SECTION 00583 - ELECTRICAL CONDUIT ON STRUCTURES

(Follow all instructions. If there are no instructions above a subsection, paragraph, sentence, or bullet, then include it in the project. The specifications may be modified to include project specific specifications, but all additions, deletions, or modifications must be sent to the ODOT Technical Resource and State Specifications Engineer for review and approval.)

Replace Section 00583 of the Standard Specifications with the following Section 00583:

Descriptions

00583.00 Scope - This Work consists of furnishing and installing electrical conduit systems attached to or encased in Structures as shown or as directed.

00583.01 Abbreviations:

GRC - Galvanized rigid conduit
LFNC - Liquid tight flexible non-metallic conduit
PVC - Polyvinyl chloride
RMC - Rigid metallic conduit
RTRC - Reinforced thermosetting resin conduit
SS - Stainless steel

00583.02 Codes and Standards - The publications listed below are referenced by this specification:

- American National Standards Institute, Inc.
  C80.1 Standard for Electrical Rigid Steel Conduit (ERSC)

- American Society for Testing and Materials (ASTM)
  B1.20.1 Pipe Threads, General Purpose, Inch
  A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  D2564 Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping System

- The Institute of Electrical and Electronics Engineers, Inc. (IEEE)
  IEEE C2 National Electrical Safety Code (NESC)

- National Electrical Manufacturers Association (NEMA)
  250 Enclosures for Electrical Equipment (1000 Volts Maximum)

- National Fire Protection Association (NFPA)
  NFPA 70 National Electric Code (NEC)

- Underwriters Laboratories Inc. (UL)
  UL 1660 Liquid-Tight Flexible Nonmetallic Conduit

UL 6	Electrical Rigid Metal Conduit - Steel
UL 6A	Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel
UL 514B	Standard for Safety Conduit, Tubing, and Cable Fittings
UL 651	Standard for Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

00583.03 Submittals - Submit detailed descriptions of all Materials to the Agency according to 00150.37 at least 21 Calendar Days before the scheduled start of the Work. Identify all relevant constituents and properties of each Material and the Specifications with which it complies. Data published by the manufacturer is acceptable.

Submit detailed procedures for the Work of this Section according to 00150.37 at least 21 Calendar Days before the scheduled start of the Work. Include the manufacturer's specifications and operating instructions for all Equipment. Do not begin Work before receiving written approval of submittals from the Engineer.

Submit stamped conduit system Working Drawings designed according to *NFPA 70 National Electrical Code* (NEC) according to 00150.35. Design Working Drawings according to the *ODOT Bridge Design Manual* ~~Section 3.14.10~~.

Submit unstamped as-built drawings according to 00150.37 showing the final location of all conduit systems within 30 Calendar Days of completing the Work.

Materials

00583.10 Conduit and Elbows - Furnish conduit and elbows meeting one of the following requirements:

(a) Extruded PVC - Extruded PVC electrical conduit and factory bent elbows conforming to UL 651. Furnish gray conduit and elbows. Furnish solvent cement conforming to ASTM D2564 or as recommended by the conduit manufacturer.

(b) Hot-dip GRC – Hot-dip GRC and elbows conforming to UL 6 and ANSI C80.1 with each end threaded per ANSI B1.20.1. Factory threads are to be hot-dip galvanized after cutting. Coating thickness is to conform to ASTM A153.

(c) 316 SS RMC - 316 SS RMC and elbows conforming to UL 6A and ANSI C80.1 with each end threaded per ANSI B1.20.1.

(d) RTRC - RTRC and elbows conforming to UL 2515 for above ground applications. Furnish conduit with UV stabilized gray pigmented resin. Furnish a joint adhesive recommended by the manufacturer.

(e) LFNC - LFNC conforming to UL1660.

00583.11 Fittings and Conduit Bodies - Furnish fittings and conduit bodies conforming to UL 514B. Furnish conduit bodies with a weather tight gasket and expansion fittings with a

weather tight seal. Set screw type fittings and conduit bodies are not allowed. Furnish fittings and conduit bodies meeting one of the following requirements:

(a) PVC or thermoplastic - Furnish gray fittings and conduit bodies.

