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Note: Users should independently evaluate the suitability of the product for their application. Before ordering, check with Tyco Electronics for most current data.

Introduction

Tyco Electronics provides wire and cable solutions for challenging environments and demanding applications. The Raychem product range includes high-performance insulated wires, coaxial and data bus cables, power cables, electronics wire, and multicore cables.

- SPEC 44 wire is an economical yet rugged dual-wall insulation system rated at 150°C [221°F], with consistently low cost and reliable performance.
- SPEC 55 wire insulation provides high reliability in harsh environments from -65°C to +200°C [-85°F to +392°F]. Resistant to electrical arc tracking, it combines the easy handling of a flexible wire with excellent resistance to scrapes, abrasion, and cut-through.
- RCW is a small size, ultra light weight insulated wire with a temperature rating of -65°C to +260°C [-85°F to +500°F]. It is resistant to electrical arc tracking in wet or dry conditions and has excellent cut-through resistance.
- Type 99T dual-wall insulation system is a 105°C [221°F] rated wire that combines excellent chemical and mechanical resistance with limited fire hazard performance.
- ElectroLoss Filterline wire reduces the vulnerability of critical circuits to high-frequency electromagnetic interference.
- Cheminax coaxial and data bus cables allow system designers to optimize minimum size and weight with impedance and attenuation characteristics.
- Multiconductor (multicore) cables organize a variety of Raychem wire and cable products in controlled geometries for specific applications. Using a computer-aided design system, Tyco Electronics can quickly design multicore cables to meet your needs. A variety of cable jackets are available to suit most applications.

Raychem wire and cable products can meet your specific application needs. Here are just a few examples:

- Limited-fire-hazard wire and cable for mass transit and marine applications.
- High-performance, high temperature automotive wiring.
- Small, light hookup wires for high-temperature applications in commercial appliances, tools, and devices.
- Very flexible, rugged, thin-wall insulated power cables.
- Low-outgassing space-vehicle wiring.
- Lightweight, shielded wire and cable constructions for aerospace applications.
- Thermocouple extension cables with a range of our high-performance insulations materials.

Contact Tyco Electronics to find out more about wire and cable and our associated interconnection products.

SPEC 44

Product Facts

- Dual wall construction
- 600, 1000 and 2500 voltage rating
- Small size, light weight
- Low smoke and low corrosive gas generation
- Resistant to most chemicals and electrical arc tracking



Applications

SPEC 44 wire has a dual wall construction which combines the outstanding physical and electrical characteristics of radiation crosslinked polyalkene with the excellent mechanical and chemical properties of radiation cross-linked polyvinylidene fluoride (PVDF).

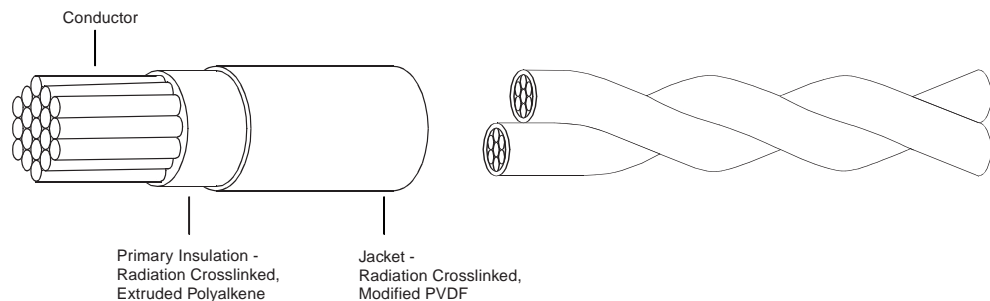
The result is a wire insulation system that offers a 150°C [302°F] temperature rating, small size, light weight, solder iron resistance, and resistance to most solvents, fuels and lubricants.

SPEC 44 wire and cable is highly flame retardant, non-melting, does not cold flow,

and though mechanically very tough, is easy to handle and install using conventional tools.

Originally developed for aerospace and military requirements in applications of high density and complex circuitry, SPEC 44 wire and cable now finds wide use throughout industry, in commercial and military electronics, avionics, on satellites, aircraft, helicopters, ships, trains, and offshore platforms where environmental conditions demand consistently reliable performance. In air-frame applications SPEC 44 constructions can offer a modern dimensional

replacement for PVC/Nylon/ Glass braid type wire and cables. SPEC 44 wire is offered in a wide range of sizes in stranded conductors, standard materials available being tin or silver-plated copper and high strength copper alloy. Voltage ratings of 600, 1000 and 2500 volts are available as standard. Shielded and jacketed versions include single and multi-conductor constructions and flat braid shields where further size and weight savings are achieved.



Available in:	Americas	Europe	Asia Pacific
	■	■	■

SPEC 44 (Continued)

Physical Characteristics

Small Size

SPEC 44 equipment wire, 600 volt rated has a 0.19 [.008] nominal wall thickness compared to 0.25 [.010] and 0.38 [.015] for equivalent PTFE and PVC wires in MIL-W-16878, MIL-W-22759 or BS G210.

Light Weight

Because of the thin wall and low density of the insulation materials considerable weight savings are made over similarly rated PTFE wires, eg:- 44A0111-22AWG equipment wire 4.62 grams/meter max
22 AWG PTFE equipment wire, MIL-W-81044 5.54 grams/meter max

General Handling

The flexibility of SPEC 44 and the ease with which it takes a 'set' makes it one of the easiest of the 'high performance' wires to install. Stripping is done with conventional die blade strippers.

For details of appropriate tools see separate wire handling guide. The tin-plated conductor usually specified is easily soldered or crimped. The insulation may be hot stamp marked or printed and does not need etching before potting.

Lengths

SPEC 44 is available in long continuous lengths and can be supplied for use on automatic cut and strip wire preparation machines.

Specifications/Approvals

MIL-W-81044, NEMA-WC-27500 (Cables)

Def Stan. 61-12 Part 18 Issue 4 - Type 1 pliable (Maintenance Range)

Def Stan. 61-12 Part 26 Issue 3 Type 2, 3, 8 & 9 & METS

VG 95218 Parts 20, 21, 22, 23 and 1000

NATO Stock Numbers (NSN's) exist for most standard constructions

Civil Aviation Authority Accessory Approval E11623

Lloyds Register of Shipping

NASA Preferred Product List

Raychem Specification 44

Typical Properties

Temperature rating	-65°C to +150°C [-85°F to +302°F]
Voltage rating (thin wall)	600 V
Voltage rating (thick wall)	2500 V
Tensile strength and elongation of insulation	28 N/mm ² , 230%, 4000 PSI
Notch propagation, 0.05mm notch	Pass
Solder iron resistance (370°C, 1 minute)	Pass
Shrinkage, 200°C	<1%
Low temperature bend	-65°C [-85°F]
Voltage withstand (thin wall)	2500 V
Resistance: fuels, oils, solvents	Pass

SPEC 44 (Continued)

Environmental Performance

Temperature Rating

SPEC 44 wire and cable is rated for continuous operation from -65°C to +150°C [-85°F to +302°F] and for short periods at temperatures as high as 300°C [572°F]. Heat ageing tests are routinely performed at temperatures of 200°C [392°F] (168 h) and 300°C [572°F] (6 h). In addition SPEC 44 insulation will not shrink back under repeated cycling.

Mechanical Performance

SPEC 44 wire provides better cut through resistance than some wires with much thicker walls. 600 volt equipment wire 44A0111 (0.19 mm wall) has 40% greater cut through resistance than 600 volt PTFE insulated wire (0.25 mm wall).

Solder Iron/Overload Resistance

The radiation crosslinking of the materials used in SPEC 44 makes them non-melting at high temperature. As a result SPEC 44 wire is resistant to prolonged contact with solder irons and is resistant to current overloads which would melt most thermoplastic insulations.

Chemical Resistance

The irradiated dual wall construction of SPEC 44 wire is highly resistant to many acids, alkalis, hydrocarbon solvents, fuels, lubricants, water, and many missile fuels and oxidizers.

Cold Flow

Radiation cross-linking of SPEC 44 prevents cold flow of the insulation — a recognized problem of some uncrosslinked materials.

Voltage Ratings

Standard available voltage ratings for SPEC 44 wire are 600 volts (0.19 mm wall thickness), 1000 volts (0.28 mm wall) and 2500 volts (0.48 mm wall).

Electrical Arc Track Resistance

SPEC 44 insulation demonstrates a total resistance to arc tracking under both wet and dry conditions at aircraft system voltages.

Low Outgassing

For use in space applications, special constructions of SPEC 44 wire are available with low outgassing characteristics, for use in an environment of high vacuum and high temperature.

Fire Hazard Performance

Flammability	Federal Aviation Reg FAR-25	Pass
	BS4066 vertical flammability	Pass
	S424 14751 (Swedish chimney)	Pass
	NFC 32070 (2) (French chimney)	Pass
	IEC 332 part 3 (Cable ladder)	Pass
Smoke/Toxicity Index	Smoke Index, Def Stan 61-12 (18)	6 per meter of wire
	Toxicity Index, Def Stan 61-12 (18)	0.8 per meter of wire
	Oxygen Index, NES 714	30% Oxygen
	Temperature Index, NES 715	>300°C [572°F]

Part Numbering System

44 X X X X X- AWG- X/X- X

Basic Product Number

Temperature Rating:

- / - 135°C (XL-PVF2 cable jacket)
- A - 150°C (XL-PVF2 cable jacket)
- AC - 150°C (same as 44AM with 90% min. shield coverage)
- AM - 150°C (M27500, shielded and/or XL-PVF2 jacketed cable)
- B - 150°C (XL-ETFE cable jacket)

Construction

- 0 - Primary wire; or unshielded & unjacketed cable
- 1 - Round braid shielded and jacketed cable**
- 2 - Tin-coated copper flat braid shielded & jacketed cable
- 3 - Round braid shielded cable, no jacket**
- 4 - Jacketed cable, no shield
- 5 - Spiral braid shielded & jacketed cable**
- 7-9 - Special constructions

Class of Wire

- 1 - 600 V, general purpose
- 2 - 1000 V, general purpose
- 3 - 2500 V, general purpose
- 4 - 600 V, outerspace*
- 5 - 1000 V, outerspace*
- 6 - 2500 V, outerspace*
- 7 - 600 V, airframe
- 8 - 600 V, medium weight

Number of Conductors

1 through 10 (designator for 10 conductor = 0)

Conductor Type

- 1 - Tin-coated copper
- 2 - Silver-coated copper
- 3 - Nickel-coated copper
- 4 - Silver-coated high strength copper alloy
- 5 - Aluminum
- 6 - Nickel-coated high strength copper alloy
- A - Silver-coated CS95
- C - Silver-coated high strength copper alloy (cadmium-free)
- D - Nickel-coated high strength copper alloy (cadmium-free)

Conductor Size (AWG)

Primary Wire Insulation Color

(code per MIL-STD-681)

- 0 - Black
- 1 - Brown
- 2 - Red
- 3 - Orange
- 4 - Yellow
- 5 - Green
- 6 - Blue
- 7 - Violet
- 8 - Gray
- 9 - White

Jacket Color

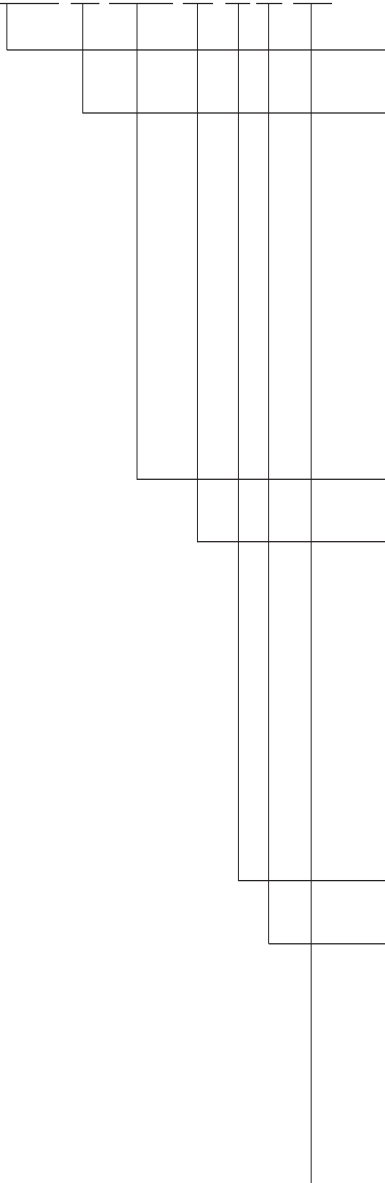
(codes same as for Primary Wire Insulation Color)

* Classes 4, 5 and 6 available only as "44/" constructions. 44/7xxx and 44A7xxx will be available as indicated on the applicable SCD.
 **Shield coating same as conductor coating except: - for Conductor Type 4, 6, C and D, shield shall be tin-coated copper

Typical ordering example	3 conductors, brown, yellow with green stripe, blue, white jacket. If 600 volt, round braid, 20 AWG tinned conductor, 44A1131-20-1/45/6-9.
Ordering information	Other constructions and custom designed wire and cable are available on request.

NEMA WC-27500 Cable
Part Numbering System

M27500 X AWG XX X X XX



Basic Specification Number

Component Wire ID/Shield Coverage Code

Shield Coverage

85%	90%
-	C
A	D
B	E
F	H
G	J
K	M
L	N
P	R
S	T

Component Wire Identification

- Colored Stripes on White Wire (9/96/93/95/92/90/94/97/98/91... etc.)
- Solid Color Wires (9/6/3/5/2/0/4/7/8/1...etc.)
- Band Marks on Solid Colors (by AWG)
- Alternate Colored Stripes (92/96/94/95/9/90/91/93/97/98...etc)
- Alternate Solid Colors (2/6/4/5/9/0/1/3/7/8...etc.)
- Number Marking on Solid Colors (by AWG)
- Number Marking on White Wires
- Band Marks on Colored Stripes (by AWG)
- Band Marks on White Wires

Conductor Size (AWG)

Basic Wire Spec Code (MIL-W-81044) and Slash Sheet

- MD - M81044/5 (44A0712)
- ME - M81044/6 (44A0711)
- MF - M81044/7 (44A0714)
- MG - M81044/8 (44A0812)
- MH - M81044/9 (44A0811)
- MJ - M81044/10 (44A0814)
- MK - M81044/11 (44A0112)
- ML - M81044/12 (44A0111)
- MM - M81044/13 (44A0114)

Number of Component Wires

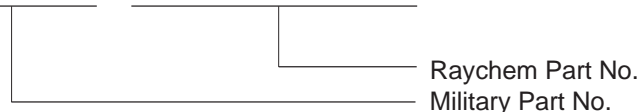
Shield Material and Style Code

- U - No shield
- T - Tin-coated copper, round
- J - Tin-coated copper, flat
- S - Silver-coated copper, round
- G - Silver-coated copper, flat
- N - Nickel-coated copper, round

Jacket Material and Style Code

- 00 - No jacket
- 08 - Crosslinked, white PVDF
- 23 - Crosslinked, white Modified ETFE

Example: **M27500-22ML3T08 = 44AM1131-22-9/96/93-9**



SPEC 44 (Continued)

Primary Wires/Twisted Pair



44A011X (600 V)
Primary Wire

44A021X (1000 V)
Primary Wire

Wire Size (AWG)	Stranding		CSA (mm ²)	44A011X (600 V)		44A021X (1000 V)	
	(mm)	#/AWG		Nom. OD	Max. Weight (g/m) lb/kft	Nom. OD	Max. Weight (g/m) lb/kft
30	7/0.10	7/38	0.06	0.68 [0.027]	1.06 [0.71]	—	—
28	7/0.13	7/36	0.09	0.76 [0.030]	1.43 [0.96]	—	—
26*	19/0.10	19/38	0.15	0.86 [0.034]	2.08 [1.4]	1.02 [0.040]	2.38 [1.6]
24	19/0.13	19/36	0.25	1.02 [0.040]	2.98 [2.0]	1.17 [0.046]	3.57 [2.4]
22	19/0.16	19/34	0.40	1.19 [0.047]	4.46 [3.0]	1.37 [0.054]	5.20 [3.5]
20	19/0.20	19/32	0.60	1.40 [0.055]	6.70 [4.5]	1.57 [0.062]	7.59 [5.1]
18	19/0.25	19/30	1.00	1.65 [0.065]	10.12 [6.8]	1.85 [0.073]	11.46 [7.7]
16	19/0.29	19/29	1.25	1.83 [0.072]	12.80 [8.6]	2.06 [0.081]	14.58 [9.8]
14	19/0.36	19/27	2.00	2.26 [0.089]	19.64 [13.2]	2.49 [0.098]	21.88 [14.7]
12	37/0.32	37/28	3.00	2.74 [0.108]	30.06 [20.0]	2.97 [0.117]	32.89 [22.1]
10	37/0.40	37/26	5.00	3.28 [0.129]	46.28 [31.1]	3.71 [0.146]	52.98 [35.6]
8	133/0.29	133/29	—	—	—	5.23 [0.206]	91.97 [61.8]

*For 44A0211-26 the stranding is 7/0.16mm 7/34 AWG



44A031X (2500 V)
Primary Wire

44A081X (600 V)
Airframe Wire

44A012X (600 V)
Twisted Pair

44A031X (2500 V)		44A081X (600 V)		44A012X (1000 V)	
Nom. OD	Max. Weight (g/m) lb/kft	Nom. OD	Max. Weight (g/m) lb/kft	Nom. OD	Max. Weight (g/m) lb/kft
—	—	—	—	1.37 [0.054]	2.38 [1.6]
—	—	—	—	1.52 [0.060]	3.13 [2.1]
1.35 [0.053]	3.13 [2.1]	1.22 [0.048]	2.98 [2.0]	1.73 [0.068]	4.47 [3.0]
1.44 [0.057]	4.46 [3.0]	1.37 [0.054]	3.87 [2.6]	2.03 [0.080]	6.69 [4.5]
1.75 [0.069]	6.40 [4.3]	1.57 [0.062]	5.65 [3.8]	2.38 [0.094]	9.82 [6.6]
1.98 [0.078]	9.08 [6.1]	1.78 [0.070]	8.04 [5.4]	2.79 [0.110]	14.73 [9.9]
2.23 [0.088]	12.95 [8.7]	2.03 [0.080]	11.91 [8.0]	3.30 [0.130]	22.32 [15.0]
2.46 [0.097]	16.22 [10.9]	2.26 [0.089]	14.73 [9.9]	3.65 [0.144]	28.42 [19.1]
2.92 [0.115]	24.10 [16.2]	2.74 [0.108]	22.17 [14.9]	4.52 [0.178]	44.35 [29.8]
3.32 [0.131]	36.01 [24.2]	3.20 [0.126]	32.59 [21.9]	5.48 [0.216]	69.00 [46.5]
4.09 [0.161]	54.32 [36.5]	3.94 [0.155]	52.08 [35.0]	—	—
96.20 [0.219]	96.73 [65.0]	92.94 [0.214]	93.46 [62.8]	—	—

SPEC 44 (Continued)

Shielded and Jacketed Cable



44A111X (600 V)
1 Conductor



44A121X (600 V)
1 Conductor

Wire Size (AWG)	Stranding		44A111X (600 V)		44A121X (600 V)	
	(mm)	#/AWG	Nom. OD	Max. Weight (g/m) lb/kft	Nom. OD	Max. Weight (g/m) lb/kft
30	7/0.10	7/38	1.47 [0.058]	5.20 [3.5]	—	—
28	7/0.13	7/36	1.55 [0.061]	5.80 [3.9]	1.60 [0.063]	5.65 [3.8]
26	19/0.10	19/38	1.57 [0.065]	6.84 [4.6]	1.73 [0.068]	6.85 [4.6]
24	19/0.13	19/36	1.83 [0.072]	8.63 [5.8]	1.98 [0.078]	9.67 [6.5]
22	19/0.16	19/34	2.01 [0.079]	10.71 [7.2]	2.24 [0.088]	12.35 [8.3]
20	19/0.20	19/32	2.26 [0.089]	14.73 [9.9]	2.54 [0.100]	17.41 [11.7]
18	19/0.25	19/30	2.62 [0.103]	20.68 [13.9]	2.82 [0.111]	22.62 [15.2]
16	19/0.29	19/29	2.79 [0.110]	24.55 [16.5]	3.02 [0.119]	26.64 [17.9]
14	19/0.36	19/27	3.22 [0.127]	34.08 [22.9]	3.45 [0.136]	36.16 [24.3]
12	37/0.32	37/28	3.70 [0.146]	47.77 [32.1]	4.14 [0.155]	49.56 [33.3]

Other sizes are also available in some constructions depending on conductor type and construction required.



44A181X (600 V)
1 Conductor



44A112X (600 V)
2 Conductor

Wire Size (AWG)	44A181X (600 V)		44A112X (600 V)	
	Nom. OD	Max. Weight (g/m) lb/kft	Nom. OD	Max. Weight (g/m) lb/kft
30	—	—	2.23 [0.088]	8.63 [5.8]
28	—	—	2.38 [0.094]	9.82 [6.6]
26	—	—	2.59 [0.102]	12.05 [8.1]
24	2.26 [0.089]	11.76 [7.9]	2.99 [0.118]	16.82 [11.3]
22	2.57 [0.101]	15.48 [10.4]	3.35 [0.132]	21.57 [14.5]
20	2.77 [0.109]	19.19 [12.9]	3.76 [0.148]	27.97 [18.8]
18	3.02 [0.119]	24.11 [16.2]	4.32 [0.170]	38.24 [25.7]
16	3.25 [0.128]	28.13 [18.9]	4.67 [0.184]	44.94 [30.2]
14	3.73 [0.147]	38.69 [26.0]	5.53 [0.218]	64.28 [43.2]
12	4.19 [0.165]	52.38 [35.2]	6.50 [0.256]	91.51 [61.5]

Other sizes are also available in some constructions depending on conductor type and construction required.

SPEC 55

Product Facts

- Resistant to electrical arc tracking in wet or dry conditions
- Single or dual wall constructions
- Small size, ultra light weight
- Exceptional chemical resistance
- -65°C to 200°C [-85°F to 392°F]



Applications

SPEC 55 wire is insulated with modified radiation cross-linked ETFE polymer. It has a temperature rating of -65°C to 200°C [-85°F to 392°F] continuous using a silver plated copper conductor, and combines the easy handling of a flexible wire with excellent scrape abrasion and cut-through characteristics.

The dual wall airframe construction of SPEC 55 wire is currently used on numerous aircraft programs. It has a choice of two total wall thicknesses, 0.25 [.010] (55A08XX 10 mil) and 0.2 [.008] (55A02XX 8 mil). Both have a contrasting core color to act as a damage indicator. Chosen for its balance of properties, SPEC 55 wire has outstanding resistance to chemicals and solvents, excellent electrical arc track resistance, and is not susceptible to UV and moisture degradation. Single wall equipment wire constructions are available in 0.10 [.004] (55/03XX 4 mil) and 0.15 [.006] (6 mil) wall thicknesses for use inside black boxes where flexibility and solder-iron resistance make it a wire which is very easy to install reliably.

Both single and dual wall insulated wires are available

in twisted pairs, triples, etc., and as shielded and jacketed cables.

Physical Characteristics

Size and Weight

SPEC 55 wire provides one of the most comprehensive wiring product ranges for aerospace users, with a wide choice of conductor sizes and insulation wall thicknesses. The dual wall airframe wire has an insulation wall thickness of either 0.2 [.008] or 0.25 [.010] for robustness in unprotected harnesses and has excellent wire to wire abrasion properties.

The single wall equipment wire has a 0.15 [.006] wall thickness for use inside equipment and protected harnesses. For high density, interconnect wiring, the 450 volt 55M041X series of equipment wire has a nominal 0.1 [.004] wall and provides considerable weight and size savings over other comparable wires.

Handling

The excellent flexibility and handleability makes SPEC 55 the ideal wire to install, both in new aircraft and equipment and for maintenance purposes. The wire is easily stripped with conventional tooling. The insulation is readily marked

by hot stamp, ink jet or laser, and can be potted without pre-etching.

SPEC 55PC Wire and Cable Insulation System

This product was originally developed to meet Boeing's material standard BMS13-48 for the 777 airliner. SPEC 55PC provides lightweight, compact insulation that matches the proven performance of our SPEC 55 wire. Today, 55PC is specified and utilized on the majority of aerospace platforms worldwide.

Tyco Electronics' rigorous, statistical-process-controlled manufacturing has produced Raychem wiring that is rugged and versatile enough for a wide range of commercial and defense aerospace applications, including electronic hook-ups in harsh, open airframe environments.

SPEC 55PC wire and cable systems feature an 8-mil airframe wire that is lighter and smaller than typical 10-mil wire, with little reduction in key mechanical performance features. SPEC 55PC wire offers flame resistance superior to FAA standards and also resists scrape abrasion, notch, propagation, cut-through, and electrical arc tracking.

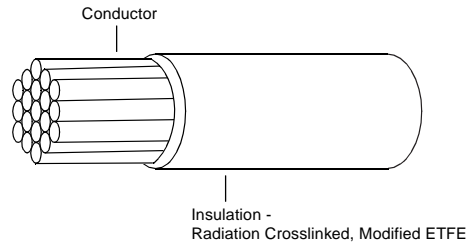
- Meets Boeing material standard BMS 13-48.
- Exceeds FAR 25 test requirements for flame resistance and smoke density.

Available in:

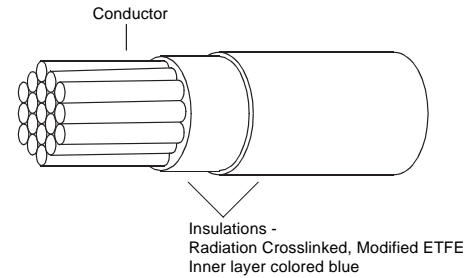
- Americas ■
- Europe ■
- Asia Pacific ■

SPEC 55 (Continued)

Specifications



SPEC 55 insulation system - single wall



SPEC 55 insulation system - dual wall

MIL-W-22759/32-35 and /41 to /46 and NEMA-WC-27500 (Cables)
Defense Standard 61-12 Part 33 Issue 4
Part 1001 and Part 1002
VDE 9426, 9427, 9428
British Standard 3G233
Civil Aviation Authority Accessory Approval E11749
Boeing BMS 13-48
Airbus ABS 0820 to 0826
NASA preferred product list
European Space Agency 3901/012, 3901/020 and 3901/022
Raychem Specification 55

Typical Properties

Temperature rating (Tin plated conductor)	-65°C to +150°C [-85°F to +302°F]
(Silver or nickel plated conductor)	-65°C to +200°C [-85°F to +392°F]
Thermal endurance	200 °C [392°F], 10000 h
Scrape abrasion (BS 3G233)	>100 cycles at 150°C [302°F]
Flexing endurance (Boeing BSS 7324)	>1000 cycles
Voltage rating	600 V, 450V
Tensile strength + elongation (core only)	(Dual wall wire) 35 N/mm ² , 125% min.
Tensile strength + total elongation (core & primary jacket)	(Dual wall wire) 35 N/mm ² , 75% min.
Notch propagation BS 3G230 0.05 mm notch	Pass
Solder iron resistance (370 °C, 1 minute)	Pass
Solderability - Tin plated copper conductor BS 3G233 conditions	<0.8 secs to wet
Shrinkage	<1%
Long term water resistance	Will not hydrolyze
Permittivity 1 KHz (ASTM D150)	2.7
Dissipation factor (ASTM D150)	0.001
FAR 25	⊖
Afterburn (sec)	30 sec. max.
Burn length	75 mm [3 in.] max.

SPEC 55 (Continued)

Environmental Performance

Temperature Rating

SPEC 55 wire and cable is rated for continuous operation from -65°C to +200°C [-85°F to +392°F] and for short periods at temperatures as high as 400°C [752°F].

Mechanical Performance

Radiation crosslinking of the SPEC 55 insulation significantly improves the following mechanical characteristics; scrape (sharp edges), cross wire abrasion, cut-through resistance and creep resistance.

Solder Iron/Overload Resistance

Radiation crosslinking ensures that the insulation resists melting at high temperatures. As a result SPEC 55 wire is resistant to hot solder irons and current overloads which would melt most thermoplastic insulations.

Chemical Resistance

SPEC 55 is unaffected by all commonly used chemicals, eg. fuels, hydraulic fluids, defluxing agents, cleaners, coolants and de-icers. It also shows excellent resistance to weathering (UV, ozone, pollutants, water).

Space Wire

SPEC 55 is available in special versions suitable for use in outer space meeting both ESA and NASA requirements for outgassing.

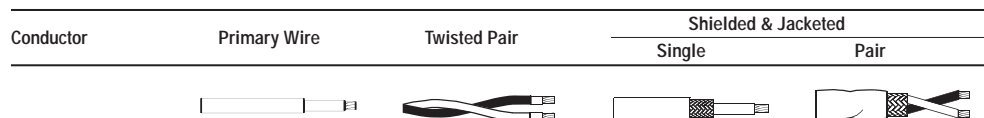
Flammability

Special additives increase the flame retardance of SPEC 55 compared to unirradiated ETFE so that it meets the latest high performance tests, eg. BS 3G230 vertical test FAR 25.

Electrical Arc Tracking Resistance

SPEC 55 insulation demonstrates resistance to arc tracking under both wet and dry conditions at aircraft system voltages.

SPEC 55 Wire & Cable:
Standard Constructions,
Nominal Sizes, Strandings,
Diameters and Weights



55PC - Extra Light Weight Constructions

For applications where weight is critical, light weight tight tolerance conductors and insulations are available. These are manufactured using statistical process control methods and achieve weights that are equal or lighter than the equivalent polyimide/PTFE constructions.

55A - AWG Conductor:
Equipment/Interconnect Wires
& Cables

SPEC 55 (Continued)

Wire Size (AWG)	Stranding (mm)	55A011X		55A012X	
		Nom. OD	Max. Weight (g per m/lbs per kft)	Nom. OD	Max. Weight (g per m/lbs per kft)
30	7/0.102	0.61 [0.024]	0.98 [0.66]	1.27 [0.048]	1.94 [1.3]
28	7/127	0.68 [0.027]	1.35 [0.91]	1.42 [0.054]	2.68 [1.8]
26	19/102	0.81 [0.032]	2.08 [1.4]	1.67 [0.064]	4.16 [2.8]
24	19/127	0.94 [0.037]	2.98 [2.0]	1.93 [0.074]	5.96 [4.0]
22	19/0.16	1.09 [0.043]	4.17 [2.8]	2.23 [0.086]	8.63 [5.8]
20	19/0.203	1.27 [0.050]	6.40 [4.3]	2.66 [0.102]	13.24 [8.9]
18	19/0.25	1.52 [0.060]	9.67 [6.5]	3.20 [0.122]	20.09 [13.5]
16	19/287	1.73 [0.068]	12.35 [8.3]	3.58 [0.138]	25.75 [17.3]
14	19/0.36	2.20 [0.085]	19.34 [13.0]	4.47 [0.172]	39.58 [26.6]
12	37/0.32	2.62 [0.103]	29.32 [19.7]	5.38 [0.208]	59.97 [40.3]
10	37/0.403	3.25 [0.128]	47.32 [31.8]	6.65 [0.256]	96.58 [64.9]
8	133/0.287	4.77 [0.188]	87.50 [58.8]	9.80 [0.376]	178.58 [120.0]

Wire Size (AWG)	55A111X		55A112X	
	Nom. OD	Max. Weight (g per m/lbs per kft)	Nom. OD	Max. Weight (g per m/lbs per kft)
30	1.51 [0.057]	5.06 [3.4]	2.12 [0.081]	7.74 [5.2]
28	1.59 [0.060]	5.80 [3.9]	2.27 [0.087]	8.90 [6.0]
26	1.71 [0.065]	6.85 [4.6]	2.53 [0.097]	11.32 [7.6]
24	1.84 [0.070]	8.19 [5.5]	2.80 [0.107]	13.84 [9.3]
22	1.99 [0.076]	10.27 [6.9]	3.07 [0.119]	17.86 [12.0]
20	2.20 [0.084]	13.40 [9.0]	3.50 [0.135]	23.81 [16.0]
18	2.45 [0.094]	17.86 [12.0]	4.10 [0.155]	32.60 [21.9]
16	2.67 [0.102]	21.73 [14.6]	4.43 [0.171]	39.73 [26.7]
14	3.10 [0.119]	30.36 [20.4]	5.30 [0.205]	57.00 [38.3]
12	3.55 [0.137]	42.41 [28.5]	6.30 [0.243]	81.10 [54.5]
10	4.20 [0.161]	62.65 [42.1]	—	—
8	5.80 [0.223]	110.42 [74.2]	—	—

55A - AWG Conductor:
Airframe Wires & Cables

Wire Size (AWG)	Stranding (mm)	55A081X		55A082X	
		Nom. OD	Max. Weight (g per m/lbs per kft)	Nom. OD	Max. Weight (g per m/lbs per kft)
26	19/102	1.01 [0.040]	2.5 [1.7]	2.10 [0.080]	5.06 [3.4]
24	19/127	1.14 [0.045]	3.4 [2.3]	2.33 [0.090]	6.84 [4.6]
22	19/0.16	1.27 [0.050]	4.8 [3.2]	2.64 [0.102]	9.98 [6.7]
20	19/0.203	1.47 [0.058]	7.0 [4.7]	3.07 [0.118]	14.73 [9.9]
18	19/0.25	1.78 [0.070]	10.7 [7.2]	3.63 [0.140]	21.88 [14.7]
16	19/287	1.96 [0.077]	13.4 [9.0]	4.06 [0.156]	27.53 [18.5]
14	19/0.36	2.40 [0.094]	20.5 [13.8]	4.90 [0.190]	42.26 [28.4]
12	37/0.32	2.82 [0.111]	30.5 [20.5]	5.80 [0.224]	63.00 [42.3]
10	37/0.403	3.40 [0.134]	48.3 [32.4]	7.10 [0.272]	98.96 [66.5]

Wire Size (AWG)	55A181X		55A182X	
	Nom. OD	Max. Weight (g per m/lbs per kft)	Nom. OD	Max. Weight (g per m/lbs per kft)
26	1.71 [0.073]	7.89 [5.3]	2.63 [0.113]	14.29 [9.6]
24	1.84 [0.078]	9.37 [6.3]	2.80 [0.123]	16.37 [11.0]
22	1.99 [0.084]	11.76 [7.9]	3.07 [0.135]	20.68 [13.9]
20	2.20 [0.092]	14.88 [10.0]	3.50 [0.151]	27.08 [18.2]
18	2.45 [0.103]	19.79 [13.3]	4.10 [0.173]	36.46 [24.5]
16	2.67 [0.111]	23.81 [16.0]	4.43 [0.189]	42.86 [28.8]
14	3.10 [0.128]	33.03 [22.2]	6.30 [0.225]	61.61 [41.4]
12	3.55 [0.145]	45.09 [30.3]	6.30 [0.259]	85.42 [57.4]
10	4.20 [0.168]	66.97 [45.0]	— [0.308]	127.54 [85.7]

55PC - AWG Conductor:
Statistical Process Controlled
Airframe Wires & Cables

SPEC 55 (Continued)

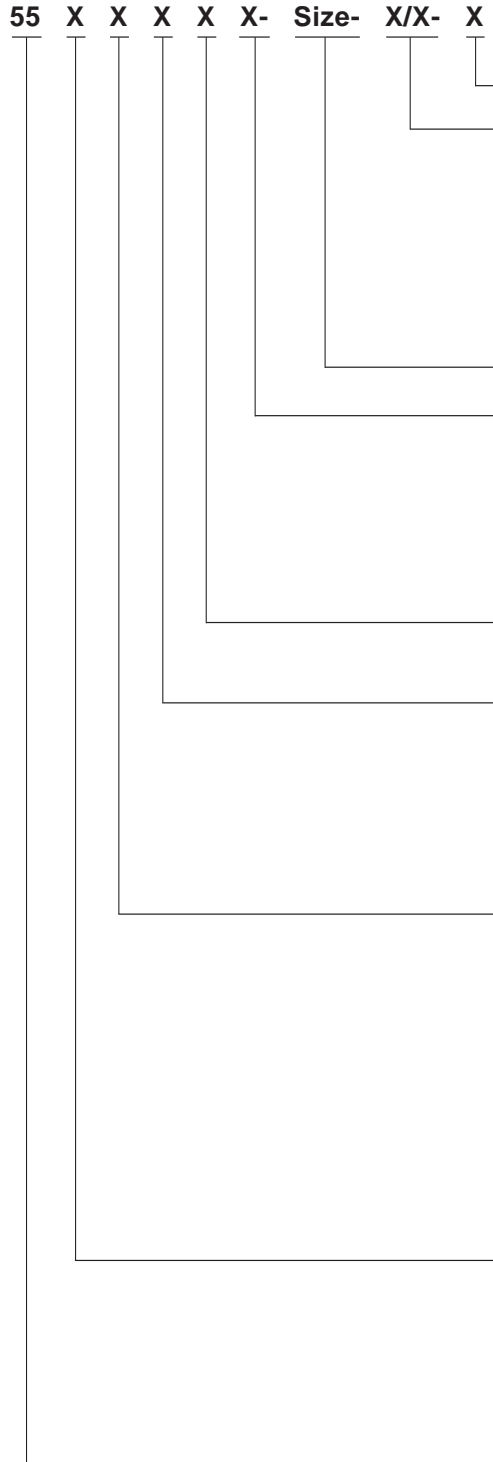
Wire Size (AWG)	Stranding (mm)	55PC021X		55PC022X	
		Nom. OD	Max. Weight (g per m/lbs per kft)	Nom. OD	Max. Weight (g per m/lbs per kft)
26	19/102	0.087 [0.045]	2.05 [1.38]	—	—
24	19/127	1.00 [0.0395]	2.95 [1.98]	2.00 [0.079]	5.95 [4.00]
22	19/0.16	1.15 [0.0455]	4.31 [2.90]	2.31 [0.091]	8.74 [5.87]
20	19/0.203	1.37 [0.0540]	6.51 [4.38]	2.74 [0.108]	13.2 [8.87]
18	19/0.25	1.61 [0.0635]	9.81 [6.59]	3.22 [0.127]	19.84 [13.33]
16	19/287	1.80 [0.0710]	12.46 [8.37]	3.60 [0.142]	25.21 [16.94]
14	19/036	2.18 [0.0860]	19.17 [12.88]	4.36 [0.172]	38.80 [26.07]
12	37/0.32	2.66 [0.1047]	29.36 [19.73]	5.30 [0.209]	59.42 [39.93]
10	37/0.403	3.27 [0.1290]	46.31 [31.12]	6.55 [0.258]	93.92 [63.11]

Wire Size (AWG)	55PC121X		55PC122X	
	Nom. OD	Max. Weight (g per m/lbs per kft)	Nom. OD	Max. Weight (g per m/lbs per kft)
26	1.52 [0.064]	6.54 [4.4]	2.33 [0.100]	11.34 [7.62]
24	1.65 [0.069]	7.86 [5.28]	2.89 [0.109]	13.90 [9.34]
22	1.80 [0.075]	9.81 [6.59]	2.89 [0.122]	17.89 [12.02]
20	2.00 [0.083]	12.83 [8.62]	3.30 [0.139]	23.84 [16.02]
18	2.23 [0.093]	17.01 [11.43]	3.78 [0.158]	32.10 [21.57]
16	2.44 [0.100]	20.36 [13.68]	4.16 [0.174]	39.00 [26.21]
14	2.79 [0.116]	28.69 [19.28]	4.92 [0.204]	55.21 [37.10]
12	3.30 [0.135]	40.73 [27.37]	5.92 [0.244]	80.23 [53.91]
10	3.98 [0.159]	59.90 [40.25]	7.39 [0.297]	123.65 [83.09]

X = 1 - Tin plated copper conductor.

