Vice President of Engineering will at all times have jurisdiction over the safety of Railroad operations, and the decision of the Railroad's Vice President of Engineering as to procedures which may affect the safety of Railroad operations shall be final, and the Contractor shall be governed by such decision.

Should any damage occur to Railroad property as a result of the Contractor's operations, and the Railroad deems it necessary to repair such damage or to perform any work for the protection of its property, the required materials, labor, and equipment shall be furnished by the Railroad, and the Contractor shall reimburse the Railroad for any costs so incurred.

### **090019.03 GROUNDING AND BONDING**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Grounding and bonding components.
- B. Provide all components necessary to complete the grounding system(s) consisting of:
  - 1. Rod electrodes.

##### **1.02 REFERENCE STANDARDS**

- A. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

##### **1.03 PERFORMANCE REQUIREMENTS**

- A. Grounding System Resistance: 5 ohms.

##### **1.04 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

#### **PART 2 PRODUCTS**

##### **2.01 ELECTRODES**

- A. Rod Electrodes: Copper.
  - 1. Diameter: 5/8 inch.
  - 2. Length: 10 feet.

##### **2.02 CONNECTORS AND ACCESSORIES**

- A. Mechanical Connectors: Bronze.
- B. Wire: Stranded copper.
- C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

#### **PART 3 EXECUTION**

##### **3.01 EXAMINATION**

- A. Verify existing conditions prior to beginning work.
- B. Verify that final backfill and compaction has been completed before driving rod electrodes.

### 3.02 INSTALLATION

- A. Install ground electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
- B. Provide bonding to meet requirements described in Quality Assurance.
- C. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

### 3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA STD ATS except Section 4.
- B. Perform inspections and tests listed in NETA STD ATS, Section 7.13.

## PART 4 MEASUREMENT AND PAYMENT

### 4.01 METHOD OF MEASUREMENT

- A. Ground rods and associated grounding conductors are to be included as part of the High Mast Tower Lighting and Panelboard.

### 4.02 BASIS OF PAYMENT

- A. Ground rods and associated grounding conductors will be paid for as part of High Mast Tower Lighting and Panelboards. This payment shall be full compensation for the complete installation in accordance to the specifications, including furnishing, handling, testing and equipment required.

## **090019.04 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Wire and cable for 600 volts and less.
- B. Wiring connectors and connections.

#### 1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006.
- B. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

#### 1.03 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

### PART 2 PRODUCTS

#### 2.01 WIRING REQUIREMENTS

- A. Exterior Locations: Use only wire in raceway.
- B. Underground Installations: Use only wire in raceway.
- C. Use solid conductor for feeders and branch circuits 10 AWG and smaller.

- D. Use stranded conductors for control circuits.
- E. Use conductor not smaller than 10 AWG for power and lighting circuits.
- F. Use conductor not smaller than 16 AWG for control circuits.

## 2.02 WIRE MANUFACTURERS

- A. Cerro Wire & Cable Company: [www.cerrowire.com](http://www.cerrowire.com).
- B. Industrial Wire & Cable, Inc: [www.iewc.com](http://www.iewc.com).
- C. Southwire Company: [www.southwire.com](http://www.southwire.com).

## 2.03 WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: NFPA 70, Type XHHW.

## 2.04 WIRING CONNECTORS

- A. Split Bolt Connectors:
- B. Solderless Pressure Connectors:
- C. Spring Wire Connectors:
- D. Compression Connectors:

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that raceway installation is complete and support and that all raceways are dry and free of debris.

### 3.02 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

### 3.03 INSTALLATION

- A. Install wire and cable securely, in a neat and workmanlike manner, as specified in NECA 1.
- B. Route wire and cable as required to meet project conditions.
  - 1. Wire and cable routing indicated is approximate unless dimensioned.
  - 2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.
- C. Use wiring methods indicated.
- D. Pull all conductors into raceway at same time.
- E. Use suitable wire pulling lubricant for building wire 4 AWG and larger.
- F. Protect exposed cable from damage.
- G. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- H. Clean conductor surfaces before installing lugs and connectors.
- I. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

- J. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- K. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- L. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

#### 3.04 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA STD ATS, except Section 4.
- B. Perform inspections and tests listed in NETA STD ATS, Section 7.3.2.

