

# Champion Engineering Specifications (XW)

## XW (EXTRA HEAVY WALL) EPOXY FIBERGLASS CONDUIT SPECIFICATIONS

### I. References

When a standard or other referenced document referred to in this specification is superseded by an approved revision, the revision shall apply.

### II. Listing

The conduit and fittings shall be listed by UL, Underwriters Laboratories, to the UL 2515A (Extra Heavy Wall) standard. Type XW Conduit shall be allowed for use in Class I, Division 2 installations when installed per NEC (National Electric Code) guidelines. All conduit shipped shall contain UL labels.

### III. UL-listed Extended Support Spans

The conduit shall be UL listed for the following extended support span lengths.

| CONDUIT SIZE | EXTRA HEAVY WALL (.250") |
|--------------|--------------------------|
| 3/4"         | 10'                      |
| 1"           | 10'                      |
| 1-1/4"       | 15'                      |
| 1-1/2"       | 15'                      |
| 2"           | 15'                      |
| 2-1/2"       | 15'                      |
| 3"           | 17'                      |
| 4"           | 17'                      |
| 5"           | 17'                      |
| 6"           | 17'                      |

### IV. Manufacturing

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°. Winding mandrels shall be straight and true so as to produce a non-tapered conduit. Tapering is allowed at the belled end.

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.

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 unless a custom color has been sourced by special request.

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 has to 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.

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

All elbows shall meet the nominal radius plus or minus 3 inches. The wall thickness shall meet tolerance as shown on facing page and the "Out of Rounds" as shown in NEMA TC 14.

All elbows shall have straight ends, fiberglass or deep socket PVC couplings (per project requirements).

All conduit bodies shall be compression molded from vinyl ester resin and utilize "Champ-Seal" gasket technology. The gasketing system will consist of a silicone-based gasket that is water-tight, corrosion-resistant and resists impression setting.

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 2515A (Extra Heavy Wall – 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
- Special customer markings (per request)

All conduit, elbows and fittings shall be **manufactured in the U.S.A. and marked as such.**

### V. Dimensions

All 2"-6" and 10" and 12" conduits shall be manufactured in ID sizes. All other sizes to be IPS.

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

Conduit shall be manufactured with following nominal dimensions:

| SIZE   | TYPE | OUTSIDE DIAMETER | INSIDE DIAMETER | WALL THICKNESS |
|--------|------|------------------|-----------------|----------------|
|        |      | INCH             | INCH            | INCH           |
| 3/4"   | XW   | 1.410"           | 0.910"          | .250"          |
| 1"     | XW   | 1.675"           | 1.175"          | .250"          |
| 1-1/4" | XW   | 2.020"           | 1.520"          | .250"          |
| 1-1/2" | XW   | 2.260"           | 1.760"          | .250"          |
| 2"     | XW   | 2.500"           | 2.000"          | .250"          |
| 2-1/2" | XW   | 3.000"           | 2.500"          | .250"          |
| 3"     | XW   | 3.500"           | 3.000"          | .250"          |
| 3-1/2" | XW   | 4.000"           | 3.500"          | .250"          |
| 4"     | XW   | 4.500"           | 4.000"          | .250"          |
| 5"     | XW   | 5.500"           | 5.000"          | .250"          |
| 6"     | XW   | 6.500"           | 6.000"          | .250"          |

### VI. Electrical Characteristics

|                     |                                |           |
|---------------------|--------------------------------|-----------|
| Volume Resistivity  | 3.8 x 10 <sup>14</sup> ohm-cm  | ASTM D257 |
| Surface Resistivity | 1.1 x 10 <sup>14</sup> ohms    | ASTM D257 |
| Dielectric Constant | 3.5 (at 10 <sup>3</sup> cps)   | ASTM D150 |
| Dissipation Factor  | 0.005 (at 10 <sup>3</sup> cps) | ASTM D150 |
| Dielectric Strength | 500 volts/mil (19.7 kv/mm)     | ASTM D149 |