4 - Silver plated high strength copper alloy conductor. (Recommended for size 24 & 26 in airframe applications and mandatory for CAA release.)

Part Numbering System



Jacket Color (in accordance with MIL-STD-681, white preferred)

Primary Wire Insulation Color

(in accordance with MIL-STD-681)

- | | | |
|-----------|------------|------------|
| 0 - Black | 3 - Orange | 7 - Violet |
| 1 - Brown | 4 - Yellow | 8 - Gray |
| 2 - Red | 5 - Green | 9 - White |
| 2L - Pink | 6 - Blue | |

Additional number after base color indicates stripe

Conductor Size

Conductor Type

- 1 - Tin-plated copper
- 2 - Silver-plated copper
- 3 - Nickel-plated copper
- 4 - Silver-plated high strength copper alloy
- 6 - Nickel-plated high strength copper alloy

Number of Conductors

- 0 - 10 conductors

Class of Wire

- 1 - 600 V equipment wire, light weight
- 2 - 600 V airframe wire, light weight
- 4 - 450 V equipment wire (55M Only sizes 20-30)
- 7 - 1000 V heavy duty, airframe wire
- 8 - 600 V airframe wire, normal weight

Constructions

- 0 - Primary wire and shielded, unjacketed cables
- 1 - Round braid screened & jacketed cable †
- 2 - Flat braid screened & jacketed cable †
- 3 - Round braid, screened cable, no jacket †
- 4 - Jacketed cable, no screen
- 5 - Spiral screened and jacketed cable †
- 8 - Special constructions (part numbers not coded)
- 9 - Special constructions including light weight

† Screen material same as conductor material except all flat screens and screen for conductor types 4 and 6 shall be tin-plated copper. Other combinations are special. (Refer to Wire and Cable Division).

Type

- A - General purpose
- M - Metric conductor
- / - Space wire
- PC- Process control
- D - Defense Standard 61-12 Part 33 Issue 4





Basic Specification Number

Typical Ordering Example	3 conductors, red, yellow, blue, 600 volt equipment wire with overall round braid, 20 AWG tinned conductor and white jacket: total part number is 55A1131-20-2/4/6-9.
Ordering Information	A list of stock policy items can be identified by contacting Tyco Electronics. Stock policy items are recognized by the use of a suffix, such as (300) defining the pack size, typically 55A0111-22-9(300). UK only.

SPEC 55 Part Numbering System

Temperature Rating	Conductor Material	AWG Range Available	Raychem Part No.	MIL-SPEC No.
600-V Lightweight Single-wall Hookup Wire, .152 [.006] Nominal Wall				
150°C [302°F]	Tin-coated copper	12-30	55A0111	M22759/32
200°C [392°F]	Silver-coated copper	12-28	55A0112	M22759/44
200°C [392°F]	Nickel-coated copper	12-28	55A0113	M22759/45
200°C [392°F]	Silver-coated high-strength alloy	20-30	55A0114	M22759/33
200°C [392°F]	Nickel-coated high-strength alloy	20-28	55A0116	M22759/46
600-V Lightweight Dual-wall Airframe Wire, .203 [.008] Nominal Wall				
150°C [302°F]	Tin-coated copper	6-26	55A0211	—
200°C [392°F]	Silver-coated copper	10-26	55A0212	—
200°C [392°F]	Nickel-coated copper	10-26	55A0213	—
200°C [392°F]	Silver-coated high-strength alloy	18-30	55A0214	—
200°C [392°F]	Nickel-coated high-strength alloy	16-26	55A0216	—
600-V Dual-wall Airframe Wire, .254 [.010] Nominal Wall				
150°C [302°F]	Tin-coated copper	00-24	55A0811	M22759/34
200°C [392°F]	Silver-coated copper	00-26	55A0812	M22759/43
200°C [392°F]	Nickel-coated copper	00-26	55A0813	M22759/41
200°C [392°F]	Silver-coated high-strength alloy	20-26	55A0814	M22759/35
200°C [392°F]	Nickel-coated high-strength alloy	20-26	55A0816	M22759/42
600-V Medium-Weight Dual-wall Airframe Wire, .381 [.015] Nominal Wall				
150°C [302°F]	Tin-coated copper	10-24	55A0711	—
200°C [392°F]	Silver-coated copper	16-24	55A0712	—
200°C [392°F]	Nickel-coated copper	16-24	55A0713	—
200°C [392°F]	Silver-coated high-strength alloy	16-24	55A0714	—
200°C [392°F]	Nickel-coated high-strength alloy	16-26	55A0716	—

SPEC 55 Cable Constructions

Construction	Number of Components	Component Conductor ¹	Shield Material ¹	Part Number		
				Light Wt. ²	Medium Wt.	
Unshielded, unjacketed		2-10	1	—	55*01X1-AWG-Y	55*08X1-AWG-Y
		2	—	55*01X2-AWG-Y	55*08X2-AWG-Y	
		3	—	55*01X3-AWG-Y	55*08X3-AWG-Y	
		4	—	55*01X4-AWG-Y	55*08X4-AWG-Y	
		6	—	55*01X6-AWG-Y	55*48X6-AWG-Y	
Unshielded, jacketed		2-10	1	—	55*41X1-AWG-Y	55*48X1-AWG-Y
		2	—	55*41X2-AWG-Y	55*48X2-AWG-Y	
		3	—	55*41X3-AWG-Y	55*48X3-AWG-Y	
		4	—	55*41X4-AWG-Y	55*48X4-AWG-Y	
		6	—	55*41X6-AWG-Y	55*18X6-AWG-Y	
Shielded (round braid), jacketed		1-10	1	1	55*11X1-AWG-Y	55*18X1-AWG-Y
		2	2	55*11X2-AWG-Y	55*18X2-AWG-Y	
		3	3	55*11X3-AWG-Y	55*18X3-AWG-Y	
		4	1	55*11X4-AWG-Y	55*18X4-AWG-Y	
		6	3	55*11X6-AWG-Y	55*18X6-AWG-Y	
Shielded (flat braid), jacketed		1-10	1	1	55*21X1-AWG-Y	55*28X1-AWG-Y
		2	1	55*21X2-AWG-Y	55*28X2-AWG-Y	
		3	1	55*21X3-AWG-Y	55*28X3-AWG-Y	
		4	1	55*21X4-AWG-Y	55*28X4-AWG-Y	
		6	1	55*21X6-AWG-Y	55*28X6-AWG-Y	

¹Type of conductor or shield material:
 1 = tin-coated copper
 2 = silver-coated copper
 3 = nickel-coated copper
 4 = silver-coated high-strength copper alloy
 6 = nickel-coated high-strength copper alloy
 * = A or PC

² X = no. of wire components
 Y = color code
 For complete part number, see Part Numbering System on page 9-15.

NEMA WC-27500 Cable
Part Numbering System

M27500 X AWG XX X X XX

Basic Specification Number

Component Wire ID/Shield Coverage Code

Shield Coverage

85%	90%
-	C
A	D
B	E
F	H
G	J
K	M
L	N
P	R
S	T

Component Wire Identification

Colored Stripes on White Wire
(9/96/93/95/92/90/94/97/98/91... etc.)
Solid Color Wires (9/6/3/5/2/0/4/7/8/1...etc.)
Band Marks on Solid Colors (by AWG)
Alternate Colored Stripes
(92/96/94/95/9/90/91/93/97/98...etc.)
Alternate Solid Colors (2/6/4/5/9/0/1/3/7/8...etc.)
Number Marking on Solid Colors (by AWG)
Number Marking on White Wires
Band Marks on Colored Stripes (by AWG)
Band Marks on White Wires

Conductor Size (AWG)

Basic Wire Spec Code (MIL-W-22759) and Slash Sheet

- SB - 32 = 55A0111
- SC - 33 = 55A0114
- SD - 34 = 55A0811
- for 2 AWG and larger, use 55A8039
- SE - 35 = 55A0814
- SM - 41 = 55A0813
- for 2 AWG and larger, use 55A8595
- SN - 42 = 55A0816
- SP - 43 = 55A0812
- for 2 AWG and larger, use 55A6089
- SR - 44 = 55A0112
- SS - 45 = 55A0113
- ST - 46 = 55A0116

Number of Component Wires

1 through 9; 10 Components = 0

Shield Material and Style Code

- U - No shield
- T - Tin-coated copper, round
- J - Tin-coated copper, flat
- S - Silver-coated copper, round
- G - Silver-coated copper, flat
- N - Nickel-coated copper, round
- V - Tin-coated copper, round, double shield
- W - Silver-coated copper, round, double shield

Jacket Material and Style Code

- 00 - No jacket
- 23 - Single jacket crosslinked, modified ETFE, white
- 73 - Double jacket crosslinked, modified ETFE, white

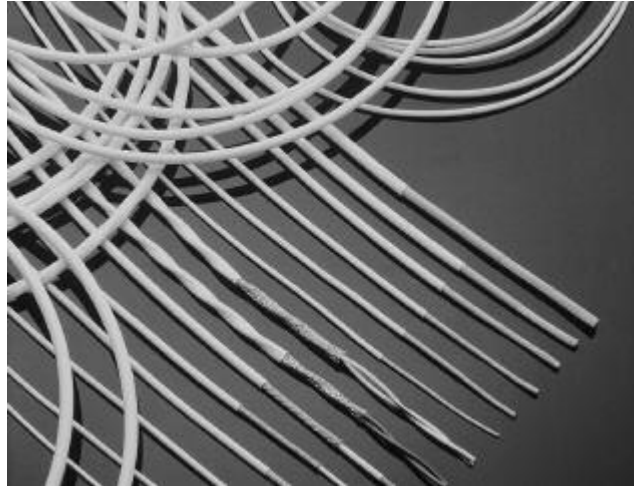
Example: **M27500-22SB3T23 = 55AM1131-22-9/96/93-9**

Raychem Part No.
Military Part No.

RCW

Product Facts

- -65°C to +260°C [-85°F to +500°F]
- Small size, ultra light weight
- Resistant to electrical arc tracking in wet or dry conditions
- Excellent cut-through resistance
- Exceptional chemical resistance



Applications

Raychem Composite Wire (RCW) is insulated with a combination of PTFE and Polyimide materials. It has a temperature rating of -65°C to +260°C [-85°F to +500°F] continuous using a nickel-plated conductor, and combines the easy handling of a flexible wire with excellent cut-through characteristics.

Chosen for its balance of properties, RCW has outstanding resistance to chemicals and solvents, excellent arc track resistance, and is not susceptible to UV and moisture degradation.

RCW can be supplied in a thin wall, lightweight construction which provides considerable weight and size savings over comparable wires.

RCW is available in twisted pairs, triples, etc. and shielded and jacketed constructions.

Physical Characteristics

Size and Weight

RCW provides one of the most comprehensive wiring product ranges for aerospace users with a wide choice of conductor sizes and insulation wall thicknesses.

RCW airframe wire has an insulation wall thickness of either .006" or 0.008" for robustness in unprotected harnesses and has excellent wire-to-wire abrasion properties.

Handling

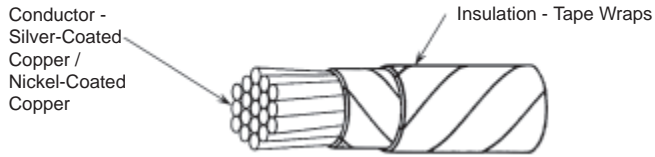
Excellent flexibility and handleability makes RCW ideal for installation in new aircraft and equipment, and is easily replaced during maintenance procedures.

RCW is easily stripped with conventional tooling, and readily marked by laser or ink jet.

Available in:	
Americas	■
Europe	■
Asia Pacific	■

RCW (Continued)

Specifications



RCW insulation system

MIL-DTL-22759/81-92

Lockheed Martin Selected C-Specs

Typical Properties

	Lightweight / Normal Weight
Conductor	Silver Copper / Nickel Copper
Temperature	-65°C to +200°C [-85°F to +392°F] / -65°C to +260°C [85°F to +500°F]
Voltage Rating	600V
Dielectric Strength	4,000 volts/mil (avg. min.)
Wet Arc Propagation Resistance	MIL-STD-2223 Method 3006 *
Dry Arc Propagation Resistance	MIL-DTD-2223 Method 3007 *
Dynamic Cut-Through	ASTM D 3032 Section 22 *
Flammability	MIL-STD-2223, Method 1006, Procedure A *
Insulation Resistance	5000 megohms for 1000 ft. (min.)
Life Cycle	500 hours @ 230°C [446°F] / 500 hrs @ 290°C [554°F]
Low Temperature (Cold Bend)	-65°C [-85°F] (4 hrs)
Smoke	200°C [392°F] / 260°C [500°F] No visible smoke
Thermal Index	200°C [392°F] min. / 260°C min. [500°F] 10,000 hrs.

*as defined by the applicable MIL-Spec slash sheets

Environmental Performance

Temperature Rating

RCW wire and cable is rated for continuous operation from -65°C to +260°C [-85°F to +500°F] and for short periods at temperatures as high as 320°C [608°F].

Mechanical Performance

RCW incorporates superior abrasion protection and cut-through performance. Like all Raychem products, this latest addition is designed for electrical and electronic applications in tough environments.

Chemical Resistance

RCW is unaffected by all commonly used chemicals, eg. fuels, hydraulic fluids, defluxing agents, cleaners, coolants and de-icers. It also shows excellent resistance to weathering (UV, ozone, pollutants, water). RCW is highly resistant to hydrolysis.

Flammability/Smoke

Advanced combination of materials allow superior performance in areas such as flammability and smoke generation properties. Exceeds FAR 25 test requirements for flame resistance and smoke density.

Electrical Arc Tracking Resistance

RCW insulation demonstrates resistance to arc tracking under both wet and dry conditions at aircraft system voltages.

RCW Wire & Cable: Standard Constructions, Nominal Strandings, Diameters and Weights

Conductor	Primary Wire	Twisted Pair	Shielded & Jacketed	
			Single	Pair

RCW - AWG Conductor:
Equipment/Interconnect Wires
& Cables
(Lightweight)

RCW (Continued)

Wire Size (AWG)	Stranding (mm)	RCW59XX		RCWxWx2U00-AWG	
		Nom. OD (max.)	Max. Weight (g per m/lbs per kft)	Nom. OD (max.)	Max. Weight (g per m/lbs per kft)
26	19 x 38	0.48 [0.019]	2.13 [1.43]	1.73 [0.068]	4.35 [2.92]
24	19 x 36	0.61 [0.024]	2.87 [1.93]	1.93 [0.076]	5.86 [3.94]
22	19 x 34	0.76 [0.030]	4.24 [2.85]	2.18 [0.086]	8.65 [5.81]
20	19 x 32	0.97 [0.038]	6.52 [4.38]	2.59 [0.102]	13.30 [8.94]
18	19 x 30	1.22 [0.048]	9.82 [6.60]	3.05 [0.120]	20.09 [13.5]
16	19 x 29	1.37 [0.054]	12.35 [8.30]	3.40 [0.134]	25.15 [16.9]
14	19x 27	1.73 [0.068]	18.75 [12.6]	4.06 [0.160]	38.25 [25.7]
12	37 x 28	2.21 [0.087]	29.17 [19.6]	5.08 [0.200]	59.53 [40.0]
10	37 x 26	2.79 [0.110]	45.54 [30.6]	6.25 [0.246]	92.86 [62.4]

Wire Size (AWG)	Shield Size (AWG)	RCWxWx1xxx-AWG-x		RCWxWx2xxx-AWG-x	
		Nom. OD max.	Max. Weight@90% (g per m/lbs per kft)	Nom. OD max.	Max. Weight@90% (g per m/lbs per kft)
26	38	1.83 [0.072]	8.27 [5.56]	2.69 [0.106]	13.84 [9.30]
24	38	1.93 [0.076]	9.52 [6.40]	2.89 [0.114]	16.22 [10.9]
22	38	2.06 [0.081]	11.55 [7.76]	3.15 [0.124]	20.24 [13.6]
20	38	2.26 [0.089]	14.88 [10.0]	3.56 [0.140]	26.64 [17.9]
18	38	2.49 [0.098]	19.35 [13.0]	4.01 [0.158]	35.42 [23.8]
16	38	2.67 [0.105]	22.77 [15.3]	4.37 [0.172]	42.12 [28.3]
14	38	2.99 [0.118]	30.95 [20.8]	5.03 [0.198]	58.19 [39.1]
12	38	3.50 [0.138]	44.05 [29.6]	6.15 [0.242]	85.57 [57.5]
10	38	4.09 [0.161]	63.69 [42.8]	7.32[0.288]	124.41[83.6]

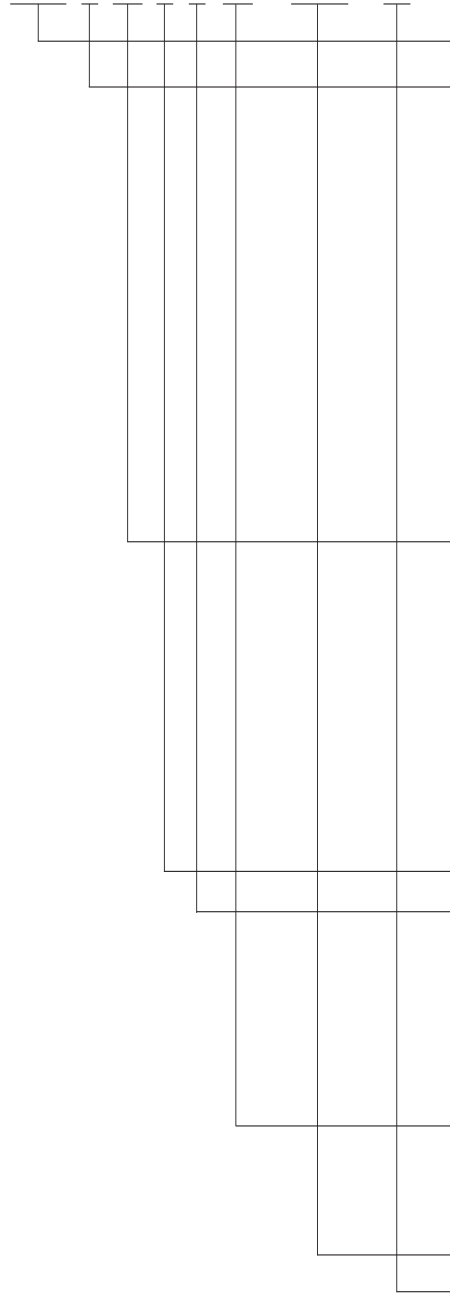
RCW - AWG Conductor:
Airframe Wires & Cables
(Normal Weight)

Wire Size (AWG)	Stranding (mm)	RCW59xx		RCWxWx2U00-AWG	
		Nom. OD max.	Max. Weight (g per m/lbs per kft)	Nom. OD max.	Max. Weight@90% (g per m/lbs per kft)
26	19 x 38	0.52 [0.0204]	2.31 [1.55]	1.88 [0.074]	4.70 [3.16]
24	19 x 36	0.62 [0.0244]	3.19 [2.15]	2.13 [0.084]	6.53 [4.39]
22	19 x 34	0.87 [0.0314]	4.46 [3.00]	2.39 [0.094]	9.11 [6.12]
20	19 x 32	1.00 [0.0394]	6.77 [4.55]	2.79 [0.110]	13.81 [9.28]
18	19 x 30	1.25 [0.0494]	9.97 [6.70]	3.30 [0.130]	20.39 [13.70]
16	19 x 29	1.41 [0.0554]	12.80 [8.60]	3.71 [0.146]	26.04 [17.50]
14	19 x 27	1.76 [0.0694]	19.27 [12.95]	4.37 [0.172]	39.29 [26.40]
12	37 x 28	2.27 [0.0894]	29.91 [20.10]	5.33 [0.210]	61.01 [41.00]
10	37 x 26	2.84 [0.112]	46.73 [31.40]	6.45 [0.254]	95.39 [64.10]
8	133 x 29	4.29 [0.169]	85.72 [57.60]	9.55 [0.376]	174.86[117.50]
6	133 x 27	5.38 [0.212]	131.40 [88.30]	—	—
4	133 x 25	6.81 [0.268]	212.81 [143.0]	—	—

Wire Size (AWG)	Shield Size (AWG)	RCWxWx1xxx-AWG-x		RCWxWx2xxx-AWG-x	
		Nom. OD max.	Max. Weight@90% (g per m/lbs per kft)	Nom. OD max.	Max. Weight@90% (g per m/lbs per kft)
26	38	1.91 [0.075]	8.82 [5.93]	2.84 [0.112]	14.88 [10.0]
24	38	2.03 [0.080]	10.45 [7.02]	3.10 [0.122]	18.01 [12.1]
22	38	2.16 [0.085]	12.28 [8.25]	3.35 [0.132]	21.58 [14.5]
20	38	2.36 [0.093]	15.63 [10.50]	3.76 [0.148]	27.98 [18.8]
18	38	2.62 [0.103]	20.09 [13.50]	4.27 [0.168]	36.76 [24.7]
16	38	2.82 [0.111]	24.11 [16.20]	4.67 [0.184]	44.35 [29.8]
14	38	3.15 [0.124]	32.29 [21.70]	5.33 [0.210]	60.57 [40.7]
12	38	3.63 [0.143]	45.54 [30.60]	6.40 [0.252]	88.25 [59.3]
10	38	4.19 [0.165]	65.33 [43.90]	7.52 [0.296]	127.83 [85.9]

Part Numbering System —
Cable
(Per NEMA WC 27500)

RCW X XX # X XX - AWG - X



Basic Product Number

Component Wire ID/Shield Coverage Code (per WC 27500)

(Note: Some ID methods of WC 27500 may not be available - standard codes offered are A, B, D and E, as defined below)

- A - 85% min. shield cov. (if applic.); solid wire colors selected in order from the following: White, Blue, Orange, Green, Red, Black, Yellow, Violet, Gray, Brown
- B - 85% min. shield coverage (if applic.); band-marked solid wire colors based on AWG size as follows:

AWG	Color	AWG	Color	AWG	Color
26	Black	18	White	10	Brown
24	Blue	16	Blue	8	Red
22	Green	14	Green	6	Blue
20	Red	12	Yellow	4	Yellow

- D - Same as A, except 90% min. shield coverage
- E - Same as B, except 90% min. shield coverage

Component Wire Code (per WC 27500) and MIL-W-22759 Slash Sheet

- WC = 81 = RCW5981
- WE = 82 = RCW5982
- WJ = 86 = RCW5986
- WK = 87 = RCW5987
- WM = 89 = RCW5989
- WN = 90 = RCW5990
- WP = 91 = RCW5991
- WR = 92 = RCW5992

Number of Component Wires

Shield Code (per WC 27500)

- U - No Shield
- T - Tin-coated copper, round
- S - Silver-coated copper, round
- N - Nickel-coated copper, round
- G - Silver-coated copper, flat

Jacket Code (per WC 27500)

- 00 - No jacket
- 06 - PTFE tape wrap
- 24 - FP/PI/FP and PTFE tape wraps

Conductor Size (AWG)

Jacket Color Code (per MIL-STD-681)

- 0 - Black
- 1 - Brown
- 2 - Red
- 3 - Orange
- 4 - Yellow
- 5 - Green
- 6 - Blue
- 7 - Violet
- 8 - Gray
- 9 - White

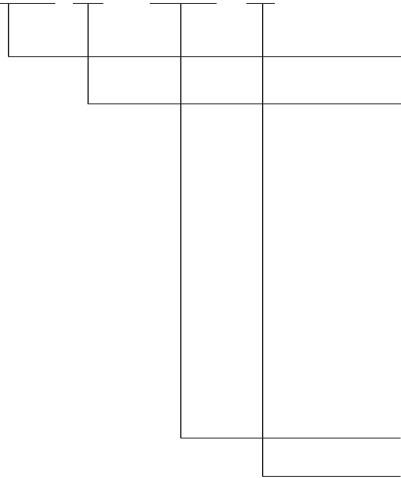
Example:

RCWAWJ2G24-22-9 = M27500A22WJ2G24



Part Numbering System —
Primary Wire
(Per MIL-W-22759)

RCW59 XX - AWG - X



Basic Product Number

MIL-W-22759 Slash Sheet as follows:

- 81 - Lightweight, silver-coated, high-strength or ultra high-strength copper alloy, AWG 26-20
- 82 - Lightweight, nickel-coated, high-strength or ultra high-strength copper alloy, AWG 26-20
- 86 - Normal weight, silver-coated copper, AWG 26-4
- 87 - Normal weight, nickel-coated copper, AWG 26-4
- 89 - Normal weight, silver-coated, high-strength or ultra high-strength copper alloy, AWG 26-20
- 90 - Normal weight, nickel-coated, high-strength or ultra high-strength copper alloy, AWG 26-20
- 91 - Lightweight, silver-coated copper, AWG 26-10
- 92 - Lightweight, nickel-coated copper, AWG 26-10

Conductor Size (AWG)

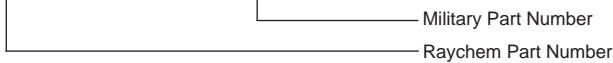
Insulation Color Code (per MIL-STD-681)

(Note: Colors are in accordance with the UV laser markable color limits specified in the applicable MIL-W-22759 slash sheet. Standard wire color is white).

- | | |
|------------|------------|
| 0 - Black | 5 - Green |
| 1 - Brown | 6 - Blue |
| 2 - Red | 7 - Violet |
| 3 - Orange | 8 - Gray |
| 4 - Yellow | 9 - White |

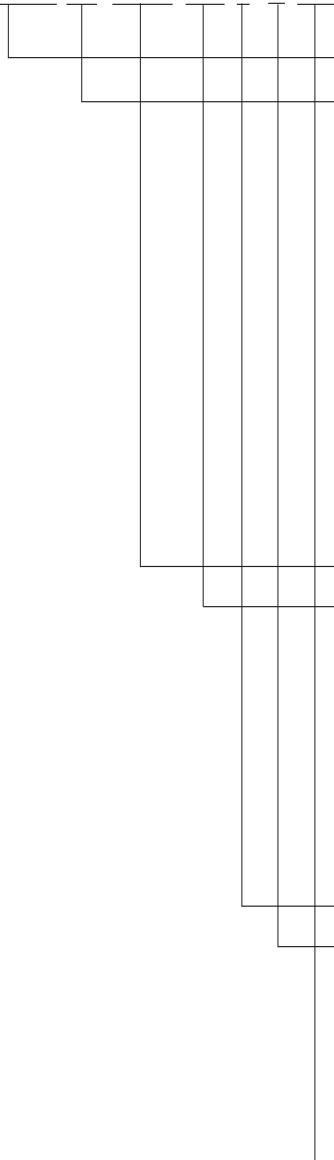
Example:

RCW5991-22-9 = M27559/91-22-9



Part Numbering System —
Cable
(Per NEMA WC 27500)

M27500 X AWG XX # X XX



Basic Product Number

Component Wire ID/Shield Coverage Code

(Note: Some ID methods may not be available for RCW cable - standard codes offered are A, B, D and E, as defined below)

A - 85% min. shield cov. (if applic.); solid wire colors selected in order from the following: White, Blue, Orange, Green, Red, Black, Yellow, Violet, Gray, Brown

B - 85% min. shield coverage (if applic.); band-marked solid wire colors based on AWG size as follows:

AWG	Color	AWG	Color	AWG	Color
26	Black	18	White	10	Brown
24	Blue	16	Blue	8	Red
22	Green	14	Green	6	Blue
20	Red	12	Yellow	4	Yellow

D - Same as A, except 90% min. shield coverage

E - Same as B, except 90% min. shield coverage

Conductor Size (AWG)

Basic Wire Spec Code (MIL-W-22759 Slash sheet & RCW Wire)

- WC = 81 = RCW5981
- WE = 82 = RCW5982
- WJ = 86 = RCW5986
- WK = 87 = RCW5987
- WM = 89 = RCW5989
- WN = 90 = RCW5990
- WP = 91 = RCW5991
- WR = 92 = RCW5992

Number of Component Wires

Shield Material and Style Code

- U - No Shield
- T - Tin-coated copper, round
- S - Silver-coated copper, round
- N - Nickel-coated copper, round
- G - Silver-coated copper, flat

Jacket Material and Style Code

- 00 - No jacket
- 06 - PTFE tape wrap, white
- 24 - FP/PI/FP and PTFE tape wraps, white

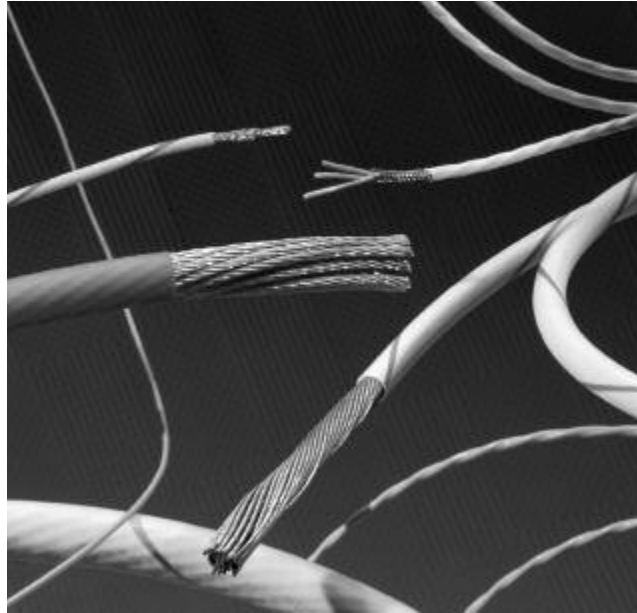
Example:

M27500A22WJ2G24 = RCWAWJ2G24-22-9



Product Facts

- Reduced weight
- Flexibility
- Low outgassing
- Function over a broad temperature range
- Flammability
- Arc track resistance
- Resistance to atomic oxygen
- Radiation resistance
- High quality and reliability
- Ease of fabrication (into Harnesses due to flexibility)
- Agency approvals
- -65°C up to +150°C [-85°F up to +302°F]
- Small size
- 600V rating
- Optional high strand count for increased flexibility
- Variety of insulation/jacket options
- Dual wall and single wall options
- Easy to install
- Mechanically tough
- Compliance with FAR 25 flammability requirements
- Resistance to harsh fluids & solvents per MIL-W-22759



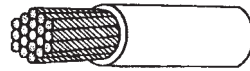
Applications

FlexLine wire (also known as SPEC 80) is insulated with a flexible modified radiation cross-linked ETFE polymer. It has a temperature rating of -65°C to +150°C [-85°F to +302°F] continuous using silver copper conductor, and combines the easy handling of our SPEC 55 wire and cable with additional flexibility. FlexLine wire is used in a broad range of applications, from Hook-up wire to Power Cables.