(b) Hot-Dip galvanized malleable iron - Coating thickness is to conform to ASTM A153.

(c) 316 SS - Furnish uncoated conduit bodies.

00583.12 Junction Boxes - Furnish UL listed junction boxes meeting one of the following requirements:

(a) PVC or Thermoplastic - PVC or thermoplastic conforming to NEMA 250 Type 4X. Furnish gray junction boxes.

(b) Galvanized Steel - Galvanized steel conforming to NEMA 250 Type 4. Coating thickness is to conform to ASTM A153.

(c) 316 SS - 316 SS conforming to NEMA 250 Type 4X

(d) GFRP - GFRP conforming to NEMA 250 Type 4X.

00583.13 Supports - Furnish supports meeting one of the following:

(a) Hot-dip galvanized - Hot-dip galvanized wedge type anchors, bolts, threaded rod, nuts, and washers according to 02560.10. Furnish hot-dip galvanized steel channel strut, hangers, clamps, support straps, and coil inserts. Coating thickness is to conform to ASTM A153.

(b) 316 SS - 316 SS wedge type anchors, bolts, threaded rod and nuts conforming to ASTM A193/194, Grade B8M, B8MA, B8M2, or B8M3, Class 1, 1A, 1D, or 2 or ASTM F593/594 Group 2 Condition CW. Furnish 316 SS channel strut, hangers, clamps, support straps, and coil inserts, and washers.

For built-up conduit hanger assemblies, furnish assemblies constructed from the same alloy group and with the same finish as the Materials listed in the subsection.

Adhesive anchoring systems and PVC conduit straps are not allowed.

00583.14 Fire Barrier Sealant - Provide a UL listed fire barrier sealant rated for wall, floor, or ceiling penetrations.

00583.15 Electrical Isolation - Furnish non-conductive resin according to 00535.10 designated as “high strength”.

Furnish neoprene rubber sheets, nylon washers and nylon bolt-hole inserts.

00583.15 Pull Line - Furnish Materials meeting the following requirements:

- Provide nylon, polypropylene, or polyester pull line or rope with a minimum tensile strength of 1,000 pounds.

Labor

00583.30 Electrician Qualifications - Provide electricians licensed in the State of Oregon, holding a General Journeyman or General Supervising license.

00583.31 Supervisor Qualifications - Supervise all Work in the section using Oregon licensed electricians holding a General Supervising license.

Construction

00583.40 General - Install conduit systems on structures in accordance with:

- National Fire Protection Association, *National Electrical Code* (NEC)
- Institute of Electrical and Electronics Engineers, Inc., *National Electrical Safety Code* (NESC)
- *Oregon Electrical Specialty Code* (OESC)
- *ODOT Bridge Design Manual* (BDM)
- Any other local rules, regulations and ordinances which may apply

Field verify all dimensions. Install anchoring systems as shown following all manufacturer's instructions. Install conduit in the location and of the sizes shown. If field dimensions dictate that conduit size or route differ from the Plans, obtain written approval from the Engineer before proceeding.

Only drill through structural members with written approval from the Engineer. Locate reinforcing bars before drilling through concrete. Perform drilling through concrete without drilling through reinforcing bars unless otherwise approved, in writing. Repair any damage to the surrounding concrete as directed by the Engineer using an appropriate repair product from the QPL.

Metallic raceways, fittings, boxes, and cabinets shall be free from contact with reinforcing steel.

Where conduits passing through openings are exposed in finished rooms, use a UL listed fire barrier sealant filling Material.

00583.41 Field Cutting - Provide square-cut or square-formed ends on all sections of conduit. Remove any internal and external sharp edges.

Only field cut, clean, and prepare RTRC joints as recommended by the manufacturer.

Field thread cut ends of GRC and RMC according to ANSI B1.20.1 following all manufacturer's recommendations.

00583.42 Bends and Routing - All bends in conduit 1 1/2" diameter and smaller may be made using manual or power tools designed for the purpose. Redirect conduit with 2" and larger diameter with manufactured elbows or conduit bodies.