### PART 4 MEASUREMENT AND PAYMENT

#### 4.01 METHOD OF MEASUREMENT

- A. The quantity of conductors will be measured per linear foot installed within conduits, pullboxes and equipment for each size conductor used.

#### 4.02 BASIS OF PAYMENT

- A. Conductors will be paid for at the contract price per linear foot. This payment shall be full compensation for the complete installation in accordance to the specifications, including terminations, furnishing, handling, testing, and equipment required.

### **090019.05 CONDUIT**

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Conduit, fittings and conduit bodies.

##### 1.02 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
- B. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006.
- C. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT); National Electrical Contractors Association; 2006.
- D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2007.
- E. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit; National Electrical Manufacturers Association; 2003.
- F. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association; 2004.
- G. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

##### 1.03 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

#### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Accept conduit on site. Inspect for damage.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- C. Protect PVC conduit from sunlight.

### PART 2 PRODUCTS

#### 2.01 CONDUIT REQUIREMENTS

- A. Conduit Size: Comply with NFPA 70.
- B. Underground Installations:
  - 1. More than 5 Feet from Foundation Wall: Use thickwall non-metallic conduit or thinwall non-metallic conduit.
  - 2. Within 5 Feet from Foundation Wall: Use thickwall nonmetallic conduit or thinwall non-metallic conduit.
  - 3. In or Under Slab on Grade: Use rigid steel conduit, thickwall non-metallic conduit, or thinwall non-metallic conduit.
  - 4. Directionally bored conduit shall be HDPE type.
- C. Outdoor Locations Above Grade: Use rigid steel conduit.
- D. Wet and Damp Locations: Use rigid steel conduit or intermediate metal conduit.

#### 2.02 METAL CONDUIT

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

#### 2.03 PVC COATED METAL CONDUIT

- A. Description: NEMA RN 1; rigid steel conduit with external PVC coating.
- B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

#### 2.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Description: Interlocked steel construction with PVC jacket.
- B. Fittings: NEMA FB 1.

#### 2.05 NONMETALLIC CONDUIT

- A. Description: NEMA TC 2; Schedule 40 or Schedule 80 PVC.
- B. HDPE conduit shall be suitable for directionally boring, NEMA TC-7. Install in accordance with manufacturer's written instructions.
- C. Fittings and Conduit Bodies: NEMA TC 3.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

#### 3.02 INSTALLATION

- A. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 1.

- B. Install steel conduit as specified in NECA 101.
- C. Install nonmetallic conduit in accordance with manufacturer's instructions.
- D. Arrange supports to prevent misalignment during wiring installation.
- E. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- F. Route exposed conduit parallel and perpendicular to supports.
- G. Maintain adequate clearance between conduit and other underground utilities.
- H. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
- I. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- J. Bring conduit to shoulder of fittings; fasten securely.
- K. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- L. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations.
- M. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch size.
- N. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- O. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, or expansion joints.
- P. Provide suitable pull string in each empty conduit except sleeves and nipples.
- Q. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- R. Ground and bond conduit under provisions of Grounding and Bonding Section.

**PART 4 MEASUREMENT AND PAYMENT**

**4.01 METHOD OF MEASUREMENT**

- A. The quantity of conduits will be measured per linear foot installed for each size conduit installed.

**4.02 BASIS OF PAYMENT**

- A. Conduit will be paid for at the contract price per linear foot. This payment shall be full compensation for the complete installation in accordance to the specifications, including all horizontal directional drilling, fittings, hardware, furnishing, handling, testing, and equipment required.

**090019.06 ELECTRICAL UTILITY SERVICES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Service racks.
- B. Metering transformer cabinets.
- C. Meter bases.

## 1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

## 1.03 SYSTEM DESCRIPTION

- A. System Characteristics: 480Y/277 volts, three phase, four-wire, 60 Hertz.

## 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Convene one week prior to commencing work of this section. Review service entrance requirements and details with Utility Company representative.