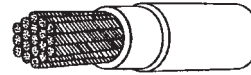
FlexLine wire constructions provide maximum flexibility similar to the MIL-W-22759 products in Mechanical, Chemical and Thermal properties.

Available in:	Americas	Europe	Asia Pacific
	■	■	■

FlexLine Insulation System



Single Wall



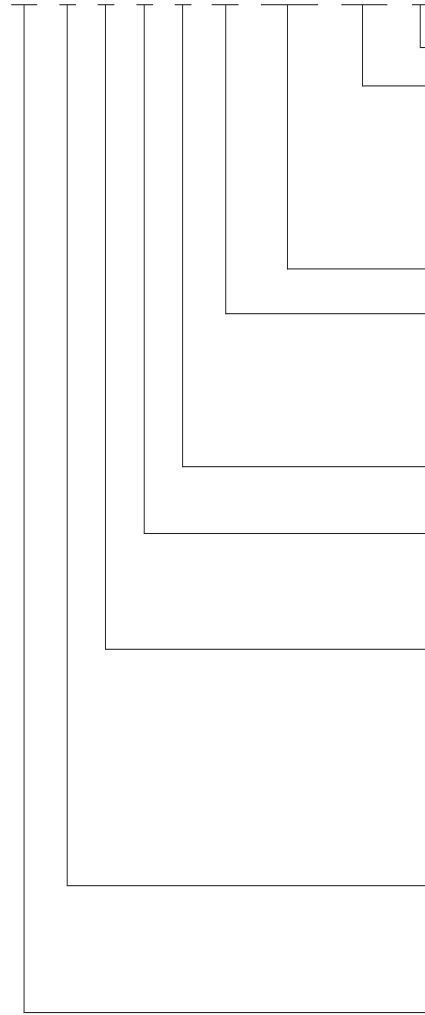
Dual Wall

Single Wall 82 Wire
 High strand count conductors
 Light weight
 AWG sizes 28 to 00
 (6-mil nominal insulation thickness)

Dual Wall 81 Wire
 Standard M22759 conductor stranding
 Increased toughness
 AWG sizes 28 to 000
 (10-mil nominal insulation thickness)

Part Numbering System

8x X X X X X- Size- X/X- X



Jacket Color Identification Code (in accordance with MIL-STD-681)

Primary Wire Insulation Color
 (in accordance with MIL-STD-681)

- | | | |
|------------|------------|-----------|
| 0 - Black | 4 - Yellow | 8 - Gray |
| 1 - Brown | 5 - Green | 9 - White |
| 2 - Red | 6 - Blue | |
| 3 - Orange | 7 - Violet | |

Conductor Size (AWG)

Conductor Type

- | | |
|--------------------------|--|
| 1 - Tin-coated copper | 4 - Silver-coated high strength copper alloy |
| 2 - Silver-coated copper | 6 - Nickel-coated high strength copper alloy |
| 3 - Nickel-coated copper | |

Number of Conductors

1 through 9

Class of Wire

- 1 - 600 V general purpose wire, lightweight
- 8 - 600 V airframe wire, normal weight

Construction

- 0 - Primary wire & unshielded, unjacketed
- 1 - Round-braid shielded & jacketed cable*
- 2 - Flat-braid shielded & jacketed cable*
- 3 - Round-braid shielded cable, no jacket*
- 4 - Jacketed cable, no shield
- 5 - Spiral-shielded & jacketed cable*
- 6-9 Special constructions

Wire Type

- A - General Purpose
- / - Outer Space
- AC- 90% Shield Coverage

Basic Specification Number

- 1 - Normal Stranding
- 2 - High Stranding

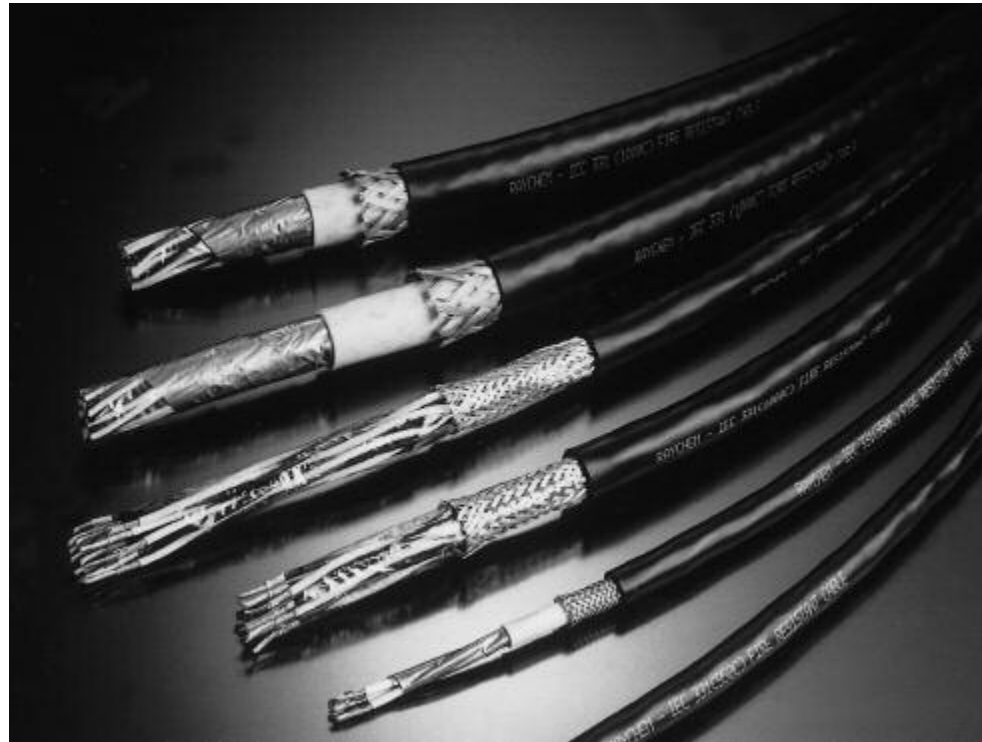
* Shield coating same as conductor coating except for the following:
 - shield for conductor type 4 shall be tin-coated copper
 - round braid shield constructions for conductor type 6 shall be nickel-coated copper
 - flat braid shield constructions for conductor type 6 shall be tin-coated copper
 Other shield variations are designated as Special Constructions

Halogen-Free, Fire Resistant Cable Range

Product Facts

- Highly flame retardant
- Halogen-free
- Low smoke generation
- Low toxicity index
- Low acid gas emission
- Low water uptake
- Compatible with Raychem System 100 heat-shrink components, heat-shrink tubing, molded parts and adhesives

FR-1000



Applications

Tyco Electronics has developed a new halogen-free, lightweight, small size, fire resistant Raychem cable to exceed the exacting fire resistant requirements of IEC 60331 (ie withstands 950°C [1742°F] for 3 hours as opposed to the 750°C [1382°F] requirement) and meet the flame-retardant requirements of IEC 60332-3 (Cat A), while maintaining significant size and weight savings over conventional materials.

FR-1000 cable consists of Raychem Type 95 primary wire with a Zerohal jacket and can be used throughout the installation, simplifying the selection for designers and electrical engineers. By a combination of our proven expertise in polymer and radiation chemistry, low fire hazard technology and precision extrusion capability,

Tyco Electronics has been able to develop a range of Raychem cables featuring reduced size and weight over existing thickwall cables. This offers savings of approximately 30% and optimizes the space available. This results in lower installed costs by downsizing connectors, glanding, cable support structures, and reduced time on installation.

With increasing complexity of electronic systems, sensors, communications and safety equipment, more cables are required to fit into smaller spaces. FR-1000 small size cable can offer distinct advantages over conventional cables.

These include:

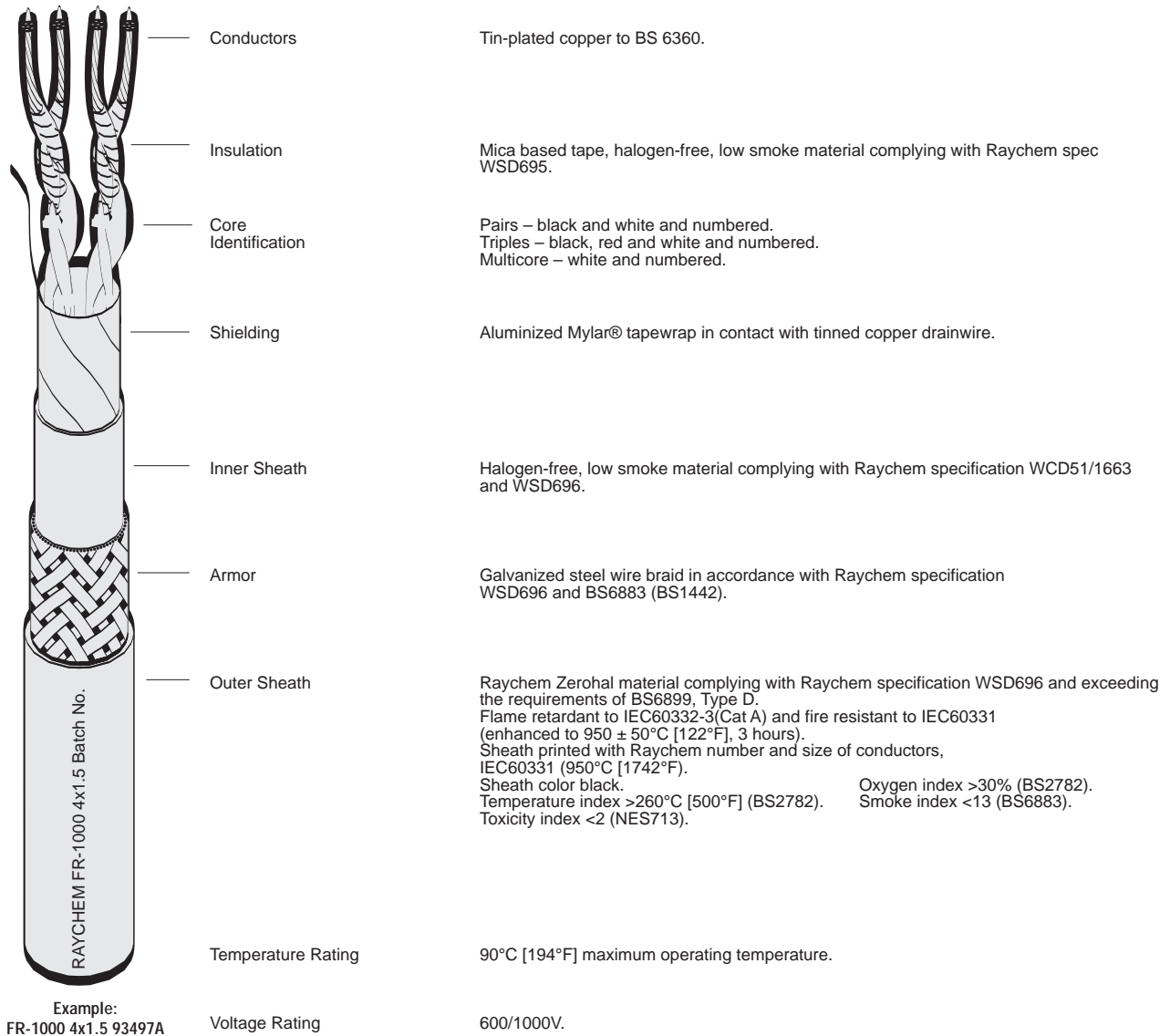
- Tough and flexible constructions aiding installation through smaller bend radii and extending service life.
- Controlled dimensions simplifying connector and transit selection.
- Resistance to widely used fluids such as diesel fuels, oils, and greases.

Operating Temperature Range

-30°C to +90°C
[-22°F to +194°F]

Available in:	Americas	Europe	Asia Pacific
	■	■	■

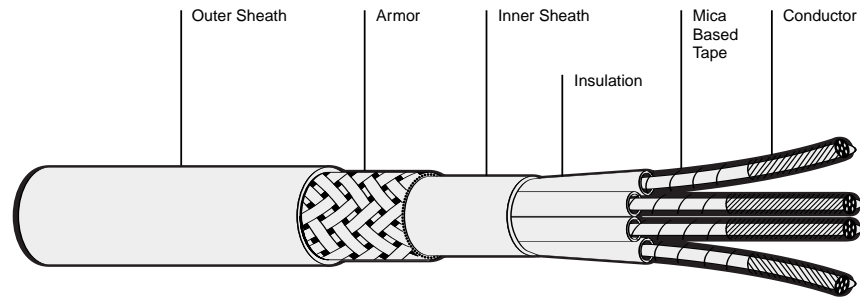
Generic Cable Construction



MYLAR is a trademark of Dupont Teijin Films U.S.

Halogen-Free, Fire Resistant Cable Range

FR-1000 (Continued)



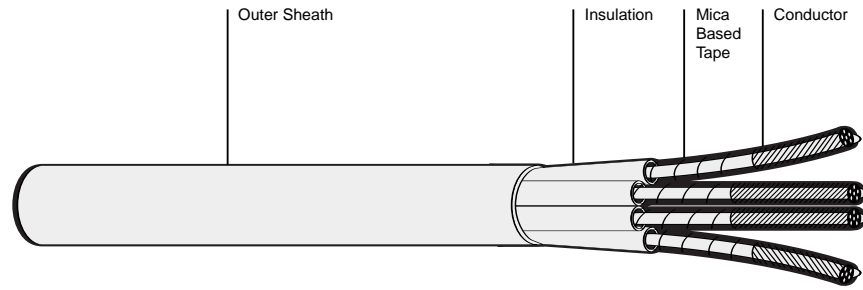
FR-1000 Multicore Control Cables, Unshielded, Armored, 600/1000V*

Selection Table

Part No. EPD	Construction	Conductor Stranding	CSA Nominal mm ²	Diameter Over Inner Sheath	Cable			Nominal Weight kg/km	Jacket Color
					Outer Diameter				
					(min.)	(max.)			
87486A	2x1.5	19/0.32	1.5	6.6 [.260]	10.2 [.402]	11.2 [.441]	178	Black	
87488A	3x1.5	19/0.32	1.5	7.1 [.280]	10.8 [.425]	11.6 [.457]	203	Black	
87490A	4x1.5	19/0.32	1.5	7.7 [.303]	11.2 [.441]	12.4 [.488]	236	Black	
87492A	7x1.5	19/0.32	1.5	9.4 [.370]	13.0 [.512]	14.4 [.567]	328	Black	
87494A	12x1.5	19/0.32	1.5	12.5 [.492]	16.0 [.630]	17.6 [.693]	486	Black	
87496A	19x1.5	19/0.32	1.5	14.7 [.579]	18.2 [.717]	20.2 [.795]	677	Black	
87498A	27x1.5	19/0.32	1.5	17.9 [.705]	21.3 [.839]	23.5 [.925]	906	Black	
87487A	2x2.5	7/0.67	2.5	7.7 [.303]	11.2 [.441]	12.4 [.488]	224	Black	
87489A	3x2.5	7/0.67	2.5	8.2 [.323]	11.7 [.461]	12.9 [.508]	257	Black	
87491A	4x2.5	7/0.67	2.5	9.0 [.354]	12.6 [.496]	14.0 [.551]	312	Black	
87493A	7x2.5	7/0.67	2.5	10.9 [.429]	14.7 [.579]	15.7 [.618]	429	Black	
87495A	12x2.5	7/0.67	2.5	14.6 [.575]	18.1 [.713]	20.1 [.791]	661	Black	
87497A	19x2.5	7/0.67	2.5	17.5 [.689]	20.9 [.823]	23.1 [.909]	936	Black	
87499A	27x2.5	7/0.67	2.5	21.1 [.831]	25.3 [.996]	27.3 [1.075]	1321	Black	

*Cables are armored with an overall galvanized steel wire braid armor.

FR-1000 (Continued)



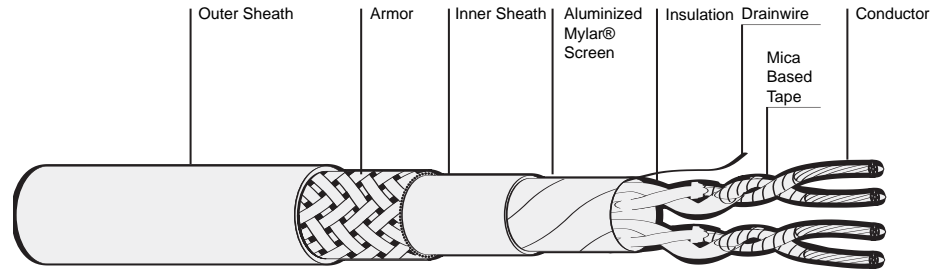
FR-1000 Multicore Control Cables, Unshielded, Unarmored, 600/1000V

Selection Table

Part No. EPD	Construction	Conductor Stranding	CSA Nominal mm ²	Outer Diameter		Cable Nominal Weight kg/km	Jacket Color
				(min.)	(max.)		
				87472A	2x1.5		
87474A	3x1.5	19/0.32	1.5	7.8 [.307]	8.6 [.339]	108	Black
87476A	4x1.5	19/0.32	1.5	8.4 [.331]	9.2 [.362]	134	Black
87478A	7x1.5	19/0.32	1.5	10.1 [.398]	11.1 [.437]	204	Black
87480A	12x1.5	19/0.32	1.5	13.3 [.524]	14.3 [.563]	332	Black
87482A	19x1.5	19/0.32	1.5	15.2 [.598]	16.8 [.661]	490	Black
87484A	27x1.5	19/0.32	1.5	18.5 [.728]	19.9 [.783]	684	Black
87473A	2x2.5	7/0.67	2.5	8.4 [.331]	9.2 [.362]	122	Black
87475A	3x2.5	7/0.67	2.5	8.8 [.346]	9.8 [.386]	150	Black
87477A	4x2.5	7/0.67	2.5	9.7 [.382]	10.7 [.421]	192	Black
87479A	7x2.5	7/0.67	2.5	11.5 [.453]	12.7 [.500]	288	Black
87481A	12x2.5	7/0.67	2.5	15.1 [.594]	16.7 [.657]	475	Black
87483A	19x2.5	7/0.67	2.5	17.9 [.705]	19.7 [.776]	720	Black
87485A	27x2.5	7/0.67	2.5	21.3 [.839]	23.5 [.925]	995	Black

Conductors	Tin plated copper to BS6360
Insulation	Mica based tape, halogen-free, low smoke material complying with Raychem specification WSD695
Core Identification	White and numbered
Inner Sheath	Halogen-free, low smoke material complying with Raychem specification WCD51/1663 and WSD696
Armor	Galvanized steel wire braid in accordance with Raychem specification WSD696 and BS6883 (BS1442)
Outer Sheath	Raychem Zerohal material complying with Raychem specification WSD696 and exceeding the requirements of BS6899, Type D Flame retardant to IEC60332-3(Cat A) and fire resistant to IEC60331 (enhanced to 950 +/- 50°C [122°F], 3 hours) Sheath printed with number and size of conductors, IEC331, Raychem, voltage rating and EPD number Sheath color black Oxygen index >30% (BS2782), Temperature index > 260°C (BS2782), Smoke index <13 (BS6883) Toxicity Index <2 (NES713)
Temperature Rating	90°C [194°F] maximum conductor operating temperature
Voltage Rating	600/1000V

Halogen-Free, Fire Resistant Cable Range



FR-1000 Multipair Control Cables, Collectively Shielded and Armored 600/1000V*

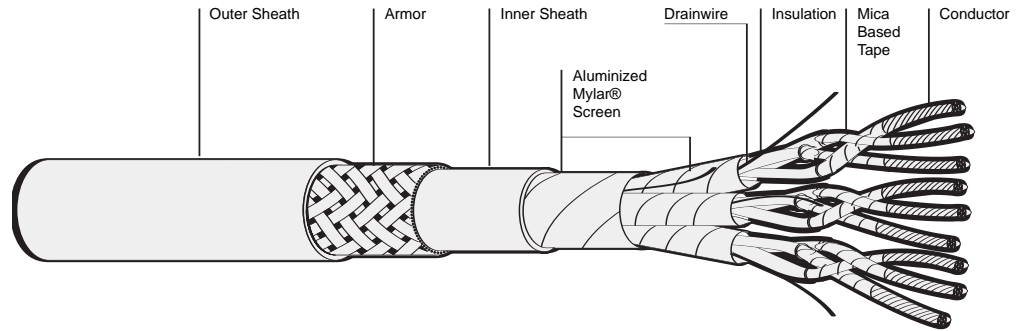
Selection Table

Part No. EPD	Construction	Conductor Stranding	CSA Nominal mm ²	Diameter (Nominal)		Cable			
				Over Shield	Over Inner Sheath	Outer Diameter		Nominal Weight kg/km	Jacket Color
						(min.)	(max.)		
93491A	3x2x0.75	19/0.23	0.75	9.7 [.382]	11.1 [.437]	14.6 [.575]	16.2 [.638]	319	Grey
93492A	7x2x0.75	19/0.23	0.75	13.1 [.516]	14.6 [.575]	18.1 [.713]	20.1 [.791]	484	Grey
93493A	12x2x0.75	19/0.23	0.75	16.4 [.646]	18.1 [.713]	21.5 [.846]	23.7 [.933]	685	Grey
93494A	20x2x0.75	19/0.23	0.75	21.2 [.835]	23.0 [.906]	26.8 [1.055]	29.6 [1.165]	1090	Grey
87500A	2x1.5	19/0.32	1.5	5.4 [.213]	6.7 [.264]	10.7 [.421]	11.3 [.445]	192	Black
87501A	2x2x1.5	19/0.32	1.5	7.2 [.283]	8.6 [.339]	12.3 [.484]	13.5 [.531]	267	Black
87502A	3x2x1.5	19/0.32	1.5	11.2 [.441]	12.7 [.500]	16.1 [.634]	17.9 [.705]	404	Black
87503A	5x2x1.5	19/0.32	1.5	13.8 [.543]	15.3 [.602]	18.8 [.740]	20.8 [.819]	541	Black
87504A	7x2x1.5	19/0.32	1.5	15.2 [.598]	16.9 [.665]	20.3 [.799]	22.5 [.886]	649	Black
87505A	10x2x1.5	19/0.32	1.5	17.5 [.705]	19.2 [.756]	22.5 [.886]	24.9 [.980]	817	Black
87506A	12x2x1.5	19/0.32	1.5	19.0 [.748]	20.7 [.815]	25.2 [.992]	26.6 [1.047]	999	Black
87507A	20x2x1.5	19/0.32	1.5	24.7 [.972]	26.5 [1.043]	30.5 [1.201]	33.7 [1.327]	1541	Black
87508A	24x2x1.5	19/0.32	1.5	26.6 [1.047]	28.6 [1.126]	33.6 [1.323]	35.6 [1.402]	1762	Black

*Cables have an overall aluminized Mylar® shield with drainwire and an overall galvanized steel wire braid armor.

MYLAR is a trademark of Dupont Teijin Films U.S.

FR-1000 (Continued)



FR-1000 Multitrip control cables, Collectively Shielded and Armored, 600/1000V*

Selection Table

Part No. EPD	Construction	Conductor Stranding	CSA Nominal mm²	Diameter (Nominal)		Cable			
				Over Shield	Over Inner Sheath	Outer Diameter		Nominal Weight kg/km	Jacket Color
						(min.)	(max.)		
87509A	1x3x1.5	19/0.32	1.5	5.9 [.232]	7.2 [.283]	10.7 [.421]	11.9 [.469]	216	Black
87510A	3x3x1.5	19/0.32	1.5	12.0 [.472]	13.5 [.531]	16.9 [.665]	18.7 [.736]	480	Black
87511A	7x3x1.5	19/0.32	1.5	16.2 [.638]	17.9 [.705]	21.3 [.839]	23.5 [.925]	815	Black
87512A	12x3x1.5	19/0.32	1.5	22.2 [.874]	24.0 [.945]	28.1 [1.106]	31.1 [1.224]	1357	Black

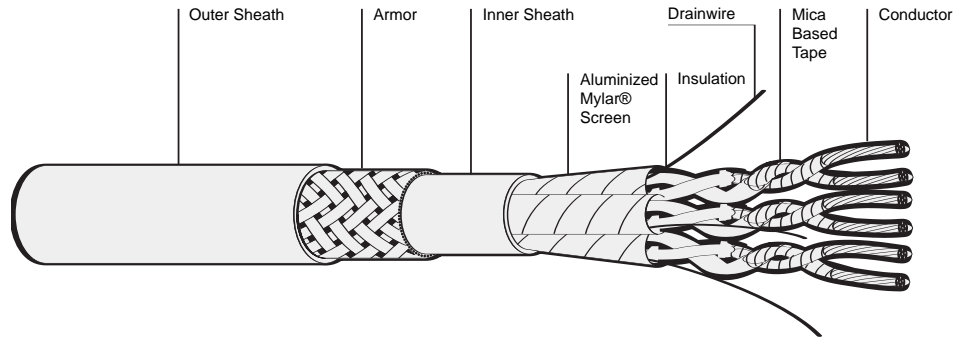
*Cables have an overall aluminized Mylar® shield with drainwire and an overall galvanized steel wire braid armor.

Conductors	Tin plated copper to BS6360
Insulation	Mica based tape, halogen-free, low smoke material complying with Raychem specification WSD695
Core Identification	Pairs – black and white and numbered. Triples – black, red and white and numbered
Shielding	Aluminized Mylar® tapewrap in contact with tinned copper drainwire
Inner Sheath	Halogen-free, low smoke material complying with Raychem specification WCD51/1663 and WCD696
Armor	Galvanized steel wire braid in accordance with Raychem specification WSD696 and BS6883 (BS1442)
Outer Sheath	Raychem Zerohal material complying with Raychem specification WSD696 and exceeding the requirements of BS6899, Type D. Flame retardant to IEC60332-3(Cat A) and fire resistant to IEC60331 (enhanced to 950 +/- 50°C [122°F]z, 3 hours) Sheath printed with number and size of conductors, IEC331, Raychem, voltage rating and EPD number Sheath color black Oxygen index >30% (BS2782), Temperature index > 260°C [482°F] (BS2782), Smoke index <13 (BS6883) Toxicity Index <2 (NES713)
Temperature Rating	90°C maximum conductor operating temperature
Voltage Rating	600/1000V

MYLAR is a trademark of Dupont Teijin Films U.S.

FR-1000 (Continued)

Halogen-Free, Fire Resistant Cable Range



FR-1000 Multipair Control Cables, Collectively Shielded and Armored 600/1000V*

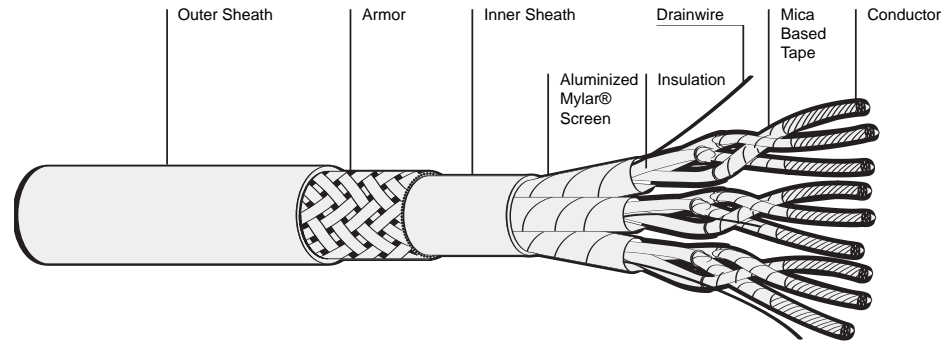
Selection Table

Part No. EPD	Construction	Conductor Stranding	CSA Nominal mm ²	Diameter (Nominal)		Cable			
				Over Shield	Over Inner Sheath	Outer Diameter		Nominal Weight kg/km	Jacket Color
						(min.)	(max.)		
93491A	3x2x0.75	19/0.23	0.75	9.7 [.382]	11.1 [.437]	14.6 [.575]	16.2 [.638]	319	Grey
93492A	7x2x0.75	19/0.23	0.75	13.1 [.516]	14.6 [.575]	18.1 [.713]	20.1 [.791]	484	Grey
93493A	12x2x0.75	19/0.23	0.75	16.4 [.646]	18.1 [.713]	21.5 [.846]	23.7 [.933]	685	Grey
93494A	20x2x0.75	19/0.23	0.75	21.2 [.835]	23.0 [.906]	26.8 [1.055]	29.6 [1.165]	1090	Grey
87500A	2x1.5	19/0.32	1.5	5.4 [.213]	6.7 [.264]	10.7 [.421]	11.3 [.445]	192	Black
87501A	2x2x1.5	19/0.32	1.5	7.2 [.283]	8.6 [.339]	12.3 [.484]	13.5 [.531]	267	Black
87502A	3x2x1.5	19/0.32	1.5	11.2 [.441]	12.7 [.500]	16.1 [.634]	17.9 [.705]	404	Black
87503A	5x2x1.5	19/0.32	1.5	13.8 [.543]	15.3 [.602]	18.8 [.740]	20.8 [.819]	541	Black
87504A	7x2x1.5	19/0.32	1.5	15.2 [.598]	16.9 [.665]	20.3 [.799]	22.5 [.886]	649	Black
87505A	10x2x1.5	19/0.32	1.5	17.5 [.689]	19.2 [.756]	22.5 [.886]	24.9 [.980]	817	Black
87506A	12x2x1.5	19/0.32	1.5	19.0 [.748]	20.7 [.815]	25.2 [.992]	26.6 [1.047]	999	Black
87507A	20x2x1.5	19/0.32	1.5	24.7 [.972]	26.5 [1.043]	30.5 [1.201]	33.7 [1.327]	1541	Black
87508A	24x2x1.5	19/0.32	1.5	26.6 [1.047]	28.6 [1.126]	33.6 [1.323]	35.6 [1.402]	1762	Black

*Cables have an overall aluminized Mylar® shield with drainwire and an overall galvanized steel wire braid armor.

MYLAR is a trademark of Dupont Teijin Films U.S.

FR-1000 (Continued)



FR-1000 Multitrip Control Cables,
Individually Shielded, Armored,
600/1000V*

Selection Table

Part No. EPD	Construction	Conductor Stranding	CSA Nominal mm ²	Diameter (Nominal) Over Inner Sheath	Cable				Jacket Color
					Outer Diameter		Nominal Weight kg/km		
					(min.)	(max.)			
93500A	3x3x0.75	19/0.23	0.75	12.4 [.488]	15.9 [.626]	17.5 [.689]	407	Grey	
93501A	7x3x0.75	19/0.23	0.75	16.8 [.661]	20.2 [.795]	22.4 [.881]	682	Grey	
93502A	12x3x0.75	19/0.23	0.75	22.6 [.890]	26.4 [1.039]	29.2 [1.150]	1111	Grey	
93503A	3x1.00	19/0.25	1.0	6.6 [.260]	10.6 [.417]	11.6 [.457]	198	Grey	

*Cables have pairs individually shielded with aluminumized Mylar® and drainwire and an overall galvanized steel wire braid armor.

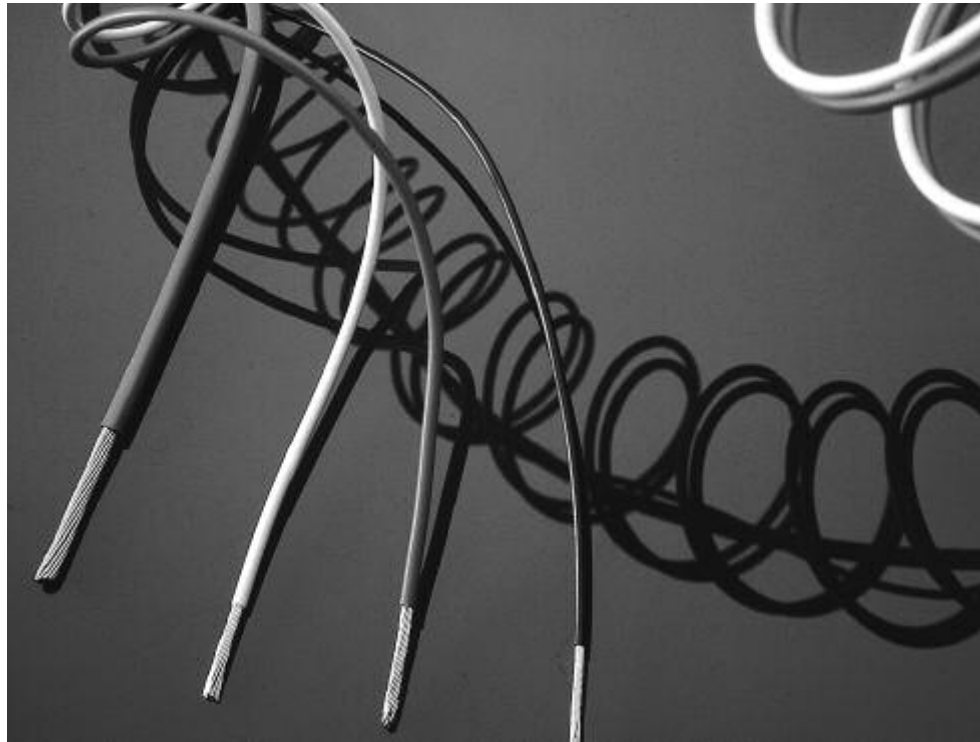
Conductors	Tin plated copper to BS6360
Insulation	Mica based tape, halogen-free, low smoke material complying with Raychem specification WSD695
Core Identification	Pairs – black and white and numbered. Triples – black, red and white and numbered
Shielding	Aluminumized Mylar® tapewrap in contact with tinned copper drainwire
Inner Sheath	Halogen-free, low smoke material complying with Raychem specification WCD51/1663 and WSD696
Armor	Galvanized steel wire braid in accordance with Raychem specification WSD696 and BS6883 (BS1442)
Outer Sheath	Raychem Zerohal material complying with Raychem specification WSD696 and exceeding the requirements of BS6899, Type D. Flame retardant to IEC60332-3(Cat A) and fire resistant to IEC60331 (enhanced to 950 +/- 50°C [122°F], 3 hours) Sheath printed with number and size of conductors, IEC331, Raychem, voltage rating and EPD number Sheath color black Oxygen index >30% (BS2782), Temperature index > 260°C [500°F] (BS2782), Smoke index <13 (BS6883) Toxicity Index <2 (NES713)
Temperature Rating	90°C [194°F] maximum conductor operating temperature
Voltage Rating	600/1000V

MYLAR is a trademark of Dupont Teijin Films U.S.