### VII. Mechanical Characteristics

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

|                                    |   |              |
|------------------------------------|---|--------------|
| Tensile Strength, Axial            | 11,000 psi (76 MPa)   | ASTM D2105   |
| Compressive Strength               | 12,000 psi (83 MPa)   | ASTM D695    |
| Ultimate Elongation                | 2% psi (9.6 GPa)  | ASTM D2105   |
| Modulus of Elasticity (4" conduit) | 1.4 x 10 <sup>6</sup> psi (9.6 GPa)                             | ASTM D2105   |
| Thermal Conductivity               | 2.0 Btu.in/ft <sup>2</sup> .hr.°F (0.30 W/m.K)                  | 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 <sup>-5</sup> in/in/°F (2.2 x 10 <sup>-5</sup> m/m/°C) | ASTM D696    |

**Impact Resistance: ASTM D2444**

| SIZE   | TYPE | ASTM D2444   |
|--------|------|--------------|
| 3/4"   | XW   | 150 lbs/ft   |
| 1"     | XW   | 400 lbs/ft   |
| 1-1/4" | XW   | 400 lbs/ft   |
| 1-1/2" | XW   | 500 lbs/ft   |
| 2"     | XW   | 550 lbs/ft   |
| 2-1/2" | XW   | 600 lbs/ft   |
| 3"     | XW   | 700 lbs/ft   |
| 3-1/2" | XW   | 850 lbs/ft   |
| 4"     | XW   | 1,000 lbs/ft |
| 5"     | XW   | 1,200 lbs/ft |
| 6"     | XW   | 1,300 lbs/ft |

**Stiffness at 5% Deflection: ASTM D2412**

| SIZE   | TYPE | ASTM D2412                  |
|--------|------|-----------------------------|
| 3/4"   | XW   | 2,500 lb/ft/in <sup>2</sup> |
| 1"     | XW   | 2,400 lb/ft/in <sup>2</sup> |
| 1-1/4" | XW   | 2,100 lb/ft/in <sup>2</sup> |
| 1-1/2" | XW   | 2,000 lb/ft/in <sup>2</sup> |
| 2"     | XW   | 1,300 lb/ft/in <sup>2</sup> |
| 2-1/2" | XW   | 800 lb/ft/in <sup>2</sup>   |
| 3"     | XW   | 600 lb/ft/in <sup>2</sup>   |
| 3-1/2" | XW   | 450 lb/ft/in <sup>2</sup>   |
| 4"     | XW   | 250 lb/ft/in <sup>2</sup>   |
| 5"     | XW   | 180 lb/ft/in <sup>2</sup>   |
| 6"     | XW   | 150 lb/ft/in <sup>2</sup>   |

**VIII. Fire Resistance and Flame Spread**

Conduit shall meet UL specifications of UL 2420 (below ground) and UL 2515 (above ground), i.e. the flame shall extinguish within 30 seconds each time after four consecutive applications of 15 seconds and shall extinguish within 60 seconds after the fifth flame application also being 15 seconds in duration.

**IX. Quality Assurance Program**

Manufacturer shall have a current Certificate, issued by an independent and accredited company, of compliance with an **ISO 9001:2015 Quality Management System**.

**X. Joining System**

**Conduit Straight Socket**

The conduit shall be supplied with a bonded coupling or an integral wound bell on one end and a machined spigot on the other end. A two-part adhesive, epoxy resin system, designed to permanently bond fittings and joints of conduit shall be properly mixed and applied to the spigot end before joining the conduits together. The adhesive shall be available for use in three different ambient temperatures, 70°F, 40°F and 20°F. The adhesive shall be supplied from the same manufacturer of conduit and fittings in order not to void the listing by UL.

## XI. 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             |

## XII. 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" in length. The SMC material shall be fire resistant to UL 2515 specifications and shall be halogen free.

All conduit bodies shall be supplied with Champion's unique "Champ-Seal" gasketing system. This is a silicone-based, water-tight, corrosion-resistant gasketing system that completely resists impression setting.

## XIII. Environmental

Manufacturer shall have a current Certificate, issued by an independent and accredited company, of compliance with an **ISO 14001:2015 Environmental Management Systems and Performance**.

## XIV. Installation Training

Manufacturer may provide (upon request) contractor installation training for field cutting, joint preparation, joint assembly, field bending and RTRC field cut sealing (with field cutting sealant) at manufacturer's discretion.