



tyco

Electronics

Introducing...



Raychem Heat-Shrinkable NBCCS Tubing & Molded Parts

DESCRIPTION

- Nuclear, Biological and Chemical Contamination Survivable (NBCCS)
- 125°C, 175°C and 200°C rated materials
- Black tubing with 2:1 shrink ratio
- Broadest available range of molded parts configurations

FOR MORE INFORMATION

Technical Support
Internet: www.tycoelectronics.com
E-mail:
newproducts@tycoelectronics.com

USA: 1-800-522-6752
Canada: 1-905-470-4425
Mexico: 52-55-1106-0800
C. America: 57-1-254-4444

South America: 55-11-2103-6000
Hong Kong: 852-2735-1628
Japan: 81-44-844-8013
UK: 44-208-420-8341

Raychem Heat-Shrinkable NBCCS Tubing & Molded Parts

KEY FEATURES

- Tubing has been hardened to withstand the damaging effect of NBC contamination and decontamination.
- Maximum use of materials that do not absorb contaminants and facilitate rapid removal with decontaminants.
- Survivable after live agent exposure to HD, VX & TGD at interior and exterior exposure levels.
- Decontaminable using DS-2 & STB
- RT-770, RT-780 and RT-790 tubing and molded parts meets all of the flammability and fluid resistance demands of current military ground vehicles
- Tyco Electronics also offers compatible adhesives, wire and other harness components designed for the same environmental survivability.

TEMPERATURE RATING

- System 770 -55°C to +125°C (Heat-shrinkable part recovery temperature: 150°C)
- System 780 -55°C to +175°C (Heat-shrinkable part recovery temperature: 180°C)
- System 790 -65°C to +200°C (Heat-shrinkable part recovery temperature: 220°C)

SPECIFICATIONS

- Tested to SCX-15112 or SCX-15111 for survivability in standard military vehicle fluids
- Tested to the Army Materiel Requirements for NBCSS in accordance with Test Operation Procedures for TOP 8-2-510, NBC Contamination Survivability
- Aids compliance with Army Regulation 70-75 - "Survivability of Army Personnel & Materiel"

MOLDED PARTS (See SCD for detailed molded parts dimensions & material availability)

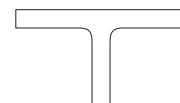
Low-profile lipped boots for use with a circular connector adapter 202F211 to 274
222F211 to 285
202G211 to 253



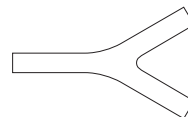
Compressible lipped boots for use with a circular connector adapter 202C611 to 663
202G611 to 653



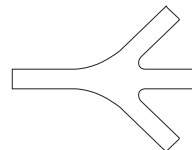
"T" Transitions 301A511 to 514
"T" Transitions with reduced diameter 322C512 to 514



"Y" Transitions 381A301 to 304
"Y" Transitions with reduced diameter 382C302 to 332



Trident Transitions 462A421 to 424



ORDERING INFORMATION

TUBING:

- Always order the largest size that will fit snugly over the component being covered.
- Wall thickness will be less if recovery is restricted during shrinking.
- Standard color is black.

Example:

RT-XXX - 3/8 - 0 - SP
Product Size Color Packaging

MOLDED PARTS:

Example:

202F221 -780 -0
Shape Material Color

Raychem RT-770

PRODUCT DIMENSIONS

Size	As Supplied Inside Diameter		Recovered Dimensions							
	Minimum		Inside Diameter Maximum		Minimum		Wall Thickness Maximum		Nominal	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
1/8	0.125	3.17	0.062	1.57	0.011	0.28	0.017	0.43	0.014	0.35
3/16	0.187	4.74	0.093	2.36	0.013	0.33	0.019	0.48	0.016	0.41
1/4	0.250	6.35	0.125	3.17	0.015	0.38	0.022	0.56	0.018	0.46
3/8	0.375	9.50	0.187	4.74	0.018	0.46	0.024	0.61	0.020	0.51
1/2	0.500	12.70	0.250	6.35	0.020	0.51	0.026	0.66	0.022	0.56
5/8	0.625	15.90	0.312	7.93	0.023	0.58	0.030	0.76	0.026	0.66
3/4	0.750	19.05	0.375	9.50	0.029	0.74	0.036	0.91	0.032	0.81
1	1.000	25.40	0.500	12.70	0.034	0.86	0.041	1.04	0.037	0.99
1-1/4	1.250	31.75	0.625	15.87	0.037	0.94	0.044	1.12	0.040	1.01
1-1/2	1.500	38.10	0.750	19.05	0.041	1.04	0.048	1.22	0.045	1.14
2	2.000	50.80	1.000	25.40	0.044	1.12	0.052	1.32	0.048	1.22