## 1.05 QUALITY ASSURANCE

- A. Utility Company: Mid American Energy
- B. Perform work in accordance with utility company written requirements and NFPA 70.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

## PART 2 PRODUCTS

### 2.01 COMPONENTS

- A. Metering Transformer Cabinets: Sheet metal cabinet with hinged door, conforming to utility company requirements, with provisions for locking and sealing.
- B. Meter Base: Rated 200 amperes continuous duty with all features required by utility company.
- C. Other Components: As required by utility company.

### 2.02 METER BASE

- A. Enclosure Materials
  - 1. Meter sockets shall meet Company specifications and shall be UL Listed.
  - 2. Shall be steel (plated or made of galvanized steel) or aluminum.
  - 3. The finish shall be tough, non-fading and have a long service life.
- B. Insulating Materials
  - 1. Bus Support – Shall be high strength and track-resistant.
  - 2. Sheet Insulation – High dielectric strength.
  - 3. Insulating materials meet UL requirements.
- C. Mounting Bases
  - 1. Shall be high impact strength, track-resistant.
- D. Safety Shield Barriers
  - 1. Shall be track-resistant.
- E. Connectors
  - 1. Shall have high strength tops.
  - 2. Single hex screw and floating pressure pad; shall be tin-plated, suitable for copper or aluminum wire; shall have a built-in, anti-turn provision.
  - 3. Shall meet UL requirements for electrical connectors.
  - 4. Only one conductor per lay in connector is allowed.



F. Jaws

1. Shall be tin-plated electrolytic copper. Jaws rated at 100 A and above shall be spring reinforced.
2. Spring, clip type add-on 5th terminals are not allowed.

G. Covers

1. Shall be one piece.
2. Shall be lockable using a hasp-type lock.
3. Shall be ringless type.

H. Installation Ease

1. Door shall be removable for installation ease.
2. Terminals shall accept copper or aluminum wire for installation flexibility.
3. Enclosure shall have a broad range of concentric knock-outs to accommodate varied wiring needs.
4. Horn bypasses are required on all residential meter sockets rated at 200 amps or less.
5. Commercial sockets less than 200 amps require a horn bypass.
6. Commercial installations require a manual lever bypass.

PART 3 EXECUTION

3.01 PREPARATION

- A. Arrange with utility company to obtain permanent electric service to the Project, on behalf of the Iowa Interstate Railroad.
- B. Include all cost associated with new service as part of bid.

3.02 INSTALLATION

- A. Install service rack, weatherhead, metering transformer cabinets, and meter base as required by utility company.
- B. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

PART 4 MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

- A. The electrical service will be measured as a single unit for the complete installation of a new electrical service, including aid-to-construction costs, metering equipment, service racks and other components as required by the utility company.

4.02 BASIS OF PAYMENT

- A. Electrical Service will be paid for at the contract price for complete installation of the new electrical service. This payment shall be full compensation for the complete installation in accordance to the specifications and utility company requirements, including terminations, furnishing, handling, testing, and equipment required.

**090019.07 EXISTING EXTERIOR LUMINAIRES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removal, Cleaning, Re-lamping and Re-aiming of existing pole mounted light fixtures.
- B. Poles.

1.02 REFERENCE STANDARDS

- A. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low

Pressure Sodium Lamps (Multiple-Supply Type); 2002.

- B. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems; 2006.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

#### 1.03 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Submit product data for each lamp type to be provided.
- C. Product Data: Provide dimensions, ratings, and performance data.

#### 1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

#### 1.05 COORDINATION

- A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

### PART 2 PRODUCTS

#### 2.01 LUMINAIRES

- A. Furnish products as indicated on the Drawings.

#### 2.02 BALLASTS

- A. High Intensity Discharge (HID) Ballasts: ANSI C82.4, metal halide ballast, suitable for lamp specified.
  - 1. Voltage: Match luminaire voltage.

#### 2.03 LAMPS

- A. Manufacturers:
  - 1. GE Lighting: [www.gelighting.com](http://www.gelighting.com).
  - 2. Philips Lighting Co of NA: [www.lighting.philips.com](http://www.lighting.philips.com).
  - 3. Osram Sylvania.
- B. Lamp Types: As indicated for each luminaire.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install fixtures securely, in a neat and workmanlike manner.
- B. Replace lamps in each luminaire.
- C. Clean lenses of each fixtures with non corrosive cleaning agent.

