MICHIGAN

DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION

FOR

**SCALE CONTROLS**

GND:DLK 1 of 6 APPR:BMB:RPB:10-23-23

**a. Description.** This work consists of excavation and backfill for conduit, conductors, cabling, electrical equipment, and materials shown on the plans. Ensure all work for scale controls is done in accordance with the requirements of sections 818, 819 and 918 of the Standard Specifications for Construction except as noted herein or on the plans and details.

1. Applicable Standards and Codes:

A. *IEEE - Institute of Electrical and Electronic Engineers*.

B. *UL - Underwriters Laboratories, Inc*.

C. *NEMA - National Electrical Manufacturers Association*.

D. *NEC - National Electrical Code*.

E. *ASTM - American Society for Testing and Materials*.

F. *ANSI - American National Standards Institute*.

G. *NBFU - National Board of Fire Underwriters*.

H. *NFPA - National Fire Protection Association*.

I. *NECA - National Electrical Contractors “Standard of Installation”*.

J. *Joint Industrial Council (JIC)*.

K. *Code of Federal Regulations (CFR). Title 29 Labor, Subpart S-Electrical*.

**b. Materials.**

1. Conduit for Direct Burial Applications. Furnish Schedule 80 non-metallic rigid conduit conforming to *NEC Article 347*.

2. Couplings and Connectors. Furnish non-metallic conduit coupling and connectors to be glue adhesive type, making waterproof.

3. Fittings. Furnish UL listed.

4. Low Voltage and Power Conductors. Ensure all wire and cable is in accordance with the *NEC* and any local ordinances that apply and meets all applicable *ASTM* specifications. Ensure cable is *UL* approved. Furnish coated soft drawn copper conductors that are standard AWG sizes. Ensure all wire and cable has the size, voltage rating, type of insulation and the manufacturer’s name permanently marked on the outer covering at regular intervals. The manufacturer must furnish to the MDOT all splicing or terminating information necessary for proper installation of the cable. Ensure bare ground conductors are soft drawn copper.

Any cable used for an electric service entrance feeder must have an underground service entrance (USE) cable rating. Ensure cable sized #2 AWG and smaller is *UL* listed Type RHH/RHW/USE. Ensure cable sized larger than #2 AWG is *UL* listed Type RHH/RHW/USE. Conductors provided for 120/240 volt power systems to be stranded per *ASTM B8* soft drawn copper. Minimum size conductor utilized is #14 AWG for control circuits and #12 AWG for power circuits.

Color code conductor insulation as follows:

Line Voltage - Black

Grounding Conductor - Green

Neutral - White

Control - Red

DC Circuits- Blue

Voltage from External Source - Yellow

Ensure color is integral with the insulation compound applied by cable manufacturer. The *UL* listing mark, cable voltage, insulation type and ratings, as well as the cable size must all be clearly printed on the cable in a color contrasting with the insulation color.

5. Terminations - Splices. Use Burndy, Blackburn, 3M, or approved equivalent as shown on plans.

6. System Grounding.

A. Grounding Electrode. Two - 10 foot, 5/8 inch diameter copper clad steel electrodes.

B. Ground Connections.

(1) To be exothermically welded when concealed.

(2) To be mechanical where exposed to view.

C. Grounding Electrode Conductor. Grounding electrode conductor is to be copper sized in accordance with *Table 250.66 of NEC* and as shown on the plans.

D. Equipment Grounding Conductors. Ensure equipment grounding conductors are copper and sized in accordance with *Table 250.122 of NEC* and as shown on the plans.

7. Electrical Equipment and Materials. Ensure all electrical equipment and material is furnished new and accepted, or certified, or listed or labeled or otherwise determined to be safe by a nationally recognized testing laboratory (NRTL). Commonly accepted NRTL’s are *UL* and *Factory Mutual, Inc. (FM)*.

8. Directional Bore. Open trench direct burial conduit as called for on plans is the preferred method of installation. The Contractor is responsible for review of soil conditions, providing all equipment necessary to complete work and is responsible for methods and techniques used. The Contractor, at his own expense and with prior written approval from Engineer, may directional bore conduit in lieu of open trench. If approval to directional bore is given, then ensure materials and construction for directional bore are per sections 818 and 819 of the Standard Specifications for Construction.