PHYSICAL

PROPERTY	UNIT	RT-770 TYPE I TUBING	RT-770 TYPE II MOLDED PARTS	TEST METHOD
Dimensions	Inches (<i>mm</i>)	In accordance with Table 1	In accordance with applicable SCD	RT-770
Tensile Strength	Psi (<i>MPa</i>)	2500 (<i>17.2</i>) minimum	2500 (<i>17.2</i>) minimum	ASTM D 412
Ultimate Elongation	Percent	300 minimum	300 minimum	ASTM D 412
Secant Modulus (expanded), 2%	Psi (<i>MPa</i>)	100,000 (<i>689</i>) maximum	100,000 (<i>689</i>) maximum	ASTM 882
Specific Gravity	--	1.85 maximum	1.85 maximum	ASTM D 792
Low Temperature Flexibility 4 hours at -55±3°C (-67±5°F)	--	No cracking	No cracking	RT-770
Heat Shock 4 hours at 225±5°C (437±9°F)	--	No dripping, flowing or cracking	No dripping, flowing or cracking	RT-770
Heat Resistance 336 hours at 175±3°C (347±5°F) Followed by tests for: Tensile Strength Ultimate Elongation	Psi (<i>MPa</i>) Percent	2000 (<i>13.8</i>) minimum 250 minimum	2000 (<i>13.8</i>) minimum 250 minimum	RT-770

ELECTRICAL

PROPERTY	UNIT	RT-770 TYPE I TUBING	RT-770 TYPE II MOLDED PARTS	TEST METHOD
Dielectric Strength	Volts/mil (<i>kV/mm</i>)	400 (<i>15.7</i>) minimum	400 (<i>15.7</i>) minimum	ASTM D 149
Volume Resistivity	Ohm-cm	1 x 10 ¹¹ minimum	1 x 10 ¹¹ minimum	ASTM D 257

NUCLEAR

PROPERTY	UNIT	RT-770 TYPE I TUBING	RT-770 TYPE II MOLDED PARTS	TEST METHOD
Radiation Resistance -10 Mrads gamma Followed by tests for: Tensile Strength Ultimate Elongation	Psi (<i>MPa</i>) Percent	2000 (<i>13.8</i>) minimum 150 minimum	2000 (<i>13.8</i>) minimum 150 minimum	RT-770

Raychem RT-770

CHEMICAL

PROPERTY	UNIT	RT-770 TYPE I TUBING	RT-770 TYPE II MOLDED PARTS	TEST METHOD
Copper Mirror Corrosion 16 hours at 175±3°C (347±5°F)	--	Non Corrosive	Non Corrosive	ASTM D 2671 Procedure A
Fungus Resistance	Growth	Rating of 1 or less	Rating of 1 or less	ASTM G21
Water Absorption 24 hours at 23±3°C (73±5°F)	Percent	0.5 maximum	0.5 maximum	ASTM D 570
Flammability Average Burn Time	Seconds	15 maximum	--	ASTM D 2671 Procedure A
Average Burn Time Average extent of burning	Seconds Inches	--	15 maximum 1 maximum	ASTM D 635-98
Fluid Resistance 24 hours at 23±3°C (73±5°F) a) JP-8 Jet Fuel (MIL-DTL-83133) b) Diesel Fuel (VV-F-800, DF-2)				RT-770
Followed by tests for:				
Tensile Strength	Psi (MPa)	2000 (13.8) minimum	2000 (13.8) minimum	
Ultimate Elongation	Percent	250 minimum	250 minimum	
Weight Increase	Percent	3 maximum	3 maximum	
24 hours at 50±3°C (122±5°F) a) Bore Cleaner (MIL-PRF-372) b) Anti-Icing Fluid (SAE-AMS-1424) c) Salt-5% solution (ASTM D 632) d) Lubricating Oil (MIL-PRF-2104) e) Lubricating Oil (MIL-PRF-23699) f) Arctic Lube (MIL-PRF-46167) g) Cleaning Compound (A-A-59133) h) Electrolyte (P/N 10873919)				
Followed by tests for:				
Tensile Strength	Psi (MPa)	2000 (13.8) minimum	2000 (13.8) minimum	
Ultimate Elongation	Percent	250 minimum	250 minimum	
Weight Increase	Percent	3 maximum	3 maximum	
24 hours at 71±3°C (160±5°F) Hydraulic, synthetic (MIL-PRF-46170)				
Followed by tests for:				
Tensile Strength	Psi (MPa)	2000 (13.8) minimum	2000 (13.8) minimum	
Ultimate Elongation	Percent	250 minimum	250 minimum	
Weight Increase	Percent	3 maximum	3 maximum	
4 hours at 23±3°C (73±5°F) a) Decontaminating Agent, DS-2 (MIL-D-50030) b) Decontaminating Agent, STB (MIL-DTL-12468) 5% Solution				RT-770
Followed by tests for:				
Tensile Strength	Psi (MPa)	2000 (13.8) minimum	2000 (13.8) minimum	
Ultimate Elongation	Percent	250 minimum	250 minimum	
Weight Increase	Percent	3 maximum	3 maximum	

