SP- 150203
(New)

SPECIAL PROVISIONS
FOR
BRIDGE ELECTRICAL SYSTEM

Scott County
IM-NHS-074-1(198)5--03-82

Effective Date
April 25, 2017

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

150203.01 DESCRIPTION.

A. The work covered under this item consists of furnishing all labor, material, equipment, and components to install a bridge electrical system with interconnecting wiring to each side of the bridge and various power and control equipment and devices as indicated on the contract drawings and to the Engineer's satisfaction. In general, this work consists of, but is not limited to main distribution panelboard, transformer, subpanelboard-transformer combination units, control cabinets, enclosures, pull boxes, junction boxes, receptacles, conduit, wiring, and other miscellaneous components and hardware as required.

B. All work in this contract shall comply with the National Electrical Code (NEC), latest edition.

150203.02 MATERIALS.

A. Conduit.

1. The sizes of conduits shall be as indicated on the drawings, and shall not be smaller than 3/4 inch.

2. Electrical metallic tubing (EMT) may be used for rigid conduits and fittings for dry, indoor installation (inside the arches only) and, if used, shall be hot-dip galvanized steel, conforming to ANSI Standard C80.3 and UL Safety Standard UL797. EMT shall have an organic corrosion resistant, low friction interior coating that lowers wire pulling friction. All EMT couplings and fittings shall be compression type, zinc plated steel, die cast zinc, or malleable iron.

3. Rigid conduits and fittings for concrete encasement shall be hot-dip galvanized steel, conforming to ANSI Standard C80.1 and UL Safety Standard UL6. All threads and/or damage to the galvanized coating shall be field repaired by solvent cleaning and then coating with approved cold-galvanizing compound.

4. Rigid conduits and fittings for outdoor areas shall be hot-dip galvanized steel conforming to ANSl Standard C80.1 and UL Standard UL6, and shall have a factory-applied polyvinyl-chloride (PVC) exterior coating. The galvanized surfaces of the conduit and fittings shall be coated with an epoxy-acrylic primer before PVC coating. A urethane coating shall be applied to the interior. The urethane interior coating shall afford sufficient flexibility to permit field bending without cracking or flaking of the interior coating. All threads on conduits, couplings and fittings shall be protected by a urethane coating. Threads, breaks, scars, or other interruptions in the PVC coating shall be repaired as per the conduit manufacturer's recommended procedure.

5. Conduit "C" bodies, "L" bodies, pulling elbows, couplings, clamps, U-bolts, and fittings used with PVC coated conduits shall have the same coating as the conduit. Conduit bodies, pulling elbows, and couplings shall also have flexible PVC sleeves which extend to overlap the PVC coating on the conduit.

6. All conduit joints shall be threaded, using standard taper thread. Straight or clamp joints shall not be used. All thread cuts after galvanizing shall be thoroughly cleaned, degreased and coated with an approved cold-galvanizing compound. A clear urethane coating shall be applied to all conduit joints and threads before installation.

7. Flexible conduits shall be hot-dip galvanized steel, in accordance with UL Standard UL 1 and Federal Specification WW-C-566. All outdoor flexible conduits shall be made liquid-tight by covering the steel core with a smooth, abrasion-resistant, liquid-tight polyvinyl chloride cover.

8. Couplings, connectors, and fittings shall be of a type specifically designed and manufactured for the purpose.

B. Junction and Pull Boxes.

1. Junction and Pull Boxes, Outdoors: All boxes used outdoors shall be NEMA 4 stainless steel or galvanized cast iron, provided with screw-fastened, gasketed covers and stainless steel hardware. Each box shall be sized in compliance with the requirements of the NEC.

2. Junction and Pull Boxes, Dry Locations: All boxes used inside the arches in dry locations shall be galvanized steel, galvanized cast iron, or copper-free cast aluminum, with plated hardware. Each box shall be sized in compliance with the requirements of the NEC.

C. Wire and Wiring.

1. Single Conductor Cable: Single conductor cable shall be soft-drawn copper, conforming to ASTM 83, and stranding shall be in accordance with ASTM 68. The insulation shall be heat and moisture resistant, cross-linked, polyethylene, 600 volt insulation, conforming to NEC ratings XHHW/XHHW-2.

2. Multiple Conductor Cable: The cable shall consist of multiple stranded, copper conductors, conforming to the requirement stated above for Single Conductor Cable, with the number of conductors as shown on the plans. Fillers shall be flame retardant and moisture resistant, provided as required, to form a full circular cross-section of the cable. The cable conductors shall be helically wrapped with a moisture-resistant binder tape. The cable overall jacket shall be chlorosulfonated polyethelene (Hypalon) or equivalent, meeting the flame test requirements of IEEE 383

3. Flexible Cable: The flexible cable shall have minimum class K stranding, soft drawn copper conductors, conforming to ASTM 83 and ASTM 8172, rated as Type SOW/SOOW cable. The cable shall have a sun-light and oil resistant overall jacket.