Type 99M

Product Facts

- Low flammability
- Low smoke generation
- Low toxicity index
- Low generation of corrosive gases
- Small size, lightweight



Applications

Type 99M wire has a dual wall construction of radiation cross-linked modified polyester. This combines excellent mechanical performance and chemical resistance with a range of enhanced fire hazard properties. Type 99M wire is designed to meet the stringent low fire hazard performance now being specified by many authorities, in particular for naval, mass transit and industrial control panel wiring.

During the 1980's there were major changes in the demands of many wire and cable specifications to reduce the risks associated with all aspects of fire

hazards. Specifications such as Def Stan 61-12 Part 18, have been developed over the last decade demanding improved performance of wires and cables under fire conditions.

This has led to a tightening of the requirements for flammability, smoke generation, corrosive gas generation and hazardous fume emission. Type 99M wire achieves these improvements in performance whilst retaining small size, light weight, flexibility, handleability, resistance to carbon arc tracking and resistance to chemicals and fluids.

Physical Characteristics

Handleability

Type 99M wire has been designed to be compatible with modern wiring and harnessing techniques. It is a flexible wire with virtually no springback once set. It is easily stripped with tools such as conventional die-blade strippers.

Small Size

Type 99M equipment wire has a nominal 0.2 mm insulation wall thickness which is comparable to other established thin wall wires such as SPEC 44 wire.

Light Weight

Type 99M wire is designed to have the same weights as SPEC 44 wire.

Available in:	Americas	Europe	Asia Pacific
	■	■	■

Approvals

Type 99M (Continued)

Raychem WCD 281

Def Stan 61-12 Part 18 Issue 4 Type 1

Italian Navy STN-SR-01

Lloyds Register

Type 99M Wire and Cable - Nominal Sizes, Strandings and Weights



99M011X (600 V)
Primary Wire



99M021X (1000 V)
Primary Wire



99M1111
Shielded & Jacketed



99M1121
Shielded & Jacketed

Primary Wires/Shielded and Jacketed Cables - 99M

Size	Stranding (mm)	99M011X (600 V)		99M021X (1000 V)		99M1111		99M1121	
		OD	Weight (g/m)	OD	Weight (g/m)	OD	Weight (g/m)	OD	Weight (g/m)
26	19x0.10	0.88 [.035]	2.00	1.01 [.040]	2.2	1.80 [.071]	7.5	2.91 [.115]	13.3
24	19x0.12	0.98 [.039]	3.00	1.17 [.046]	3.4	1.90 [.075]	9.2	3.20 [.126]	16.6
22	19x0.15	1.13 [.044]	4.40	1.37 [.054]	4.9	2.05 [.081]	11.1	3.52 [.139]	20.5
20	19x0.20	1.40 [.055]	6.50	1.57 [.062]	7.3	2.30 [.091]	14.6	4.02 [.158]	27.7
18	19x0.25	1.65 [.065]	9.90	1.85 [.073]	10.9	2.55 [.100]	19.3	4.57 [.180]	37.1
16	19x0.30	1.90 [.075]	14.15	2.10 [.083]	14.5	2.95 [.116]	24.9	5.13 [.202]	48.5
14	37x0.25	2.25 [.089]	18.62	2.50 [.098]	21.8	3.13 [.123]	30.9	5.72 [.225]	60.5
12	37x0.32	2.60 [.102]	25.70	2.97 [.117]	31.3	3.48 [.137]	43.4	6.42 [.253]	86.0

Typical Properties

Test	Method	Typical value
Temperature rating	BS G230	125°C [257°F]
Voltage rating	Raychem	600 V thin wall
Tensile strength/elongation of insulation	—	30 MPa/250%
Notch propagation (0.05 mm notch)	BS G230	Pass
Shrinkage 200°C [392°F]	BS G230	<1%
Low temperature bend	BS G230	-55°C [-67°F]
Voltage withstand	BS G230	2.5 kV
Insulation resistance (20°C [68°F])	BS G230	1000 M ohms km (min)
Pliability rating	Def Stan 61-12 (18)	82 - Pliable
Fluid resistance	Def Stan 61-12 (18)	
Fuels - aircraft		Pass
Oils - (ASTM No 3)		Pass
Solvents		Pass

Type 99M (Continued)

Environmental Properties

Mechanical Performance

The scrape abrasion and cut through resistance of Type 99M wire out performs the well-established performance of SPEC 44 wire throughout its operating temperature range.

Fluid Resistance

Type 99M wire demonstrates outstanding resistance to most acids, alkalis, hydrocarbon solvents, fuels, lubricants and water.

Electrical Arc Tracking

Type 99M wire is resistant to electrical arc tracking under both wet and dry conditions.

Voltage Ratings

Standard available voltage ratings for Type 99M wire are 600 V (0.2 mm wall thickness) and 1000 V (0.3 mm wall thickness).

Fire Hazard Characteristics

Low Toxicity Index

Type 99M wire is designed to meet the low hazardous fume emission levels required in modern specifications. For example, the change in the Toxicity Index requirement from 1.5 to 0.2 between Issue 2 and Issue 3 of Def Stan 61-12 (Part 18), is met by Type 99M wire.

Flammability

Type 99M wire has passed some of the most stringent flammability tests, such as the test in IEC 332 Part 3 (ladder test) and Underwriter's Laboratory for VW1 (individual wire)

Smoke Generation

Type 99M wire has been designed to meet stringent smoke tests such as those specified in Def Stan 61-12 (Part 18) and in many mass transit specifications.

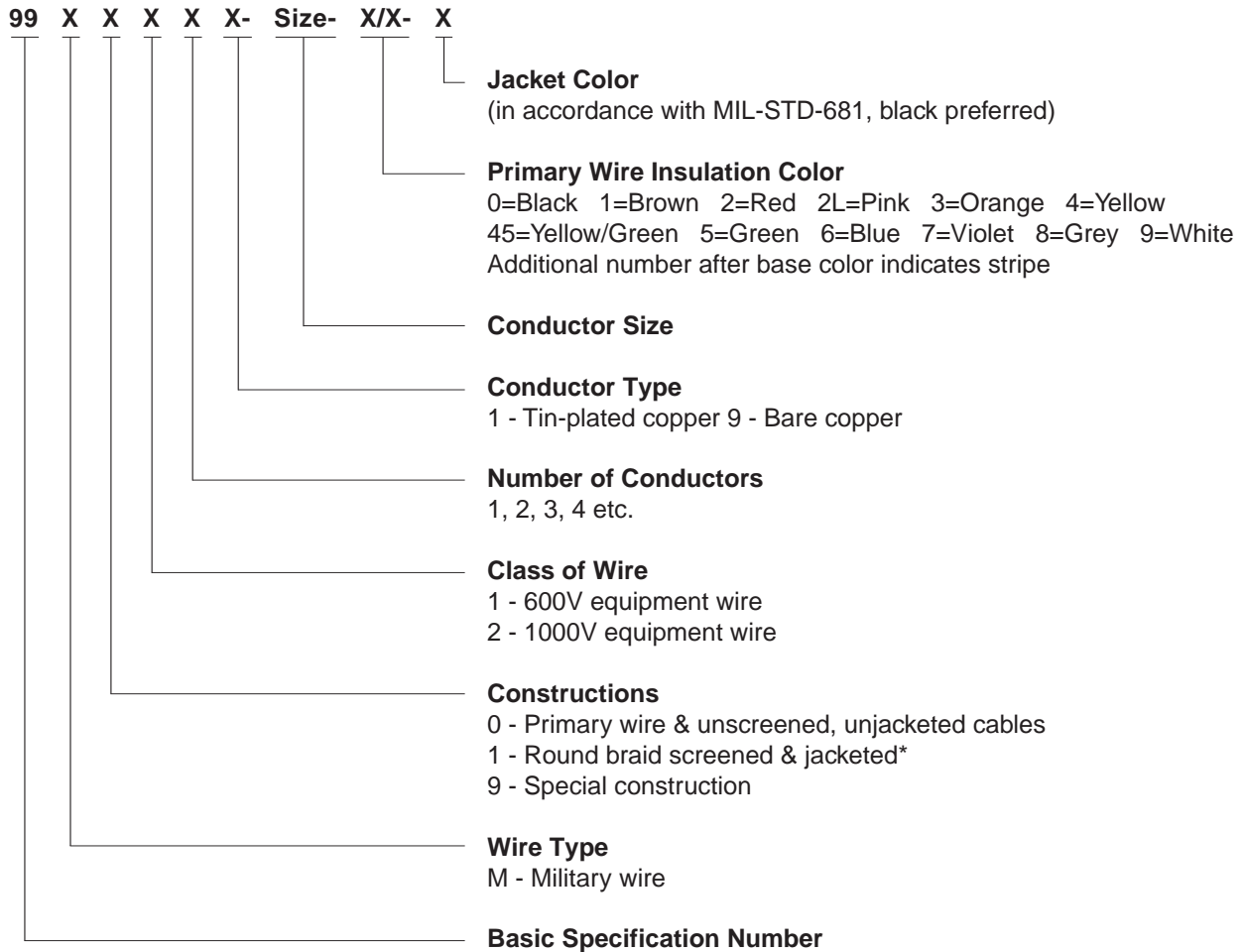
Corrosivity

Type 99M wire has a low corrosive gas emission, demonstrated by its low acid gas value and meets the latest requirements of low fire hazard specifications.

Fire Hazard Properties

Test	Method	Typical value
Flammability	IEC 332 Pt 3	Pass
Toxicity index	Def Stan 61-12 (18)	0.1 per meter of wire
Smoke index	Def Stan 61-12 (18)	8 per meter of wire
Acid gas equivalent	TDE 76/P/76	<1.5%

Part Numbering System



* The cable jackets are Raychem Zerohal and the preferred color is black.

Zerohal 100A

Product Facts

- Halogen free, low smoke
- Highly flame retardant
- Flexible, easy to install
- Small size, lightweight (thin wall construction)



Applications

Raychem's latest generation LFH, thinwall wire has been designed for use primarily in signal, control and light power circuits in subway, regional and high speed trains. It is ideal for applications where space and weight are at a premium; fire safety is important; reliability is imperative; rugged properties to withstand service in an RMT environment are required.

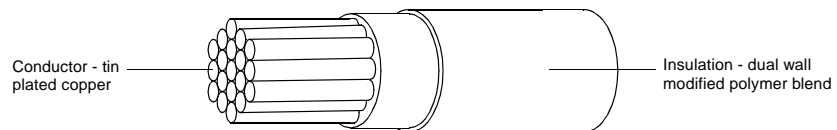
The construction is a dual wall combination of Raychem formulated polymer blends developed to meet the specification requirements while maintaining the desirable features of small size, lightweight, flexibility, non-wrinkling, ease of stripping,

compatibility with standard stripping equipment, lack of recoil and mechanical robustness.

Physical Characteristics

Handleability

Zerohal 100A has been designed for minimum recoil during harnessing operations, to be readily handleable by modern wiring and harnessing techniques and to be easily stripped with standard equipment and tools.



Available in:	Americas	Europe	Asia Pacific
	■	■	■

Typical Properties

Test	Method	Typical Values			
Physical Properties					
Insulation Tensile Strength and Ultimate Elongation	ASTM D3032	Tensile Strength 3500 psi minimum Ultimate Elongation 250% minimum			
Scrape Abrasion Resistance	AAR S 501	1000 cycles minimum (90°, 0.01 inch radial edge blade, 6N load, 20°C [68°F])			
Dynamic Cut Through	ASTM D3032	20 lbs. minimum (90°, 0.01 inch radial edge blade, 0.2 inch per min, 20°C [68°F])			
Static Cut-through Penetration	AAR S 501	No contact with the conductor (90°, 0.01 inch radial edge blade, 10 min, 9N load, 125°C [257°F])			
Thermal Properties					
Temperature Index	ASTM D3032	10,000 hours minimum at 125°C [257°F]			
Accelerated ageing	ASTM D3032	No cracks, flow or dielectric breakdown. (168hr at 170°C [338°F])			
Shrinkage	IEC 811-1-3	0.5% maximum at each end. (6hr at 160°C [320°F])			
Insulation Blocking	MIL-W-22759E	Cores must be easily separated without damage (24hr at 125°C [257°F], 6X mandrel.)			
Electrical Properties					
IR Constant	ASTM D3032	>10000 MΩkft at 20°C [68°F] >100 MΩkft at 60°C [140°F] >10 MΩkft at 90°C [194°F]			
Environmental Properties					
Fluid Immersion	ASTM D3032	Fluid	NATO code	Temp (°C)	Time (hr)
		ASTM No. 1 Oil	—	100	70
		IRM 902 Oil	—	100	70
		IRM 903 Oil	—	100	70
		70/30 iso-octane/toluene	—	23	24
		Engine lubricating oil	O-236	70	24
		Grease	G-354	70	24
		Hydraulic fluid, petroleum base	H-515	50	24
		Silicone damping fluid	S-1724	70	24
		Automotive brake fluid	H-542	23	24
		Fire resistant hydraulic fluid	H-544	50	24
		De-icing fluid	S-745	23	24
Methyl Ethyl Ketone	—	23	1		
5% max swell. No dielectric breakdown. (30mm diameter mandrel)					
Fire Hazard Properties					
Flammability - small scale	IEC 332-1	Charring confined between 50mm and 540mm from lower edge of top support. (Single vertical wire, 60 s flame)			
Flammability - large scale	IEC 332-3	2.5m maximum burn length. (Five 3.5m long 37-wire bundles, vertical, 20.5 kW flame)			
Smoke - small scale	ISO 5659-2	Ds1.5 of 100 max., Ds4 of 150 max., Dmax of 150 max., VOF4 of 300 max. (‘NBS’ smoke box with cone heater, 1.8m of wire 50 kW/m2 heat flux with and without a pilot flame)			
Smoke - large scale	IEC 1034	90% minimum transmittance. (3m cube smoke box. Eight 1m long 7-wire bundles, horizontal. Fire source: 1 litre burning alcohol.)			
Toxicity	IMO FTPC	Toxicity index < 1 (Test conditions as in smoke - small scale)			
Halogen Content	IEC 684-2	Less than 0.2% Cl + Br + I. Less than 0.1% F (Wet chemical analysis)			
Copper Mirror Corrosion	ASTM D2671	5% maximum etched area. (0.4g sample, 200°C [392°F], 16hr.)			
Acid Gas Detection	IEC 754-2	pH greater than 4.3 10 μS/mm maximum (1g sample, tube furnace, T > 935°C [1715°F], gases dissolved in water)			

Ordering Information

Wire Size AWG	Stranding No x AWG Dia (mm)	Conductor Diameter		Finished Wire Maximum Resistance at 20°C /kft/km	Diameter		Maximum Weight lbs/kft kg/km	Part No.
		Min.	Max.		Min.	Max.		
24	19x36	0.550 [0.022]	0.63 [0.025]	25.7 [84.32]	1.09 [0.043]	1.19 [0.047]	2.41 [3.59]	100A0111-24-*
22	19x34	0.735 [0.029]	0.79 [0.031]	15.9 [52.2]	1.26 [0.050]	1.33 [0.052]	3.34 [4.98]	100A0111-22*
20	19x32	0.940 [0.037]	1.01 [0.040]	9.9 [32.4]	1.46 [0.057]	1.54 [0.061]	4.98 [7.42]	100A0111-20*
18	19x30	1.170 [0.046]	1.26 [0.050]	6.2 [20.4]	1.69 [0.067]	1.79 [0.071]	7.31 [10.89]	100A0111-18*
16	19x29	1.321 [0.052]	1.37 [0.054]	4.8 [15.8]	1.84 [0.072]	1.94 [0.076]	9.19 [13.70]	100A0111-16*
14	19x27	1.650 [0.065]	1.79 [0.070]	3.1 [10.0]	2.27 [0.089]	2.39 [0.094]	14.45 [21.53]	100A0111-14*
12	37x28	2.080 [0.082]	2.24 [0.088]	2.0 [6.63]	2.71 [0.107]	2.86 [0.113]	21.03 [31.33]	100A0111-12*
10	37x26	2.690 [0.106]	2.83 [0.111]	1.3 [4.13]	3.33 [0.131]	3.51 [0.138]	33.27 [49.58]	100A0111-10*

Zerohal 100A (Continued)

Environmental Properties

Fluid Resistance

Zerohal 100A wire demonstrates an outstanding balance of resistance to a wide range of commonly used solvents, fluids and lubricants.

Voltage Rating

Zerohal 100A wire is a 600 volt rated wire.

Fire Hazard Characteristics

Zerohal 100A is a halogen free insulation system and does not contain phosphorus or sulphur. It meets the toxicity, smoke density, halogen content, corrosivity and flammability requirements of major recognized agencies.

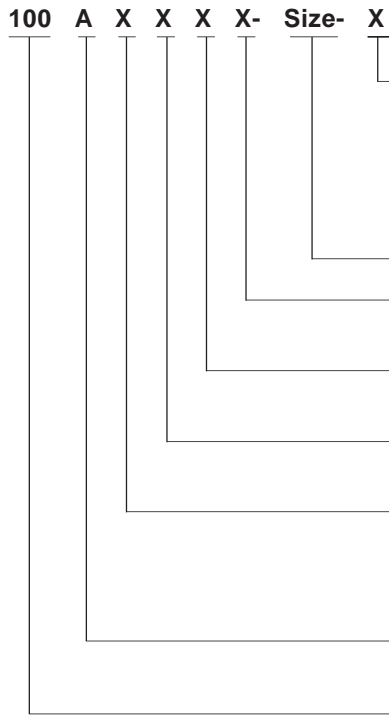
Flammability

Zerohal 100A meets the flammability/burning behavior requirements of major recognized agencies.

Fire Hazard Properties

Test	Method	Typical Value
Flammability - small scale	IEC 332-1	Charring confined between 50mm and 540mm from lower edge of top support. (Single vertical wire, 60 s flame)
Flammability - large scale	IEC 332-3	2.5m maximum burn length. (Five 3.5m long 37-wire bundles, vertical, 20.5 kW flame)
Flammability	IEEE 383	Pass
Smoke - small scale	ISO 5659-2	Ds1.5 of 100 max., Ds4 of 150 max., Dmax of 150 max., VOF4 of 300 max. ('NBS' smoke box with cone heater, 1.8m of wire 50 kW/m ² heat flux with and without a pilot flame)
Smoke - small scale	ASTM E662	Smoke density - Ds4 (Max.) Flaming - 200 Non-Flaming - 75
Toxicity	IMO FTPC	Toxicity index < 1 (Test conditions as in smoke - small scale)
Halogen Content	IEC 684-2	Less than 0.2% Cl + Br + I. Less than 0.1% F (Wet chemical analysis)
Copper Mirror Corrosion	ASTM D2671	5% maximum etched area. (0.4g sample, 200°C [392°F], 16hr.)
Acid Gas Detection	IEC 754-2	pH greater than 4.3 10 µS/mm maximum (1g sample, tube furnace, T > 935°C [715°F], gases dissolved in water)

Part Numbering System



Primary Wire Insulation Color

- 0 - Black
- 1 - Brown
- 2 - Red
- 3 - Orange
- 4 - Yellow
- 5 - Green
- 6 - Blue
- 7 - Violet
- 8 - Gray
- 9 - White

Conductor Size

Conductor Type

- 1 - Tin-plated copper

Number of Conductors

- 1 to 9

Class of Wire

- 1 - 600 V equipment wire

Construction

- 0 - Primary wire and unscreened, unjacketed cables
- 1 - Roundbraid, screened and jacketed
- 4 - Jacketed, no screen

Wire Type

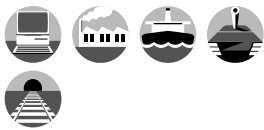
- A - AWG construction (US Specification)

Basic Specification Number

Zerohal 100G

Product Facts

- Qualified to VG 95218-20, Type E
- Halogen free, low smoke
- Highly flame retardant
- Flexible, easy to install
- Small size, lightweight (thin wall construction)



Applications

Zerohal 100G wire has been developed to meet the requirements of German Specification VG 95218-20, Type E primary wire.

The construction is a dual wall combination of Raychem formulated polymer blends developed to meet the specification requirements while maintaining the desirable features of small size, light-weight, flexibility, non-wrinkling, ease of stripping, compatibility with standard stripping equipment, lack of recoil and mechanical robustness.

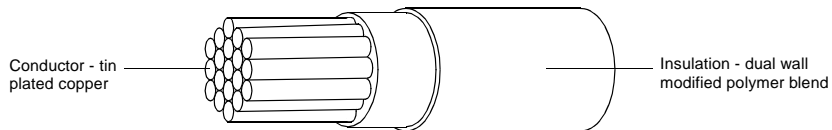
System

- System 100

Physical Characteristics

Handleability

Zerohal 100G wire has been designed for minimum recoil during harnessing operations, to be readily handleable by modern wiring and harnessing techniques and to be easily stripped with standard equipment and tools.



Available in:	Americas	Europe	Asia Pacific
	■	■	■

Approvals

Typical Properties

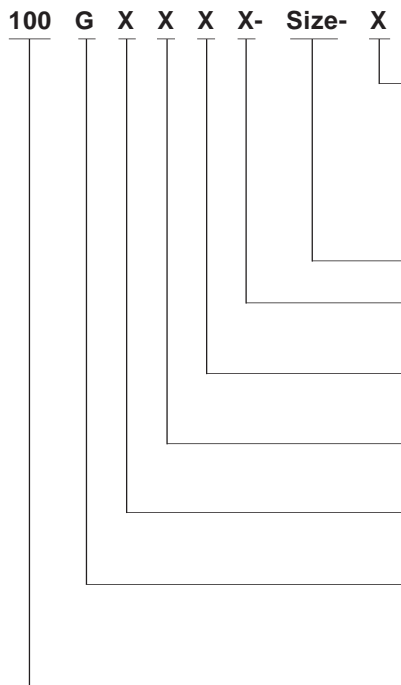
Zerohal 100G (Continued)

VG 95218-20, Type E (Electrical cables and insulated wires for low frequency - Part 20: Single core insulated wires.)

Test	Method	Typical Value
Max. operating temperature	VG 95218-20, ASTM D 3032	125°C [257°F] (20,000 h)
Insulation shrinkage (160°C)	DIN VDE 0472 Pt 628, IEC 811-1-3	< 0.5%
Low temperature bend	VG 95218 - Pt 2	-55°C [-67 °F]
Pressure test at high temperature	DIN VDE 0472 Pt 609, IEC 811-3-1	125°C [257°F] < 30% indentation
Heat aging (150°C, 6 h)	DIN VDE 0472 Pt 303,	No cracking, no dielectric
(140°C, 120 h)	IEC 811-1-2	breakdown
Voltage rating	VG 95218-20	750/1300 V AC
Abrasion resistance	VG 95218 - Pt 2	Pass
Insulation blocking (125°C)	VG 95218 - Pt 2	Pass
Voltage withstand (23°C, 2.5 kV rms)	DIN VDE 0472 pt 509	Pass
Insulation resistance	DIN VDE 0472 pt 502, IEC 885-1	> 500 M ohms. km (20°C [68°F]) > 0.5 M ohms. km (90°C [194°F])
Chemical resistance		
Grease (G-354)*	VG 95218 - Pt 2, 70°C 24h	< 5% diameter change, no dielectric breakdown
Hydraulic fluid (H-515, H-544)*	VG 95218 - Pt 2, 50°C 24h	< 5% diameter change, no dielectric breakdown
Brake fluid (H-542)*	VG 95218 - Pt 2, 23°C 24h	< 5% diameter change, no dielectric breakdown
De-icing fluid (S-745)*	VG 95218 - Pt 2, 23°C 24h	< 5% diameter change, no dielectric breakdown
MEK	VG 95218 - Pt 2, 23°C 1h	< 5% diameter change, no dielectric breakdown
70/30 ISO-Octane/Toluene	VG 95218 - Pt 2, 23°C 24h	< 5% diameter change, no dielectric breakdown
Insulation		
Tensile strength	DIN VDE 0472 pt 602, IEC 811-1-1	> 20 MPa
Elongation at break	DIN VDE 0472 pt 602, IEC 811-1-1	> 200%

*NATO code. For further details please consult the German Standard VG 95218-20, Type E.

Part Numbering System



Primary Wire Insulation Color

- 0 - Black
- 1 - Brown
- 2 - Red
- 2L - Pink
- 3 - Orange
- 4 - Yellow
- 5 - Green
- 6 - Blue
- 7 - Violet
- 8 - Gray
- 9 - White

NB. VG 95218 T020-EXXX wire only available in colors 0, 1, 45, 6, 9

Conductor Size

Conductor Type

- 1 - Tin-plated copper

Number of Conductors

- 1

Class of Wire

- 1 - 750 V equipment wire

Construction

- 0 - Primary wire

Wire Type

- G - Meeting the performance requirements of German Specification VG 95218-20, Type E

Basic Specification Number

Zerohal 100G (Continued)

Environmental Properties

Fluid Resistance

Zerohal 100G wire demonstrates an outstanding balance of resistance to a wide range of commonly used solvents, fluids and lubricants.

Voltage Rating

Zerohal 100G wire is a 750/1300 V AC rated wire.

Fire Hazard Characteristics

Zerohal 100G is a halogen free insulation system and does not contain phosphorus or sulphur. It meets the toxicity, smoke density, halogen content, corrosivity and flammability requirements of VG 95218-20, Type E.

Flammability

Zerohal 100G meets the flammability/burning behavior requirements of VG 95218-20, Type E.

Fire Hazard Properties

Test	Method	Typical value
Toxicity	NES 713	3.5
Smoke density	IEC 1034 Pt 1 and 2	95% light transmittance
Halogen content	DIN VDE 0472 pt 815	Non-detected
Corrosivity of combustion gases	DIN VDE 0472 pt 813, IEC 754-2	5.0 pH, <4 µS/mm conductivity
Flammability	VG 95218 Pt 2	< 15 sec afterburn < 150 mm burn length

Ordering Information

Conductor Nominal Cross Sectional Area mm ²	Stranding No x nom Dia (mm)	Diameter		Insulated Wire Maximum Resistance at 20°C ohms/km	Diameter		Maximum Weight g/m	VG 95218 Part No.	Part No.
		min.	max.		min.	max.			
0.40	19x0.16	0.74 [.029]	0.79 [.031]	50.50	1.28 [.050]	1.39 [.055]	5.17	VG 95218 T020-E02*	100G0111-0.40-*
0.50	19x0.18	0.82 [.032]	0.90 [.035]	40.10	1.37 [.054]	1.47 [.058]	6.60	VG 95218 T020-E03*	100G0111-0.50-*
0.60	19x0.20	0.95 [.037]	1.01 [.040]	31.10	1.47 [.058]	1.57 [.062]	7.54	VG 95218 T020-E04*	100G0111-0.60-*
0.75	19x0.23	1.04 [.041]	1.15 [.045]	26.70	1.59 [.063]	1.70 [.067]	8.90	VG 95218 T020-E05*	100G0111-0.75-*
1.00	19x0.25	1.17 [.046]	1.26 [.050]	20.00	1.69 [.067]	1.80 [.071]	10.73	VG 95218 T020-E06*	100G0111-1.00-*
1.20	19x0.29	1.32 [.052]	1.42 [.056]	15.30	1.88 [.074]	1.98 [.078]	13.59	VG 95218 T020-E07*	100G0111-1.20-*
1.50	37x0.23	1.46 [.057]	1.58 [.062]	13.70	2.03 [.080]	2.13 [.084]	15.96	VG 95218 T020-E08*	100G0111-1.50-*
2.00	37x0.25	1.68 [.066]	1.82 [.072]	10.50	2.31 [.091]	2.41 [.095]	20.29	VG 95218 T020-E09*	100G0111-2.00-*
2.50	37x0.29	1.85 [.073]	2.01 [.079]	8.21	2.48 [.098]	2.63 [.104]	25.65	VG 95218 T020-E10*	100G0111-2.50-*
3.00	37x0.32	2.12 [.083]	2.24 [.088]	6.58	2.70 [.106]	2.86 [.113]	31.00	VG 95218 T020-E11*	100G0111-3.00-*
4.00	56x0.30	2.41 [.095]	2.56 [.101]	4.86	3.01 [.119]	3.16 [.124]	43.48	—	100G0111-4.00-*

The VG 95218-20, Type E specification defines that the insulation color shall be black, brown, yellow/green, blue or white only.

To ensure full compliance with the specification, order the VG 95218 part number complete with color code.

Raychem Type 100G wire, meeting the performance requirements of VG 95218-20, Type E, is available in other colors (see part numbering system). To order these colors, order the Raychem 100G part number.

*Color code in accordance with part number system.



Available in:

- Americas ■
- Europe ■
- Asia Pacific ■

FlexLite



Selection Guide

Application	Temperature Rating (°C/°F)	Features and Benefits	Product Name
Intermittent-duty motors and heating elements	-45°C to 125°C -49°F to 257°F	<ul style="list-style-type: none"> ■ Insulation that does not melt and flow at high temperatures ■ Excellent chemical resistance ■ VW-1 	FlexLite DW
Electronics, appliance, and motor applications	-55°C to 135°C -67°F to 275°F	<ul style="list-style-type: none"> ■ Small size, light weight ■ No plasticizers or corrosive outgassing ■ Good mechanical and shop handling characteristics 	FlexLite TW
General purpose appliance wire	-55°C to 150°C -67°F to 302°F	<ul style="list-style-type: none"> ■ VW-1 ■ Excellent chemical resistance ■ Insulation does not melt and flow at high temperature 	FlexLite MT
Lighting, motor applications	-55°C to 200°C -67°F to 392°F	<ul style="list-style-type: none"> ■ VW-1 ■ Excellent shop handling ■ No cold-flow problems 	FlexLite HT
Lighting, appliances, motors	-65°C to 250°C -85°F to 482°F	<ul style="list-style-type: none"> ■ Very high temperature ■ VW-1 ■ Superb chemical resistance ■ Excellent shop handling 	FlexLite TX

FlexLite/UL Style Cross-Reference

Primary Wire

Product	UL Style	Temperature Rating	Voltage Rating	AWG Range	Part Description
FlexLite DW	3584	125°C [257°F]	600 volts	4–28	FLDWX031X
FlexLite TW	10208	135°C [275°F]	600 volts	10–32	FLTWX031X
FlexLite MT	10916	150°C [302°F]	600 volts	6–26	FLMTX031X
FlexLite HT	3557	200°C [392°F]	600 volts	6–26	FLHTX031X
FlexLite TX	10297	250°C [482°F]	600 volts	4–28	FLTX031X

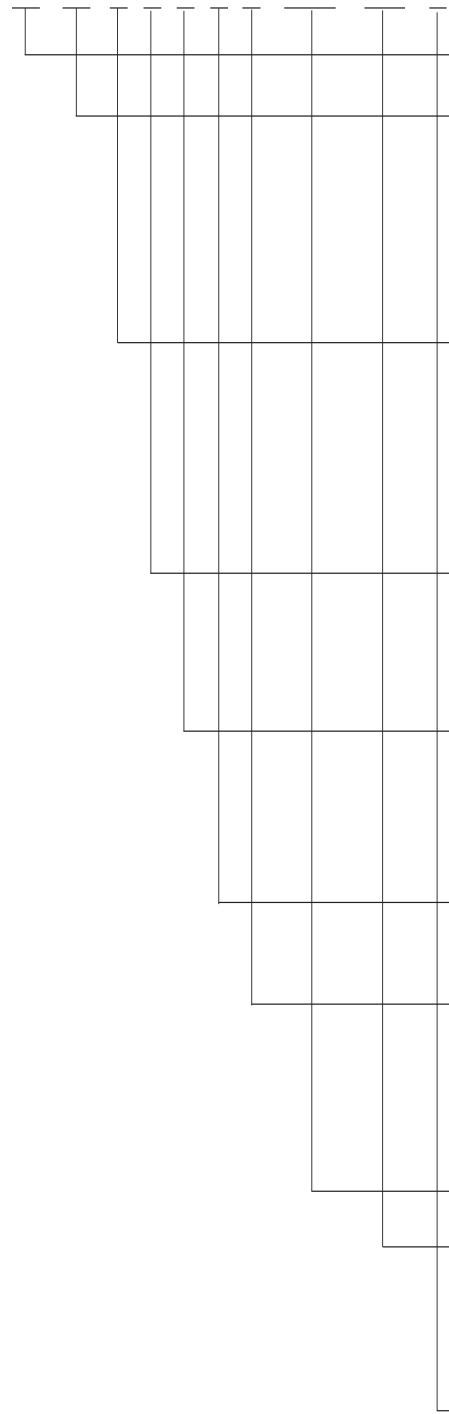
Note: Additional UL-recognized cable constructions are available. Please contact Tyco Electronics for details.

UL Marking and Labeling

All FlexLite products are UL labeled and reel marked. UL surface marking is additional. Please contact Tyco Electronics for further information.

Part Numbering System

FL XX X X X X X - Size - X/X - X



Basic Product Number

Product Type (UL Style - Temperature Rating)

- DW - UL Style 3584 - 125°C
- TW - UL Style 10208 - 135°C
- MT - UL Style 10916 - 150°C
- HT - UL Style 3557 - 200°C
- TX - UL Style 10297 - 250°C

Conductor Stranding

- A - Solid
- B - 7 strand
- C - 19 strand
- D - 37 strand
- E - Rope Lay

Construction

- 0 - Primary wire; or unshielded & unjacketed cable
- 1 - Round braid shielded & jacketed cable*
- 6 - Special constructions

Class of Wire

- 1 - 150 volt
- 2 - 300 volt
- 3 - 600 volt

Number of Conductors

1 through 10 (designator for 10 conductor = 0)

Conductor Type

- 1 - Tin-coated copper
- 2 - Silver-coated copper
- 3 - Nickel coated copper
- 9 - Bare copper

Conductor Size (AWG) or (Metric)

Primary Wire Insulation Color (code per MIL-STD-681)

- 0 - Black 3 - Orange 6 - Blue 9 - White
- 1 - Brown 4 - Yellow 7 - Violet
- 2 - Red 5 - Green 8 - Gray

Jacket Color (code per MIL-STD-681)

(codes same as for Primary Wire Insulation Color)

*Shield coating same as conductor coating

Typical ordering example	19 strand, 20 AWG tin-coated copper, two component, shielded and jacketed cable, 600 volt, blue and white components, white jacket; part number FLDWC1321-20-6/9-9.
Ordering information	For product requiring CUR (Canadian UL) or CSA marking in 14-10 AWG, 19 strand conductors only, the part numbering descriptions above DO NOT apply. Please contact Tyco Electronics for further information.