9. Fiber Optic Cable. Fiber must be 4-strand multimode 62.5/125 indoor/outdoor type cable. Cable provided by Mettler-Toledo as part of scale system.

10. Loop Detector Lead-In Cable. Furnish cable with one pair #14 AWG tinned copper conductor insulated with low density color coded (one black, one clear) polyethylene, aluminum/polyester tape wrap with #16 AWG tinned copper drain wire, and a jacket of black, low density polyethylene. Ensure cable is constructed in accordance with International Municipal Signal Association *(IMSA) 50-2*. Cable will be furnished by Mettler-Toledo as part of scale system.

**c. Submittals.** Submit materials and equipment for review to the Engineer as required herein. Ensure each sheet of descriptive literature submitted is clearly marked to identify the materials, or equipment, and show the specification subsection for which the equipment applies.

1. Submit schematics and connection diagrams for all electrical equipment. A manufacturer’s standard connection diagram or schematic showing more than one scheme of connection will not be accepted unless it is clearly marked to show the intended connections.

2. Submittals showing more than the specific item under consideration must have the pertinent description paragraph for which the equipment applies too, circled or “high-lighted” with a marker intended for that purpose.

3. Prepare and maintain record drawings current with work completed. Show all changes to underground and other hidden work. Submit to Engineer on completion of project.

4. Provide records of insulation test (megohm check) on buried conductors in conduit.

**d. Construction.**

1. Conduit.

A. Install the conduit in accordance with the manufacturer’s recommendations. All buried conduits must have locations marked on plans.

B. Ensure all conduit below grade is *UL* Listed PVC Schedule 80 electrical conduit for direct bury conduit and for Schedule 80, coilable polyethylene conduit for directional bore applications.

C. Ensure all exposed conduit is intermediate metal conduit (IMC).

D. Ensure bends are standard or long-radius ells with a maximum equivalent of four-quarter bends in any run between pulling joints.

E. Install only undamaged conduit. Plug ends to prevent entry of dirt and moisture.

F. Layout conduit routing to avoid structural obstructions and minimizing crossovers. Ensure conduit runs are installed in a neat and well-planned arrangement and in a manner that will not interfere with access to equipment or with the use of access ways.

G. Conduit runs as shown on the plans are schematic, ensure exact routing of conduit is field verified by the Contractor and approved by the Engineer. Make field bends and offsets uniform and symmetrical, without flattening conduit or scarring conduit finish and of minimum radius for each size as given in *NEC Article 344*.

2. Wires and Cable.

A. Provide cable on original reels or in boxes and ensure it is new and unused.

B. Store cables in a dry protected area and protect cable ends in accordance with manufacturer’s recommendations.

3. Grounding.

A. Bond all the non-current carrying parts of all electrical lighting poles together and bond equipment enclosures with bare copper ground wire as shown on the plans.

B. All power circuit conduits must include a ground conductor sized per the *NEC*. Attach grounding conductors to equipment by means of approved copper alloy solder-less grounding lugs or clamps which must be secured to the equipment and the grounding point by means of hex-head cap screws or machine bolts after the contact surfaces have been cleaned to bright metal.

4. Equipment Clearances.

A. Maintain clearances from electric panels, and other electrical installations as required by the *NEC* and the *CFR*.

B. Maintain working clearances around electrical equipment as required for proper maintenance and operation.

5. Identifications.

A. Provide identification signs on all existing and new equipment, switches, breakers, and panels.

B. Provide an updated type written circuit identification schedule in each distribution or branch circuit panelboard and load center that is modified by this work under glass or plastic. Each circuit to be identified by load being served.

6. Code and Standards. These specifications are minimum requirements and govern except, where made more stringent by other sections of this specification or local, state, or federal laws or regulations. In the event of conflict between these specifications and applicable codes and regulations, the more stringent requirement governs.

7. Plans. Plans and specifications are provided for assistance to the Contractor and are diagrammatic only to indicate the general arrangement and location of circuits, outlets, etc. Exact locations will be determined by field conditions and governed by the buildings and site where dimensioned. Deviations from the arrangement indicated to meet actual conditions are to be made with no additional expense to the contract. Throughout the progress of construction, the Contractor must keep a set of detailed field record plans, including the exact location of concealed work and underground utilities. This requirement does not authorize any deviations from the contract plans without prior approval from the Engineer. Ensure the field record information is marked in a legible manner on prints of the plans. At the completion of work, deliver the field record information to the Engineer.