#### 3.02 FIELD QUALITY CONTROL

- A. Perform field inspection, testing, and adjusting.
- B. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

#### 3.03 ADJUSTING

- A. Aim and adjust luminaires to provide illumination, distribution on areas indicated on Drawings.

### 3.04 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosure.
- C. Clean photometric control surfaces as recommended by manufacturer.

## PART 4 MEASUREMENT AND PAYMENT

### 4.01 METHOD OF MEASUREMENT

- A. Per luminaire.

### 4.02 BASIS OF PAYMENT

- A. Work to existing luminaires will be paid for at the contract price. This payment shall be full compensation for the complete installation in accordance to the specifications and drawings, including cleaning, re-lamping and aiming.

## **090019.08 LIGHTING CONTACTORS**

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Lighting contactors.

#### 1.02 REFERENCE STANDARDS

- A. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association; 2000 (R2005).
- B. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

#### 1.03 SUBMITTALS

- A. Product Data: Provide dimensions, size, voltage ratings and current ratings.
- B. Maintenance Data: Include instructions for replacing and maintaining coil and contacts.

#### 1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Eaton Electrical/Cutler-Hammer: [www.eatonelectrical.com](http://www.eatonelectrical.com).
- B. Square D: [www.squared.com](http://www.squared.com).
- C. General Electric.
- D. Siemens

#### 2.02 LIGHTING CONTACTORS

- A. Description: NEMA ICS 2, magnetic lighting contactor.

- B. Configuration: Electrically held.
- C. Coil operating voltage: 120 volts, 60 Hertz.
- D. Poles: As required to match circuit configuration and control function.
- E. Contact Rating: Match branch circuit overcurrent protection, considering derating for continuous loads.
- F. Enclosure: NEMA 3R Rainproof
- G. Accessories:
  - 1. Selector Switch: ON/OFF/AUTOMATIC.
  - 2. Indicating Light: RED.
  - 3. Auxiliary Contacts: One, normally open.
  - 4. Control Power Transformers: 120 volt secondary in each enclosed contactor. Provide fused primary and secondary, and bond un-fused leg of secondary to enclosure.

### 2.03 DISCONNECTS

- A. Combination Contactors: Combine contactor with disconnect in common enclosure.
- B. Disconnects: Thermal magnetic circuit breaker with integral thermal and instantaneous magnetic trip in each pole; UL listed.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install enclosed contactors where indicated, in accordance with manufacturer's instructions.
- B. Install enclosed contactors plumb.
- C. Height: 5 ft to operating handle.
- D. Provide engraved plastic nameplates on interior of door.

### 3.02 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform applicable inspections and tests listed in NETA STD ATS, Section 7.16.1.

## PART 4 MEASUREMENT AND PAYMENT

### 4.01 METHOD OF MEASUREMENT

- A. The quantity of lighting contactors will be measured per device installed.

### 4.02 BASIS OF PAYMENT

- A. Lighting Contactors will be paid for at the contract price per measurement unit. This payment shall be full compensation for the complete installation in accordance to the specifications, including terminations, furnishing, handling, testing, and equipment required.

## **090019.09 DISCONNECTS**

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Nonfusible switches.

## 1.02 REFERENCE STANDARDS

- A. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).
- B. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

## 1.03 SUBMITTALS

- A. Product Data: Provide switch ratings and enclosure dimensions.

## 1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Eaton Electrical/Cutler-Hammer: [www.eatonelectrical.com](http://www.eatonelectrical.com).
- B. GE Industrial: [www.geindustrial.com](http://www.geindustrial.com).
- C. Square D: [www.squared.com](http://www.squared.com).
- D. Siemens.

### 2.02 COMPONENTS

- A. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
  - 1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
  - 2. Handle lockable in OFF position.
- B. Enclosures: NEMA KS 1.
  - 1. Exterior Locations: Type 3R, unless noted otherwise on the drawings.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.
- C. Apply engraved nameplate on exterior door of disconnect switch.

### 3.02 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA STD ATS, except Section 4.
- B. Perform inspections and tests listed in NETA STD ATS, Section 7.5.

## PART 4 MEASUREMENT AND PAYMENT

### 4.03 METHOD OF MEASUREMENT

- A. The quantity of disconnects will be measured per device installed.