PRODUCT DIMENSIONS

Size	As Supplied Inside Diameter		Recovered Dimensions							
			Inside Diameter		Wall Thickness				Nominal	
	Minimum		Maximum		Minimum		Maximum			
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
1/8	0.125	3.17	0.062	1.57	0.011	0.28	0.017	0.43	0.014	0.35
3/16	0.187	4.74	0.093	2.36	0.013	0.33	0.019	0.48	0.016	0.41
1/4	0.250	6.35	0.125	3.17	0.015	0.38	0.022	0.56	0.018	0.46
3/8	0.375	9.50	0.187	4.74	0.018	0.46	0.024	0.61	0.020	0.51
1/2	0.500	12.70	0.250	6.35	0.020	0.51	0.026	0.66	0.022	0.56
5/8	0.625	15.90	0.312	7.93	0.023	0.58	0.030	0.76	0.026	0.66
3/4	0.750	19.05	0.375	9.50	0.029	0.74	0.036	0.91	0.032	0.81
1	1.000	25.40	0.500	12.70	0.034	0.86	0.041	1.04	0.037	0.99
1-1/4	1.250	31.75	0.625	15.87	0.037	0.94	0.044	1.12	0.040	1.01
1-1/2	1.500	38.10	0.750	19.05	0.041	1.04	0.048	1.22	0.045	1.14
2	2.000	50.80	1.000	25.40	0.044	1.12	0.052	1.32	0.048	1.22

PHYSICAL

PROPERTY	UNIT	RT-780 TYPE I TUBING	RT-780 TYPE II MOLDED PARTS	TEST METHOD
Dimensions	Inches (<i>mm</i>)	In accordance with Table 1	In accordance with applicable SCD	RT-780
Tensile Strength	Psi (<i>MPa</i>)	3000 (<i>20.7</i>) minimum	3000 (<i>20.7</i>) minimum	ASTM D 412
Ultimate Elongation	Percent	300 minimum	300 minimum	ASTM D 412
Secant Modulus (expanded), 2%	Psi (<i>MPa</i>)	50,000 (<i>345</i>) maximum	50,000 (<i>345</i>) maximum	ASTM 882
Specific Gravity	--	2.0 maximum	2.0 maximum	ASTM D 792
Low Temperature Flexibility 4 hours at -55±3°C (-65±5°F)	--	No cracking	No cracking	RT-780
Heat Shock 4 hours at 275±5°C (527±9°F)	--	No dripping, flowing or cracking	No dripping, flowing or cracking	RT-780
Heat Resistance 336 hours at 200±3°C (392±5°F) Followed by tests for: Tensile Strength Ultimate Elongation				RT-780
	Psi (<i>MPa</i>)	2000 (<i>13.8</i>) minimum	2000 (<i>13.8</i>) minimum	
	Percent	250 minimum	250 minimum	

ELECTRICAL

PROPERTY	UNIT	RT-780 TYPE I TUBING	RT-780 TYPE II MOLDED PARTS	TEST METHOD
Dielectric Strength	Volts/mil (<i>kV/mm</i>)	200 (<i>7.9</i>) minimum	200 (<i>7.9</i>) minimum	ASTM D 149
Volume Resistivity	Ohm-cm	1 x 10 ¹¹ minimum	1 x 10 ¹¹ minimum	ASTM D 257

NUCLEAR

PROPERTY	UNIT	RT-780 TYPE I TUBING	RT-780 TYPE II MOLDED PARTS	TEST METHOD
Radiation Resistance -10 Mrads gamma Followed by tests for: Tensile Strength Ultimate Elongation				RT-780
	Psi (<i>MPa</i>)	2000 (<i>13.8</i>) minimum	2000 (<i>13.8</i>) minimum	
	Percent	150 minimum	150 minimum	