Dual-Wall Primary Wire

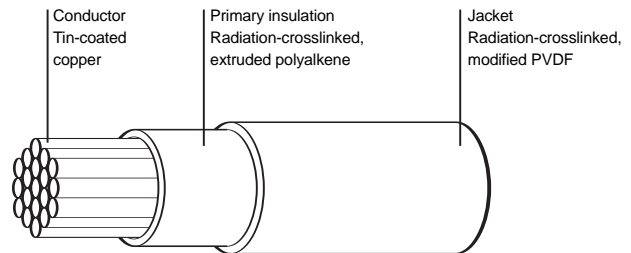
Product Facts

- UL rated operating temperature to 125°C [257°F]
- Non melting insulation material
- Thin-wall product for size and weight savings
- Excellent chemical resistance
- Dual-wall construction for increased mechanical performance
- Compatibility with automated stripping equipment
- Variety of colors and constructions



Applications

FlexLite DW (FLDW) offers a high-performance non melting insulation suitable for a variety of applications, especially those with occasional high-temperature excursions, such as high-power battery-operated devices or intermittent-duty motors or heating elements.



Specifications/Approvals

Series	UL	CUR	CSA	Raychem
DW	Style 3584 Flammability VW-1 Temperature rating 125°C [257°F]	Recognized	Certified AWMIA	WCD-3106

Available in:	Americas	Europe	Asia Pacific
	■	■	■

Construction Details

Part No.	Wire Size (AWG)	Conductor Stranding (No. x AWG)	Nominal Diameter mm [inch]	Finished Wire Maximum Resistance at 20°C (68°F) Ω/km [Ω/1000 ft]	Diameter			Nominal Weight in kg/km [lb/1000 ft]
					Minimum mm [inch]	Nominal mm [inch]	Maximum mm [inch]	
FLDWC0311-26-*	26	19 x 38	.470 [.0185]	132 [40.1]	.965 [.038]	1.02 [.040]	1.07 [.042]	2.38 [1.6]
FLDWC0311-24-*	24	19 x 36	.597 [.0235]	83.3 [25.4]	1.12 [.044]	1.17 [.046]	1.22 [.048]	3.57 [2.4]
FLDWC0311-22-*	22	19 x 34	.749 [.0295]	52.2 [15.9]	1.32 [.052]	1.37 [.054]	1.42 [.056]	5.21 [3.5]
FLDWC0311-20-*	20	19 x 32	.953 [.0375]	32.0 [9.76]	1.52 [.060]	1.57 [.062]	1.63 [.064]	7.59 [5.1]
FLDWC0311-18-*	18	19 x 30	1.18 [.0465]	20.4 [6.22]	1.78 [.070]	1.85 [.073]	1.93 [.076]	11.46 [7.7]
FLDWC0311-16-*	16	19 x 29	1.33 [.0525]	15.8 [4.82]	1.98 [.078]	2.06 [.081]	2.13 [.084]	14.58 [9.8]
FLDWC0311-14-*	14	19 x 27	1.68 [.0660]	10.0 [3.05]	2.39 [.094]	2.49 [.098]	2.59 [.102]	21.88 [14.7]
FLDWD0311-12-*	12	37 x 28	2.16 [.0850]	6.59 [2.01]	2.87 [.113]	2.97 [.117]	3.07 [.121]	32.89 [22.1]

* Replace asterisk with color code designator:
 0 = Black 3 = Orange 7 = Violet
 1 = Brown 4 = Yellow 8 = Gray
 2 = Red 5 = Green 9 = White
 For example: FLDWC0311-20-9 = AWG 20, white.

Construction Details

Nominal CSA Part No.	Wire Size (mm ²)	Conductor Stranding (No. x Dia.)	Diameter		Finished Wire Maximum Resistance at 20°C (68°F) Ω/km [Ω/1000 ft]	Diameter			Nominal Weight in kg/km [lb/1000 ft]
			(min.) mm [inch]	(max.) mm [inch]		Lower Spec. Limit mm [inch]	Target Value mm [inch]	Upper Spec. Limit mm [inch]	
FLDWC0311-0.25*	0.25	19 x 0.127	0.55 [.022]	0.63 [.025]	83.6 [25.5]	1.12 [.044]	1.17 [.046]	1.22 [.048]	3.77 [2.53]
FLDWC0311-0.35*	0.35	19 x 0.15	0.72 [.028]	0.77 [.030]	56.1 [17.1]	1.31 [.052]	1.37 [.054]	1.42 [.056]	5.17 [3.46]
FLDWC0311-0.50*	0.50	19 x 0.19	0.86 [.034]	0.88 [.035]	40.1 [12.2]	1.46 [.057]	1.51 [.059]	1.56 [.061]	6.92 [4.64]
FLDWC0311-0.75*	0.75	19 x 0.23	1.05 [.041]	1.08 [.043]	24.7 [7.53]	1.65 [.065]	1.70 [.067]	1.75 [.069]	9.53 [6.39]
FLDWC0311-1.00*	1.00	19 x 0.25	1.17 [.046]	1.26 [.050]	20.0 [6.1]	1.78 [.070]	1.85 [.073]	1.93 [.076]	11.88 [7.96]
FLDWC0311-1.50*	1.50	19 x 0.32	1.46 [.057]	1.51 [.059]	13.7 [4.2]	2.21 [.095]	2.28 [.090]	2.36 [.093]	17.88 [11.98]

* Replace asterisk with color code designator:
 0 = Black 3 = Orange 6 = Blue 9 = White
 1 = Brown 4 = Yellow 7 = Violet
 2 = Red 5 = Green 8 = Gray
 For example: FLDWC0311-20-9 = AWG 20, white.
 FLDWC0311-1.00-9 = Size 1.00 mm², white.

For product requiring CUR (Canadian UL) or CSA marking in 14-10 AWG, 19 strand conductors only, the part numbering descriptions above DO NOT apply. Please contact Tyco Electronics for further information.

Electronics

FlexLite TW

Thin-Wall Hookup Wire and Cable

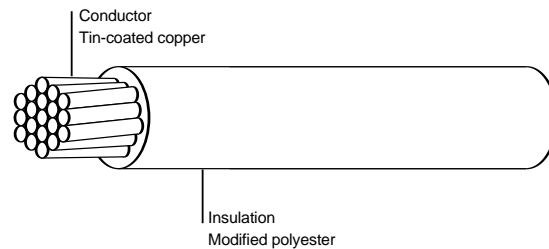
Product Facts

- UL rated operating temperature to 135°C [275°F]
- Thin-wall product for size and weight savings
- Tough insulation material
- Excellent chemical resistance
- Gauge sizes from 10-32 AWG
- No plasticizers or corrosive outgassing, which can be detrimental to sensitive electrical and electronic components



Applications

FlexLite TW (FLTW) wire is commonly used in applications that demand smaller, more rugged components, often in elevated temperatures. Designed to offer reduced size while maintaining superior mechanical performance, FLTW in many cases is a lower-cost solution than expensive fluoropolymer wire.



Available in:	Americas	Europe	Asia Pacific
	■	■	■

Specifications/Approvals

FlexLite TW (Continued)

Series	UL	CUR	CSA	Raychem
TW	Style 10208 Temperature rating 135°C [275°F]	Recognized	Certified AWMIA	WCD-3106

Construction Details

Part No.	Wire Size (AWG)	Conductor Stranding (No. x AWG)	Nominal Diameter mm [inch]	Finished Wire Maximum Resistance at 20°C (68°F) Ω/km [Ω /1000 ft]	Diameter			Nominal Weight in kg/km [lb/1000 ft]
					Minimum mm [inch]	Nominal mm [inch]	Maximum mm [inch]	
FLTWC0311-26-*	26	19 x 38	.470 [.0185]	132 [40.1]	.813 [.032]	.864 [.034]	.914 [.036]	1.93 [1.3]
FLTWC0311-24-*	24	19 x 36	.597 [.0235]	83.3 [25.4]	.965 [.038]	1.02 [.040]	1.07 [.042]	2.83 [1.9]
FLTWC0311-22-*	22	19 x 34	.749 [.0295]	52.2 [15.9]	1.14 [.045]	1.19 [.047]	1.24 [.049]	4.17 [2.8]
FLTWC0311-20-*	20	19 x 32	.953 [.0375]	32.0 [9.76]	1.35 [.053]	1.40 [.055]	1.45 [.057]	6.25 [4.2]
FLTWC0311-18-*	18	19 x 30	1.18 [.0465]	20.4 [6.22]	1.60 [.063]	1.65 [.065]	1.70 [.067]	9.52 [6.4]
FLTWC0311-16-*	16	19 x 29	1.33 [.0525]	15.8 [4.82]	1.75 [.069]	1.83 [.072]	1.91 [.075]	12.20 [8.2]
FLTWC0311-14-*	14	19 x 27	1.68 [.0660]	10.0 [3.05]	2.16 [.085]	2.26 [.089]	2.36 [.093]	18.90 [12.7]
FLTWD0311-12-*	12	37 x 28	2.16 [.0850]	6.59 [2.01]	2.64 [.104]	2.74 [.108]	2.84 [.112]	28.87 [19.4]

* Replace asterisk with color code designator:
 0 = Black 3 = Orange 6 = Blue 9 = White
 1 = Brown 4 = Yellow 7 = Violet
 2 = Red 5 = Green 8 = Gray
 For example: FLTWC0311-22-9 = AWG 22, white.

For product requiring CUR (Canadian UL) or CSA marking in 14-10 AWG, 19 strand conductors only, the part numbering descriptions above DO NOT apply. Please contact Tyco Electronics for further information.

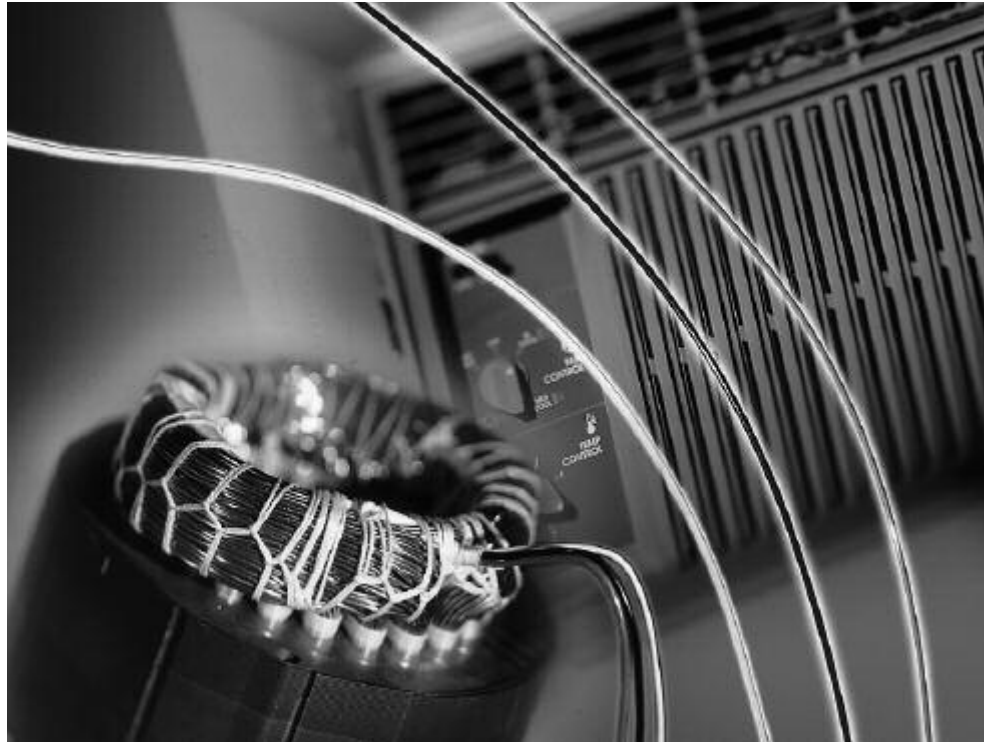
Electronics

FlexLite MT

Medium Temperature Hookup Wire

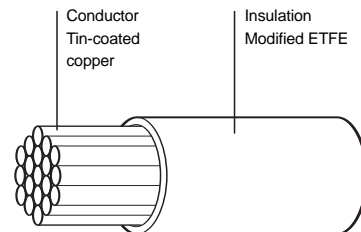
Product Facts

- UL rated operating temperature to 150°C [302°F]
- Thin-wall, for size and weight savings
- Tough fluoropolymer insulation material
- Excellent stripping and handling
- Variety of constructions and colors
- VW-1 flammability rating
- 600 V rating



Applications

FlexLite MT is a general purpose wire for appliance, electronics, and electrical equipment that require 150°C [302°F] and 600 V ratings.



Available in:	Americas	Europe	Asia Pacific
	■	■	■

Electronics

FlexLite MT (Continued)

Specifications/Approvals

Series	UL	CUR	Raychem
MT	Style 10916 Flammability VW-1 Temperature rating 150°C [302°F]	Recognized	WCD-3106

Construction Details

Part No.	Wire Size (AWG)	Conductor Stranding (No. x AWG)	Nominal Diameter mm [inch]	Finished wire Maximum Resistance at 20°C (68°F) Ω/km [Ω /1000 ft]	Diameter			Nominal Weight in kg/km [lb/1000 ft]
					Minimum mm [inch]	Nominal mm [inch]	Maximum mm [inch]	
FLMTC0311-26-*	26	19 x 38	.470 [.0185]	150 [45.8]	.765 [.030]	.800 [.032]	.836 [.034]	1.89 [1.29]
FLMTC0311-24-*	24	19 x 36	.597 [.0235]	94.2 [28.7]	.892 [.035]	.927 [.037]	.963 [.039]	2.75 [1.88]
FLMTC0311-22-*	22	19 x 34	.749 [.0295]	59.4 [18.1]	1.04 [.041]	1.08 [.043]	1.12 [.045]	4.08 [2.75]
FLMTC0311-20-*	20	19 x 32	.953 [.0375]	37.4 [11.4]	1.25 [.049]	1.28 [.051]	1.32 [.053]	6.21 [4.17]
FLMTC0311-18-*	18	19 x 30	1.18 [.0465]	23.5 [7.15]	1.52 [.060]	1.56 [.062]	1.61 [.064]	9.66 [6.49]

* Replace asterisk with color code designator:
 0 = Black 3 = Orange 6 = Blue 9 = White
 1 = Brown 4 = Yellow 7 = Violet
 2 = Red 5 = Green 8 = Gray
 For example: FLMTC0311-18-9 = AWG 18, white.

For product requiring CUR (Canadian UL) or CSA marking in 14-10 AWG, 19 strand conductors only, the part numbering descriptions above DO NOT apply. Please contact Tyco Electronics for further information.

High-Temperature Hookup Wire

Product Facts

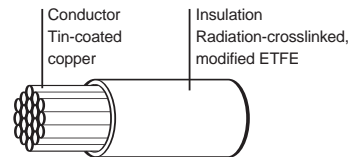
- UL rated operating temperature to 200°C [392°F]
- Exceptional chemical resistance
- Thin-wall, for size and weight savings
- Tough fluoropolymer insulation material
- Excellent stripping and handling
- Variety of constructions and colors
- Crosslinked to minimize cold flow
- VW-1 flammability rating
- 600 V rating

FlexLite HT



Applications

FlexLite HT (FLHT) wire is the product of choice for high-temperature applications. It offers shop-handling advantages over silicone/ fiberglass constructions (SF1/SF2) and is cost-competitive with other fluoropolymer wire. Applications include halogen lights and small high-end appliances where space and temperature are issues.



Available in:	Americas	Europe	Asia Pacific
	■	■	■

Electronics

FlexLite HT (Continued)

Specifications/Approvals

Series	UL	CUR	CSA	Raychem
HT	Style 3557 Flammability VW-1 Temperature rating 200°C [392°F]	Recognized	Certified AWMIA/B	WCD-3106

Construction Details

Part No.	Wire Size (AWG)	Conductor Stranding (No. x AWG)	Nominal Diameter mm [inch]	Finished Wire Maximum Resistance at 20°C (68°F) Ω/km [Ω /1000 ft]	Diameter			Nominal Weight in kg/km [lb/1000 ft]
					Minimum mm [inch]	Nominal mm [inch]	Maximum mm [inch]	
FLHTC0311-26*	26	19 x 38	.470 [.0185]	132 [40.1]	.765 [.0301]	.800 [.0315]	.836 [.0329]	1.89 [1.27]
FLHTC0311-24*	24	19 x 36	.597 [.0235]	83.3 [25.4]	.892 [.0351]	.927 [.0365]	.963 [.0379]	2.75 [1.85]
FLHTC0311-22*	22	19 x 34	.749 [.0295]	52.2 [15.9]	1.04 [.0411]	1.08 [.0425]	1.12 [.0439]	4.08 [2.74]
FLHTC0311-20*	20	19 x 32	.953 [.0375]	32.0 [9.76]	1.25 [.0491]	1.28 [.0505]	1.32 [.0519]	6.21 [4.17]
FLHTC0311-18*	18	19 x 30	1.18 [.0465]	20.4 [6.22]	1.48 [.0583]	1.52 [.0600]	1.57 [.0617]	9.43 [6.34]
FLHTC0311-16*	16	19 x 29	1.33 [.0525]	15.8 [4.82]	1.67 [.0656]	1.71 [.0675]	1.76 [.0694]	12.0 [8.09]
FLHTC0311-14*	14	19 x 27	1.68 [.0660]	10.0 [3.05]	2.03 [.0799]	2.08 [.0820]	2.14 [.0841]	18.6 [12.5]
FLHTD0311-12*	12	37 x 28	2.16 [.0850]	6.59 [2.01]	2.50 [.0984]	2.57 [.1010]	2.63 [.1036]	28.7 [19.3]

Construction Details

Part No.	Nominal CSA (mm²)	Conductor Stranding No/Dia. (mm)	Diameter		Finished Wire Maximum Resistance at 20°C (68°F) (ohms/km)	Diameter			Nominal Weight (kg/km)
			(min.) mm [inch]	(max.) mm [inch]		Lower Spec. Limit mm [inch]	Target Value mm [inch]	Upper Spec. Limit mm [inch]	
FLHTC0311-0.25*	0.25	19/0.127	0.55 [.022]	0.63 [.025]	84.3	0.96 [.038]	1.00 [.039]	1.03 [.041]	2.95
FLHTC0311-0.35*	0.35	19/0.15	0.74 [.029]	0.76 [.030]	56.1	1.12 [.044]	1.16 [.046]	1.19 [.047]	4.22
FLHTC0311-0.50*	0.50	19/0.19	0.86 [.034]	0.88 [.035]	40.1	1.24 [.049]	1.27 [.050]	1.31 [.052]	5.59
FLHTC0311-0.75*	0.75	19/0.23	1.05 [.041]	1.08 [.043]	24.7	1.43 [.056]	1.47 [.058]	1.51 [.059]	7.95
FLHTC0311-1.00*	1.00	19/0.25	1.17 [.046]	1.26 [.050]	20.0	1.58 [.062]	1.62 [.064]	1.66 [.065]	9.85
FLHTC0311-1.50*	1.50	19/0.32	1.35 [.053]	1.58 [.062]	13.7	1.82 [.072]	1.87 [.074]	1.92 [.076]	15.69
FLHTC0311-2.00*	2.00	19/0.36	1.66 [.065]	1.79 [.070]	9.7	2.05 [.081]	2.10 [.083]	2.16 [.085]	18.67
FLHTC0311-2.50-	2.50	19/0.41	1.85 [.073]	2.01 [.080]	8.2	2.24 [.088]	2.31 [.091]	2.38 [.094]	24.62

* Replace asterisk with color code designator:
 0 = Black 3 = Orange 6 = Blue 9 = White
 1 = Brown 4 = Yellow 7 = Violet
 2 = Red 5 = Green 8 = Gray
 For example: FLHTC0311-22-9 = AWG 22, white.
 FLHTC0311-0.50-9 = Size 0.50mm², white.

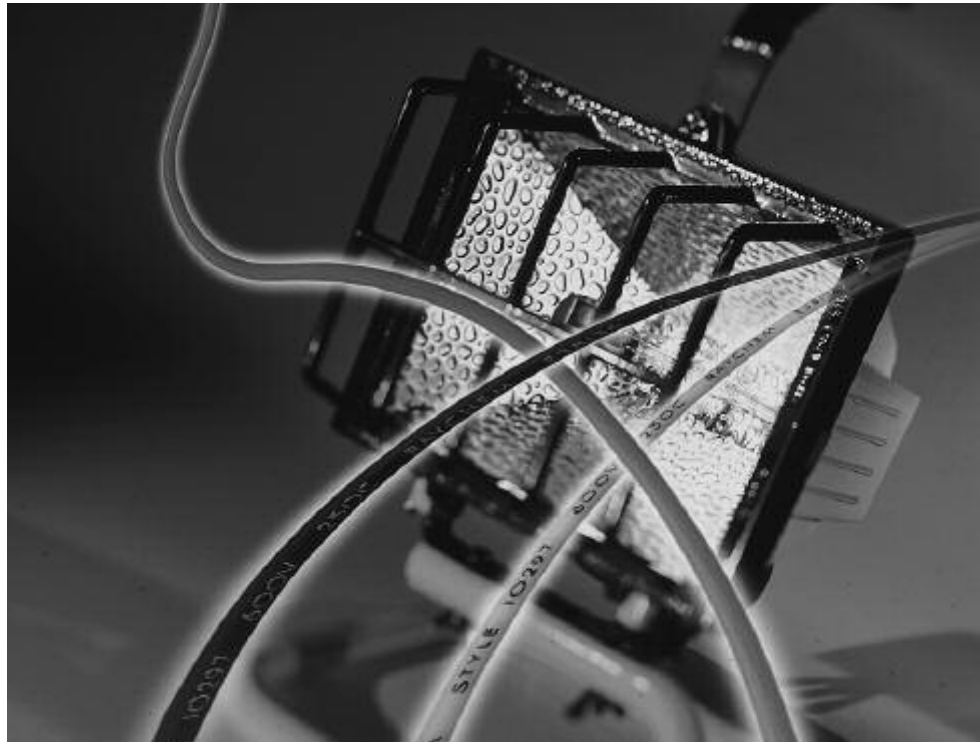
For product requiring CUR (Canadian UL) or CSA marking in 14-10 AWG, 19 strand conductors only, the part numbering descriptions above DO NOT apply. Please contact Tyco Electronics for further information.

FlexLite TX

Ultrahigh-Temperature Hookup Wire

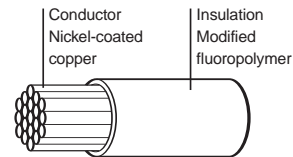
Product Facts

- UL rated operating temperature -65°C to 250°C [-85°F to 482°F]
- UL Style 10297
- 600 V rating
- Clear legible wire marking
- Excellent fluid resistance
- Excellent handling characteristics



Applications

FlexLite TX wire is a UL recognized hookup wire for lighting fixtures, appliance, wiring and industrial applications requiring a 250°C [482°F] rated wire.



Available in:	Americas	Europe	Asia Pacific
	■	■	■

FlexLite TX (Continued)

Specifications/Approvals

Series	UL	CUR	CSA	Raychem
TX	Style 10297 Flammability VW-1 Temperature Rating 250°C [482°F]	Recognized	AWMIA/B	WCD-3106

Construction Details

Part No.	Wire Size (AWG)	Conductor Stranding (No. x AWG)	Nominal Diameter mm [inch]	Finished Wire Maximum Resistance at 20°C (68°F) Ω/km [Ω /1000 ft]	Diameter			Nominal Weight in kg/km [lb/1000 ft]
					Minimum mm [inch]	Nominal mm [inch]	Maximum mm [inch]	
FLTXB0313-28*	28	7 x 36	.368 [.0145]	224 [68.2]	.940 [.037]	.991 [.039]	1.04 [.041]	2.20 [1.48]
FLTXC0313-26*	26	19 x 38	.470 [.0185]	132 [40.1]	1.04 [.041]	1.09 [.043]	1.14 [.045]	2.96 [1.99]
FLTXC0313-24*	24	19 x 36	.597 [.0235]	83.3 [25.4]	1.17 [.046]	1.22 [.048]	1.27 [.050]	3.97 [2.67]
FLTXC0313-22*	22	19 x 34	.749 [.0295]	52.2 [15.9]	1.30 [.051]	1.37 [.054]	1.45 [.057]	5.46 [3.67]
FLTXC0313-20*	20	19 x 32	.953 [.0375]	32.0 [9.76]	1.50 [.059]	1.57 [.062]	1.65 [.065]	7.84 [5.27]
FLTXC0313-18*	18	19 x 30	1.18 [.0465]	20.4 [6.22]	1.73 [.068]	1.80 [.071]	1.88 [.074]	11.3 [7.60]
FLTXC0313-16*	16	19 x 29	1.33 [.0525]	15.8 [4.82]	1.88 [.074]	1.96 [.077]	2.03 [.080]	13.9 [9.32]
FLTXC0313-14*	14	19 x 27	1.68 [.0660]	10.0 [3.05]	2.18 [.086]	2.29 [.090]	2.39 [.094]	20.5 [13.8]
FLTXD0313-12*	12	37 x 28	2.16 [.0850]	6.59 [2.01]	2.67 [.105]	2.77 [.109]	2.87 [.113]	30.8 [20.7]
FLTXD0313-10*	10	37 x 26	2.72 [.1070]	4.13 [1.26]	3.23 [.127]	3.33 [.131]	3.43 [.135]	48.1 [32.3]

* Replace asterisk with color code designator:
 0 = Black 3 = Orange 6 = Blue 9 = White
 1 = Brown 4 = Yellow 7 = Violet
 2 = Red 5 = Green 8 = Gray
 For example: FLTXC0313-18-9 = AWG 18, white.

For product requiring CUR (Canadian UL) or CSA marking in 14-10 AWG, 19 strand conductors only, the part numbering descriptions above DO NOT apply. Please contact Tyco Electronics logistics for further information.

Flexible, Double Insulated, High Performance Wire for a Wide Range of Industrial Applications

Product Facts

- Highly flame retardant/non melting
- Limited fire hazard
- 600V rated
- Excellent fluid resistance
- Flexible
- Double insulation (for Class 2 equipment)
- Tough, thin wall
- Small size, light weight

FLT



Applications

FLT dual-wall wire combines flexibility with tough thin wall insulation to enable bundles to be routed through areas in which conventional wires cannot be used. Typical applications include control panels, instruments, lighting equipment, electrical appliances, electric motors, electric pumps, robotics, and the automotive industries.

Available in:	Americas	Europe	Asia Pacific
		■	

Approvals

FLT (Continued)

UL Styles 1385
CSA Class 5851
IEC 332-1

Standard Colors

Color Code	Black 0	Brown 1	Red 2	Orange 3	Yellow 4
Color Code	Green 5	Blue 6	Violet 7	Grey 8	White 9

Physical Characteristics

Small Size

FLT equipment wire 600 volt rated has a 0.20 mm nominal wall thickness compared to 0.25mm and 0.38mm for equivalent PTFE and PVC wires in MIL-W-16878, MIL-W-22759 or BS3G210.

For Example: FLT0111 - 0.35 equipment wire 4.38 grams/meter max.

22 AWG PTFE equipment wire MIL-W-22759 5.54 grams/meter max.

strippers. For details of appropriate tools see separate wire handling guide. The tin-plated copper conductor usually specified is easily soldered or crimped.

Light Weight

Due to the thin wall and low density of the insulation materials, considerable weight savings are made over similarly rated PTFE wires.

General Handling

The flexibility of FLT and the ease with which it takes a 'set' makes it one of the easiest of the 'high performance' wires to install. Stripping is done with conventional die blade

Lengths

FLT is available in long continuous lengths and can be supplied for use on automatic cut and strip preparation machines.

Typical Properties

Temperature rated	(Tin-plated conductor) -65°C to +150°C [-85°F to +302°F]
Rated at 125°C [257°F]	In UL style sheet 1385
Voltage rating	600V
No Voltage rating specified	In UL style sheet 1385
Tensile strength + elongation of insulation	30 N/mm ² , 230%
Notch propagation BS 3G230 0.05 mm notch	Pass
Meets BS4066/IEC332-1 Flammability test	Pass
Solder iron resistance (370°C [698°F], 1 minute)	Pass
Shrinkage @ +150°C [+302°F]	< 1%
Low temperature bend	-65°C [-85°F]

Flexible, Double Insulated, High Performance Wire for a Wide Range of Industrial Applications

FLT (Continued)

Environmental Performance

Temperature Rating

FLT wire is rated for continuous operation from -65°C to +125°C [-85°F to +257°F] and for short periods at much higher temperatures.

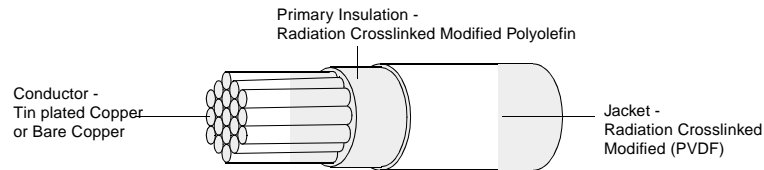
Mechanical Performance

Radiation crosslinking of the FLT insulation significantly improves the following mechanical characteristics; scrape (sharp edges), cut-through resistance and creep resistance.

Solder Iron/Overload Resistance

Radiation crosslinking ensures that the insulation does not melt at high temperature. As a result FLT wire is resistant to hot solder irons and current overloads which would melt most thermoplastic insulations.

Ordering Information



Nominal CSA mm ²	Conductor Stranding No/Dia mm	Conductor Diameter		Finished Wire Maximum Resistance @20°C (68°F) ohms/km	Diameter		Nominal Weight kg/km	Ordering Description
		min. mm [inch]	max. mm [inch]		min. mm [inch]	max. mm [inch]		
0.25	19/0.127	0.55 [.022]	0.63 [.025]	83.6	0.91 [.036]	1.04 [.041]	2.96	FLT011X-0.25-Y
0.35	19/0.15	0.70 [.028]	0.80 [.031]	56.1	1.06 [.042]	1.21 [.048]	4.14	FLT011X-0.35-Y
0.50	19/0.19	0.82 [.032]	0.90 [.035]	40.1	1.18 [.046]	1.31 [.052]	6.63	FLT011X-0.50-Y
0.75	19/0.23	1.05 [.041]	1.15 [.045]	24.7	1.41 [.056]	1.56 [.061]	8.20	FLT011X-0.75-Y
1.00	19/0.25	1.17 [.046]	1.26 [.050]	20.0	1.55 [.061]	1.70 [.067]	10.86	FLT011X-1.00-Y
1.50	19/0.32	1.35 [.053]	1.60 [.063]	13.7	1.73 [.068]	2.06 [.081]	16.47	FLT011X-1.50-Y
2.00	19/0.36	1.66 [.065]	1.85 [.073]	9.9	2.12 [.083]	2.38 [.093]	20.32	FLT011X-2.00-Y
2.50	19/0.41	1.85 [.073]	2.05 [.081]	8.2	2.31 [.091]	2.61 [.103]	26.56	FLT011X-2.50-Y

Note: X = Conductor Type 1 = Tin Plated Copper 9 = Bare Copper
Y = Color (see color code on page 9-58)

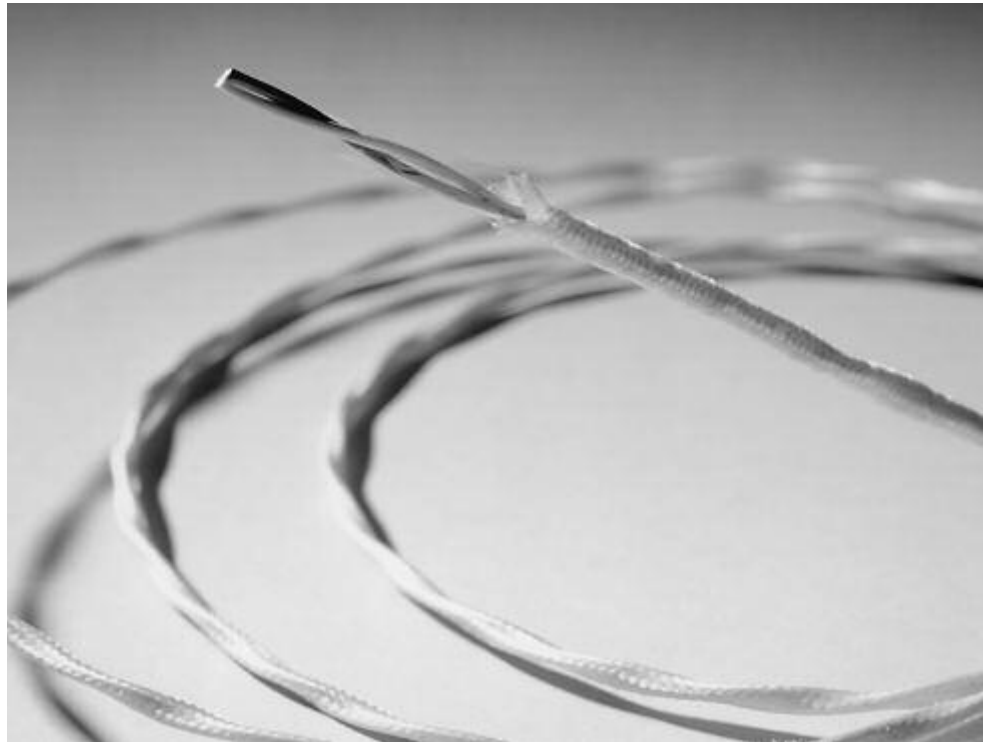
9 Wire and Cable

Product Facts

- 19-strand conductor for flexibility



Thermocouple Extension Cable



Applications

Tyco Electronics manufactures a broad range of Raychem Thermocouple extension cables in four thermoelement combinations. Each provides accurate transmission of electromotive force (EMF) from a Thermocouple element lead wire of the same conductor material to a thermometer, also known as a pyrometer.

All four types of Thermocouple extension cables use 19-strand conductors and are available in twisted pair, jacketed twisted pair, and shielded

and jacketed twisted pair configurations. A range of cables is available from 16 AWG to 24 AWG.

Wires and cables are insulated and jacketed with radiation-crosslinked ETFE, which has a continuous operating temperature of -65°C to +200°C [-85°F to +392°F]. This material, which is fully specified in Raychem SPEC 55, has excellent physical properties and is highly resistant to a wide range of chemicals.

Operating Temperature Range

-65°C to 200°C
[-85°F to 392°F]

Available in:	Americas	Europe	Asia Pacific
	■	■	■

Properties

Extension Cable Type	Thermoelement Combination	Initial Calibration Tolerances for Thermocouple Extension Wires		
		Temperature Range	Limit of Range	EMF (mv)* (min.-max.)
EX	Chromel-Constantan	0°C to 200°C [0°F to 392°F]	±1.7°C [35.1°F]	6.18-6.45
JX	Iron-Constantan	0°C to 200°C [0°F to 392°F]	±2.2°C [36.0°F]	5.15-5.39
KX	Chromel-Alumel	0°C to 200°C [0°F to 392°F]	±2.2°C [36.0°F]	4.00-4.19
TX	Copper-Constantan	0°C to 100°C [0°F to 212°F]	±1.0°C [32.0°F]	4.24-4.32

Note: The above is in accordance with ANSI-MC-96.1-1982.
 *EMF is measured in millivolts (mv) at 100°C [212°F] with reference junction at 0°C [0°F].

