SPECIAL PROVISIONS
FOR
FIBERGLASS CONDUIT EMBEDDED IN STRUCTURE

Pottawattamie County
IMX-029-3(262)56--02-78
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Effective Date
December 21, 2021

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.

150793.01 DESCRIPTION.

The special provision covers the roadway lighting fiberglass conduit as identified in the plans. It is located within the light blisters and the bridge deck.

150793.02 MATERIALS.

A. Manufacturing.

1. The conduit shall be fiberglass conduit, also known as Reinforced Thermosetting Resin Conduit (RTRC), manufactured using the single circuit filament winding process. Multi circuit windings are not allowed. The conduit shall have a winding angle as close as possible to 54.75 degrees. Winding mandrels shall be straight and true so as to produce a non-tapered conduit. Tapering is allowed at the belled end.

2. The resin system shall be epoxy based, with no fillers, using an anhydride curing agent. The fiberglass shall consist of continuous E-glass Grade “A” roving. All additives for increasing flame spread and lowering smoke density shall be halogen free, i.e. not contain chlorine or bromine.

3. Carbon black shall be used as ultraviolet inhibitor to protect the conduit and fittings during storage and exposure to the outdoors. Conduit and elbows shall be black in color.

4. Curing shall be done using an oven and shall take place in two steps. The first curing zone shall bring the conduit slowly to the gel temperature. The second zone shall post-cure the conduit at no less than 350°F. The pipe must be properly cured so that when measuring the glass transition temperature with a differential calorimeter the difference between the first measurement and the second shall not exceed 5°F.

5. The internal conduit and elbow walls shall be smooth, and all fibers embedded in the epoxy.

6. All elbows shall meet the nominal radius ± 2 degrees. The wall thickness shall meet tolerance as shown below and the "Out of Rounds" as shown in NEMA TC 14.

7. All elbows shall have straight ends.

8. All conduits and elbows shall be durably and legibly marked in accordance to NEMA TC 14. In addition, the following information shall be included:
   - NEMA TC 14.
   - UL 2515 AG (Above Ground).
   - Manufacturer and Reseller (if the conduit was modified or bent other than by the manufacturer).
   - Date of Manufacturing of conduit and elbows.
   - Elbows shall be marked with the angle and radius.

9. All conduit, elbows and fittings shall be manufactured in the USA and marked as such.

B. 150793.03 DIMENSIONS.

1. Conduit shall be manufactured with following nominal dimensions:

		Outside Diameter (inch)	Inside Diameter (inch)	Wall Thickness (inch)
3/4"	SW	1.050	0.910	.070
1"	SW	1.315	1.175	.070
1 1/4"	SW	1.660	1.520	.070
1 1/2"	SW	1.900	1.760	.070
2"	SW	2.375	2.235	.070
2 1/2"	SW	2.875	2.735	.070
3"	SW	3.500	3.360	.070
3 1/2"	SW	4.000	3.860	.070
4"	SW	4.460	4.320	.070
5"	MW	5.572	5.380	.096
6"	MW	6.627	6.435	.096

2. Conduit shall be manufactured having non-tapered sections (except for integral belled ends).

C. ELECTRICAL CHARACTERISTICS.

Dielectric strength shall exceed 500 volts per mil when tested in accordance with ASTM

D. MECHANICAL CHARACTERISTICS.

The conduit shall have following mechanical strength when tested in accordance with referenced test method:

Characteristic	Value	Test
Tensile strength, axial	11,000 psi	ASTM D2105
Compressive strength	12,000 psi	ASTM D695
Ultimate elongation	2% psi	ASTM D2105
Modulus of elasticity (4" conduit)	$1.4 \times 10^{+6}$ psi	ASTM D2105
Thermal conductivity	2.0 BTU/(ft^2)(hr)(^oF/in)	ASTM D5930-1
Specific gravity	1.9	ASTM D792
Glass content	65-75%	API 15LR
Water absorption	1% max	ASTM D570

