



Energy Division

WCSF
Raychem heat-shrinkable
heavy-wall flame-retarded
tubing for nuclear
environments

WCSF

Heat-shrinkable heavy-wall flame-retarded tubing for nuclear environments

Raychem WCSF tubing is a heavy-wall, flame-retarded, heat-shrinkable tubing. It is pre-coated with a hot melt, radiation-resistant adhesive to provide a positive environmental seal. It is designed for electrical insulating up to 1000 V and general purpose sealing applications where flame retardancy, radiation resistance and severe environmental performance are required.

WCSF tubing is suitable for a wide range of jointing or connection applications for Class 1E wire and cable systems in accordance with IEEE 383. Each connection is individually insulated and sealed. Additionally, the sleeves can also be used for a wide range of related applications including sealing, oversheath replacement and strain relief throughout the plant. They can also be supplied as kits of components for specific applications.

WCSF tubing is already qualified for a 60-year service life to take into account the requirements of the third generation of nuclear power plants.



The heat-shrinkability of Tyco Electronics' Raychem WCSF tubing provides fast and easy installation, positive visual inspection and a pre-engineered insulation thickness to assure consistent installation.

WCSF tubing is supplied under the comprehensive Tyco Electronics' Raychem Quality Assurance Programme with certified documentation to meet industry requirements for safety related electrical equipment.

WCSF properties		Test method	Requirement		
Tensile strength		ISO 37	8.2 N/mm ² min.		
Ultimate elongation		ISO 37	250 % min.		
Density		ISO 1183/3 Method A	1.35 g/cm ³ max.		
Accelerated ageing	200 h at 175° C	ISO 188			
	1600 h at 150° C				
	Tensile strength			ISO 37	7 N/mm ² min.
	Ultimate elongation	ISO 37	100 % min.		
Low temperature flexibility	4 hours at -55° C	ASTM D2671 Procedure C	no cracking		
Flammability		ICEA S-19-81 Sec. 6. 19.6	self-extinguishing in < 1 min		
Dielectric strength	nominal wall thickness 2.5 mm	IEC 60243/1+2	75 kV/cm min.		
Volume resistivity		IEC 60093	1 x 10 ¹⁵ Ωcm min.		
Water absorption		ISO 60062	< 0.5 % after 24 h at 23° ± 2°C		
Corrosive effect	16 h at 135° C	ASTM D2671 Procedure A	no corrosion		
Heat ageing and radiation	200 h at 175° C followed by 50 Mrad gamma-radiation (0.5 - 1.0 Mrad/h) followed by:	Raychem internal test method			
	Tensile strength			ISO 37	5.5 N/mm ² min.
	Ultimate elongation			ISO 37	50 % min.
Additional properties	Further details are given in Raychem specification PPS 3010.				

WCSF

Performance

Flammability

The product has passed the IEEE 1202, Section 7.2 (IEEE 383) Flame Test at both 70,000 and 210,000 BTU/hour (Test Report EDR 5348).

Heat ageing

40 and 60-year life at 90°C established using the Arrhenius method (Test Report EDR 5331).

Radiation

Functional operability has been verified after 2180 kGy (218 Mrad) of gamma exposure (Test report EDR 5336 & EDR 5389).

LOCA

WCSF tubing has been tested to LOCA/HELB profiles based on the guidelines of IEEE 323 and 383 (Test Report EDR 5336 & EDR 5389).

Key test parameters include:

- 40 and 60 year thermal aging at 90 °C
- 2180 kGy (218 Mrad) radiation exposure
- 30 day LOCA test
- 30 day chemical spray
- Double peak profile with:
 - max. temperature 218° C
 - max. pressure 8 bar (120 psig)

