

SWFR

Single Wall, Heat Shrink Tubing

Highly flame-retardant, UL VW-1 rated, Zerohal tubing

PRODUCT DESCRIPTION

SWFR tubing from TE Connectivity (TE) is a cost effective, highly flame-retardant, 2:1 shrink ratio tubing made irradiated, cross-linked polyolefin. It insulates and mechanically protects components, electrical connections, and terminations. SWFR is offered in two very flexible types. X2 is a thin wall tubing, and X4 is a very thin wall tubing. The thicker wall of the X2 offers better protection, while the space-saving thinner wall of the X4 permits denser packing of protected components and a faster shrink time to better protect against thermal damage of temperature-sensitive components. Both types are halogen free, permitting their use in enclosed spaces where toxic gasses from burning materials containing halogens is undesirable.

KEY FEATURES

- Highly flame-retardant with UL VW-1 and CSA OFT flammability rating
- Environmentally friendly formula is essentially free of halogens, permitting use in enclosed areas where emission of toxic gasses from burning materials containing halogens is undesirable.

APPLICATIONS

- Household appliances
- Automotive
- Commercial electronics & communications
- Consumer products
- Industrial equipment
- Rail & Mass Transit

STANDARDS AND SPECIFICATIONS

- Customer drawings: SWFR X2 and SWFR X4
- UL 224 VW-1, CSA OFT
- UL file E35586
- CSA file LR31929

ELECTRICAL, MECHANICAL, & MATERIALS

- Provides excellent electrical insulation
- Provides mechanical protection from abrasion
- Highly flexible X2 thin wall & X4 very thin wall types
- Non-halogenated irradiated polyolefin
- RoHS & REACH compliant

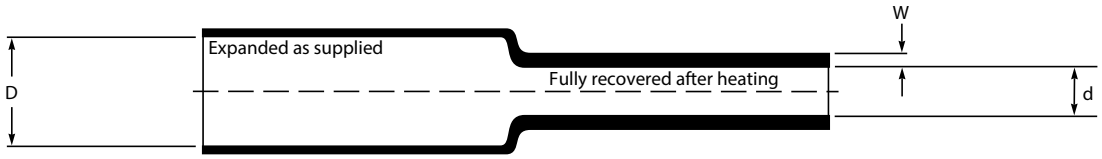
TEMPERATURE RATING

- Minimum shrink temperature 70°C [158°F]
- Full recovery temperature 90°C [194°F]
- Operating temperature -30°C to 125°C [22°F to 257°F]

ORDERING INFORMATION

- Color: Black (-0)
- Packaging: (-SP) spool, varying lengths (consult TE for details) & (-FSP) flat on spool (only for sizes 8mm & larger)
- Ordering description: Specify product type, size, color, packaging & surface marking. For example, X2-2.0-0-SP-SM
- Product is now available surface marked (except 0.6 size X4)

DIMENSIONS



Product Type	Size	Minimum Expanded I.D. (D)	Maximum Recovered I.D. (d)	Total Recovered Wall Thickness (W)
X2 (Thin Wall)	1.0	1.3	0.5	0.44
	1.5	1.9	0.75	0.44
	2.0	2.4	1.0	0.44
	2.5	2.9	1.25	0.44
	3.0	3.4	1.5	0.44
	3.5	3.8	1.75	0.46
	4.0	4.3	2.0	0.46
	5.0	5.3	2.5	0.56
	6.0	6.3	3.0	0.56
	7.0	7.3	3.5	0.56
	8.0	8.3	4.0	0.56
	9.0	9.3	4.5	0.56
	10.0	10.1	5.0	0.56
	11.0	11.1	5.5	0.56
	12.0	12.4	6.0	0.56
	16.0	16.5	8.0	0.69
	18.0	18.6	9.0	0.77
	20.0	21.0	10.0	0.77
	25.0	26.4	12.5	0.77
	30.0	31.6	15.0	0.89
X4 (Very Thin Wall)	0.6	0.7	0.3	0.25
	0.8	0.95	0.4	0.25
	1.0	1.15	0.5	0.25
	1.5	1.65	0.75	0.25
	2.0	2.05	1.0	0.26
	2.5	2.55	1.25	0.28
	3.0	3.05	1.5	0.28
	3.5	3.55	1.75	0.28
	4.0	4.15	2.0	0.28
	6.0	6.1	3.0	0.33
	8.0	8.1	4.0	0.33
	9.0	9.1	4.5	0.33
	10.0	10.0	5.0	0.33
	12.0	12.4	6.0	0.33
	18.0	18.6	9.0	0.46
	25.0	25.4	12.5	0.46