#### 4.04 BASIS OF PAYMENT

- A. Disconnects will be paid for at the contract price per measurement unit. This payment shall be full compensation for the complete installation in accordance to the specifications, including terminations, furnishing, handling, testing, and equipment required.

### **090019.10 PANELBOARDS**

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Lighting and appliance panelboards.

##### 1.02 RELATED REQUIREMENTS

- A. Section - Grounding and Bonding.

##### 1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006.
- B. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; 2006.
- C. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2002.
- D. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007.
- E. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

##### 1.04 SUBMITTALS

- A. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- B. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.
- C. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

##### 1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

##### 1.06 MAINTENANCE MATERIALS

- A. Furnish two of each panelboard key.

#### PART 2 PRODUCTS

##### 2.01 MANUFACTURERS

- A. Eaton Electrical/Cutler-Hammer: [www.eatonelectrical.com](http://www.eatonelectrical.com).
- B. GE Industrial: [www.geindustrial.com](http://www.geindustrial.com).
- C. Square D: [www.squared.com](http://www.squared.com).
- D. Siemens.

## 2.02 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
- B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus where scheduled.
- C. Minimum Integrated Short Circuit Rating: As indicated.
  - 1. 480 Volt Panelboards: 14,000 amperes RMS symmetrical, unless noted otherwise on the drawings.
- D. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
  - 1. Type SWD and HID rated for lighting circuits.
- E. Enclosure: NEMA PB 1, Type 1, unless noted otherwise on the drawings.
- F. Cabinet Box: 6 inches deep, 20 inches wide for 240 volt and less panelboards, 20 inches wide for 480 volt panelboards.
- G. Cabinet Front: Flush cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
- H. Series rated panelboards are not acceptable.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.
- B. Install panelboards plumb.
- C. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
- D. Provide filler plates for unused spaces in panelboards.
- E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- F. Provide engraved plastic nameplates indicating panel name, voltage, conductor coloring.
- G. Ground and bond panelboard enclosure according to Section 16060.

### 3.02 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA STD ATS, except Section 4.
- B. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, and Section 7.6 for circuit breakers.

### 3.03 ADJUSTING

- A. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

## PART 4 MEASUREMENT AND PAYMENT

### 4.05 METHOD OF MEASUREMENT

- A. The quantity of panelboards will be measured per device installed.

### 4.06 BASIS OF PAYMENT

- A. Panelboards will be paid for at the contract price per measurement unit. This payment shall be

full compensation for the complete installation in accordance to the specifications, including terminations, furnishing, handling, testing, and equipment required.

## **090019.11 HORIZONTAL DIRECTIONAL DRILLING**

### **PART 1 GENERAL**

#### **1.01 WORK INCLUDED**

- A. This Section covers the installation of underground electrical feeder conduits in the sizes indicated and at the locations shown on the drawings, using horizontal directional drilling (HDD). Some horizontal directional drilling may be required under existing buildings and structural foundations.
- B. HDD is a trenchless excavation method, which is accomplished in three phases. The first phase consists of drilling a small diameter pilot hole along a designed directional path. The second phase consists of enlarging the pilot hole to a diameter suitable for installation of the conduit. The third phase consists of pulling the conduit into the enlarged hole. HDD is accomplished using a specialized horizontal drilling rig with ancillary tools and equipment.
- C. Services furnished by the Contractor shall be performed in accordance with standard HDD industry practices and these Contract Documents and shall include all labor, equipment, and consumables necessary to complete the work, including the following tasks:
  - 1. Clearing, grading, and general site and access preparation necessary for construction operations.
  - 2. Transportation of all equipment, labor, consumables, and materials to and from the site of the work.
  - 3. Erection of horizontal drilling equipment.
  - 4. Locate all existing utilities as required.
  - 5. Drilling of a small diameter pilot hole along the path defined on the drawings.
  - 6. Reaming the pilot hole to a diameter suitable for installation of the conduits.
  - 7. Prefabrication of the conduits.
  - 8. Installation of the conduits in the reamed hole.
  - 9. Flush debris and swab water from conduit(s).
  - 10. Install a pull string in each conduit.
  - 11. Clean-up and restoration of all work areas.
  - 12. Recording as-built location of the conduits on the drawings.
  - 13. Other items of work as required.
  - 14. The Contractor shall furnish all labor, materials, tools, equipment, drilling fluids, and other items as necessary for a complete and functional installation as required.