Product Dimensions** (Nominal)

AWG Size	Twisted Pair		Twisted, Jacketed Pair		Twisted, Shielded, 38 AWG Braid Strand, Jacketed Pair	
	Outside Diameter	Weight in kg/km (lb/1000 ft)	Outside Diameter	Weight in kg/km (lb/1000 ft)	Outside Diameter	Weight in kg/km (lb/1000 ft)
24	2.29 [.090]	7.3 [4.9]	2.67 [.106]	9.9 [6.7]	3.12 [.123]	16.5 [11.1]
22	2.60 [.102]	9.9 [6.7]	2.99 [.118]	13.0 [8.8]	3.43 [.135]	21.4 [14.4]
20	2.99 [.118]	14.4 [9.7]	3.40 [.134]	18.0 [12.1]	3.83 [.151]	27.8 [18.7]
18	3.56 [.140]	20.9 [14.1]	3.96 [.156]	25.1 [16.9]	4.34 [.173]	37.5 [25.2]
16	3.96 [.156]	26.3 [17.7]	4.37 [.172]	30.9 [20.8]	4.80 [.189]	44.9 [30.2]

**Dimensions for 19-strand-conductor thermocouple. Extension Types EX, JX, KX, and TX.

Extension Cable

Color-Coding

Thermocouple extension cables are available with the wires color-coded in accordance with four standards: MIL-STD-687, ANSI-MC-96.1, British Standard Code BS 1843, and Japanese JIS-C-1602.

Special Cables

Thermocouple extension cables are also available in solid-conductor and seven-strand-conductor configurations. They come in a variety of thermoelement combinations, gauges,

insulations, and multiple-pair designs, and they are available for outer space applications. Contact Tyco Electronics for details.

Extension Cable

Type EX	Chromel +	Constantan -	Jacket (if present)	Color code Wire	Jacket
ANSI-MC-96.1	Violet	Red	Violet	7/2	7
British Std.-BS 1843	Brown	Blue	Brown	1/6	1
JIS-C-1602	Violet	Red	Violet	7/2	7
Type JX	Iron +	Constantan -	Jacket	Wire	Jacket
MIL-STD-687	Black	Yellow	White	0/4	9
ANSI-MC-96.1	White	Red	Black	9/2	0
British Std.-BS 1843	Yellow	Blue	Black	4/6	0
JIS-C-1602	Red	White	Yellow	2/9	4
Type KX	Chromel +	Alumel -	Jacket	Wire	Jacket
MIL-STD-687	White	Green	White	9/5	9
ANSI-MC-96.1	Yellow	Red	Yellow	4/2	4
British Std.-BS 1843	Brown	Blue	Red	1/6	2
JIS-C-1602	Red	White	Blue	2/9	6
Type TX	Copper +	Constantan -	Jacket	Wire	Jacket
MIL-STD-687	Red	Yellow	White	2/4	9
ANSI-MC-96.1	Blue	Red	Blue	6/2	6
British Std.-BS 1843	White	Blue	Blue	9/6	6
JIS-C-1602	Red	White	Brown	2/9	1

**Part Number
Selection Table**

Thermocouple Extension Cable (Continued)

The Thermocouple cable options outlined in the table on the previous page can be ordered from the table below.

Tyco Electronics will assign a new part number on request for cables falling outside the range shown in the table.

Type	Twisted Pair	Twisted, Jacketed Pair	Shield Plating*	Twisted, Shielded, Jacketed Pair
EX	CTC-0077	CTC-0079	T	CTC-0074
			N	55A6169
JX	55A8131	CTC-0080	T	CTC-0044
			T	CTC-0018
KX	55A8002	CTC-0012	N	CTC-0015
			S	CTC-0057
			T	CTC-0073
TX	CTC-0078	CTC-0081	T	CTC-0073

*T = Tin-coated copper.
N = Nickel-coated copper.
S = Silver-coated copper.

Lightweight, Ruggedized Filterline Wire and Cable

Product Facts

- Suppresses EMI above 100 MHz
- Light weight, small size
- SPEC 55 insulation
- 600 volt
- -65°C to 150°C † [-85°F to 302°F]

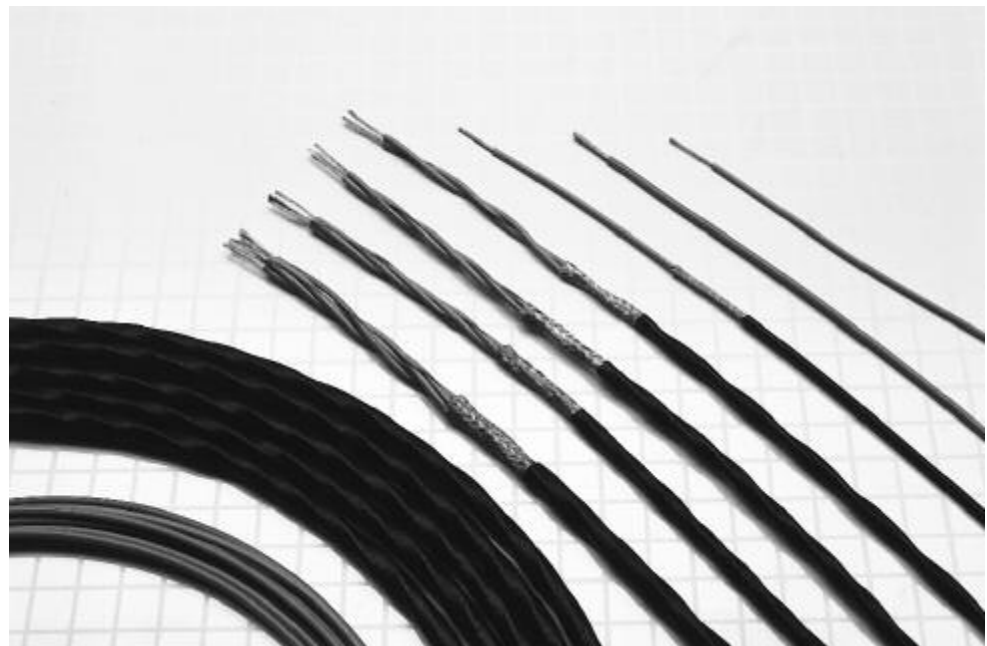
† -65°C to 200°C [-85°F to 392°F] also available



Available in:

- Americas ■
- Europe ■
- Asia Pacific ■

ElectroLoss Filterline



Applications

Today's performance needs for military and commercial electronic systems require increasingly sophisticated equipment and greater use of composite structures and enclosures. As electronics become more sensitive, the EMI protection level for electrical equipment is increasing. The Raychem ElectroLoss FilterLine wire and cable provide a high degree of EMI protection while functioning as conventional electrical wiring.

ElectroLoss FilterLine products include high-performance wire and cable, which when used as specified, suppress conducted and radiated EMI above 100 MHz.

A reliable alternative to conventional discrete filters and filter-pin connectors, ElectroLoss FilterLine cables are flexible, lightweight, and compatible with high-density connectors.

The Raychem ElectroLoss FilterLine wire and cable meets the performance requirements of MIL-C-85485, a military specification developed to provide EMI protection for military electrical interconnects.

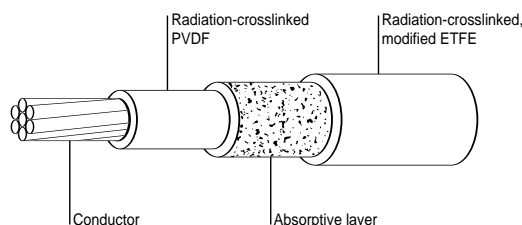
The absorptive layer in ElectroLoss FilterLine cable is constructed of a ferrite-loaded high-temperature polymer, which provides high-frequency EMI absorptive characteristics. Achieving maximum attenuation requires concentrating the electromagnetic fields

in the absorptive layer — either with a metallic shield on each wire or by an overall metallic shield protecting a bundle of individual component wires.

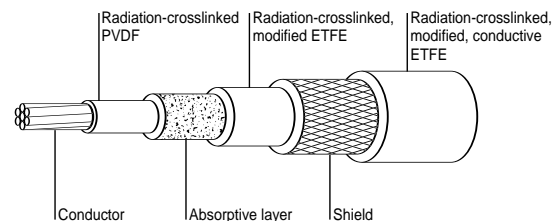
Radiation-crosslinked, modified conductive EFTE jackets are used over shielded filter line cables to eliminate pathways between adjacent cable shields.

Application-driven alternative ElectroLoss FilterLine constructions built to the same rigorous standards demanded of the MIL SPEC products are also available. These alternatives offer significant weight savings through the use of flat braids, improved laser mark contrast, and a broader choice of conductors.

55FA0511



55FB1511



† -65°C to 200°C [-85°F to 392°F] also available.

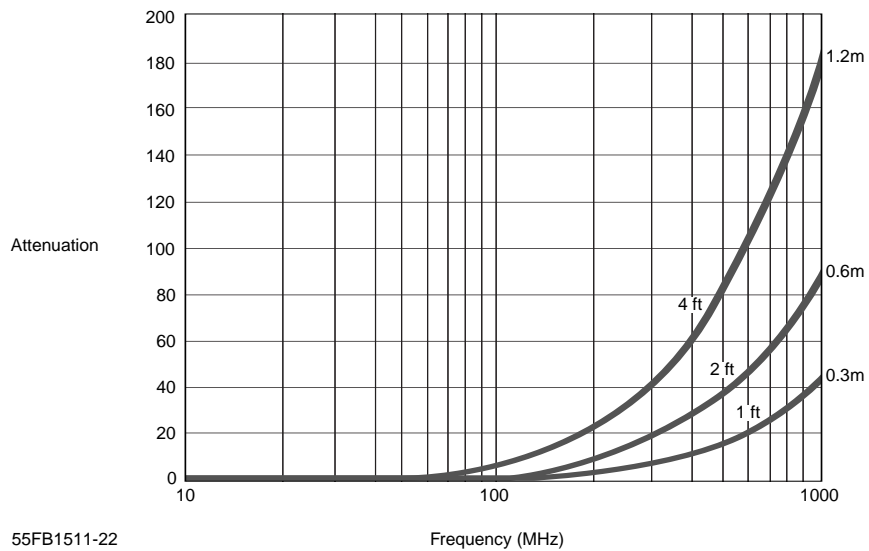
ElectroLoss Filterline (Continued)

Performance

Effective against conducted EMI ElectroLoss FilterLine wire and cable systems attenuate high-frequency signals to pass with minimum loss. When properly installed and used, filter line wire and cables function as low-pass electrical filters, attenuating both

conducted and radiated EMI above 100MHz. The performance of ElectroLoss FilterLine product is best demonstrated by measuring the attenuation (insertion loss) of a length of cable over a broad range of frequencies. Graph 1 depicts typical insertion loss characteristics.

Graph 1 - Typical insertion loss



55FB1511-22

Temperature rating	-65°C to +150°C † [-85°F to 302°F]
Voltage rating	600V r.m.s

† -65°C to 200°C [-85°F to 392°F] also available

Lightweight, Ruggedized
Filterline Wire and Cable

Single Conductor Wire
Specifications

AWG Size	Conductor Stranding (Number x AWG)	Maximum Outside Diameter mm (in)	Maximum Weight Kg/Km (lb/1000 ft)	MIL-SPEC Part Number	Raychem Part Number
24	19 x 36 silver coated high strength copper alloy	1.19 [.047]	4.46 [3.0]	M85485/10-24A	55FA0514-24-*
22	19 x 34 tin coated copper	1.37 [.054]	5.95 [4.0]	M85485/9-22A	55FA0511-22-*
20	19 x 32 tin coated copper	1.57 [.062]	8.63 [5.8]	M85485/9-20A	55FA0511-20-*
18	19 x 30 tin coated copper	1.85 [.073]	12.95 [8.7]	M85485/9-18A	55FA0511-18-*
16	19 x 29 tin coated copper	2.08 [.082]	16.67 [11.2]	M85485/9-16A	55FA0511-16-*
14	19 x 27 tin coated copper	2.51 [.099]	23.96 [16.1]	M85485/9-14A	55FA0511-14-*
12	37 x 28 tin coated copper	2.95 [.116]	35.71 [24.0]	M85485/9-12A	55FA0511-12-*
10	37 x 26 tin coated copper	3.58 [.141]	55.06 [37.0]	M85485/9-10A	55FA0511-10-*

* The color of component wire shall be light violet designated by 7L. The designated colors for components in finished cable shall be light violet for component 1 and light violet with stripe designators for remaining component wires as follows:

Component wire	1	2	3	4	5
Color designator	7L	7L6	7L3	7L5	7L2

Unshielded, Unjacketed 2-5
Conductor Cable
Specifications

AWG Size	Number of Conductor	Maximum Outside Diameter	Maximum Weight Kg/Km (lb/1000 ft)	MIL-SPEC Part Number	Raychem Part Number.
24	2	2.39 [.094]	9.08 [6.1]	M85485/11-24M2A	55FA0524-24.*
22	2	2.74 [.108]	12.20 [8.2]	M85485/11-22T2A	55FA0521-22.*
20	2	3.15 [.124]	17.56 [11.8]	M85485/11-20T2A	55FA0521-20.*
18	2	3.71 [.146]	26.34 [17.7]	M85485/11-18T2A	55FA0521-18.*
16	2	4.17 [.164]	33.93 [22.8]	M85485/11-16T2A	55FA0521-16.*
14	2	5.03 [.198]	48.81 [32.8]	M85485/11-14T2A	55FA0521-14.*
24	3	2.59 [.102]	13.69 [9.2]	M85485/11-24M3A	55FA0534-24.*
22	3	2.97 [.117]	18.15 [12.2]	M85485/11-22T3A	55FA0531-22.*
20	3	3.40 [.134]	26.34 [17.7]	M85485/11-20T3A	55FA0531-20.*
18	3	4.01 [.158]	39.58 [26.6]	M85485/11-18T3A	55FA0531-18.*
16	3	4.50 [.177]	51.03 [34.3]	M85485/11-16T3A	55FA0531-16.*
14	3	5.44 [.214]	73.36 [49.3]	M85485/11-14T3A	55FA0531-14.*
24	4	3.28 [.129]	18.15 [12.2]	M85485/11-24M4A	55FA0544-24.*
22	4	3.78 [.149]	24.25 [16.3]	M85485/11-22T4A	55FA0541-22.*
20	4	4.34 [.171]	35.27 [23.7]	M85485/11-20T4A	55FA0541-20.*
18	4	5.11 [.201]	52.82 [35.5]	M85485/11-18T4A	55FA0541-18.*
16	4	5.74 [.226]	68.00 [45.7]	M85485/11-16T4A	55FA0541-16.*
14	4	6.91 [.272]	97.76 [65.7]	M85485/11-14T4A	55FA0541-14.*
24	5	3.58 [.141]	22.77 [15.3]	M85485/11-24M5A	55FA0554-24.*
22	5	4.11 [.162]	30.36 [20.4]	M85485/11-22T5A	55FA0551-22.*
20	5	4.72 [.186]	44.04 [29.6]	M85485/11-20T5A	55FA0551-20.*
18	5	5.56 [.219]	66.07 [44.4]	M85485/11-18T5A	55FA0551-18.*
16	5	6.25 [.246]	84.96 [57.1]	M85485/11-16T5A	55FA0551-16.*
14	5	7.54 [.297]	122.16 [82.1]	M85485/11-14T5A	55FA0551-14.*

* The color of component wire shall be light violet designated by 7L.
The designated colors for components in finished cable shall be light violet for component 1 and light violet with stripe designators for remaining component wires as follows:

Component wire	1	2	3	4	5
Color designator	7L	7L6	7L3	7L5	7L2

**Lightweight, Ruggedized
Filterline Wire and Cable**

Shielded, Jacketed 1-5
Conductor Cable
Specifications

ElectroLoss Filterline Wire and
Cable Light Weight
Ruggedized Constructions

AWG Size	Number of Conductors	Shield Size AWG Tin Coated Copper	Maximum Outside Diameter mm (in)	Maximum Weight Kg/Km (lb/1000 ft)	MIL-SPEC Part Number	Raychem Part Number
24	1	38	2.13 [.084]	10.86 [7.3]	M85485/12-24U1A	55FB1514-24-*
22	1	38	2.31 [.091]	13.09 [8.8]	M85485/12-22T1A	55FB1511-22-*
20	1	38	2.51 [.099]	16.67 [11.2]	M85485/12-20T1A	55FB1511-20-*
18	1	38	2.79 [.110]	22.17 [14.9]	M85485/12-18T1A	55FB1511-18-*
16	1	38	3.02 [.119]	26.78 [18.0]	M85485/12-16T1A	55FB1511-16-*
14	1	38	3.45 [.136]	35.86 [24.1]	M85485/12-14T1A	55FB1511-14-*
12	1	38	3.89 [.153]	49.40 [33.2]	M85485/12-12T1A	55FB1511-12-*
10	1	38	4.55 [.179]	71.57 [48.1]	M85485/12-10T1A	55FB1511-10-*
24	2	38	3.33 [.131]	19.34 [13.0]	M85485/12-24U2A	55FB1524-24-*
22	2	38	3.68 [.145]	23.81 [16.0]	M85485/12-22T2A	55FB1521-22-*
20	2	38	4.09 [.161]	30.50 [20.5]	M85485/12-20T2A	55FB1521-20-*
18	2	38	4.65 [.183]	41.37 [27.8]	M85485/12-18T2A	55FB1521-18-*
16	2	38	5.11 [.201]	50.59 [34.0]	M85485/12-16T2A	55FB1521-16-*
14	2	38	6.02 [.237]	69.49 [46.7]	M85485/12-14T2A	55FB1521-14-*
24	3	38	3.53 [.139]	25.30 [17.0]	M85485/12-24U3A	55FB1534-24-*
22	3	38	3.91 [.154]	31.10 [20.9]	M85485/12-22T3A	55FB1531-22-*
20	3	38	4.34 [.171]	41.07 [27.6]	M85485/12-20T3A	55FB1531-20-*
18	3	38	4.95 [.195]	56.54 [38.0]	M85485/12-18T3A	55FB1531-18-*
16	3	38	5.44 [.214]	69.94 [47.0]	M85485/12-16T3A	55FB1531-16-*
14	3	38	6.43 [.253]	96.87 [65.1]	M85485/12-14T3A	55FB1531-14-*
24	4	38	4.19 [.165]	31.69 [21.3]	M85485/12-24U4A	55FB1544-24-*
22	4	38	4.67 [.184]	39.58 [26.6]	M85485/12-22T4A	55FB1541-22-*
20	4	38	5.23 [.206]	52.68 [35.4]	M85485/12-20T4A	55FB1541-20-*
18	4	38	5.99 [.236]	72.91 [49.0]	M85485/12-18T4A	55FB1541-18-*
16	4	38	6.68 [.263]	91.36 [61.4]	M85485/12-16T4A	55FB1541-16-*
14	4	38	7.85 [.309]	125.59 [84.4]	M85485/12-14T4A	55FB1541-14-*
24	5	38	4.52 [.178]	37.80 [25.4]	M85485/12-24U5A	55FB1554-24-*
22	5	38	5.05 [.199]	47.32 [31.8]	M85485/12-22T5A	55FB1551-22-*
20	5	38	5.66 [.223]	63.39 [42.6]	M85485/12-20T5A	55FB1551-20-*
18	5	38	6.55 [.258]	89.43 [60.1]	M85485/12-18T5A	55FB1551-18-*
16	5	38	7.24 [.285]	111.00 [74.6]	M85485/12-16T5A	55FB1551-16-*
14	5	38	8.53 [.336]	153.26 [103.0]	M85485/12-14T5A	55FB1551-14-*

* The color of component wire shall be light violet designated by 7L.
The designated colors for components in finished cable shall be light violet for component 1 and light violet with stripe designators for remaining component wires as follows:

Component wire	1	2	3	4	5
Color designator	7L	7L6	7L3	7L5	7L2

Fluid Resistance

Fluids	Hydrocarbons
	Fuels and lubricants
	Alcohols
	Cleaning fluids
	Glycols
	Synthetic fuels and lubricants
	Ketones

Small, Lightweight Coaxial Cables

Product Facts

- Light weight, small size
- Temperature range of -65°C to 200°C [-85°F to 392°F]
- Low capacitance and attenuation
- High velocity of propagation
- High flexibility

Cheminax Coaxial Cables

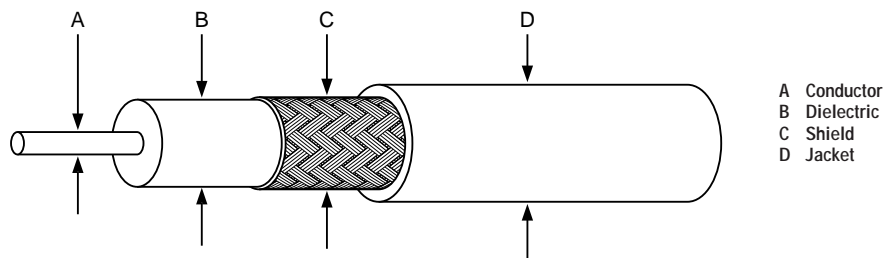


Applications

Cheminax controlled electrical cables are used in the aircraft and aerospace industries. They have a wide range of applications in missiles, avionics, radio-frequency and microwave systems, computers, security and surveillance systems, and communications. Cheminax coaxial cables were designed to solve interconnect problems in

electronic systems, such as computers, military equipment, and other areas of high-density packing, where cables are required to perform to more exacting specifications than standard radio-grade (RG) or UL recognized (UR) constructions. Tyco Electronics' advanced materials technology has allowed the design and development of Raychem

Cheminax miniature coaxial cables that offer substantial savings in size and weight while improving mechanical performance and reducing attenuation. Cables can be designed that are either smaller and lighter than standard RG and UR cables or provide significantly lower attenuation and capacitance with no significant increase in size.



Available in:	Americas	Europe	Asia Pacific
	■	■	■

Part Numbering System

95 27 A 1 3 1 7 - 0 Example: 9527A1317-0
 XX XX X X X X X X - X

Jacket Color Identification Code

- | | | |
|------------|------------|------------------------|
| 0 - Black | 4 - Yellow | 8 - Gray |
| 1 - Brown | 5 - Green | 9 - White |
| 2 - Red | 6 - Blue | 9X - Translucent White |
| 3 - Orange | 7 - Violet | X - Clear |

Conductor Type

- 1 - Tin-coated copper
- 2 - Silver-coated copper
- 3 - Nickel-coated copper
- 4 - Silver-coated high strength copper alloy
- 5 - Aluminum
- 6 - Nickel-coated high strength copper alloy
- 7 - Tin-coated copper-clad steel
- 8 - Silver-coated copper-clad steel
- 9 - Bare copper
- 0 - Other
- A - Silver-coated CS95

Dielectric Material

- | | |
|------------------------------|--------------------------------|
| 1 - Rayfoam L (Polyethylene) | 6 - Modified XL-ETFE (SPEC 55) |
| 2 - Rayfoam H (Foamed FEP) | 7 - Flex XL-ETFE |
| 3 - Rayolin F (Solid) | 8 - Rayfoam M (Foamed MFA) |
| 4 - Modified FEP (Solid) | 0 - Other |

Outer Jacket Material

- | | |
|--------------------------------------|-----------------------------------|
| 1 - General purpose PVF ² | 6 - Modified XL-ETFE (SPEC 55) |
| 2 - Outerspace PVF ² | 7 - Flex XL-ETFE (SPEC 80) |
| 3 - Thermorad F & S | 8 - Zerohal & Thermorad Low Smoke |
| 4 - Modified FEP | 9 - None |
| 5 - ETFE (Uncrosslinked) | 0 - Other |

Construction

- | | |
|------------------------|----------------------|
| 1 - Round braid | 6 - Triax - other |
| 2 - Flat braid | 7 - Other |
| 3 - 2 round braids | 8 - Composite shield |
| 4 - 2 shields (other) | 9 - Core only |
| 5 - Triax-round braids | 0 - Other |

Variation

- | | |
|---------------------------------|------------------------------|
| A - Standard | U - Low Loss |
| B - Low Noise | W - Waterblocked |
| C-Z - Sequential within any PNs | S - Outer Space Requirements |

Conductor Size (AWG)

Always 2 digits - 0X if under 10 AWG

Impedance

Always 2 digits - last 2 digits if over 100 ohms
 0X (1 digit) if under 10 ohms

Cheminax Coaxial Cables (Continued)

Specifications/Approvals

Series	Raychem
Cheminax cables	1200

Product Dimensions (Nominal)

Typical Product Part No.	Impedance (ohms)	Capacitance pF/m (pF/ft)	Attenuation at 400 MHz dB/100m (dB/100 ft)	A	B	C	D	Weight in kg/km (lb/1000ft)
				Conductor Diameter	Dielectric Diameter	Shield Diameter	Jacket Diameter	
5012E1339	50	98.4 [30.0]	14.8 [4.5]	2.26 [.089]	7.24 [.285]	7.98 [.314]	10.24 [.403]	162.2 [109.0]
5012M1612	50	82.0 [25.0]	16.1 [4.9]	2.26 [.089]	6.07 [.239]	6.60 [.260]	7.06 [.278]	74.5 [50.1]
5024A1311	50	83.7 [25.5]	50.3 [15.3]	0.62 [.025]	1.70 [.067]	2.18 [.085]	2.67 [.104]	11.8 [7.9]
5026D1027	50	88.9 [27.1]	63.7 [19.4]	0.48 [.019]	1.27 [.050]	1.70 [.067]	2.21 [.087]	11.8 [7.9]
5030A1317	50	90.2 [27.5]	97.5 [29.7]	0.30 [.012]	0.79 [.031]	1.12 [.044]	1.57 [.062]	4.5 [3.0]
5030A1424	50	100.4 [30.6]	94.5 [28.8]	0.30 [.012]	0.86 [.034]	1.19 [.047]	1.60 [.063]	5.7 [3.8]
7520A1311	75	56.1 [17.1]	20.0 [6.1]	1.02 [.040]	4.57 [.180]	5.11 [.201]	6.12 [.241]	43.2 [29.0]
7524A1311	75	56.4 [17.2]	31.8 [9.7]	0.62 [.025]	2.82 [.111]	3.25 [.128]	3.86 [.152]	19.2 [12.9]
7528H1424	75	54.5 [16.6]	44.0 [13.4]	0.32 [.013]	1.37 [.054]	1.73 [.068]	2.13 [.084]	8.9 [6.0]
7530A1317	75	60.4 [18.3]	58.8 [17.9]	0.30 [.012]	1.35 [.053]	1.78 [.07]	2.29 [.09]	8.3 [5.6]
7530H1424	75	57.4 [17.5]	58.1 [17.7]	0.30 [.012]	1.30 [.051]	1.73 [.068]	2.03 [.08]	8.5 [5.7]
9522A1311	95	44.3 [13.5]	19.7 [6.0]	0.79 [.031]	5.51 [.217]	6.05 [.238]	7.32 [.288]	55.1 [37.0]
9527J1528	95	44.3 [13.5]	31.8 [9.7]	0.43 [.017]	2.84 [.112]	3.18 [.125]	3.58 [.141]	19.2 [12.9]
9530H1014	95	44.3 [13.5]	44.3 [13.5]	0.30 [.012]	1.83 [.072]	2.26 [.089]	2.62 [.103]	13.1 [8.8]

Note: All values are nominal.

Product Characteristics

General	Conductor Range Operating Temperature Range*	12 AWG to 30 AWG -65°C to 200°C [-85°F to 392°F]
Electrical	Impedance range Dielectric constant Velocity of propagation	50 ohms to 125 ohms 1.65–2.3 67%–80%

*Temperature rating varies depending on materials used in specific construction.

Small, Lightweight Coaxial Cables

Properties (per SCD)

Physical	Typical Value of Dielectric Material					
	Rayfoam L	Rayfoam H	Rayolin F			
Tensile (min.)	6.8 MPa (1000 psi)	4.1 MPa (600 psi)	12.2 MPa (1800 psi)			
Elongation (min.)	50%	50%	200%			
Electrical						
Dielectric withstand (min.)	1000 V	1000 V	1000 V			
Velocity of propagation (nom.)	78%	78%	67%			
Dielectric constant	1.65	1.65	2.2			
Physical	Type Value of Jacket Material					
	Thermorad	SPEC 55	FlexLine	FEP	Zerohal	SPEC 44
Tensile (min.)	13.6 MPa (2000 psi)	34 MPa (5000 psi)	20.4 MPa (3000 psi)	13.6 MPa (2000 psi)	8.2 MPa (1200 psi)	27.2 MPa (2500 psi)
Elongation (min.)	250%	50%	100%	200%	150%	150%
Temperature (max.)	125°C [257°F]	200°C [392°F]	200°C [392°F]	200°C [392°F]	125°C [257°F]	150°C [302°F]
Flammability*	Method C	Method B	Method B	Method B	Method B	Method B
Fluid category*	C	A	A	A	C	

*See Raychem specification WCD-1200 for details.

Raychem Alternatives to RG Cables

RG/U	Raychem Alternative	Comments
4	5020A3311-0	Small/light
	5018D3311-0	Improved electricals
5	5018D3311-0	Small/light
8	5012E1339-0	Dimensionally similar
11	7518A1311-0	Small/light
29	5020A1311-0	Small/light
31	5012E1339-0	Dimensionally similar
55	5020A3311-0	Small/light
	5018D3311-0	Improved electricals
58	5021D1331-0	Dimensionally similar
	5020A1311-0	Small/light
	5018A1311-0	Improved electricals
59	7523D1331-0	Dimensionally similar
	7524A1311-0	Small/light
62	7520A1311-0	Improved electricals
	9524A1311-0	Small/light
63	2524A1311-0	Small/light
87	5012A3311-0	Small/light
89	5012A3311-0	Small/light
115	5012A3311-0	Small/light
122	5020A1311-0	Improved electricals
124	7524A1311-0	Small/light
133	9524A1311-0	Small/light
140	7524A1311-0	Small/light
141	5020A1311-0	Small/light
142	5019D3318-0	Small/light
	5018D3311-0	Improved electricals
144	7518A1311-0	Small/light
149	7518A1311-0	Small/light

RG/U	Raychem Alternative	Comments
159	5020A1311-0	Small/light
174	5026A1311-0	Small/light
	5024A1311-0	Improved electricals
178	5030A1317-0	Small/light
	5028A1317-0	Improved electricals
179	7530A1317-0	Small/light
	7528A1317-0	Improved electricals
180	9530E1014-0	Small/light
	9527A1318-9	Improved electricals
188	5026A1311-0	Small/light
	5024A1311-0	Improved electricals
210	9524A1311-0	Small/light
213	5012E1339-0	Dimensionally similar
214	5012A3311-0	Small/light
223	5019D3318-0	Small/light
	5018D3311-0	Improved electricals
225	5012A3311-0	Small/light
235	5012A3311-0	Small/light
279	7524A1311-0	Dimensionally similar
282	5024A1311-0	Small/light
302	7524A1311-0	Small/light
303	5020A1311-0	Small/light
304	5018A1311-0	Small/light
316	5026A1311-0	Small/light
	5024A1311-0	Improved electricals
393	5012A3311-0	Small/light
400	5020A3311-0	Small/light
	5018D3311-0	Improved electricals
403	5030A5314-0	Small/light

Note: To complement the mechanical and electrical features of Cheminax miniature coax cable, Tyco Electronics offers Raychem SolderSleeve, SolderTacts, and PinPak termination devices and RF connector devices. Controlled electrical cables and components are available for data bus systems.

Cheminax — High Performance Alternatives to Standard Cables (Continued)

Raychem Alternatives to UR Cables

UR	Raychem Alternative	Comments
43	5020A1311-0	Small/light
57	7518A1311-0	Small/light
65	7518A1311-0	Small/light
67	5012E1339-0	Dimensionally similar
70	7524A1311-0	Small/light
72	5020A1311-0	Small/light
76	5020A1311-0	Small/light
84	7524A1311-0	Small/light
90	7522A1311-0	Small/light
95	5026A1311-0	Small/light
96	9524A1311-0	Dimensionally similar
102	5012E1339-0	Dimensionally similar
104	7522A1311-0	Small/light
105	7518A1311-0	Small/light
106	7222A1311-0	Small/light
107	5012E1339-0	Small/light
108	5020A1311-0	Small/light
109	5026A1311-0	Small/light
110	5030A1317-0	Small/light
111	7530A1317-0	Small/light
112	5012A3311-0	Small/light
113	7518A1311-0	Small/light
116	5026A1311-0	Small/light
117	7524A1311-0	Small/light
200	7524A1311-0	Dimensionally similar
201	7522A1311-0	Dimensionally similar
202	7522A1311-0	Dimensionally similar
203	7520A1311-0	Small/light
204	7518A1311-0	Dimensionally similar
205	7518A1311-0	Dimensionally similar
207	7524A1311-0	Small/light
208	7524A1311-0	Small/light
210	7524A1311-0	Small/light
301	5020A1311-0	Small/light
306	7524A1311-0	Small/light

Note: To complement the mechanical and electrical features of Cheminax miniature coax cable, Tyco Electronics offers Raychem Solder Sleeve, SolderTacts, and PinPak termination devices and RF connector devices. Controlled electrical cables and components are available for data bus systems. For further information see the Electrical Interconnect Products section of this catalog.

Small, Lightweight Twin Axial Cables

Product Facts

- Light weight, small size
- Temperature range of
-65°C to 200°C
[-85°F to 392°F]
- Low capacitance
- High data rates
- Excellent shop handling



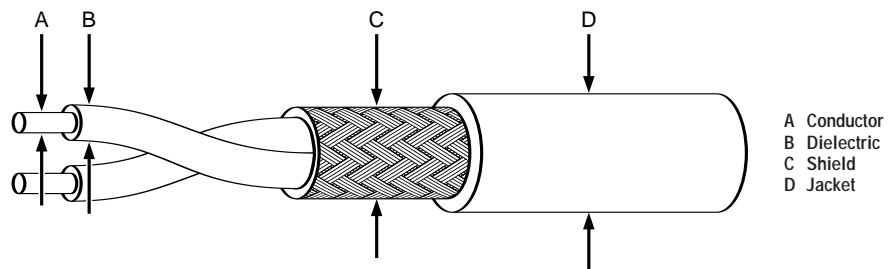
Cheminax Twin Axial Cable



Applications

These small, lightweight cables are specially designed for use in MIL-STD-1553 data bus applications. Raychem materials technology allows the design and construction of cables that meet rigorous electrical and environmental performance requirements while minimizing size and weight.

Cheminax twin axial cables provide elegant solutions to an increasing range of data bus and multiplex signal transmission applications.