PRODUCT DESCRIPTION & ORDERING INFORMATION

Product Type	Material Description	Material Number
X2 (Thin Wall)	X2-1.0-0-SP-SM	EM7479-000
	X2-1.5-0-SP-SM	EM7480-000
	X2-2.0-0-SP-SM	EM7481-000
	X2-2.5-0-SP-SM	EM7482-000
	X2-3.0-0-SP-SM	EM7483-000
	X2-3.5-0-SP-SM	EM7484-000
	X2-4.0-0-SP-SM	EM7485-000
	X2-5.0-0-SP-SM	EM7486-000
	X2-6.0-0-SP-SM	EM7487-000
	X2-7.0-0-SP-SM	EM7488-000
	X2-8.0-0-FSP-SM	EM7489-000
	X2-9.0-0-FSP-SM	EM7490-000
	X2-10.0-0-FSP-SM	EM7491-000
	X2-11.0-0-FSP-SM	EM7492-000
	X2-12.0-0-FSP-SM	EM7493-000
	X2-16.0-0-FSP-SM	EM6974-000
	X2-18.0-0-FSP-SM	EM7496-000
	X2-20.0-0-FSP-SM	EM6975-000
	X2-25.0-0-FSP-SM	EM7494-000
	X2-30.0-0-FSP-SM	EM7497-000

Product Type	Material Description	Material Number
X4 (Very Thin Wall)	X4-0.6-0-SP	EM6977-000
	X4-0.8-0-SP-SM	EM7499-000
	X4-1.0-0-SP-SM	EM7500-000
	X4-1.5-0-SP-SM	EM7501-000
	X4-2.0-0-SP-SM	EM7502-000
	X4-2.5-0-SP-SM	EM7503-000
	X4-3.0-0-SP-SM	EM7504-000
	X4-3.5-0-SP-SM	EM7505-000
	X4-4.0-0-SP-SM	EM7506-000
	X4-6.0-0-SP-SM	EM7507-000
	X4-8.0-0-SP-SM	EM6978-000
	X4-9.0-0-SP-SM	EM7508-000
	X4-10-0-SP-SM	EM6979-000
	X4-12.0-0-FSP-SM	EM7548-000
	X4-18.0-0-FSP-SM	EM7549-000
	X4-25.0-0-FSP-SM	EM7550-000