#### **1.02 REFERENCES**

- A. ANSI/AWWA C-600

#### **1.03 QUALIFICATIONS AND EXPERIENCE**

- A. Contractor installing the horizontal directionally drilled conduit(s) shall be commonly engaged and well experienced in installations using this technique. Contractor shall, within the past five (5) years, have successfully completed projects of a similar length, diameter, and conditions using horizontal directional drilling and installing the same type of conduit.

#### **1.04 SUBMITTAL DATA**

- A. Submit the following data on Contractor Qualifications at pre-construction meeting:
  - 1. A listing of similar past projects installed using horizontal directional drilling within the past five (5) years.
  - 2. A list of references including contact person with telephone number for each referenced project.
  - 3. Background information on key personnel proposed for use on the project.



- B. Submit Project Record Documents as required, including as-built location of all conduits.

#### 1.05 GENERAL

- A. Contractor shall be responsible for providing equipment and materials of sufficient size and capabilities along with adequately experienced labor as required for a complete installation in accordance with the contract requirements.

#### 1.06 MATERIALS

- A. Horizontal Directional Drilling Equipment shall have adequate thrust, pullback, and torque capabilities to successfully complete the installation.
- B. The equipment shall have a tracking and guidance system, which will accurately locate the drilling head and pilot hole during drilling of the pilot hole.
- C. Equipment shall be capable of measuring drill string axial and torsional loads, and of measuring drilling fluid discharge rate and pressure.
- D. Drilling Fluid System shall be capable of mixing and delivering the drilling fluid to the drill head or the reamer in the volumes and pressures required. Contractor shall maximize recirculation of drilling fluid surface returns. Contractor shall provide solids control and fluid cleaning equipment of a configuration and capacity that can process surface returns and produce drilling fluid suitable for reuse.
- E. Drilling Fluid shall be used as required during the installation of the pilot hole, enlarging of the pilot hole, and installation of the conduits. No fluid will be accepted or utilized that does not comply with permit requirements and environmental regulations. Drilling fluids shall be environmentally safe.
- F. Contractor shall be responsible for obtaining, transporting, and storing any water required for drilling fluids.
- G. Drill Pipe (drill stem) shall be of sufficient size and strength to resist all installation loadings including tensile, compressive, bending, and torsional loads. The Contractor in sizing the drill pipe shall use an appropriate safety factor.
- H. Drill Head configuration shall be as selected by the Contractor and compatible with requirements for location system.
- I. Reamer and Swivels shall be as selected by the Contractor. Reamer and swivel assembly shall be capable of enlarging borehole while preventing damage due to rotation of the conduits during its pullback into its final position. Pulling head, reamer, and swivel assembly shall be acceptable to the conduit manufacturer.
- J. Conduit(s) shall be as specified in Conduit Section and/or as supplemented herein.

#### 1.07 INSTALLATION

- A. Staging and Set-up
  1. The Contractor shall perform surveying for layout of installation. The entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations. If Contractor is using a magnetic guidance system, the drill path shall be surveyed for any surface geo-magnetic variations or anomalies.
  2. The Contractor shall be responsible for locating any and all underground facilities as required. Contractor shall be responsible for all losses and repairs occasioned by damage to underground facilities resulting from drilling operations. Contractor shall, as a minimum, undertake the following steps prior to commencing drilling operations:
    - a. Contact the utility location/notification service for the construction area.
    - b. Positively locate and stake all existing lines, cables, or other underground facilities and if needed, expose any facilities, which are located within 10' of the designed drilled path.

