GENERAL

- Conduit shall be phenolic fiberglass as manufactured by Champion Fiberglass, Inc. using the single circuit filament winding process.
- Conduit, elbows and fittings shall be manufactured from a phenol based resin and hardener with an appropriate E-glass roving manufactured by the same single circuit filament winding process. Resin shall be free of fillers.
- Conduit shall be supplied with either an integral wound bell and machined spigot or a bonded coupling and a machined spigot.
- Conduit, elbows, fittings, and adhesive are specified for use throughout a temperature range of -60°F ***(-51°C)*** to 1850°F ***(1010°C)***.
- Conduit, elbows, fittings, and adhesive shall be constructed of noncombustible materials in accordance with the requirements of ASTM E136.
- Conduit shall be wound on steel mandrels at a helix winding angle to the longitudinal axis appropriate to produce conduit that meets the physical requirements of this specification. Mandrels shall be straight and true so as to produce a non-tapered conduit. Tapering is allowed at the belled end.
- Conduit shall be free from all defects including indentations, delamination, pinholes, foreign inclusions, and resin-starved areas. The conduit shall be round. The bore of the conduit shall be smooth and uniform. All conduit ends shall be cut at right angles to the axis of the conduit.
- Conduit shall not be manufactured with a condensation reaction of phenol and formaldehyde. This is so that there is no residual formaldehyde or any corrosive by-products.

ELECTRICAL PROPERTIES

• Dielectric Strength	150 volts/mil. ***(5.9 kv/mm)***	ASTM D 149

PHYSICAL AND MECHANICAL PROPERTIES

• Tensile Strength (Axial)	7,000 psi ***(62 MPa)***	ASTM D 2105
• Modulus of Elasticity (4" conduit)	1.2 X 10^6 psi ***(8.3 GPa)***	ASTM D 2105
• Thermal Conductivity	1.67 BTU/(ft^2)(hr.)(°F/in) ***(0.24 mk/W)***	ASTM D 5930-01
• Specific Gravity	1.70-1.75	ASTM D 792
• Glass Content	70% ± 5%	API SPEC 15 LR
• Water Absorption	Less than 1.0%	ASTM D 570
• Barcol Hardness	70 ± 2	ASTM D2583
• Temperature Range	-60°F to +1850°F	ASTM E119 (1850°F 2 hours)
• Vertical Flame Test FT4	Passed	CSA 22.2

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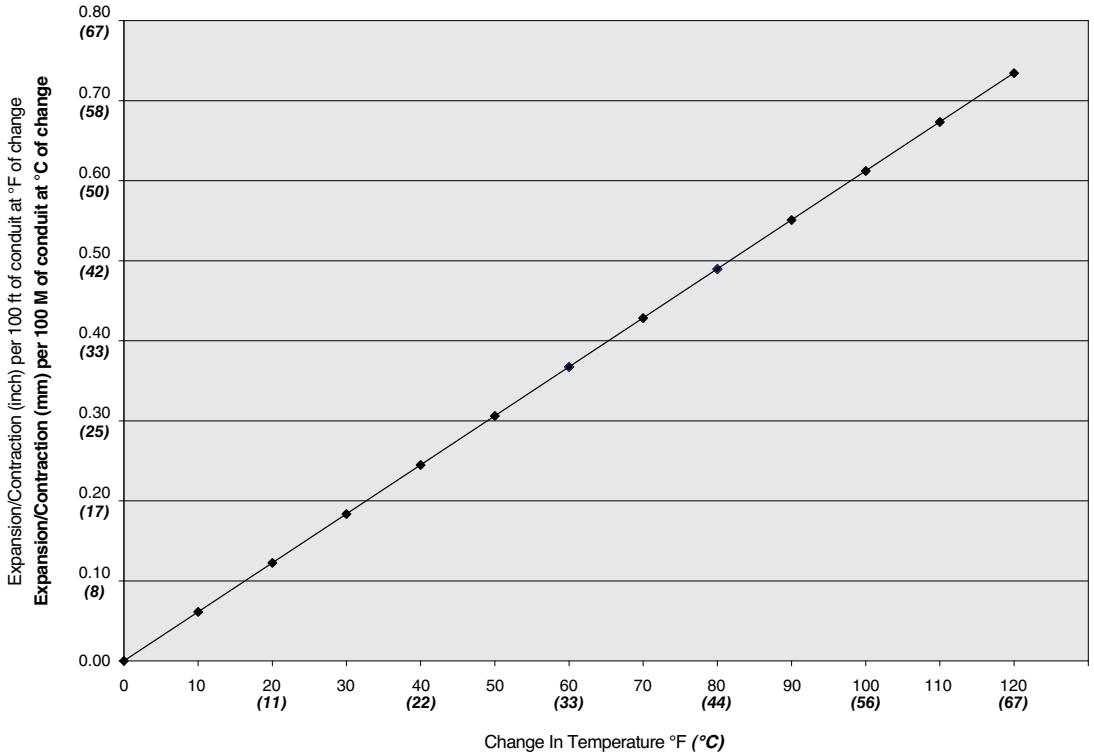
PHYSICAL AND MECHANICAL PROPERTIES (CONT.)