For additional part numbers visit www.te.com/SWFRtubing

Part Number
X2-2.0-0-SP-SM



X2 THIN WALL PROPERTY REQUIREMENTS

Property	Unit	Requirement	Test Method
Physical			
Dimensions	mm	As shown in DIMENSIONS table	ASTM D 2671
Longitudinal change ASTM D 2671 UL 224	 percent percent	 +1, -5 +3, -3	 ASTM D 2671 UL 224
Eccentricity (recovered)	percent	30 maximum	ASTM D 2671
Tensile strength	MPa (*psi*)	10.3 (1500) minimum	ASTM D 2671
Ultimate elongation	percent	200 minimum	ASTM D 2671
Secant modulus (as supplied)	MPa (*psi*)	172 (2.5 x 10^4) maximum	ASTM D 2671
Low-temperature flexibility (1 hour at –30°C/–22°F)		No cracking	UL 224
Heat shock (4 hours at 250°C/482°F)		No cracking	UL 224
Heat aging (7 days at 158°C/316°F)			UL 224
Followed by tests for:			
Tensile strength	MPa (psi)	70% minimum of unaged specimens	UL 224
Ultimate elongation	percent	100 minimum	UL 224
Flexibility		No cracking	ASTM D 2671
Dielectric withstand at 2500V	seconds	60 minimum	ASTM D 2671
Dielectric breakdown	volts	50% minimum of unaged specimens	UL 224
Dielectric strength	kV/mm (volts/mil)	19.7 (500) minimum	ASTM D 2671
Restricted shrinkage		Pass	UL 224
Electrical			
Dielectric withstand at 2500V	seconds	60 minimum	ASTM D 2671
Dielectric strength	kV/mm (volts/mil)	19.7 (500) minimum	ASTM D 2671
Volume resistivity	ohm-cm	10^{14} minimum	ASTM D 2671
Chemical			
Corrosive effect (7 days at 158°C/316°F)		No corrosion	ASTM D 2671
Copper stability (7 days at 158°C/316°F)		No brittleness, glazing, cracking, or severe discoloration of tubing.No pitting or blackening of copper.	ASTM D 2671
Followed by tests for:			
Ultimate elongation	percent	100 minimum	ASTM 2671
Flammability		Pass	UL 224, VW-1

X4 VERY THIN WALL PROPERTY REQUIREMENTS

Property	Unit	Requirement	Test Method
Physical			
Dimensions	mm	As shown in DIMENSIONS table	ASTM D 2671
Longitudinal change ASTM D 2671 UL 224	 percent percent	 +1, -15 +3, -3	 ASTM D 2671 UL 224
Eccentricity (recovered)	percent	30 maximum	ASTM D 2671
Tensile strength	MPa (*psi*)	10.3 (1500) minimum	ASTM D 2671
Ultimate elongation	percent	200 minimum	ASTM D 2671
Secant modulus (as supplied)	MPa (*psi*)	103 (1.5 x 10^4) maximum	ASTM D 2671
Low-temperature flexibility (1 hour at –30°C/–22°F)		No cracking	UL 224
Heat shock (4 hours at 250°C/482°F)		No cracking	UL 224
Heat aging (7 days at 158°C/316°F)			UL 224
Followed by tests for:			
Tensile strength	MPa (psi)	70% minimum of unaged specimens	UL 224
Ultimate elongation	percent	100 minimum	UL 224
Flexibility		No cracking	ASTM D 2671
Dielectric withstand at 2500V	seconds	60 minimum	ASTM D 2671
Dielectric breakdown	volts	50% minimum of unaged specimens	UL 224
Dielectric strength	kV/mm (volts/mil)	19.7 (500) minimum	ASTM D 2671
Restricted shrinkage		Pass	UL 224
Electrical			
Dielectric withstand at 2500V	seconds	60 minimum	ASTM D 2671
Dielectric strength	kV/mm (volts/mil)	19.7 (500) minimum	ASTM D 2671
Volume resistivity	ohm-cm	10^{14} minimum	ASTM D 2671
Chemical			
Corrosive effect (7 days at 158°C/316°F)		No corrosion	ASTM D 2671
Copper stability (7 days at 158°C/316°F)		No brittleness, glazing, cracking, or severe discoloration of tubing.No pitting or blackening of copper.	ASTM D 2671
Followed by tests for:			
Ultimate elongation	percent	100 minimum	ASTM 2671
Flammability		Pass	UL 224, VW-1

FOR MORE INFORMATION

Visit www.te.com and enter search term “SWFR,” or visit www.te.com/SWFRtubing.

TE TECHNICAL SUPPORT CENTER

USA:	+1 (800) 522-6752
Canada:	+1 (905) 475-6222
Mexico:	+52 (0) 55-1106-0800
Latin/S. America	+54 (0) 11-4733-2200
Germany:	+49 (0) 6251-133-1999
UK:	+44 (0) 800-267666
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1-1773894-4 7/19 Revised

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