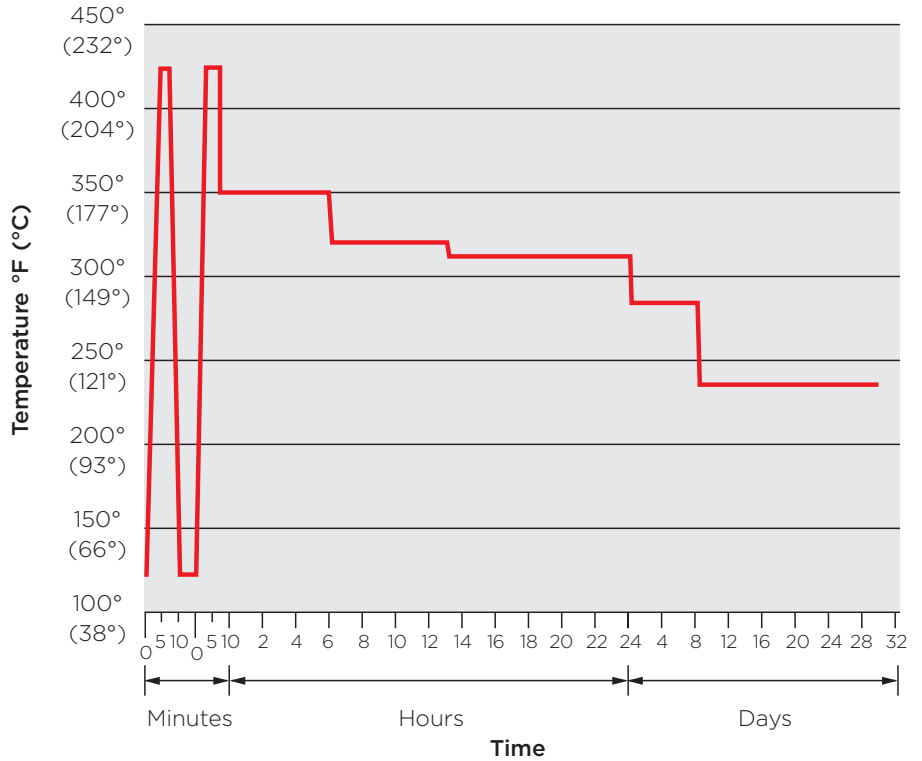
Qualification

Individual qualification tests for specific customer applications are the responsibility of the user.