Available in:	Americas	Europe	Asia Pacific
	■	■	■

Cheminax Twin Axial Cable (Continued)

Specifications/Approvals

Series	Raychem
Cheminax cables	1200

Product Dimensions*

Typical Product Part No.	Impedance (ohms)	Capacitance pF/m(pF/ft)	A	B	C	D	Weight in kg/km (lb/1000ft)
			Conductor Diameter	Dielectric Diameter	Shield Diameter	Jacket Diameter	
5024A1661	50	104.7 [31.9]	.64 [.025]	0.89 [.035]	2.21 [.087]	2.62 [.103]	14.4 [9.7]
5026A1664	50	136.2 [41.5]	.48 [.019]	0.66 [.026]	1.75 [.069]	2.16 [.085]	10.0 [6.7]
7520A1662	75	74.2 [22.6]	1.02 [.040]	2.03 [.080]	4.60 [.181]	5.05 [.199]	42.9 [28.8]
7526J1660	75	88.6 [27.0]	.48 [.019]	0.99 [.039]	2.41 [.095]	2.82 [.111]	14.9 [10.0]
7820D0331	78	67.3 [20.5]	1.02 [.040]	2.11 [.083]	4.75 [.187]	5.72 [.225]	46.9 [31.5]
7824E0422	78	55.1 [16.8]	.64 [.025]	1.19 [.047]	2.82 [.111]	3.33 [.131]	19.6 [13.2]
0022E0311	100	49.2 [15.0]	.79 [.031]	1.98 [.078]	4.39 [.173]	5.16 [.203]	30.5 [20.5]
0024A0024	100	44.3 [13.5]	.64 [.025]	1.30 [.051]	3.02 [.119]	3.63 [.143]	25.1 [16.9]
0026A0024	100	44.0 [13.4]	.48 [.019]	1.14 [.045]	2.72 [.107]	3.23 [.127]	18.7 [12.6]
2524H0524	125	39.4 [12.0]	.64 [.025]	1.83 [.072]	4.09 [.161]	4.50 [.177]	25.3 [17.7]
2526E1114	125	36.1 [11.0]	.48 [.019]	1.40 [.055]	3.33 [.131]	3.73 [.147]	21.7 [14.6]
2530A0314	125	39.4 [12.0]	.30 [.012]	0.86 [.034]	2.16 [.085]	2.67 [.105]	10.6 [7.1]
10595-24	70	91.9 [28.0]	.64 [.025]	1.19 [.047]	2.82 [.111]	3.23 [.127]	17.9 [12.0]
10606-26	75	91.9 [28.0]	.53 [.021]	0.99 [.039]	2.41 [.095]	2.82 [.111]	13.4 [9.0]
10612-24	77	91.9 [28.0]	.64 [.025]	1.22 [.048]	2.90 [.114]	3.30 [.130]	23.7 [15.9]
10613-24	77	91.9 [28.0]	.64 [.025]	1.22 [.048]	3.33 [.131]	3.73 [.147]	39.0 [26.2]
10614-24	77	91.9 [28.0]	.64 [.025]	1.22 [.048]	3.73 [.147]	4.09 [.161]	40.3 [27.1]

*All dimensions are nominal.

Small, Lightweight Twin Axial Cables

Product Characteristics

General	Conductor range Operating temperature range*	20 AWG to 30 AWG -65°C to 200°C [-85°F to 392°F]
Electrical	Impedance range Capacitance range	50 ohms to 125 ohms 30 pF/ft to 10 pF/ft

*Temperature rating varies depending on materials used in specific construction.

Properties (per SCD)

Physical	Typical Value of Dielectric Material					
	Rayfoam L	Rayfoam H	Rayolin F	FEP (solid)	Radiation-Crosslinked XL ETFE	
Tensile (min.)	6.8 MPa (1000 psi)	9.1 MPa (600 psi)	12.2 MPa (1800 psi)	6.8 MPa (1000 psi)	34 MPa (5000 psi)	
Elongation (min.)	50%	50%	200%	150%	50%	
Electrical						
Dielectric withstand (min.)	1000 V	1000 V	1000 V	1000 V	1000 V	
Velocity of propagation (nom.)	78%	78%	67%	69%	61%	
Permittivity (nom.)	1.65	1.65	2.2	2.1	2.7	
Physical	Typical Value of Jacket Material					
	Thermorad	SPEC 55	FlexLine	FEP	Zerohal	SPEC 44
Tensile (min.)	13.6 MPa (2000 psi)	34 MPa (5000 psi)	20.4 MPa (3000 psi)	13.6 MPa (2000 psi)	8.2 MPa (1200 psi)	27.2 MPa (2500 psi)
Elongation (min.)	250%	50%	100%	200%	150%	150%
Temperature (max.)	125°C [257°F]	200°C [392°F]	200°C [392°F]	200°C [392°F]	125°C [257°F]	150°C [302°F]
Flammability**	Method C	Method B	Method B	Method B	Method B	Method B
Fluid category**	C	A	A	A	C	B

*See Raychem specification WCD-1200 for details.

Product Facts

- Temperature capability: -55°C to +260°C [-67°F to +500°F]
- Small size, lightweight
- System compatibility with other Raychem products
- Complete range of components
- Specially formulated jacket materials
- Special shielding to address EMI/EMC problems
- Custom designed and purpose built
- Fast response—design, pricing, and delivery
- Prototype length facility
- Raychem Dynalink extended flex-life and increased flexibility
- Fire-resistant: circuit integrity (IEC331, enhanced 950°C [1742°F], 3 hours)
- Small-size, lightweight, low-fire-hazard for modern high-speed vessels



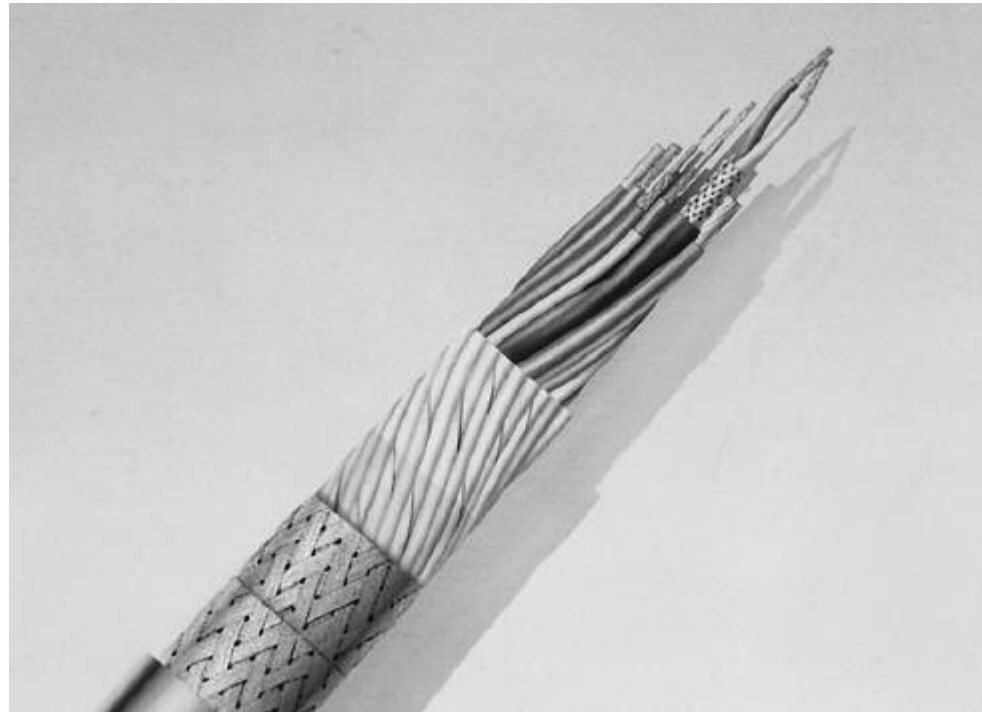
Available in:

- Americas ■
- Europe ■
- Asia Pacific ■

Specifications/Approvals

Multiconductor (Multicore) Cables

Custom-designed and standard Multiconductor (Multicore) Cables



Applications

Tyco Electronics is the leading manufacturer of Raychem custom-designed, small-size, lightweight, high-performance multiconductor (multicore) cables. Applications are found in the aerospace, commercial marine, naval, mass transportation, automotive, offshore, military ground vehicle, ground support, high-performance instrumentation, industrial, and commercial markets. Raychem multiconductor (multicore) cables have been approved to many standards demanding high performance criteria in service use.

Multiconductor (Multicore) Cables Purpose Built and Designed Using Raychem Components and Technology

Multiconductor cables are used in widely varying applications and environments. Careful consideration must be given to the selection of components with the right combination of physical, chemical, and electrical properties for specific applications.

Tyco Electronics' leadership in the technologies of polymer blending and subsequent radiation crosslinking has led to the development of a particularly broad range of Raychem cables. High-performance component wires and miniature coaxial cables are combined with unique cable jacket materi-

als to meet the requirements of demanding environments.

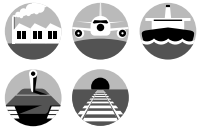
Established as one of the leading manufacturers of special purpose Raychem cables, Tyco Electronics has continued to develop both its design and manufacturing expertise.

Development of a sophisticated CAD system has allowed increasingly rapid response to any design request, followed by manufacturing to the highest quality standards.

Planar Film-Bonded Cables

Tyco Electronics can custom-design and build a variety of Raychem component wires and cables onto high-performance carrier films. Components and carriers are matched to ensure temperature and environmental stability.

Agency	Industry	Military	Raychem
Underwriters' Laboratories	Lloyd's Register of Shipping	Def. Stan. 61-12 Pt 25	WCD series
BSENISO9001	Det Norske Veritas	VG 95218 Pts 27 and 28	—
MSV 34410-34413, 34435,34436	—	—	—



Multicore Cables



Design Flexibility

Components

- SPEC 44 wire and cable
- SPEC 55 wire and cable
- Type 99 wire and cable
- 100 wire
- Coaxial cables
- ElectroLoss FilterLine cables
- Flexible power cables
- Optical fibers
- Special components

Wraps and Braids

- Fabric and film tapes
- Kevlar® or steel strength members
- Full range of electrical screens (including SuperScreens)

Jacket Materials

- FDR 25 - Fluid resistant, flexible, high temperature
- Thermorad - General purpose
- Thermorad HTF/ - Very high temperature, Fluoroelastomer fluid resistant
- Raythane C - Tough and flexible
- Raythane FR - Tough, flexible, flame-retardant
- Rayolin - Low moisture transmission
- Neoprene - Low-temperature flexibility
- Zerohal - LFH

KEVLAR is a trademark of E. I. du Pont de Nemours and Company

Properties and Specifications

Specifications and Approvals (Components and Jacket Materials)

Specifications UK Designation	FDR 25	Zerohal	Fluoro- elastomer	Thermorad	Rayolin	Raythane C	AFR	Neoprene	44 Wire	55 Wire	100 Wire	99 Wire	Hytrel
US Designation		Zerohal	Thermorad HTF	Thermorad F		Raythane FR		Thermorad NTFR	44 Wire	55 Wire	100 Wire		
Def Stan 61-12 Part 31 (NES 518)		X											
Def Stan 61-12 Part 25		X							X				
Def Stan 61-12 Part 18 type 1 (issue 4) (Maintenance range)									X				
Def Stan 61-12 Part 18 type 1 (issue 4)		X										X	
Def Stan 61-12 Part 25		X										X	
Def Stan 61-12 Part 26									X				
34435, 34436		X							X				
VG 95218 Part 20, 21, 22 and 23									X	X			
VG 95218 Part 24, 25 and 26	X												
VG 95218 Part 27 and 28	X	X							X		X		
VG 95218 Part 1000									X				
VG 95218 Part 1001 and 1002										X			
MIL-C-24640 (PMS 400)		X							X				
MIL-W-81044/MIL-C-27500									X				
MIL-W-22759/MIL-C-27500										X			
A014000		X											X
O2-517		X			X				X				
Approvals													
Lloyds Register of Shipping/DNV		X		X		X			X				X
Bureau Veritas	X	X	X	X		X	X	X	X	X			
UL				X		X (FR)	X		X	X			
CAA									X	X			
BWB	X			X					X	X			
VDE	X			X					X	X			
Det Norskeveritas													
Germanischer Lloyds		X										X	
American Bureau of Shipping		X										X	
Lloyds		X										X	
Bureau Veritas		X										X	

Major Cable Specifications

Country	Cable Specification	Specification Description	Approved Jacket
UK	Def Stan 61-12 Part 25	Royal Navy specification covering limited fire hazard thin-wall insulated electric cables using Def-Stan 61-12 Part 18 approved wire. Signal, control and light power circuits.	Zerohal
Germany	VG 95218 (parts 27 and 28)	Military ground systems specification for signal, control and power cables. Wire to VG 95218 Parts 20-23 and 1000.	FDR-25
USA	MIL-C-24640 (PMS 400)	Navy specification covering limited fire hazard thin-wall insulated electric cables for signal, control and light power circuits. Wire to MIL-W-81044.	Zerohal

Summary of Typical Cable Jacket Properties

UK Designation	US Designation	Property				Chemical Resistance		
		Temperature Range °C*	Abrasion Resistance	Flexibility	Flame Resistance	Acid	Alkaline	Hydrocarbon
FDR25	—	-40 to 150	Fair	Very good	Self-ext;ing	Good	Good	Very Good
Zerohal	Zerohal UK & US	-30 to 105	Good	Good	Self-ext;ing	Good	Good	Good
Fluoroelastomer	Thermorad HTF	-20 to 200	Good	Good	Nonburning	Excellent	Excellent	Excellent
Thermorad	Thermorad F	-55 to 125	Good	Good	Self-ext;ing	Good	Good	Good
Raythane C	—	-25 to 80	Excellent	Excellent	Self-ext;ing	Fair	Fair	Excellent
—	Raythane FR	-65 to 90	Excellent	Excellent	Self-ext;ing	Fair	Fair	Excellent
Neoprene	Thermorad NTFR	-55 to 110	Very Good	Excellent	Self-ext;ing	Good	Good	Good
Rayolin	—	-55 to 95	Very Good	Fair	—	Good	Good	Good
AFR	—	-40 to 105	Excellent	Good	Self-ext;ing	Good	Good	Good
—	Thermorad LS	-30 to 105	Good	Good	Self-ext;ing	Good	Good	Good
—	Thermorad O	-55 to 125	Good	Good	Self-ext;ing	Good	Good	Good
—	Thermorad 300	-65 to 200	Very Good	Fair	Self-ext;ing	Excellent	Excellent	Excellent
Polyvinylidene Fluoride	Thermorad K	-65 to 150	Very Good	Fair	Self-ext;ing	Excellent	Good	Excellent
Modified ETFE	Thermorad HT	-65 to 200	Very Good	Fair	Self-ext;ing	Excellent	Excellent	Excellent
Modified Flexible ETFE	Thermorad FL	-55 to 200	Very Good	Good	Self-ext;ing	Excellent	Excellent	Excellent

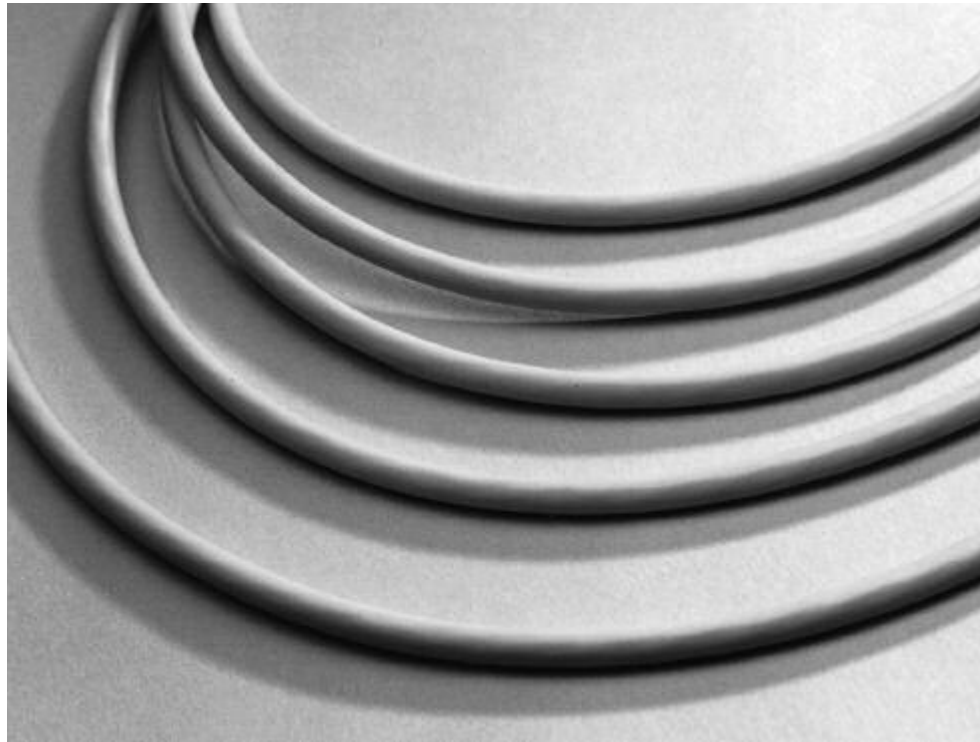
*Operating temperatures for cables are application dependent. Figures shown are for guidance only. In many cases the limits shown may be extended at both ends of the temperature range. Consult Tyco Electronics for guidance.

Flexible, Diesel Resistant Wire and Cable Jacket Material

Product Facts

- Highly flame retardant
- Compatible with Raychem System 25 tubing, molded parts and adhesives
- Qualified to VG standards

FDR25



Available in:

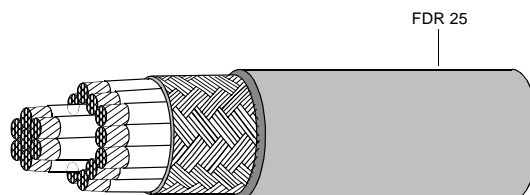
- Americas ■
- Europe ■
- Asia Pacific ■

Applications

FDR 25 cable jacket was originally developed for the Leopard II main battle tank to provide an exceptional range of properties. Used in compartments exposed to hot diesel fuels and vibration, FDR 25 resists a wide range of aggressive fluids and offers excellent low temperature flexibility. These properties have also led to a widespread use of FDR 25 on other military vehicles and in many applications such as test and communications equipment. FDR 25 is fully compatible with Raychem's high performance harnessing system — System 25.

Operating Temperature Range

-40°C to 150°C
[-40°F to 302°F]



Typical Characteristics when Tested in Accordance with Raychem Specification WCD 2002 (UK) and WCD 3304 (US)

Mechanical	Tensile strength (MPa)	20	
	Elongation (%)	500	
	Tear strength (N/mm)	5	
	Abrasion resistance (1.6 kg load) Cold bend	40 scrapes min. -40°C [-40°F]	
Thermal aging	Endurance IEC 216	2500 h 150°C [302°F]	
	Heat aging 120h, 175°C [347°F]	TS 8 MPa (min). Eb 150% (min)	
	Heat shock 4 h at 225°C [437°F]	No cracks, drips or flowing, 6 mm total shrinkage in 300 mm	
Fluid resistance	24 h immersion	% Retention of properties Tensile strength Elongation	
	Diesel fuels 70°C [158°F]	70	70
	Hydraulic fluids 50°C [122°F]	70	70
	Lubricating oils 100°C [212°F]	70	80
	Cleaning fluids 23°C [73°F]	90	95
	Deicing fluids 23°C [73°F]	90	95
Electrical	Insulation resistance 20°C [68°F] M ohm.km min.	2	
	45° flammability	30 s (max) afterburn 100 mm (max) burn length	
Other	Vertical flammability	Self extinguishing	
	Acid gas	4% HCl equivalent (max.)	

Low Fire Hazard Performance Wire and Cable Jacket Material

Product Facts

- Halogen free
- Low smoke generation
- Highly flame retarded
- Low toxicity index
- Low corrosive gas emission
- Temperature rating -30°C to +105°C [-22°F to +221°F]



Available in:

- | | |
|--------------|---|
| Americas | ■ |
| Europe | ■ |
| Asia Pacific | ■ |

Zerohal



Applications

Cables rarely initiate fires, but they could be involved in them and can significantly increase the damage caused should they propagate the fire. Until recently the flame retarding of cables was achieved by the use of halogenated flame retardants which are effective fire suppressants, but which unfortunately produce dense smoke and corrosive acid gases when burned. These effects are highly undesirable in a fire, hindering evacuation and fire fighting, endangering life and causing corrosion damage to expensive and vital equipment.

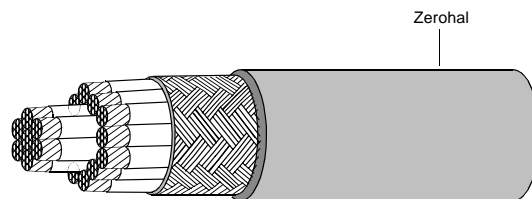
Raychem Zerohal is a halogen-free cable jacket material developed by Tyco Electronics and approved to the most exacting requirements for low fire hazard cables in many countries and, as such, is the most widely accepted material for these applications in the marine, process and mass transport industries. Combined with SPEC 44 wire or Type 99 and 100 wire, this jacket material provides small size, light weight cables (approximately 40% weight saving over conventional materials).

Zerohal combines the good mechanical and electrical features of some conventional cables with good flame retardancy, low smoke generation, low evolution of hazardous and corrosive gases, and good resistance to diesel fuel, lubricating oils and water.

Zerohal jacket material is fully compatible with the low fire hazard harnessing system - System 100.

System

- System 100



Zerohal (Continued)

Product Characteristics when Tested in Accordance with Raychem Specification WCD 2015 and WC 2001 (Zerohal with Fungicide)

Mechanical	Tensile strength (MPa)	8	
	Elongation (%)	200	
	Tear strength (N/mm)	5	
	Abrasion resistance (1.6 kg load)	30 scrapes min.	
	Cold bend	-30°C [-22°F]	
Thermal aging	Heat aging 120 h 130°C [266°F]	60% min retention of TS and Eb	
	Heat shock 4 h at 225°C [437°F]	No cracks, drips or flowing, 6 mm total shrinkage in 300 mm	
Fluid resistance	Retention of properties		
		Tensile strength	Elongation
	Diesel fuels 100°C [212°F] /24 h	85	75
	IRM 902 24h, 100°C [212°F]	90	75
	Lubricating oils 50°C [122°F]/24 h	80	75
Electrical	Water uptake (ASTM D570) 70°C [158°F]/28 days	2% weight uptake (max)	
	Insulation resistance 20°C [68°F] M ohms km (min)	40	
Other	45° flammability	Self extinguishing	
	Vertical flammability (Swedish Chimney)	Self extinguishing	
	Acid gas	1.2% HCl equivalent (max)	
	Limiting oxygen index	32%	
	Temperature index	275°C [527°F]	
	Toxicity index	2.5 per 100 g	
	Smoke index	18	
Halogen content	None detected		

Low Fire Hazard Performance Flammability

Current thinking on fire hazard defines the term 'Fire Risk'. This description recognizes that the risk in a fire situation is influenced strongly from several factors including, ignitability, heat release, smoke evolution and toxic gas emission together with flammability.

There are several test procedures available used to assess flammability of wires and cables. Still in widespread use is Limiting Oxygen Index (LOI), but it is now generally recognized that because the test is conducted on a single specimen (of cable jacket or wire) in laboratory conditions, the results are, at best, only weakly correlated to actual fire situations. Critical Temperature Index (CTI), is a related test and assesses performance at elevated temperature but nevertheless it is still conducted on a single specimen. More recent evidence

and thinking places significantly greater importance on large scale flammability tests, such as IEC 60332-3, in which the sample consists of several bundles of wires. These tests predict more accurately the likely behavior of cables in actual fire scenarios. Raychem Zerohal cable jackets give very good results in small scale laboratory based tests (e.g. LOI, CTI) and Zerohal cables perform very well in large scale tests (e.g. IEC 60332-3). Overall Zerohal jacketed cables have been shown to exhibit excellent flammability characteristics.

Corrosivity

Under fire conditions, polymers containing halogens, sulphur and phosphorous all form corrosive acid gases or liquids. These acids can then attack items such as printed circuit boards, connectors, control relays and metal structures, including steel reinforcement bars embedded in concrete.

Test methods to evaluate corrosivity involve direct measurement of the amount of acid gas produced during pyrolysis, eg to British Rail Specification TDE 76/P/16 or measurement of pH and electrical conductivities of solutions.

Toxicity Index

The various gases given off by combustion of polymeric materials are toxic to differing degrees.

The Def Stan 02-713, assesses the concentration of each of the possible by-products and, by measuring the amounts of these materials, a Toxicity Index is assigned.

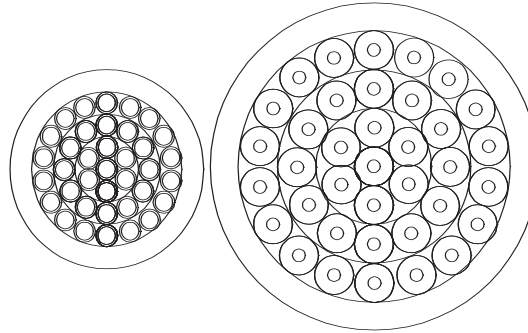
Zerohal jacket material has a typical Toxicity Index of 1.7, compared to a typical value of 6 for CSP and 20 for PVC jacketed cable. The Def Stan 61-12 part 31 specification requirement for a cable jacket is <5.

Smoke

The problems of classifying flammability and corrosive gas generation equally apply to measuring smoke generation. The method accepted by most authorities involves the use of the NBS smoke chamber where optical density of the chamber's atmosphere is constantly measured during pyrolysis.

The 10% visibility line indicates the density of smoke which would cause human disorientation and confusion. The rate of change of smoke density can be summarized to a single numerical value, as in NES 711, to give a smoke index for a material and thus offers simple comparison of materials performance.

Zerohal (Continued)



	Raychem Cable to Def Stan 61-12 Pt25	Cable to DGS 212
Diameter	12.5 mm (nom.)	21.3 mm
Weight	328 g/m (nom.)	526 g/m
Conductor	0.60 mm ² (nom.)	0.5 mm ²

Ships are becoming smaller and more sophisticated, with an ever increasing complexity of electronic systems, sensors and weapons. As technology advances shipbuilders are called upon to update and modify existing systems or fit completely new ones. The proliferation of electronic hardware requires more and more communication systems to transfer data from one place to another. To provide all the necessary interconnections, hundreds of multicore cables have to run throughout the ship. These, along with cables for power, lighting and other basic services, create a severe space problem within ducts and hangers. For the vessel to achieve maximum speed, maneuverability and range, it is vital to

keep the "top weight" to a minimum and since most of the equipment is located on the upper decks, system weight must be kept as low as possible.

The diagram shows a lightweight cable compared with a traditional Navy cable having the same cross-sectional area of copper. Both cables have the same number of conductors. A saving in size has been made on the insulation material, but without sacrificing the mechanical or electrical characteristics of the cable. A typical saving in cable tray volume could be as high as 40%. Lightweight cables can also save in excess of twenty tons on a typical frigate and three to five tons on a fast patrol boat.

Raychem lightweight, small size cables are giving reliable service in frigates, corvettes, fast patrol boats, hydrofoils and submarines in many major Navies.

Due to recent improvements in manufacturing, Raychem can now offer an even tighter tolerance of $\pm 2.5\%$ on cable diameter. This is well within the limits imposed by specifications such as Def Stan 61-12 part 25, and offers significant benefits to system designers, particularly where cable glanding is involved.

Weight savings within "maxima allowed" by existing specifications are also achievable.

Other applications

The increasing awareness of many areas of industry of the need to minimize fire hazard risk is leading to a rapid growth in the use of Zerohal jacketed cables. Applications include rail and mass transit, offshore platforms and other enclosed areas where a fire would present a significant threat to people or equipment.

High Temperature Performance Wire and Cable Jacket Material

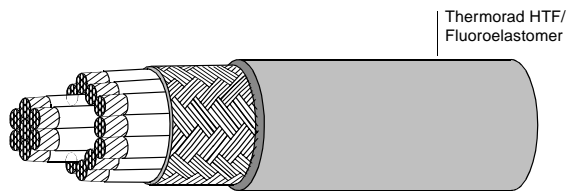
Product Facts

- High temperature capability
-20°C to +200°C [-4°F to 392°F]
- Excellent chemical resistance
- Flame retardant
- Continuous aircraft fuel immersion



Available in:

- Americas ■
- Europe ■
- Asia Pacific ■



Thermorad HTF/ Fluoroelastomer



Applications

Thermorad HTF/ Fluoroelastomer is a material specially formulated for use in applications where exceptional performance is required.

It displays excellent stability during continuous high temperature exposure to adverse chemical environments.

Thermorad HTF/ Fluoroelastomer has a continuous operating tempera-

ture of up to 200°C [392°F], and finds applications in aircraft fuel tanks and on high performance engine cables. Thermorad HTF/ Fluoroelastomer cable jackets are compatible with the Raychem high temperature harnessing systems — System 200.

System

- System 200

Typical Characteristics when Tested in Accordance with Raychem Specification WCD 51/367

Mechanical	Tensile strength	12 MPa	
	Elongation	400%	
	Abrasion resistance (1.6 kg load)	40 scrapes min.	
	Cold bend -0°C ± 3°C [37°F]	No cracking	
Thermal aging	Heat age	168 h 250°C [482°F]	
	Heat shock 4 h at 300°C ± 3°C [572°F ± 37°F]	No cracks, drips or flowing, 6 mm total shrinkage in 300 mm	
Fluid resistance	72 h immersion	% Retention	
	Diesel oil 100°C [212°F]	Tensile strength	Elongation
	ASTM No 2 oil 100°C [212°F]	60	60
Electrical	Insulation resistance 20°C [68°F] M ohms. km (min)	10	
Other	45° flammability	30 s (max) afterburn 100 mm (max) burn length	
	Vertical flammability	Self extinguishing	

General Purpose Wire and Cable Jacket Material

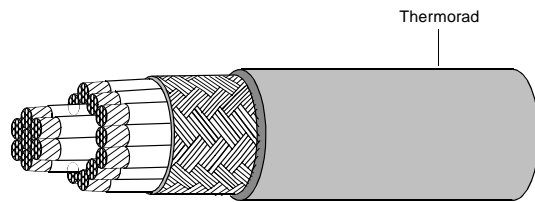
Product Facts

- Temperature rating -55°C to +125°C [-67°F to 257°F]
- Highly flame retardant
- Resistant to fuels, oils and greases
- Resistant to NBC decontaminant
- UL approved



Available in:

- Americas ■
- Europe ■
- Asia Pacific ■



Typical Characteristics when Tested in Accordance with Raychem Specification WCD 51/1602 (UK) and WCD 3310 (US)

Mechanical	Tensile strength	22 MPa	
	Elongation	550%	
	Abrasion resistance (1.6 kg load)	300 scrapes min.	
	Cold bend	-55°C [-67°F]	
Thermal aging	Heat aging 120 h, 170°C [338°F]	60% min. retention of TS and Eb	
	Heat shock 4 hours at 225°C [437°F]	No cracks, drips or flowing, 6 mm total shrinkage in 300 mm	
Fluid resistance	% Retention of properties		
	72 hour immersion, 50°C [122°F]	Tensile strength	Elongation
	IRM 902	60	60
	Skydrol®	60	60
Electrical	Insulation resistance 20°C [68°F] M ohms km (min)	100	
Other	45° flammability	30 s (max.) afterburn 75 mm (max.) burn length	
	Acid gas	4% HCl equivalent (max.)	

Thermorad/Thermorad F



Applications

Thermorad is a general purpose jacket material which is unaffected by most common chemicals and solvents and is suitable for use during N.B.C. decontamination. Thermorad is highly flame retardant and has an overall balance of physical and chemical properties.

Thermorad cables find widespread use in industrial, commercial and military applications. This includes railways, commercial vehicles, medical equipment, communication equipment and commercial electronics. Thermorad cable jackets are compatible with Raychem polyolefin tubings, molded parts and adhesives.

Raythane, Neoprene, Rayolin and AFR

Specialized Wire and Cable Jacket Material

Product Facts

Raythane C

- -25°C to +80°C
[-13°F to +176°F]

and Raythane FR

- -65°C to +90°C
[-85°F to +194°F]

- Mechanically tough
- Can be overmolded

Rayolin

- -55°C to +95°C
[-67°F to +203°F]

- Excellent long term water immersion
- Can be overmolded
- Compatible with Raychem's underwater cable splices

Neoprene (US designation Thermorad NTFR)

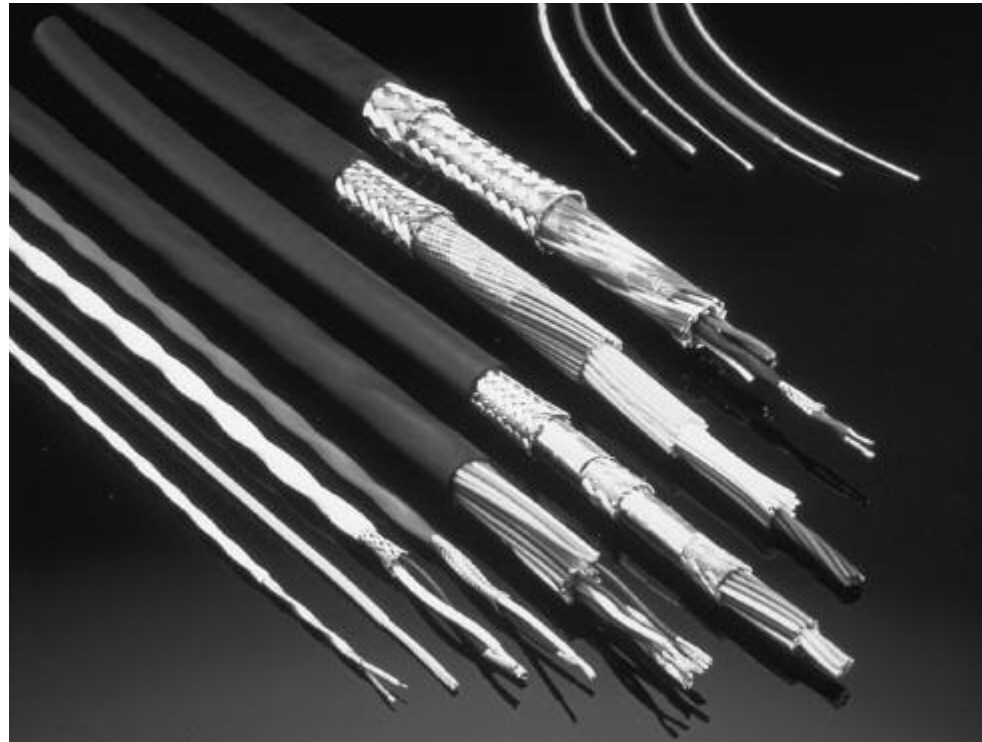
- -55°C to +90°C
[-67°F to +194°F]

- Extreme flexibility
- Highly flexible at low temperatures

AFR

- -40°C to +105°C
[-40°F to +221°F]

- Abrasion resistant
- Fuel resistant
- Flame retardant



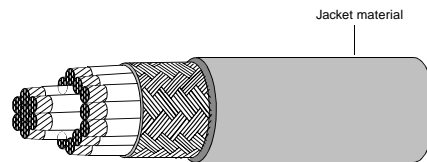
Applications

In addition to the preferred cable jacket materials, Tyco Electronics offers a variety of Raychem cable jackets for specialized applications. For example, specialized materials are available for extreme low temperature flexibility or for enhanced abrasion resistance, or non-cross-linked materials for cable splicing or overmolding.