CHEMICAL

PROPERTY	UNIT	RT-780 TYPE I TUBING	RT-780 TYPE II MOLDED PARTS	TEST METHOD
Copper Mirror Corrosion 16 hours at 175±3°C (347±5°F)	--	Non Corrosive	Non Corrosive	ASTM D 2671 Procedure A
Fungus Resistance	Growth	Rating of 1 or less	Rating of 1 or less	ASTM G 21
Water Absorption 24 hours at 23±3°C (73±5°F)	Percent	0.5 maximum	0.5 maximum	ASTM D 570
Flammability	--	1) 25% max. flag burn 2) No burning of cotton 3) No flaming or glowing longer than 30 seconds		ASTM D 2671 Procedure C
Average Burn Time Average extent of burning	Seconds Inches	--	15 maximum 1 maximum	ASTM D 635-98
Fluid Resistance 24 hours at 23±3°C (73±5°F) a) JP-8 Jet Fuel (MIL-DTL-83133)				RT-780
Followed by tests for:				
Tensile Strength	Psi (MPa)	2000 (13.8) minimum	2000 (13.8) minimum	
Ultimate Elongation	Percent	250 minimum	250 minimum	
Weight Increase	Percent	3 maximum	3 maximum	
24 hours at 50±3°C (122±5°F) a) Bore Cleaner (MIL-PRF-372) b) Diesel Fuel DF-2 (A-A-52557A) c) Anti-Icing Fluid (SAE-AMS-1424) d) Salt-5% solution (ASTM D 632) e) Lubricating Oil (MIL-PRF-2104) f) Lubricating Oil (MIL-PRF-23699) g) Arctic Lube (MIL-PRF-46167) h) Cleaning Compound (A-A-59133) i) Electrolyte (P/N 10873919)				
Followed by tests for:				
Tensile Strength	Psi (MPa)	2000 (13.8) minimum	2000 (13.8) minimum	
Ultimate Elongation	Percent	250 minimum	250 minimum	
Weight Increase	Percent	3 maximum	3 maximum	
24 hours at 71±3°C (160±5°F) Hydraulic, synthetic (MIL-PRF-46170)				
Followed by tests for:				
Tensile Strength	Psi (MPa)	2000 (13.8) minimum	2000 (13.8) minimum	
Ultimate Elongation	Percent	250 minimum	250 minimum	
Weight Increase	Percent	3 maximum	3 maximum	
4 hours at 23±3°C (73±5°F) a) Decontaminating Agent, DS-2 (MIL-D-50030) b) Decontaminating Agent, STB (MIL-DTL-12468) 5% Solution				RT-780
Followed by tests for:				
Tensile Strength	Psi (MPa)	2000 (13.8) minimum	2000 (13.8) minimum	
Ultimate Elongation	Percent	250 minimum	250 minimum	
Weight Increase	Percent	3 maximum	3 maximum	

PRODUCT DIMENSIONS

Size	As Supplied Inside Diameter		Recovered Dimensions							
	Minimum		Inside Diameter Maximum		Wall Thickness				Nominal	
	in.	mm	in.	mm	Minimum		Maximum		in.	mm
1/8	0.125	3.17	0.062	1.57	0.010	0.25	0.016	0.41	0.012	0.30
3/16	0.187	4.74	0.093	2.36	0.011	0.28	0.018	0.46	0.014	0.36
1/4	0.250	6.35	0.125	3.17	0.013	0.33	0.020	0.51	0.016	0.41
3/8	0.375	9.50	0.187	4.74	0.016	0.41	0.023	0.58	0.019	0.48
1/2	0.500	12.70	0.250	6.35	0.016	0.41	0.023	0.58	0.019	0.48
5/8	0.625	15.90	0.313	7.95	0.019	0.48	0.026	0.66	0.022	0.56
3/4	0.750	19.05	0.375	9.50	0.024	0.61	0.031	0.79	0.027	0.69
1	1.000	25.40	0.500	12.70	0.028	0.71	0.035	0.89	0.031	0.79
1-1/4	1.250	31.75	0.625	15.87	0.030	0.76	0.037	0.94	0.033	0.84
1-1/2	1.500	38.10	0.750	19.05	0.034	0.86	0.041	1.04	0.037	0.94
2	2.000	50.80	1.000	25.40	0.037	0.94	0.044	1.12	0.040	1.02