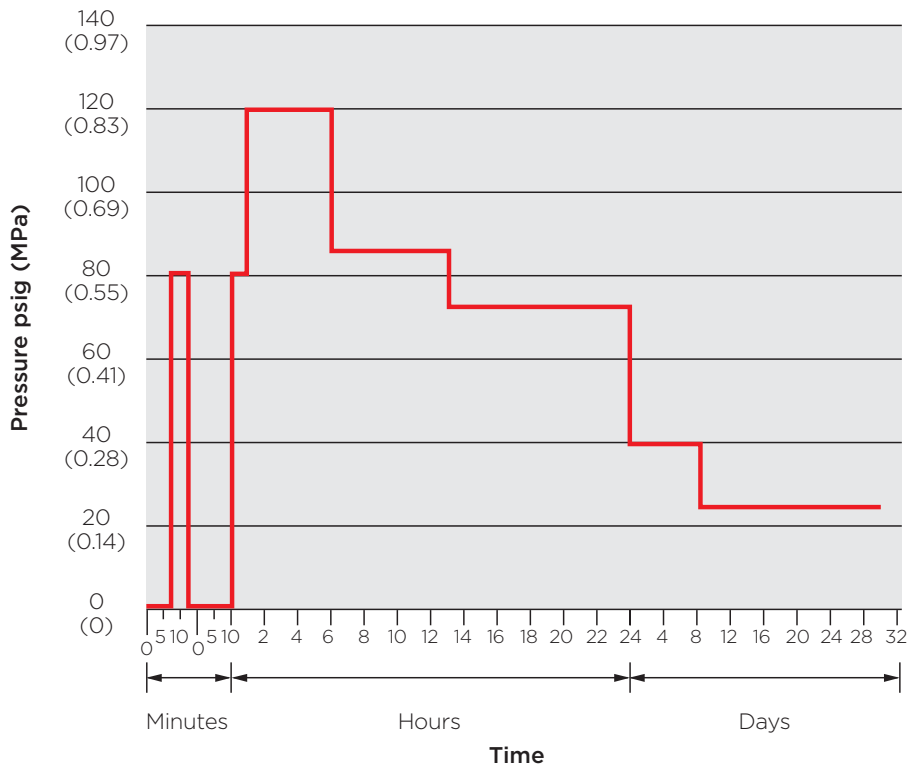


LOCA profiles

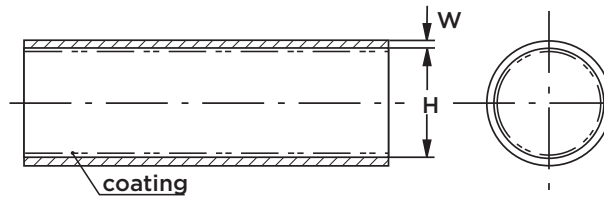
Temperature profile



Pressure profile



Dimensions



Tubing size	Standard cut length (mm)	Length on spool uncoated only (meter)	Use range (mm)	H a min.	H b max.	W b min.	Note
WCSF-050-3/1	1000	30	1.3 - 1.8	3.3	1.3	0.9	1) 2) 3)
WCSF-070-6/2	1000	30	1.8 - 4.4 (3.6)*	6.4	1.8	1.9	1) 2)
WCSF-115-9/3	1000	30	2.9 - 7.3 (5.8)*	8.9	2.9	2.2	1) 2)
WCSF-200-18/5	1000	30	5.1 - 12.7 (10.2)*	17.8	5.1	2.5	1) 2)
WCSF-300-28/8	1000	15	7.9 - 19.0 (15.2)*	27.9	7.6	3.8	1)
WCSF-500-38/13	1000	15	14.0 - 32.0	38.1	12.7	4.3	1)
WCSF-650-50/17	1000	12	18.0 - 41.0	50.8	16.5	4.3	1)
WCSF-1000-76/26	1000	9	28.0 - 64.0	76.2	25.4	4.3	
WCSF-1500-114/38	1000	9	43.0 - 97.0	114.3	38.1	4.3	
WCSF-2500-177/63	1000	9	70.0 - 159.0	177.8	63.5	4.3	

()* Maximum use range over bolted connections.

Standard lengths and coatings

Other lengths on request. All lengths subject to standard cutting tolerances. Coated tubing not available on spools.

Notes:

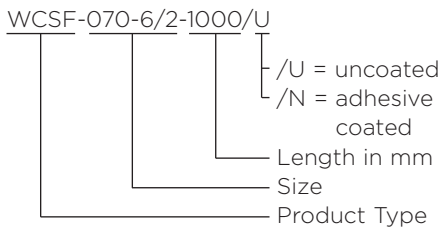
Longitudinal change after free recovery: +0 % to -10 %

Dimensions in millimeters
a = as supplied
b = after free recovery

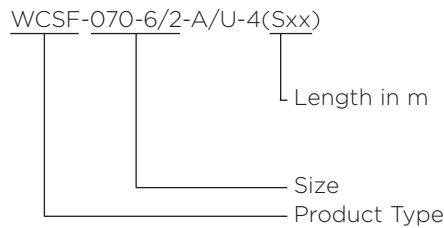
The application range is for applications subject to high temperature accident conditions such as LOCA or HELB.

- 1) Fiberglass bolt pads are required for bolted connections in all cases. Recommended bolt pad is EPPA-109N sized as needed.
- 2) These tubings can be used as splice insulation sleeve and are qualified with 25 mm seal length. All others require 50 mm seal length.
- 3) When used as a shim or small wire jacketing the use range of WCSF-050-3/1-/N is 1.3 - 2.5 mm.

Ordering example standard length



Ordering example spool/uncoated



Raychem WCSF tubing is supplied complete with installation instructions.

For further details on this product or any other Raychem products please contact your local sales representative.

All of the above information, including drawings, illustrations and graphic designs, reflects our present understanding and is to the best of our knowledge and belief correct and reliable. Users, however, should independently evaluate the suitability of each product for the desired application. Under no circumstances does this constitute an assurance of any particular quality or performance. Such an assurance is only provided in the context of our product specifications or explicit contractual arrangements. Our liability for these products is set forth in our standard terms and conditions of sale. Raychem, TE Logo and Tyco Electronics are trademarks.

Energy Division - innovative and economical solutions for the electrical power industry: cable accessories, connectors & fittings, insulators & insulation, surge arresters, switching equipment, lighting controls, Power Measurement and Control.

Tyco Electronics Raychem GmbH
Energy Division
Finsinger Feld 1
85521 Ottobrunn/Munich, Germany

Phone: +49-89-6089-0
Fax: +49-89-6096345

<http://energy.tycoelectronics.com>



Our commitment. Your advantage.