- c. Modify drilling practices and downhole assemblies to prevent damage to existing facilities.
  3. Prior to beginning the work, the Contractor shall prepare a bore plan for each segment drilled. The bore plan shall show finished grade, deflection and radius of the pilot bore, all existing utilities with minimum vertical and horizontal clearance. The proposed clearance shall exceed the guidance system accuracy tolerance by a minimum of 100%.
  4. Contractor shall position and anchor drill unit as required. Proper setbacks shall be provided to allow for installation of the conduits at the locations indicated on the drawings and to avoid excessive steep entry and exit angles for the pilot hole and the installed conduit(s).
  5. Make necessary provisions for operation of the tracking, locating, and instrumentation systems.
- B. Boring of Pilot Hole
  1. Install pilot hole using steerable drilling head. Pilot hole shall be drilled along the path shown on the drawings to the tolerances listed herein. However, in all cases, right-of-way restrictions shall take precedence over the listed tolerances. Regardless of the tolerance achieved, no pilot hole will be accepted if it will result in any or all of the conduits being installed in violation of right-of-way restrictions. Additionally, concern for adjacent utilities and/or structures shall take precedence over the listed tolerances. Listing of tolerances shall not relieve Contractor from responsibility for safe operations or damage to adjacent utilities and structures.
  2. Alignment of the conduit(s) shall be as shown on the drawings and within the listed tolerances. If curves are allowed by the Engineer, the joint deflections of the conduit(s) shall not exceed the recommendations of the conduit manufacturer.
  3. Monitor location of drill head as required to install pilot hole to indicated lines and grades, but in no instance shall the interval between locating the drilling head exceed 5' in length along the alignment.
  4. Use drilling fluids as required to lubricate and support the pilot hole excavation. Drilling fluids shall be environmentally safe.
  5. Pilot hole shall be free from abrupt changes in line or grade that could result in unacceptably high loadings on the drill pipe or the conduit(s) during installation.
- C. Pre-reaming of Pilot Hole
  1. Subsequent to construction of pilot hole, Contractor may, at his option, pre-ream the pilot hole as necessary for installation of the conduit(s).
  2. Pre-reaming operations shall be conducted at the discretion of the Contractor. Contractor shall insure that a hole sufficient to accommodate the pull section of conduit(s) has been produced. Any damage to the conduit(s) resulting from inadequate pre-reaming shall be the responsibility of the Contractor. All provisions of this Specification relating to simultaneous reaming and pulling back operations shall also pertain to pre-reaming operations.
  3. Use drilling fluids as required to lubricate and support the reamed pilot hole. Drilling fluids shall be environmentally safe.
  4. Use of pre-reaming shall be at the option of the Contractor, however, lack of pre-reaming shall not result in excessive installation loads on the conduit(s).
- D. Reaming and Pullback of the Conduit(s)
  1. Contractor shall utilize a reamer to enlarge the pilot hole to sufficient size for installation of the conduit(s) without imposing excessive installation loadings on the conduit(s).
  2. Grippers used on the conduit(s) shall not damage adjacent sections of the conduit. Sections of the conduit utilized by the grippers shall be removed from the conduit after installation of the conduit. Pulling head, reamer, and swivel assembly shall be acceptable to the conduit manufacturer.
  3. Contractor shall handle and support the pull section of the conduit(s) so as to prevent damage to the conduit and minimize pullback forces. Pull section of conduit shall be supported as it proceeds during pull back so that it moves freely and the conduit is not

- damaged.
4. Contractor shall use drilling fluids as required to lubricate and support the reamed pilot hole, lubricate installation of the conduit(s), and completely fill all overcut of the reamed pilot hole. Drilling fluids shall be environmentally safe.
  5. The pull section of conduit(s) shall be installed in the reamed hole in such a manner that external pressures are minimized and an appropriate counter-balancing internal pressure is maintained. Any damage to the conduit resulting from external pressure during installation shall be the responsibility of Contractor. If required, the conduit(s) shall be filled with water prior to entering the ground to insure that adequate internal pressure is maintained at all points to counter balance external collapse pressures. Contractor shall submit conduit-filling procedure proposed for use for review and acceptance.
  6. The Contractor shall continuously monitor the pulling loads imposed upon the conduit(s). The maximum allowable tensile load imposed on the conduit(s) shall not exceed the recommendations of the conduit manufacturer. Contractor shall take all required measures necessary to prevent installation loads on the conduit(s) from exceeding those recommended by the conduit manufacturer. If necessary, Contractor shall at his own expense, stop the pullback of the conduit(s), remove the section of conduit installed within the enlarged pilot hole, and pre-ream the pilot hole as required to allow installation of the conduit(s) without exceeding the allowable pullback forces.
  7. After the conduit(s) have been installed, Contractor shall determine and note the installed location and depth of the conduit(s) on his as-built drawing set. Contractor shall submit a set of drawings indicating the as-built location and depth of all conduit(s) to the Engineer.