• Surface Flammability	<2	ASTM E162
• Tunnel Test, Flame Spread	<1	ASTM E84
• Tunnel Test, Smoke Density	<1	ASTM E84
• Smoke Density, D_{S4} min	<1	ASTM E662
• Smoke Density, D_{max} flaming	<30	ASTM E662
• Smoke Density, D_{max} non-flaming	<20	ASTM E662
• Coefficient of Thermal Expansion	5.1 x 10^{-6} in/in/°F ***(9.27 x 10^{-6} mm/mm/°C)***	ASTM D696



HEAT DEFLECTION

The minimum heat deflection temperature shall be 500°F ***(260°C)*** when tested at 264 psi in accordance with ASTM D 648.

TOXICITY

CHAMPION FLAME SHIELD® conduit does not contain any compounds that can release halogens - bromine or chlorine - when burning.

Gases	Values (max P.P.M.)
Hydrogen Chloride	0
Hydrogen Bromide	0
Hydrogen Cyanide	<1
Hydrogen Sulphide	0
Ammonia	0
Oxides of Nitrogen	<5
Carbon Dioxide	<10,500
Carbon Monoxide	<350

COLOR

Natural color is dark reddish brown, almost black.

DEFLECTION

Deflection is always determined at midspan.

The empirical formula for deflection is:

$$D = \frac{131 \cdot W \cdot L^4}{E(OD^4 - ID^4)}$$

Where:
- D = Midspan deflection (in.)
- OD = Outside diameter of conduit (in.)
- ID = Inside diameter of conduit (in.)
- E = Modulus of elasticity of conduit (psi), which is 1,200,000 for phenolic fiberglass conduit
- L = Distance between hangers (ft.)
- W = Total weight of cable and conduit (lbs/ft.)

It is recommended that midspan deflection never exceeds ⅝ inches *(16 mm)*.

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IMPACT RESISTANCE

The minimum impact resistance values for the conduit shall be as shown in the table below when tested in accordance with ASTM D2444.

Norminal Size	At 73.4°F *(23°C)* Impact Resistance lbs. ft. *(Nm)*				At 32.4°F *(0°C)* Impact Resistance lbs. ft. *(Nm)*			
	SW	MW	HW	XW	SW	MW	HW	XW
¾	8 *(11)*	-- --	-- --	50 *(68)*	8 *(11)*	-- --	-- --	50 *(68)*
1	12 *(16)*	-- --	-- --	160 *(215)*	12 *(16)*	-- --	-- --	160 *(215)*
1¼	12 *(16)*	-- --	-- --	160 *(215)*	12 *(16)*	-- --	-- --	160 *(215)*
1½	14 *(19)*	-- --	-- --	175 *(235)*	14 *(19)*	-- --	-- --	175 *(235)*
2	16 *(22)*	-- --	-- --	200 *(270)*	16 *(22)*	-- --	-- --	200 *(270)*
2½	19 *(26)*	-- --	-- --	210 *(285)*	19 *(26)*	-- --	-- --	210 *(285)*
3	22 *(30)*	-- --	-- --	245 *(330)*	22 *(30)*	-- --	-- --	245 *(330)*
3½	28 *(38)*	-- --	-- --	300 *(405)*	28 *(38)*	-- --	-- --	300 *(405)*
4	32 *(43)*	-- --	40 *(54)*	350 *(470)*	32 *(43)*	-- --	40 *(54)*	350 *(470)*
5	-- --	54 *(73)*	60 *(81)*	420 *(565)*	-- --	54 *(73)*	60 *(81)*	420 *(565)*
6	-- --	66 *(89)*	72 *(98)*	455 *(615)*	-- --	66 *(89)*	72 *(98)*	455 *(615)*

STIFFNESS

The minimum conduit stiffness at five percent deflection for all sizes of conduit shall not be less than the values given in table below when tested in accordance with ASTM D2412