4. Bare Conductor: The conductor shall be Class 6, annealed copper conductor, conforming to ASTM B3, with size as shown for grounding.

5. Wire Coding: All wires shall be color-coded for phase identification, per NEC, Section 210-5. The white neutrals shall be of same size as phase wires. On insulated, exposed ends of conductors, colored tape/paint shall be used. In addition, the name of the manufacturer, insulation type, voltage rating, and size and quantity of the wires shall be clearly and permanently imprinted throughout the length of each conductor or cable.

6. Packaging: Conductors and cables delivered to the site of the project shall be in original packaging or on factory reels, fully identified with tags or labels, indicating the manufacturer's name and date of manufacture.

D. Grounding Plates, Cables.

1. Ground Plates: Ground plates shall be furnished as indicated on the drawings. Ground plates shall consist of bronze plates for flush embedment in piers below water level with one flat surface of the plate exposed to the water as shown on the drawings.

2. Ground Cables: Ground cables shall consist of insulated copper cable for embedment in the pier concrete, sized and attached to the Ground Plates as shown on the drawings.

3. Exposed grounding cables shall be un-insulated copper, sized and furnished as shown on the drawings.

E. Wiring Devices.

1. Wiring Devices Boxes: All exposed boxes shall be galvanized cast iron or copper-free cast aluminum provided with stainless steel screw fastened, gasketed covers. All boxes shall have threaded hubs. Each box shall have sufficient volume to accommodate the number of conductors in the box, in accordance with the requirements of the NEC. Boxes shall be not less than 2 inches deep. Boxes used for outdoor installation shall be NEMA-4. Cast aluminum boxes shall not be mounted in contact with concrete.

2. GFCI Duplex Receptacles: Duplex receptacles are to be located as shown on the drawings, and shall be 20 amps, 120 volts, three-wire grounding-type, with polarized tandem slots and U-shaped ground slot, unless otherwise indicated. The receptacles shall conform to the requirements of NEMA Standard WD-1. Bodies shall be of white LEXAN or similar compound supported by a mounting yoke having plaster ears. Receptacles shall include a front-visible LED indicating when it’s energized. Receptacles shall be side-wired, with two screws per terminal. The third grounding pole shall be internally connected to the grounding yoke. Outdoor receptacles shall be mounted in a cast iron box with a weatherproof gasketed transparent cover. Indoor receptacles shall be mounted on a cast box with a gasketed cover plate and gasketed cap(s) over all receptacle openings. The caps shall be spring-hinged flap.

3. Wall switches: Wall switches shall be of the totally enclosed tumbler, 20 amp, 120 volt, single or double pole as indicated on drawings. Bodies shall be LEXAN or similar compound. Wiring terminals shall be of the screw-type. Switches shall be rated as shown on the drawings, and shall be of the type indicated. Switches shall be ''off'' in the down position. Switches shall be weatherproof, mounted in a water-tight box furnished with a weatherproof switch cover which allows switch operation without opening the cover.

F. Equipment Cabinets and Enclosures.

1. All outdoor electrical equipment cabinets and enclosures shall be NEMA 4X stainless steel, with stainless steel mounting hardware. Size each cabinet as shown on the drawings, or as required for the equipment enclosed therein.

2. Drill a 1/8 inch drain hole in all four bottom corners of each cabinet or enclosure.

3. Conduit entrances in outdoor cabinets shall be in the bottoms or the sides only. No conduit entrances shall be made through the tops of outdoor cabinets and enclosures. All conduit entrances shall utilize approved gasketed water-tight hubs rated for wet locations.

4. Pushbuttons, switches, indicator lights and any other devices that mount through outdoor cabinet and enclosure surfaces shall be rated NEMA 4.

5. Indoor electrical equipment cabinets and enclosures shall be rated NEMA 3R or NEMA 12 unless specifically stated otherwise in the Special Provisions or drawings.

G. Exterior Walkway/Platform LED Light Fixtures.

1. The fixtures shall be 120 volt AC, LED light source providing at least 750 lumens, no more than approximately 15 watts, and shall be vapor-tight with joint gaskets to seal out dirt and moisture.

2. The fixture body shall be of high strength, copper-free cast aluminum, with frosted glass globe, and cast aluminum globe guard. The gasketed fixture shall be rated for wet locations.