#### 1.08 REJECTION

- A. The installed conduit(s) may be rejected by Engineer for the following causes:
  1. Conduits are not satisfactorily flushed of debris and water removed.
  2. Monitoring records indicate that pullback loads exerted on conduit exceeded the design loadings recommended by the conduit manufacturer.
  3. Conduits are installed outside of the allowable tolerances.
  4. If the conduit(s) are rejected by Engineer, Contractor shall, at his own expense, remove the rejected conduit(s) and install acceptable conduit(s).

#### 1.09 TOLERANCES

- A. Tolerances for the pilot hole and the installed conduits shall be as listed below.
- B. Vertical Tolerance. The conduit(s) shall be installed at the locations indicated on the drawings. Deviations from the general grades indicated on the drawings may be allowed, provided that:
  1. The soil cover above the top of the conduit(s) shall be not less than 4'-6" at all locations.
  2. The conduits shall maintain a downward slope towards pullboxes to provide for positive drainage of water.
- C. Horizontal Tolerance. The conduit(s) shall be installed at the locations indicated on the Plans. Minor deviations from the locations indicated on the plans may be allowed, provided that:
  1. The horizontal deviation of the conduit(s) from the location required on the drawings shall not exceed 5' at any location along the conduit route, without the prior authorization of the Engineer.
  2. The horizontal deviation shall not cause the conduits to interfere with existing structures, utilities, or result in any part of the finished work being installed in conflict with existing facilities.
- D. Contractor shall, at his own expense, compensate for installation tolerances of conduit(s) by adjusting the installation of the conduit approaches to accommodate connections to pullboxes and other conduits at each end of the horizontal directionally drilled system.

#### 1.10 CLEAN UP AND DISPOSAL OF MATERIALS

- A. Contractor shall remove all construction debris and dispose of it at an acceptable location. Disposal of construction debris shall be in accordance with environmental regulations, right-of-

way and workspace agreements, and permit requirements.

- B. Drilling fluid shall be allowed to dry and dissipate naturally in pits and the pits shall be compacted to 100% of original density after drying is complete. Drilling fluid shall not be removed from pit and/or trench.
- C. Backfill material shall be reinstalled in pit and/or trench and compacted to original density.
- D. Contractor shall employ his best efforts to maintain full annular circulation of drilling fluids. Drilling fluid returns at location other than the entry and exit points shall be minimized. In the event that annular circulation is lost, Contractor shall take steps to restore circulation. If inadvertent surface returns of drilling fluids occur, they shall be immediately contained with hand placed barriers (i.e., hay bales, sand bags, silt fences, etc.) as required. The affected area shall be diluted with fresh water and the fluid will be allowed to dry and dissipate naturally. If the amount of the surface return exceeds that which can be contained, drilling operations shall be suspended until surface return volumes can be brought under control.

**090019.12 FINAL CLEANUP.**

The Contractor shall, upon completion of the work, remove from within the limits of the property of the Railroad, all machinery, equipment, surplus materials, falsework, rubbish, or temporary buildings of said Contractor; remove the approaches to any temporary grade crossing(s) constructed for the Contractor's use, restoring same as nearly as practicable to conform to the adjoining terrain; remove any accumulated silt in Railroad's side ditches, restoring proper flow thereto, employ erosion control measures as appropriate to prevent further siltation until ground cover is reestablished; and in all other respects leave said property in a neat condition satisfactory to the Railroad's Vice President of Engineering.

**090019.13 RESPONSIBILITY OF SUPERVISION.**

Nothing in this specification shall be construed to place any responsibility on the Railroad for the quality or conduct of the work performed by the Contractor hereunder. Any approval given or supervision exercised by the Railroad hereunder, or failure of Railroad to object to any work done, material used, or method of operation shall not be construed to relieve Contractor of any obligations pursuant hereto or under the agreement this specification is appended to.