Pipe Stiffness (PS) = (F/ΔY)								
Nominal Size	At 73.4°F *(23°C)* lbf/in² *(MPa)*				At 32°F *(0°C)* lbf/in² *(MPa)*			
	SW	MW	HW	XW	SW	MW	HW	XW
¾	270 *(1.9)*	-- --	-- --	1,300 *(9.1)*	270 *(1.9)*	-- --	-- --	1,300 *(9.1)*
1	220 *(1.5)*	-- --	-- --	1,100 *(7.7)*	220 *(1.5)*	-- --	-- --	1,100 *(7.7)*
1¼	175 *(1.2)*	-- --	-- --	875 *(6.1)*	175 *(1.2)*	-- --	-- --	875 *(6.1)*
1½	155 *(1.1)*	-- --	-- --	775 *(5.4)*	155 *(1.1)*	-- --	-- --	775 *(5.4)*
2	105 *(0.70)*	-- --	-- --	525 *(3.7)*	105 *(0.70)*	-- --	-- --	525 *(3.7)*
2½	65 *(0.40)*	-- --	-- --	325 *(2.3)*	65 *(0.40)*	-- --	-- --	325 *(2.3)*
3	45 *(0.32)*	-- --	-- --	225 *(1.6)*	45 *(0.32)*	-- --	-- --	225 *(1.6)*
3½	40 *(0.28)*	-- --	-- --	200 *(1.4)*	40 *(0.28)*	-- --	-- --	200 *(1.4)*
4	35 *(0.24)*	-- --	50 *(0.35)*	175 *(1.2)*	35 *(0.24)*	-- --	50 *(0.35)*	175 *(1.2)*
5	-- --	35 *(0.24)*	38 *(0.26)*	125 *(0.88)*	-- --	35 *(0.24)*	38 *(0.26)*	125 *(0.88)*
6	-- --	25 *(0.18)*	28 *(0.19)*	50 *(0.35)*	-- --	25 *(0.18)*	28 *(0.19)*	50 *(0.35)*

WIRE FILL

Maximum allowable percentage wire fill per Table 1, Chapter 9, National Electric Code 2008

IPS sizes												
					Percent of cross section of conduit & tubing for conductors							
Trade Size		Internal Diameter in	(mm)	Total Area sq in	(sq mm)	1 conductor 53% fill sq in	(sq mm)	2 conductors 31% fill sq in	(sq mm)	Over 2 conductors 40% fill sq in	(sq mm)
¾	(19)	0.910	(23)	0.650	(419)	0.345	(222)	0.202	(130)	0.260	(168)
1	(25)	1.175	(30)	1.084	(699)	0.574	(371)	0.336	(217)	0.434	(280)
1¼	(32)	1.520	(39)	1.814	(1170)	0.961	(620)	0.562	(363)	0.725	(468)
1½	(38)	1.760	(45)	2.432	(1569)	1.289	(831)	0.754	(486)	0.973	(628)
2	(51)	2.235	(57)	3.921	(2530)	2.078	(1341)	1.216	(784)	1.569	(1012)
3	(76)	3.360	(85)	8.862	(5718)	4.697	(3030)	2.747	(1772)	3.545	(2287)
4	(102)	4.320	(110)	14.650	(9452)	7.764	(5009)	4.541	(2930)	5.860	(3781)
5	(127)	5.380	(137)	22.721	(14659)	12.042	(7769)	7.044	(4544)	9.089	(5864)
6	(152)	6.380	(162)	31.953	(20615)	16.935	(10926)	9.905	(6391)	12.781	(8246)

ID sizes											
					Percent of cross section of conduit & tubing for conductors						
Trade Size		Internal Diameter in	(mm)	Total Area sq in	(sq mm)	1 conductor 53% fill sq in	(sq mm)	2 conductors 31% fill sq in	(sq mm)	Over 2 conductors 40% fill sq in	(sq mm)
2	(51)	2.00	(51)	3.140	(2026)	1.664	(1074)	0.973	(328)	1.256	(810)
2½	(64)	2.500	(64)	7.906	(3165)	2.600	(1678)	1.521	(981)	1.963	(1266)
3	(76)	3.000	(76)	7.065	(4558)	3.744	(2416)	2.190	(1413)	2.826	(1823)
3½	(89)	3.500	(89)	9.616	(6204)	5.097	(3288)	2.981	(1923)	3.847	(2482)
4	(102)	4.000	(102)	12.560	(8103)	7.764	(5009)	3.894	(2512)	5.024	(3241)
5	(127)	5.000	(127)	19.625	(12661)	12.042	(7769)	6.084	(3925)	7.850	(5065)
6	(152)	6.000	(152)	28.260	(18232)	16.935	(10926)	8.761	(5652)	11.304	(7293)

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