If field bending is necessary, provide a bending radius not less than six times the inside diameter of the conduit. Make all bends in the conduit without kinking, flattening or appreciably reducing the internal diameter of the conduit.

Avoid trapped runs on conduit. Provide junction boxes with drain fittings at low points in exposed conduit locations.

Do not install more than the equivalent of three 90 degree bends (total 270 degrees) between junction boxes. Use conduit bodies to make sharp changes in direction.

00583.43 Expansion Fittings - Provide expansion fittings with at least a 6-inch throw for all major conduit runs at all Bridge expansion joints.

Secure the expansion fitting to the surface only at the barrel end of the fitting. Adjust the initial setting of the fitting to account for installation temperature and future expansion/contraction movement based on a minimum design temperature of 10 °F and a maximum design temperature of 110 °F.

00583.44 Joints and Terminations - For threaded joints, engage the full number of threads provided or as recommended by the manufacturer for field threaded applications.

Securely fasten conduit to junction boxes in one of the following manners:

- With the full number of threads projecting through tapped bosses.
- Liquid-tight conduit hubs.

Join PVC conduit using cement and fittings in accordance with all manufacturer's recommendations.

Join RTRC conduit using adhesive and fittings in accordance with all manufacturer's recommendations.

Make final connection of rigid conduit to electrical Equipment subject to vibration with liquid-tight flexible conduit and suitable liquid-tight connectors. Flexible conduits are used only where final connection to Equipment with rigid conduit is not practicable, or where Equipment is subject to vibration, such as to Equipment with adjustable mountings or to all machinery.

00583.45 Electrical Isolation - Provide electrical isolation of all dissimilar metals or when adjacent Materials are unknown such as attachments to painted structural steel members by one or more of the following methods:

- Neoprene pads placed between the dissimilar metals.
- Nylon washers and bolt hole inserts.
- Where the NEC requires bonding jumpers resulting in dissimilar metal joints, completely encapsulate the joint in non-conductive resin.

Maintenance

00583.60 Repair of Galvanizing - Repair damaged hot-dip galvanizing according to ASTM A780 Method A2 with a minimum zinc content of 94 percent on the dry film.

00583.61 Protection of Work and Materials - Protect conduits at all times from the entrance of water and other foreign Material by being capped or plugged overnight and when the Work is temporarily suspended.

Handle, store and protect Materials in accordance with the manufacturer's recommendations.

Finishing and Cleaning Up

00583.70 Proofing - Upon completion of conduit installation proof each conduit by pulling a solid aluminum or steel mandrel, brush, and fiberglass fish through the conduit. Use a mandrel with a minimum outside diameter 80 percent of the inside diameter of the conduit.

Proof each conduit in the presence of the Engineer. Draw the mandrel assembly through each completed conduit run manually without mechanical assistance. Mark distance to areas offering resistance to the mandrel assembly on the fiberglass fish. Repair or replace any conduit that does not proof out at no additional cost to the Agency.

00583.71 Pull Line - After conduits have proofed out, install a continuous pull line from outlet to outlet in all empty conduits without splices. Leave a minimum of two feet of slack at each outlet. Install approved caps or plugs, leaving the pull line in each conduit. Ensure pull boxes are capped or plugged after installing the pull line.

Measurement

00583.80 Measurement - The quantities of Work performed under this Section will be measured on the length basis.

Payment

00583.90 Payment - The accepted quantities of Work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) PVC Conduit System, ___ Inch Diameter	Foot
(b) GRC Conduit System, ___ Inch Diameter	Foot
(c) 316 SS RMC Conduit System, ___ Inch Diameter	Foot
(d) RTRC Conduit System, ___ Inch Diameter	Foot

Payment will be payment in full for furnishing and placing all Materials, and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

No separate or additional payment will be made for:

- Conduit supports or anchorage systems
- Fittings or junction boxes
- Proofing mandrels, brushes, or fish lines
- Pull lines
- Adhesives, sealants, or Materials used for electrical isolation

Conduit installed on Structures for traffic signal systems will be paid for according to 00990.90.