3. All necessary mounting brackets and stainless steel hardware shall also be provided.

H. Combination Panelboard Transformer.

1. Combination panelboard-transformer assemblies (mini-power centers) shall consist of a resin encapsulated distribution transformer and a circuit breaker panel furnished with main and branch circuit breakers. All live parts of the mini-power centers shall be enclosed in a NEMA 3R steel enclosure coated with an electrostatically applied baked-on powder coating. The unit shall be U. L. listed, with ratings and locations as shown on drawings.

2. A typewritten branch circuit directory shall be provided on the inside surface of the power panel section cover. All circuits shall be clearly identified by the loads they serve.

I. Molded Case Circuit Breakers.

1. Molded case circuit breakers in enclosures or panelboards shall be sized as indicated on drawings, shall be UL-listed and meet NEMA Standard No. AB1, and FS No. W-C-375B/GEN, where applicable.

2. Circuit breakers shall have toggle-type operating mechanisms, with quick- make, quick-break action and positive handle indication. Circuit breaker operating handles shall assume a center position when tripped. Two-pole and three-pole breakers shall be common-trip. Each circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole. All breakers shall be calibrated for operation in an ambient temperature of 40°C.

3. Circuit breakers shall be suitable for mounting and operating in any position.

150203.03 CONSTRUCTION.

A. General.

All electrical work must be in compliance with the requirements of Article 2523.03 of the Standard Specifications.

B. Quality Assurance.

1. Provide shop drawings, catalog cuts, or other descriptive data, as required for compliance with the requirements established within Article 1105.03 of the Standard Specifications. Working drawings, diagrams and related data shall also be provided, including, but not limited to:
- **a.** Elementary power wiring diagrams
- **b.** Grounding and bonding diagrams
- **c.** Conduit and raceway system layout diagrams, including conductor quantity and size
- **d.** Electrical apparatus certified dimensional data
- **e.** Layout details of electrical equipment

2. Coordinate electrical work with all other trades and subcontractors. Final approval of shop drawings, details and catalog cuts will not be given by the Engineer until the Contractor affixes a statement to each submittal, indicating his review of the submitted materials, applicable contract drawings and confirming compatibility.

C. Conduit.

1. All nicks, cuts, exposed surfaces of conduit joints and abrasions to PVC coating on the rigid conduit shall be repaired with the factory-supplied repair compound. The compound shall form uniform coating and adhere to the original coating.

2. The conduit terminations shall be equipped with an insulating bushing.

3. Conduits shall be run exposed or concealed, as indicated. Conduits shall be installed in accordance with the requirements of the NEC.

4. All conduits shall be supported in accordance with the NEC, with at least one support between couplings. The conduit shall be installed parallel or perpendicular to walls, structural members, or intersections, or vertical planes and ceilings with right-angle turns, consisting of cast metal fittings or symmetrical bends. Through bolts with nuts and lock washers shall be used for mounting on metal surfaces. If constructability does not allow for proper installation of through bolts, tapped holes may be used, with case-by-case prior approval from the Engineer, and provided the structural element is in a stress compression zone.

5. Conduits surface mounted on concrete shall utilize adhesive (epoxy) anchors only. Expansion anchors shall not be used. Holes drilled for anchors shall be located such that they miss the reinforcing steel.

6. All bends shall be made with an approved hickey or conduit bending machine. Tools shall provide protection of the PVC coating during bending.

7. Conduits shall be securely fastened to outlets, junction and pull boxes with full number of threads projecting through tapped bosses. Gasketed or O-ring, waterproof conduit hubs shall be used on outdoor boxes where tapped bosses are not possible.

8. Rigid conduits crossing expansion joints or at locations of the bridge structure subject to movement due to expansion, contraction and/or deflection shall be provided with expansion and deflection fittings or other means to allow movement.

9. The Contractor shall cap open conduits and exercise the necessary precautions to prevent the entrance of dirt, or foreign materials in conduits, fittings and boxes during the course of

installation. A run of conduit which has become clogged shall be entirely freed of these accumulations or shall be replaced prior to wire installation.

10. Conduits which have been crushed or deformed in any way, shall not be used for installation.

11. Grounding-type insulated throat bushings shall be provided on conduits at equipment enclosures, panelboards, and wireways where threaded bosses or threaded hubs are not used. Grounding bushings shall be bonded together and to the equipment enclosure, or to the equipment ground wire.

12. Conduits and conduit sleeves for use by others shall be capped until used.

13. All conduit connections shall be tightly connected to provide good electrical conductivity for grounding throughout the entire length of the conduit run, including flexible conduits.

14. All empty conduits shall be provided with a suitable pull wire or a nylon rope, or other approved type with not less than 12 inches of slack at each end of the pull wire. Each accessible end of the empty conduit shall be tagged with a plastic tag, identifying the purpose of the conduit and the location of the other end.