PHYSICAL

PROPERTY	UNIT	RT-790 TYPE I TUBING	RT-790 TYPE II MOLDED PARTS	TEST METHOD
Dimensions	Inches (<i>mm</i>)	In accordance with Table 1	In accordance with applicable SCD	RT-790
Tensile Strength	Psi (<i>MPa</i>)	4000 (<i>27.6</i>) minimum	4000 (<i>27.6</i>) minimum	ASTM D 412
Ultimate Elongation	Percent	300 minimum	300 minimum	ASTM D 412
Secant Modulus (expanded), 2%	Psi (<i>MPa</i>)	50,000 (<i>345</i>) maximum	50,000 (<i>345</i>) maximum	ASTM 882
Specific Gravity	--	2.0 maximum	2.0 maximum	ASTM D 792
Low Temperature Flexibility 4 hours at -65±3°C (-85±5°F)	--	No cracking	No cracking	RT-790
Heat Shock 4 hours at 300±5°C (572±9°F)	--	No dripping, flowing or cracking	No dripping, flowing or cracking	RT-790
Heat Resistance 336 hours at 250±3°C (482±5°F) Followed by tests for: Tensile Strength Ultimate Elongation				RT-790
	Psi (<i>MPa</i>)	2000 (<i>13.8</i>) minimum	2000 (<i>13.8</i>) minimum	
	Percent	150 minimum	150 minimum	

ELECTRICAL

PROPERTY	UNIT	RT-790 TYPE I TUBING	RT-790 TYPE II MOLDED PARTS	TEST METHOD
Dielectric Strength	Volts/mil (<i>kV/mm</i>)	200 (<i>7.9</i>) minimum	200 (<i>7.9</i>) minimum	ASTM D 149
Volume Resistivity	Ohm-cm	1 x 10 ¹¹ minimum	1 x 10 ¹¹ minimum	ASTM D 257

NUCLEAR

PROPERTY	UNIT	RT-790 TYPE I TUBING	RT-790 TYPE II MOLDED PARTS	TEST METHOD
Radiation Resistance -10 Mrads gamma Followed by tests for: Tensile Strength Ultimate Elongation				RT-770
	Psi (<i>MPa</i>)	3000 (<i>20.7</i>) minimum	3000 (<i>20.7</i>) minimum	
	Percent	150 minimum	150 minimum	

CHEMICAL

PROPERTY	UNIT	RT-770 TYPE I TUBING	RT-770 TYPE II MOLDED PARTS	TEST METHOD
Copper Mirror Corrosion 16 hours at 200±3°C (392±5°F)	--	Non Corrosive	Non Corrosive	ASTM D 2671 Procedure A
Fungus Resistance	Growth	Rating of 1 or less	Rating of 1 or less	ASTM G 21
Water Absorption 24 hours at 23±3°C (73±5°F)	Percent	0.5 maximum	0.5 maximum	ASTM D 570
Flammability	--	1) 25% max. flag burn 2) No burning of cotton 3) No flaming or glowing longer than 30 seconds		ASTM D 2671 Procedure C
Average Burn Time Average extent of burning	Seconds Inches	--	15 maximum 1 maximum	ASTM D 635-98
Fluid Resistance 24 hours at 23±3°C (73±5°F) a) JP-8 Jet Fuel (MIL-DTL-83133)				RT-790
Followed by tests for:				
Tensile Strength	Psi (MPa)	3500 (24.1) minimum	3500 (24.1) minimum	
Ultimate Elongation	Percent	250 minimum	250 minimum	
Weight Increase	Percent	3 maximum	3 maximum	
24 hours at 50±3°C (122±5°F) a) Bore Cleaner (MIL-PRF-372) b) Diesel Fuel DF-2 (A-A-52557A) c) Anti-Icing Fluid (SAE-AMS-1424) d) Salt-5% solution (ASTM D 632) e) Lubricating Oil (MIL-PRF-2104) f) Lubricating Oil (MIL-PRF-23699) g) Arctic Lube (MIL-PRF-46167) h) Cleaning Compound (A-A-59133) i) Electrolyte (P/N 10873919)				
Followed by tests for:				
Tensile Strength	Psi (MPa)	3500 (24.1) minimum	3500 (24.1) minimum	
Ultimate Elongation	Percent	250 minimum	250 minimum	
Weight Increase	Percent	3 maximum	3 maximum	
24 hours at 71±3°C (160±5°F) Hydraulic, synthetic (MIL-PRF-46170)				
Followed by tests for:				
Tensile Strength	Psi (MPa)	3500 (24.1) minimum	3500 (24.1) minimum	
Ultimate Elongation	Percent	250 minimum	250 minimum	
Weight Increase	Percent	3 maximum	3 maximum	
4 hours at 23±3°C (73±5°F) a) Decontaminating Agent, DS-2 (MIL-D-50030) b) Decontaminating Agent, STB (MIL-DTL-12468) 5% Solution				RT-790
Followed by tests for:				
Tensile Strength	Psi (MPa)	3500 (24.1) minimum	3500 (24.1) minimum	
Ultimate Elongation	Percent	250 minimum	250 minimum	
Weight Increase	Percent	3 maximum	3 maximum	