Available in:

- Americas ■
- Europe ■
- Asia Pacific ■



Typical Characteristics when Tested in Accordance with Raychem Specification WCD

	WCD51/1625 Raythane C	WCD3310 Raythane FR	WCD51/147 Neoprene*	WCD51/1601 Rayolin	WCD51/1619 AFR	
Mechanical	Tensile strength (MPa)	45	45	14 12	150	
	Elongation (%)	400	400	400	250	
	Abrasion resistance (1.6 kg load)	500 scrapes	500 scrapes	30 scrapes	300 scrapes	200 scrapes
	Cold bend	-25°C [-13°F]	-15°C [5°F]	-55°C [-67°F]	-55°C [-67°F]	-40°C [-40°F]
Thermal aging	Endurance (10000 h)	80°C [176°F]	90°C [194°F]	90°C [194°F]	95°C [203°F]	105°C [221°F]
Fluid resistance	24 h immersion Diesel fuels 50°C [122°F]	Excellent	Excellent	Good	—	Good
	Skydrol® 50°C [122°F]	—	—	Excellent	Excellent	Excellent
	IRM 902 100°C [212°F]	Excellent	Excellent	Good	Good	Good
Electrical	Insulation resistance 20°C [68°F] M ohms. km (min)	1	1	5	100	100
Other	45° flammability	Pass	Pass	Pass	—	Pass

* In the US use Thermorad NTFR to WCD 3314.

Interference — Designing for the Threat



Available in:

- Americas ■
- Europe ■
- Asia Pacific ■

Electrical Shielding



Applications

In many applications, shielding of cables is important, whether it be to minimize cross-talk within the cable, to prevent interference from external sources, or to eliminate radiation from the cable itself.

The design of cables to provide effective shielding over a broad frequency spectrum is complex, and cables must be tailored to

specific electromagnetic environments. From simple aluminized Mylar® film that provides electrostatic shielding, progressively more complex shielding can be designed incorporating plated copper braids and Mu metal wraps.

Optimization

Performance of conventional braiding can be significantly improved by computer optimization. This tightly controlled

process can give many times the shielding performance of a basic braided shield with minimal weight penalty or increase in optical coverage. Supershielded cables combine Mu metal wraps with optimized braids to provide even further enhanced performance, especially at low frequencies.

Available Shields

Shield type	Construction	Typical Application
Aluminized Mylar®		Electrostatic shielding
Single Braid		Low level EMI Low sensitivity
Single Optimized Braid		Sensitive lines High EMI
Double Optimized Braid		Highly sensitive lines Severe EMI
Supershielded		EMP/Tempest
Double Supershielded		Severest of applications

MYLAR is a trademark of Dupont Teijin Films U.S.

Electrical Shielding (Continued)

Measuring Shielding Efficiency

Surface Transfer Impedance (Zt)

To assess the effectiveness of a shield, Tyco Electronics has adopted the line injection method as described in IEC 1196-1 to measure the surface transfer impedance (Zt) of a cable shield. This relates the open circuit voltage generated on a component wire inside the cable to the current injected on the overall shield. The unit of Zt is Ohms per meter, thus the voltage coupling is length dependent and long cables exhibit more leakage than similar but shorter length ones. To determine the surface transfer impedance across a range of frequencies, a drive signal is generated by the internal tracking generator of a spectrum analyzer, and amplified. The voltage is induced on the center conductor of the sample which is amplified and returned to the signal generator for measurement. The understanding of leakage mechanisms has enabled Tyco Electronics to design Raychem cables with guaranteed minimum Zt values for the desired operating environment.

Supershielding

EMP Hardened Cables

The requirements for nuclear hardened cables present the engineer with a range of problems. The waveform of the EMP is such that the majority of power is dissipated in a frequency band between 1 KHz and 5 MHz, where little protection is given by conventionally shielded cables. Tyco Electronics has solved this problem with a range of

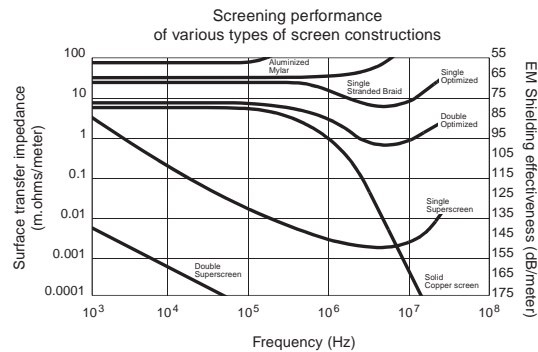
supershielded cables which give shielding performance at these frequencies by incorporating materials which change the inductance of the shield and lower the transfer impedance. Raychem supershielded cables have a sandwich construction of Mu metal tapes between optimized braids. Mu metal is a ferro-magnetic material which has a high permeability over a wide range of field strengths. It is applied to the cable in a way which maintains cable flexibility and minimizes work hardening and any consequent reduction in permeability. Supershielded cables not only give protection against EMP but also other major interference modes.

Design and Manufacturing Expertise

The problems of shielding cables are complex. However, with the introduction of optimized braids and supershielded cables, Tyco Electronics has the capability to solve the most difficult shielding problems. Shielding of cables without degrading cable flexibility can be provided for coaxial and multiconductor cables for all EMC and EMP conditions. To complement this range of cables, Tyco Electronics manufactures Raychem cable terminations and connector back fittings to give total interconnection system shielding performance.

Shielded Cables

Controlling the Threat



Testing

Tyco Electronics EMC test facilities have the capability for bulk current injection and radiation field testing in addition to surface transfer impedance measurements. The installation is a proven facility in characterizing new design parameters.



Applications

Every year, Tyco Electronics designs and builds several thousand custom, high-performance, multiconductor cables that meet unique product needs.

Design staff can draw on an extensive range of high-performance cable components and jacket materials, while incorporating both color-coding and alphanumeric marking techniques for component identification. These options, combined with a full range of EMI shields, lead to a huge variety of construction possibilities.

Tyco Electronics developed computer-aided design tools to provide a fast response to design requests. The software, used by factory engineers or product specialists in the field, can generate cable design proposals with drawings and quotations in minutes. A design drawing details all the cable data and can be used as the input to harness or cable splice (joint) design. The resulting cable is tailored to customers' exact needs in an efficient design that is superior to the compromise cable selected from a product catalog.

Quality Assurance

Raychem WCD and WSD cable specifications ensure that performance and quality standards are maintained to the highest level. Tyco Electronics manufacturing sites have obtained the highest available quality system approvals, including ISO 9000 and QS9000. Raychem cables are manufactured to meet the requirements of several major specifications.

Available in:	
Americas	■
Europe	■
Asia Pacific	■

Power Cables

Product Facts

- Choice of jacket materials
- -55°C to +125°C
[-67°F to +257°F]
- Size and weight savings
- Excellent flexibility
- Resistance to solvents and chemicals



Applications

Tyco Electronics offers a range of flexible Raychem power cables that are insulated and jacketed using materials that provide improved performance over other materials, such as CSP/EPR, silicone, or PCP/Butyl. Four different types of cable are available:

Type TR is a general purpose, single-wall, 125°C [257°F] construction normally specified for use inside cabinets in protected areas.

Type ZHI is a halogen-free 105°C [221°F] cable with good oil resistance. It is particularly suitable for use in offshore, ship, and mass transit applications where low-fire-hazard performance is required. Refer to Raychem specification WCD 2015.

Type FTR is a dual-wall, 125°C [257°F], diesel-oil-resistant cable originally developed for tank engine compartment applications. It meets the German BWB VG 95218 specification. Refer to Raychem specification WCD 2002.

Type AFR is a 105°C [221°F], single-extrusion, abrasion-resistant, flame- and fuel-resistant, radiation-crosslinked polyolefin.

Type ZHPCG is a halogen-free, 115°C [239°F] cable with good oil resistance and resistance to water. It is particularly suitable to the Mass Transit, Marine and Off-Shore industries where its low fire hazard performance and flexibility are key to a successful installation. Refer to Raychem Specification WSD 1265.

Each offers particular advantages for specific applications and each is also available in multiconductor constructions and shielded and jacketed versions. Cables offer size and weight savings, good resistance to abrasion and cut-through, and the ability to operate in difficult environments.

Available in:

- Americas ■
- Europe ■
- Asia Pacific ■

Specifications/Approvals*

Series	Agency	Military	Raychem
TR	—	Def. Stan. 61-12 Part 31 (jacket material)	WCD 2003, WCD 51/160
ZHI	—	—	WCD 2015
FTR	—	BWB VG 95218 Types G, H, and K	WCD 2002
AFR	UL style 3496	—	WCD 2011, WCD 51/160
ZHPCG	—	—	WSD 1265

*See specifications listed for details of performance.

Conductors (Tinned Soft Copper)

Conductor Size mm ²	Stranding				Max. Resistance at 20°C in Ω/km (Ω/1000 ft) Class 5/6
	IEC Class 5		IEC Class 6		
	No. x mm	Nom. Dia.	No. x mm	Nom. Dia.	
1.5	30 x 0.25	1.49 [.05]	85 x 0.15	1.53 [.06]	13.20 [4.02]
2.5	50 x 0.25	1.90 [.07]	140 x 0.15	2.40 [.09]	7.82 [2.38]
4.0	56 x 0.30	2.49 [.10]	228 x 0.15	2.90 [.11]	4.85 [1.48]
6.0	84 x 0.30	3.00 [.12]	189 x 0.20	3.60 [.14]	3.23 [0.98]
10.0	80 x 0.40	4.60 [.18]	324 x 0.20	4.55 [.18]	1.88 [0.57]
16.0	126 x 0.40	5.70 [.22]	513 x 0.20	5.50 [.22]	1.19 [0.36]
25.0	196 x 0.40	7.10 [.28]	783 x 0.20	7.30 [.29]	0.78 [0.24]
35.0	276 x 0.40	8.50 [.33]	1107 x 0.20	8.55 [.34]	0.55 [0.17]
50.0	396 x 0.40	10.30 [.41]	702 x 0.30	10.15 [.40]	0.39 [0.12]
70.0	360 x 0.50	12.40 [.49]	999 x 0.30	12.00 [.47]	0.27 [0.08]
95.0	475 x 0.50	14.50 [.57]	1332 x 0.30	14.05 [.55]	0.20 [0.06]
120.0	608 x 0.50	16.00 [.63]	1702 x 0.30	16.30 [.64]	0.15 [0.05]
150.0	777 x 0.50	18.00 [.71]	2109 x 0.30	17.40 [.68]	0.13 [0.04]
185.0	925 x 0.50	20.00 [.79]	2590 x 0.30	20.00 [.79]	0.10 [0.030]
240.0	1221 x 0.50	23.00 [.91]	—	—	0.08 [0.024]
300.0	1554 x 0.50	26.00 [1.0]	—	—	0.06 [0.018]
400.0	2035 x 0.50	30.00 [1.2]	—	—	0.05 [0.015]

Note: Types TR and FTR use IEC Class 6 conductors.
Types ZHI and AFR use IEC Class 5 conductors.

Materials Performance Summary

Material	Tensile Strength N/mm ² typical	Abrasion Resistance	Cut Through	Temperature Rating °C 1000 h	Preferred Color
TR	20	Excellent	Good	125	Black
ZHI	9	Good	Very Good	105	Black
FTR	18	Good	Good	125	Black
AFR	18	Excellent	Very Good	105	Grey
ZHPCG	8	Good	Good	115	Black

Note: Where a higher operating temperature is required, Raychem SPEC 55 provides outstanding performance up to 200°C continuous operating temperature. For these or other special applications, please contact Tyco Electronics.

Table 1. Nominal Diameters and Maximum Weights

Conductor Size (mm ²)	TR 16			FTR 16		
	Part No.	Nom. OD in mm (in)	Max. weight in kg/km (lb/1000 ft)	Part No.	Nom. OD in mm (in)	Max. weight in kg/km (lb/1000 ft)
1.5	—	—	—	—	—	—
2.5	TR 16-2.5	3.9 [.15]	34.0 [22.8]	—	—	—
4.0	-4	4.5 [.17]	51.0 [34.2]	FTR 16-4	5.6 [.22]	69.0 [46.2]
6.0	-6	5.2 [.20]	73.0 [48.9]	-6	6.3 [.25]	94.0 [63.0]
10.0	-10	6.2 [.24]	117.0 [78.4]	-10	7.5 [.29]	147.0 [98.5]
16.0	-16	7.4 [.29]	182.0 [121.9]	-16	8.8 [.35]	220.0 [147.4]
25.0	-25	9.3 [.37]	274.0 [183.6]	-25	10.7 [.42]	323.0 [216.4]
35.0	-35	10.6 [.42]	383.0 [256.6]	-35	12.1 [.48]	444.0 [297.5]
50.0	-50	12.5 [.49]	542.0 [363.1]	-50	14.0 [.55]	619.0 [414.7]
70.0	-70	14.6 [.57]	765.0 [512.6]	-70	16.2 [.64]	861.0 [576.9]
95.0	-95	17.0 [.67]	1020.0 [683.4]	-95	18.8 [.74]	1148.0 [769.2]
120.0	—	—	—	-120	21.3 [.84]	1484.0 [994.3]

Table 2. Nominal Diameters and Maximum Weights

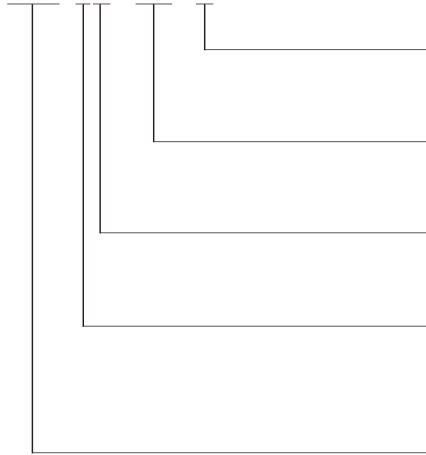
Conductor Size (mm ²)	ZHI 15			AFR 35		
	Part No.	Nom. OD in mm (in)	Max. Weight in kg/km (lb/1000 ft)	Part No.	Nom. OD in mm (in)	Max. Weight in kg/km (lb/1000 ft)
1.5	ZHI 15 -1.5	4.09 [.16]	33.5 [22.4]	AFR 35-1.5	2.8 [.11]	31.0 [20.8]
2.5	-2.5	4.69 [.18]	48.8 [32.7]	-2.5	3.9 [.15]	42.0 [28.1]
4.0	-4	5.49 [.22]	72.1 [48.3]	-4	4.8 [.19]	61.0 [40.9]
6.0	-6	6.16 [.24]	99.8 [66.9]	-6	6.2 [.24]	92.0 [61.6]
10.0	-10	8.20 [.32]	159.0 [106.5]	-10	7.0 [.28]	143.0 [95.8]
16.0	-16	9.30 [.37]	223.0 [149.4]	-16	8.1 [.32]	211.0 [141.1]
25.0	-25	10.90 [.43]	331.0 [221.8]	-25	10.3 [.41]	333.0 [223.1]
35.0	-35	12.30 [.48]	448.0 [300.2]	-35	11.7 [.46]	452.0 [302.8]
50.0	-50	14.70 [.58]	631.0 [422.8]	-50	13.7 [.54]	634.0 [424.8]
70.0	-70	16.80 [.66]	852.0 [570.8]	-70	16.0 [.63]	885.0 [593.0]
95.0	-95	19.10 [.75]	1108.0 [742.4]	-95	18.5 [.73]	1165.0 [780.6]
120.0	-120	21.00 [.83]	1438.0 [963.5]	-120	20.4 [.80]	1480.0 [991.6]
150.0	-150	23.00 [.91]	1748.0 [1171.2]	-150	22.6 [.89]	1825.0 [1222.8]
185.0	-185	25.60 [1.01]	2088.0 [1399.0]	-185	24.8 [.98]	2215.0 [1484.1]
240.0	-240	28.60 [1.13]	2705.0 [1812.4]	-240	27.8 [1.1]	2875.0 [1926.3]
300.0	-300	32.00 [1.26]	3363.0 [2253.2]	-300	32.0 [1.2]	3645.0 [2442.2]
400.0	-400	36.40 [1.43]	4396.0 [2945.3]	-400	36.0 [1.4]	4730.0 [3169.1]

Table 3. Nominal Diameters and Maximum Weights

Conductor Size (mm ²)	ZHPCG-15			ZHPCG-35		
	Part No.	Nom. OD in mm [in]	Max. Weight in kg/km [lb/1000 ft]	Part No.	Nom. OD in mm [in]	Max. Weight in kg/km [lb/1000 ft]
1	ZHPCG-15-1	3.77 [.14]	28.0 [18.1]	ZHPCG-35 -1	—	—
1.5	-1.5	3.79 [.15]	36.0 [24.2]	-1.5	4.55 [.18]	60.0 [40.3]
2.5	-2.5	4.27 [.17]	45.0 [30.2]	-2.5	5.07 [.20]	82.0 [55.1]
4.0	-4	4.64 [.18]	60.0 [40.3]	-4	5.66 [.22]	100.0 [67.2]
6.0	-6	5.31 [.21]	85.0 [57.1]	-6	6.15 [.24]	130.0 [87.4]
10.0	-10	6.53 [.26]	135.0 [90.7]	-10	7.33 [.29]	185.0 [124.3]
16.0	-16	8.03 [.32]	195.0 [131.0]	-16	8.83 [.35]	250.0 [167.9]
25.0	-25	9.70 [.38]	300.0 [201.6]	-25	10.50 [.41]	350.0 [235.2]
35.0	-35	11.30 [.44]	443.0 [297.7]	-35	11.70 [.46]	430.0 [288.9]
50.0	-50	13.50 [.53]	623.0 [418.6]	-50	13.48 [.53]	590.0 [396.5]
70.0	-70	15.60 [.61]	847.0 [569.1]	-70	15.33 [.60]	790.0 [530.8]
95.0	-95	18.10 [.71]	1119.0 [751.9]	-95	17.93 [.71]	1020.0 [685.4]
120.0	-120	19.80 [.78]	1445.0 [970.9]	-120	19.80 [.78]	1320.0 [887.0]
150.0	-150	22.00 [.87]	1775.0 [1192.7]	-150	21.44 [.84]	1550.0 [1041.5]
185.0	-185	24.40 [.96]	2115.0 [1421.2]	-184	23.28 [.92]	1900.0 [1276.7]
240.0	-240	27.80 [1.09]	2762.0 [1856.0]	-240	27.33 [1.08]	2500.0 [1679.9]
300.0	-300	31.20 [1.23]	3452.0 [2320.0]	-300	32.50 [1.28]	3562.0 [2393.5]
400.0	-400	35.20 [1.39]	4474.0 [3006.4]	-400	37.00 [1.46]	5645.0 [3793.3]

Part Numbering System

XXX XX - XX - X

**Standard Colors**

0 = Black 8 = Gray

Conductor Cross Section(1.5 to 400 mm²)**Conductor Type**

5 = IEC Class 5 - Flexible 6 = IEC Class 6 - Very flexible

Voltage Rating1 = 600/1000 V
3 = 1900/3300 V**Insulating Type**TR
FTR
ZHI
AF

Conductor Sizes, Strandings, and Resistance Values



Applications

The conductors used with Raychem wires are concentric in construction and are specifically designed for use with thin-wall insulations. The table on the next page gives nominal values for tin-plated copper, silver-plated copper, and silver-plated high-strength copper alloy (SPHSCA) constructions. Typically, tin-plated copper is suitable for use in applications up to 150°C [302°F] and silver-plated copper in applications up to 200°C [392°F] (SPEC 55 wire only).

The current-carrying capacities assume a maximum 60°C [140°F] increase in temperature of a single wire in free air at 40°C [104°F]. For details of performance in conditions other than 40°C [104°F], contact Tyco Electronics.

Available in:

- Americas ■
- Europe ■
- Asia Pacific ■

Nominal Values of American Wire Gauge (AWG) and Metric Conductors

AWG	Size	Stranding No./mm	Stranding No./AWG	Outside Diameter (min.-max.)		Max Resistance in Ω /km (Ω /1000 ft)			Current-Carrying Capacity (amps)
	mm ²					Tin-copper	Silver-copper	SPHSCA	
30	0.06	7/0.10	7/38	0.28-0.31	[0.011-0.012]	347 [106]	324 [99]	377 [115]	3.0
28	0.09	7/0.13	7/36	0.36-0.39	[0.014-0.015]	220 [67]	205 [62]	239 [73]	4.0
26	0.15	19/0.10	19/38	0.46-0.49	[0.018-0.019]	133 [40]	123 [37]	144 [44]	5.5
24	0.25	19/0.13	19/36	0.55-0.62	[0.022-0.024]	84 [26]	78 [24]	91 [28]	7.5
22	0.40	19/0.15	19/34	0.70-0.76	[0.028-0.030]	51 [16]	49 [15]	56 [17]	10.0
20	0.60	19/0.20	19/32	0.92-0.97	[0.036-0.038]	31 [9]	30 [9]	34 [10]	13.0
18	1.00	19/0.25	19/30	1.18-1.26	[0.046-0.050]	20 [6]	20 [6]	—	17.5
16	1.20	19/0.30	19/29	1.34-1.48	[0.053-0.058]	15 [4]	15 [4]	—	20.0
14	2.00	37/0.25	37/30	1.65-1.72	[0.065-0.068]	10 [3]	10 [3]	—	28.0
12	3.00	37/0.32	37/28	2.12-2.18	[0.083-0.086]	7 [2]	7 [2]	—	3705.0
10	4.50	37/0.40	37/26	2.69-2.74	[0.106-0.108]	4 [1]	4 [1]	—	53.0
8	9.00	133/0.29	133/29	4.01-4.20	[0.158-0.165]	2 [0.6]	2 [0.6]	—	78.0
6	13.5	133/0.36	133/27 [5.30]	5.03-5.48	[0.198-0.216]	1.4 [0.4]	1.4 [0.4]	—	105.0
4	21.0	133/0.45	133/25 [6.62]	6.35-6.96	[0.250-0.274]	0.9 [0.3]	0.9 [0.3]	—	142.0
2	33.0	665/0.25	665/30 [8.54]	8.13-8.64	[0.320-0.340]	0.6 [0.2]	0.6 [0.2]	—	196.0
0	51.0	1045/0.25	1045/30 [10.87]	10.00-10.80	[0.394-0.425]	0.4 [0.1]	0.4 [0.1]	—	266.0

Note: Abbreviations:

- Cond. = Conductor
- SPHSCA = Silver-plated high-strength copper
- Tin-copper = Tin-plated copper
- Silver-copper = Silver-plated copper
- N/A = Not available

For product details, please refer to relevant specification control drawing.

Current Derating Factors for Wire Bundles in Free Air

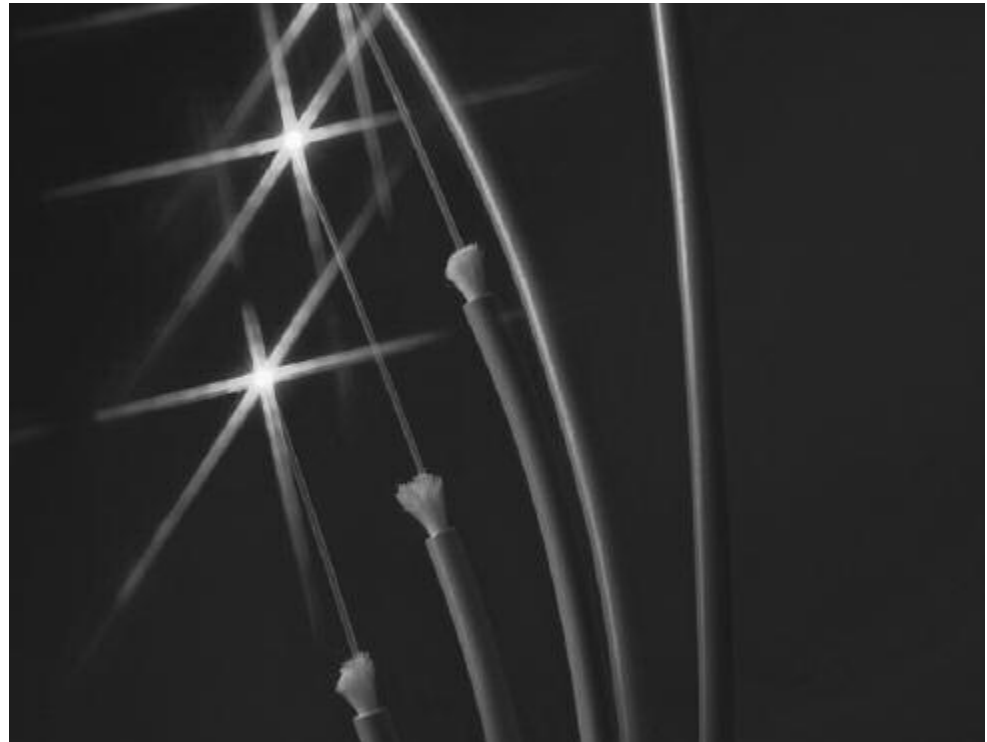
No. of wires	2	3	4	7	9	12	15	18	21	24	27	30	37
Derating factor	.825	.73	.66	.54	.49	.43	.39	.36	.33	.31	.29	.28	.26

Fiber Optic Cables**High Performance Interconnection Fiber Optic Link****Product Facts**

- Low smoke
- Low corrosive gas emission
- Limited fire hazard
- Halogen free
- Small size and lightweight
- Custom design
- Range of jacket materials
- Inherent security of transmitted signals
- Low loss, high performance cables
- Water-blocking options
- Meets the requirements of Def Stan 60-1 part 2

Typical applications

- Military communications
- Military control systems
- Naval applications
- Underwater and ROV's
- Hazardous Environments

**Standard Fiber Optic Cable Constructions**

The use of increasingly sensitive and more sophisticated equipment in marine and military applications means a corresponding requirement for high performance interconnection links. Fiber optic links offer high performance and have many advantages over copper systems such as:

- Interference immunity (EMI & RFI).
- High bandwidth (for improved message capacity).
- Small size, lightweight.
- Low loss, durability.
- Security and safety.

However, to ensure the reliability of a fiber system the cable design, materials and interconnection accessories employed are all extremely important.

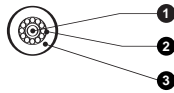
Tyco Electronics provides a range of single and multi-core Fiber Optic Cables offering innovative solutions to interconnect problems. Tyco Electronics leadership in the field of advanced material technology, coupled with more than 15 years experience of supplying ruggedized cables for marine and military applications, ensures superior performance levels in the harshest of environments.

Available in:

Americas	■
Europe	■
Asia Pacific	■

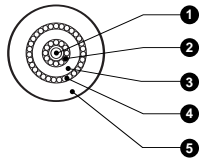
Fiber Optic Cables (Continued)

Simplex Fiber Optic Cable



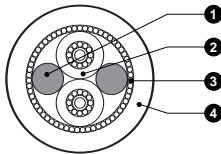
Component	Fiber Size	Qty/Diameter
1. Secondary Buffered Fiber	(62.5/125)	1
2. Strength Member	—	1.5 mm
3. Zerohal Sheath	—	2.7 ± 0.2 mm

Ruggedized Simplex Fiber Optic Cable



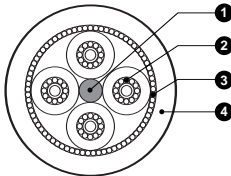
Component	Fiber size	Qty/Diameter
1. Secondary Buffered Fiber	(62.5/125)	1
2. Strength Member	—	1.5 mm
3. Zerohal Sheath	—	2.7 mm
4. Strength Member	—	3.3 mm
5. Zerohal Sheath	—	5.3 ± 0.2 mm

2 Channel Ruggedized Fiber Optic Cable



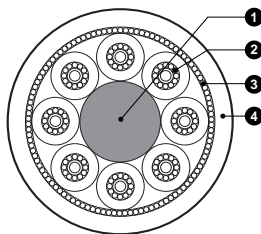
Component	Fiber size	Qty/Diameter
1. Strength Member	—	2
2. Simplex Cable	(62.5/125)	2
3. Strength Member	—	6.0 mm
4. Zerohal Sheath	—	8.2 ± 0.3 mm

4 Channel Ruggedized Fiber Optic Cable



Component	Fiber size	Qty/Diameter
1. Strength Member	—	1
2. Simplex Cable	(62.5/125)	4 / 6.7 mm
3. Strength Member	—	7.3 mm
4. Zerohal Sheath	—	9.5 ± 0.5 mm

8 Channel Ruggedized Fiber Optic Cable



Component	Fiber size	Qty/Diameter
1. Strength Member	—	1
2. Simplex Cable	(62.5/125)	8 / 9.8 mm
3. Strength Member	—	10.4 mm
4. Zerohal Sheath	—	12.5 ± 0.5 mm

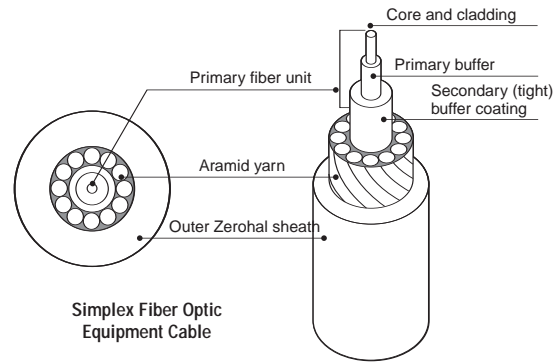
High Performance Interconnection Fiber Optic Link

Fiber Optic Cables (Continued)

Fiber Optic Equipment Cable

The diagram on the right shows a typical equipment cable, which can also be used as a sub-unit or simplex component for the larger multi-core cables, as shown in the diagrams on the previous page. The fiber used is a high performance tight buffer type comprising an all silica fiber, with multiple coatings designed to provide mechanical and environmental protection, micro-bend resistance, and ease of handling in the field. Most common fiber types are readily available (see table below) and more specialized fibers are available on request.

The equipment cable has a layer of served aramid yarn providing high flexibility and tensile strength, while the outer sheath provides environmental and mechanical protection, along with low smoke emission and chemical resistance.



The materials and types of designs employed have been thoroughly tested to Def Stan 60-1 (see test data on the next page) and Def Stan 61-12 Part 31 which demonstrate the suitability of the cables and fibers for use in high performance and critical marine applications.

While offering a standard range of tight buffered multi and single mode fiber optic cables, Tyco Electronics also offers the option of custom design for specific applications. These cables capitalize on the small size of the fiber thereby enabling efficient, ergonomic and reliable interconnection.



Typical 2-Channel Cable

Fiber Types and Common Features

Type	Attenuation	Bandwidth	Dispersion Slope	Numerical Aperture
—	dB/km@850/1300/1550nm	MHz-km@850/1300nm	ps/(nm ² -km)	—
8/125	—/0.4/0.25	n/a	0.093	0.1
50/125	3.5/1.2/—	400/600	n/a	0.20
62.5/125	3.5/1.2/—	160/500	n/a	0.275
100/140	4.5/2.0/—	200/200	n/a	0.29

All fibers supplied with a high performance three layer tight buffer. Cables can be supplied with water-blocking and marking to suit customer requirement, and any combination of the fiber types listed above.

Fiber Optic Cables (Continued)

Table of Requirements and Results from Def Stan 60 – 1 Part 2

Definition	Requirements	Part 2		
Cable tensile strength	<0.5% cable elongation no increase in attenuation at full load and after test compared to pre-test value.	1000N applied at 100N/minute	Pass	
Cable bend	No cracking or deformation of cable sheath. <0.5dB change after test.	20N load, 10 cycles of wind and unwind. 6 wraps.	Pass	
Cold bend	No cracking or deformation of cable sheath. <0.5dB change after test.	20N load, 10 cycles of wind and unwind. 6 wraps, -30°C.	Pass	
Cyclic bend	No cracking or deformation of cable sheath. <0.5dB change after test.	40N, 1000 cycles.	Pass	
Cable impact	No cracking or deformation of cable sheath. <0.5dB change after test. 100 impacts.	12.5 mm radius, 1kg hammer, 100 mm height	Pass	
Cable crush	No cracking or deformation of cable sheath. <0.5dB change after test <20% reduction from original diameter.	2000N/5 min	Pass	
Cable snatch	No cracking or deformation of cable sheath. <0.5dB change after test <20% reduction from original diameter.	1kg, 10 cycles	Pass	
Dynamic cut through	≥ 25N	85°C, 60N/minute, 0.45mm diameter needle blade	Pass	
Tear resistance	5 N/mm	—	Pass	
Shrinkage	<3mm total	16 hrs at -30°C and 16 hrs at 85°C	Pass	
Scrape abrasion	500 cycles minimum	5N, 85°C, 0.45 mm diameter needle blade	Pass	
Fluids	Volume	25 TS ret 60 Eb ret 60	Diesel F76 28 days @ 20°C	Pass
	swell	15 min % 60 min % 60	OX-30 28 days @ 50°C	Pass
	max %	15 60 60	OX-40 HS200X 28 days @ 50°C	Pass
		10 60 60	OMD-113 28 days @ 50°C	Pass
		50 50 50	OX-28 28 days @ 50°C	Pass
		10 80 80	Deionized water 28 days @ 50°C	Pass
	10 80 80	Deionized water + 3.5% NaCl 28 days @ 50°C	Pass	
Accelerated ageing	<20% change in TS/Eb/tear between 14 and 28 days. Eb ≥ 150%	110°C for 14 and 28 days.	Pass	
Arrhenius plot	40,000 hours at 85°C	End point measurement: 50% absolute elongation	Pass	
Stability	175% max. elongation, 25% max. permanent elongation.	105°C, 0.2N/mm ² stress.	Pass	
Pressure	Indentation not to exceed 50%.	85°C for 4 hrs.	Pass	
Ozone	No cracks with normal vision.	80 – 100ppm for 120 hrs	Pass	
UV light resistance	≤ 80% Eb change, ≤ 20% TS change.	8 hrs UV 55°C, 4 hrs humidity 40°C, (UV-B) 1000 hrs.	Pass	
Smoke Index	20 maximum	NES 711	Pass	
Toxicity index	5 maximum	NES 713	Pass	
Halogen index	No detectable halogens.	Sodium fusion test (Lassaigne)	Pass	
Oxygen index	29 minimum	BS 2782 Part 1 Method 141D	Pass	
Temperature index	250°C minimum	Nes 715	Pass	
Flammability	Not to reach within 50 mm of the lower clamp.	BS 4066 Part 1	Pass	