15. All through-wall conduits into bridge structures shall be made water-tight.

D. Enclosures.

1. Install at indicated or approved locations, in accordance with the manufacturer's instructions, and at convenient operating height, such that unless shown otherwise, no manually operable device will be within 3 feet of the floor or more than 6 feet above the floor.

2. Adjust, straight, plumb, and fasten securely in place.

3. Install all wall-mounted enclosures and cabinets on fabricated structural channels or angles.

4. Ground, as specified in UL 67, and in NEC, Articles 200 and 250. Connect the neutral wire directly to the neutral bus in the same panel as the circuit breaker.

5. Perform all necessary branch circuit wiring.

6. Neatly route, harness and support conductors in gutters, wiring spaces and compartments. Bending radii shall not be less than as recommended by the conductor manufacturer.

7. Isolate all aluminum boxes and enclosures from dissimilar metals with neoprene shims.

E. Conductors and Wiring.

1. Install wiring and conductors only when the raceway system has been completed. Thoroughly clean the inside of all conduits of any dirt, moisture or other foreign materials before pulling wire and cable. Pull wires and cables in conduits after an application of suitable lubricant that will have no injurious effect on the insulation of the conductors. No oil or grease shall be used.

2. No splices or joints in either feeders or branch circuit runs, except in accessible junction boxes.

3. Secure spices in circuit wiring mechanically and electrically. Conductors shall be joined by compression-type copper splicing sleeves, by means of set screw-type pressure connections having tin plated aluminum or copper bodies, or on terminal blocks. Split-bolt-type connectors

and wire nuts are not acceptable. Unless properly insulated by the connector, all joints shall be insulated at least equal to the insulation of the conductors.

4. Identify all power conductors by color-coding as follows:
   a. Phase A – Black
   b. Phase B – Red
   c. Phase C – Blue
   d. Neutral – White
   e. Ground – Green

5. Verify that circuits are wired as indicated on drawings, and are continuous and free of shorts, opens and unintentional grounds. Provide temporary power to test each circuit. Measure ground bus and grounded conductor resistance to ground, resistance between enclosure and ground bus, and between insulation and ground bus. Trouble-shoot and correct, as necessary. Resistance must be within the limits specified below:
   a. Between Enclosure and Equipment Ground Wire: Less than 0.1 ohm.
   b. Between Insulation and Ground: 100 megohms, minimum.

F. Wiring Devices.

1. Fasten surface-mounted boxes and supports with machine bolts or screws and nuts. In open overhead spaces, cast metal boxes threaded to raceways shall be separately supported by machine bolts or screws and nuts. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support with an approved-type fastener, not more than 12 inches from the box.

2. Where feeders pass through pull boxes, label the feeders to indicate clearly the circuit voltage, circuit number and panel designation.

3. Install pull boxes or pull bodies in all conduit runs, as required, and locate, as approved.

4. Locate receptacles and install, as shown on the drawings. The location shall be easily accessible.

G. Lighting Fixtures.

1. Lighting fixtures shall be installed with the types and at the locations as shown.

2. Fixtures shall be supported from structural supports, or fabricated steel supports.

3. No fixture shall be hung from chain hangers.

4. All splices shall be carefully placed in junction boxes or wiring gutters with no crowding.

5. Where aluminum is placed in contact with dissimilar metal, separate contact surface with a neoprene gasket.

6. Cables entering lighting fixture housing or body shall be provided with water- tight fittings.

7. Ground lighting fixture body.

8. Test lighting fixtures for connection, in accordance with the wiring diagram and for proper operation.

9. Test fixture body for continuity to the grounding system.

H. Prior to commencing installation, perform the following.

1. Verify that all surfaces upon which enclosures are to be mounted, are properly prepared, and that all wire pulling, required before enclosure mounting, has been completed and properly tagged. Take corrective action, if necessary.

2. Verify that enclosure mounting provisions are suitable for intended mounting. Make corrective adjustments, if necessary.

3. Verify that all factory-installed circuit breakers have the correct rating for the applicable circuit, as indicated. Take corrective action, if necessary.

4. Complete all panelboard directory cards with the information indicated. Typewrite the information on directory cards.

150203.04 METHOD OF MEASUREMENT.

Lump sum. No method of measurement.

150203.05 BASIS OF PAYMENT.

A. Payment for Bridge Electrical System is full compensation for furnishing, fabricating, installing, and testing the bridge electrical system, which shall include all labor and electrical equipment components, and materials required by the plans and specifications that are not exclusively dedicated to and included in items A. through E. listed immediately below.

B. Each of the following items have a separate Basis of Payment, and are therefore excluded from payment through this item:

1. Arch Rib Service Lighting.

2. Navigation Lighting.

3. Inspection Travelers.

4. Arch Rib Ventilation.

5. Aerial Obstruction Beacon.