8. Installation.

A. Provide and install all equipment as specified, required, or implied in this special provision except as noted. This requirement includes all labor, materials, and incidentals in a manner consistent with good practice necessary to a complete operable installation.

B. Cooperation with other trades is required by the Contractor by the reference to the structural and mechanical plans and other sections of the specifications for work by other trades and to be carried on simultaneously or sequentially with the electrical work. This requirement is to facilitate construction to proceed with no harm to the Department and/or Engineer due to the absence of cooperation. All other plans and sections of the specifications become part of the electrical specifications as they relate to electrical work.

C. Verify equipment dimensions to insure dimensional compatibility.

D. Ensure all excavation, backfilling, and concrete work is in accordance with the applicable sections of the specifications.

E. The Contractor is responsible for connecting wiring and circuitry to all equipment furnished by others and/or the Contractor, which requires electrical power or control.

F. Demonstrate to the satisfaction of the Engineer at final inspection that the wiring is complete and free from open circuits, short circuits between circuits or ground and that all systems operate satisfactorily. Ensure the entire electrical installation is demonstrated to operate in accordance with the specifications. Ensure feeders and panels are tested to verify no ground faults exist. Submit certified test data to the Engineer prior to final inspection. Ensure this test is made with no devices connected to prevent damage to equipment, and resistance is greater than one megohm.

9. Equipment Test and Operation.

A. Thoroughly clean, lubricate, and protect from damage and dirt during operation.

B. Test and operate in accordance with manufacturer’s recommendations.

**e. Measurement and Payment.** The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

**Pay Item Pay Unit**

Scale Controls, Type \_\_ Foot

**Scale Controls, Type \_\_** includes all labor, equipment, and materials (as described below) necessary to install and connect system as shown on the plans. The Contractor is to install all conduit and cables. The Contractor is to provide all materials except for cable specifically listed below as supplied by Mettler-Toledo.

**Scale Controls, Type C1** includes a 2-inch conduit, three 1/0, one #6.

**Scale Controls, Type F1** includes a 2-inch conduit and one fiber optic cable*. Cable will be supplied by Mettler-Toledo*. Contractor is responsible to install cable in conduit.

**Scale Controls, Type F2** includes a 2-inch conduit, two fiber optic cables. *Cable will be supplied by Mettler-Toledo*. Contractor is responsible to install cable in conduit.

**Scale Controls, Type G1** includes a 3-inch conduit, one #14, one #14 White, one #14 Green.

**Scale Controls, Type G2** includes a 2-inch conduit, one #10, one #10 White, one #10 Green, one #14, one #14 White, one #14 Green.

**Scale Controls, Type G3** includes a 3-inch conduit, two #10, two #10 White, two #10 Green, one #12, one #12 White, one #12 Green.

**Scale Controls, Type G4** includes a 3-inch conduit, two #12, two #12 White, one #12 Green.

**Scale Controls, Type L1** includes a 2-inch conduit, one loop lead-in cable. *Cable will be supplied by Mettler-Toledo*. Contractor is responsible to install cable in conduit.

**Scale Controls, Type L2** includes a 2-inch conduit, two loop lead-in cable. *Cable will be supplied by Mettler-Toledo*. Contractor is responsible to install cable in conduit.

**Scale Controls, Type L3** includes a 2-inch conduit, three loop lead-in cable. *Cable will be supplied by Mettler-Toledo*. Contractor is responsible to install cable in conduit.

**Scale Controls, Type L4** includes a 3-inch conduit, four loop lead-in cable. *Cable will be supplied by Mettler-Toledo*. Contractor is responsible to install cable in conduit.

**Scale Controls, Type N1** includes a 3-inch conduit, one #10, one #10 White, one #10 Green.

**Scale Controls, Type OH1** includes a 2-inch conduit, three #14 AWG.

**Scale Controls, Type OH2** includes a 2-inch conduit, four #14 AWG.