Barcol Hardness	52-56	ASTM D2583
Coefficient of thermal expansion	1.2 x 10^{-5} in/in/^{o}F	ASTM D696
Impact Resistance:		ASTM D2444
Size: 3/4" SW	20 ft. lbs.	
1" SW	25 ft. lbs.	
1 1/4" SW	30 ft. lbs.	
1 1/2" SW	35 ft. lbs.	
2" SW	40 ft. lbs.	
2 1/2" SW	55 ft. lbs.	
3" SW	70 ft. lbs.	
3 1/2" SW	80 ft. lbs.	
4" SW	85 ft. lbs.	
5" MW	140 ft. lbs.	
6" MW	160 ft. lbs.	
Stiffness at 5% Deflection:		ASTM D2412
Size: 3/4" SW	1500 lb/in/in	
1" SW	1200 lb/in/in	
1 1/4" SW	850 lb/in/in	
1 1/2" SW	600 lb/in/in	
2" SW	320 lb/in/in	
2 1/2" SW	200 lb/in/in	
3" SW	140 lb/in/in	
3 1/2" SW	85 lb/in/in	
4" SW	50 lb/in/in	
5" MW	75 lb/in/in	
6" MW	55 lb/in/in	

E. QUALITY ASSURANCE PROGRAM.

Manufacturer shall have a current Certificate, issued by an independent and accredited company, of compliance with an ISO 9001:2008 Quality Management System.

F. JOINING SYSTEM.

The conduit shall be supplied with an integral wound bell on one end and a machined end spigot on the other end. A two-component epoxy adhesive shall be applied to the spigot end before joining the conduit together. The adhesive shall be supplied in 20 fluid ounce plastic cartridges. A plastic static mixer tip shall be attached to the cartridges and be applied with an adhesive gun. The adhesive shall be available for two different ambient temperatures, 70°F and 40°F. The adhesive shall be supplied from the same manufacturer of the conduit and fittings in order to retain the UL listing.

G. FIRE RESISTANCE AND FLAME SPREAD.

Conduit shall meet specification UL 2420 (below ground) and UL 2515 (above ground), i.e. the flame shall extinguish within 15 seconds after each of five successive applications of flame per the UL standard.

H. TOXICITY.

The conduit shall not contain any compounds that can release halogens, i.e. chlorine, bromine, fluorine and iodine in more than trace amounts when burning. Following shall be the maximum values when tested in accordance to ASTM E-800:

Gases	**Values (max ppm)**
Hydrogen Chloride	0
Hydrogen Bromide	0
Hydrogen Cyanide	< 1

Hydrogen Sulfide	0
Ammonia	0
Aldehydes as HCHO	< 10
Oxides of Nitrogen	< 50
Carbon Dioxide	< 12,500
Carbon Monoxide	< 250

I. FITTINGS AND ACCESSORIES.

Fiberglass conduit fittings, elbows, and accessories shall be manufactured using one of two manufacturing procedures. The first method shall use the same process, methods, and components as used to manufacture the fiberglass conduit. The second method shall use the compression molding process, Sheet Molding Compound (SMC), for the manufacture of the finished component. The SMC material shall be a vinyl ester resin with +30% reinforcement of glass. The glass fibers should be approximately 1 inch in length. The SMC material shall be fire resistant to UL 2515 specifications and shall be halogen free. Plastic duct plugs shall be manufactured from PVC.

J. ENVIRONMENTAL.

Manufacturer shall have a current certificate, issued by an independent and accredited company, of compliance with an ISO 14001: Environmental Management Systems and Performance.

150793.03 CONSTRUCTION.

Per the contract documents.

150793.04 METHOD OF MEASUREMENT.

The quantity will not be measured for payment.

150793.05 BASIS OF PAYMENT.

The work described in these Special Provisions will not be measured or paid for separately, but shall be considered incidental to the bid items, Concrete Barrier Railing, High Performance Structural Concrete, or Structural Concrete (Bridge) as noted in the contract documents.