

Table of Contents

Introduction	9-2
High-Performance Wire and Cable	
SPEC 44 Wire and Cable	9-3 to 9-9
SPEC 55 Wire and Cable	9-10 to 9-20
FlexLine (SPEC 80) Wire and Cable	9-21, 9-22
Low-Fire-Hazard Wire and Cable	
Type 99 Wire and Cable	9-23 to 9-26
Zerohal 100A Wire and Cable	9-27 to 9-29
Zerohal 100G Wire and Cable	9-30 to 9-32
Signal and Control Cables for Offshore and Commercial Shipping	
C-Lite Low Fire Hazard Lightweight Cables	9-33 to 9-49
C-Lite F (Fire Resistant) Cable	9-50, 9-51
Commercial Wire Family	
FlexLite Wire	9-52, 9-53
FlexLite CW Wire	9-54, 9-55
FlexLite DW Wire	9-56, 9-57
FlexLite TW Wire	9-58, 9-59
FlexLite HT Wire	9-60, 9-61
Thermocouple Extension Cable	
Thermocouple Extension Cable	9-62 to 9-64
Controlled Electrical Cables	
ElectrolossFilterLine Cables	9-67 to 9-72
Cheminax Coaxial Cables	9-73 to 9-75
Cheminax High-Performance Cables	9-76
Cheminax Twin Axial Cables	9-77, 9-78
SeaLAN Ethernet Cables	9-79, 9-80
SHF-260 Highly Flexible Wire	9-81
ZEROHAL PROFIBUS Cables	9-82, 9-83
QUADLITE Quadaxial Cables	9-84 to 9-88
High Speed Copper Cable Assemblies	9-89
High Speed Copper Cables	9-90 to 9-93
Multiconductor (Multicore) Cables	
Custom Designed and Standard Multiconductor Cables	9-94
Multicore Cables	9-95, 9-96
Computer Aided Design	9-97
Custom Shipboard Cables	9-98
Braids	
RayBraid Tubular Braiding	9-99, 9-100
Cable Jacket Materials	
Properties and Specifications	9-101, 9-102
FDR 25	9-103, 9-104
Zerohal	9-105 to 9-107
Thermorad HTF/Fluoroelastomer	9-108
Thermorad/Thermorad F	9-109
Raythane, NT/Thermorad NTFR, Rayolin, and AFR	9-110
NBC	9-111, 9-112
Miscellaneous	
Electrical Shielding	9-113, 9-114
Power Cables	9-115 to 9-118

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

Introduction

TE provides wire and cable solutions for challenging environments and demanding applications. The product range includes high-performance insulated wires, coaxial and data bus cables, power cables, electronics wire, and multi-core 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 scrape abrasion, and cut-through.

■ **SPEC 80 (FlexLine)** wire is insulated with a flexible modified radiation cross-linked ETFE polymer with a temperature rating of -65°C to +200°C [-85°F to +395°F]

■ **Type 99** wire has a dual wall construction and has excellent mechanical performance and chemical resistance with a range of enhanced fire hazard properties.

■ **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 (multi-core)** cables organize a variety of TE wire and cable products in controlled geometries for specific applications.

Using a computer-aided design system, TE can quickly design multicore cables to meet your needs. A variety of cable jackets are available to suit most applications.

■ **High Speed Copper cable** designs are available for Cat 5e, Cat 6, IEEE 1394 and USB applications. This family of cables can be customized to meet specific application needs.

■ **SeaLAN Cat 5e and Zerohal PROFIBUS** cables are designed to be used in the demanding marine environmental conditions while still meeting the high performance data standards.

■ **Quadlite** quadraxial cables, rated up to 200°C, offer small size and light weight high speed solutions in aerospace applications which require data protocols such as 100BaseT, 1000BaseT, FiberChannel and IEEE 1394.

■ **C-Lite low fire hazard lightweight cables** offer significant size and weight reduction, when compared to conventional insulation systems, while at the same time meeting key criteria such as low fire hazard performance and mechanical robustness.

■ **FlexLite commercial wire** family is available in various constructions for a variety of applications with temperature ratings from -45°C up to 250°C.

FLCW is a general purpose and motor lead wire.

FLDW is a dual-wall primary wire.

FLTW is a thin-wall hookup wire and cable.

FLHT is a high-temperature hookup wire.

FLTX is an ultra-high temperature hookup wire.

TE 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 insulation materials.

Contact TE 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
- 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).

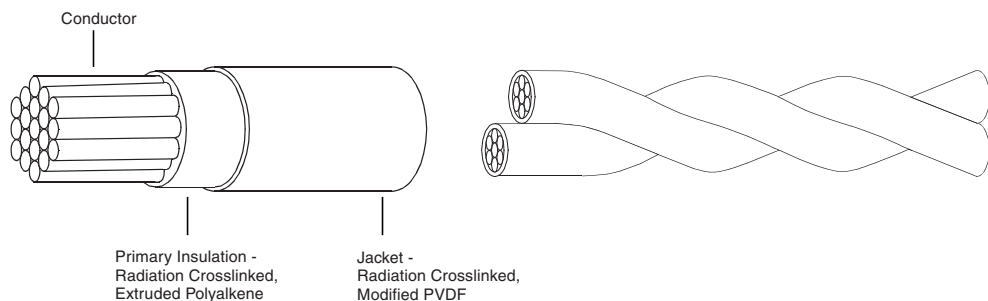
The result is a wire insulation system that offers a 150°C [302°F] temperature rating, small size, light weight, solder iron resistance, and resistance to most solvents, fuels and lubricants.

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, military ground systems, and offshore platforms where environmental conditions demand consistently reliable performance. In airframe 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-DTL-16878, SAE AS22759 or BS 3G210.

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 4.45 grams/meter max
22 AWG PTFE equipment wire, AS-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.

The tin-plated conductor usually specified is easily soldered or crimped. The insulation may be easily 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

AS-81044, NEMA-WC-27500 (Cables)
Def Stan. 61-12 Part 18 - Type 1 pliable (Maintenance Range)
Def Stan. 61-12 Part 26 All types
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
TE Specification 44

NOTE:

Please check with TE personnel to ensure the product you wish to purchase is manufactured and released to the specification required.

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 , (4000 PSI), 230%
Notch propagation, 0.05mm notch	Pass
Solder iron resistance (370°C, 1 minute)	Pass
Shrinkage, 300°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 hr) and 300°C [572°F] (6 hr). 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 insulation.

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 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.

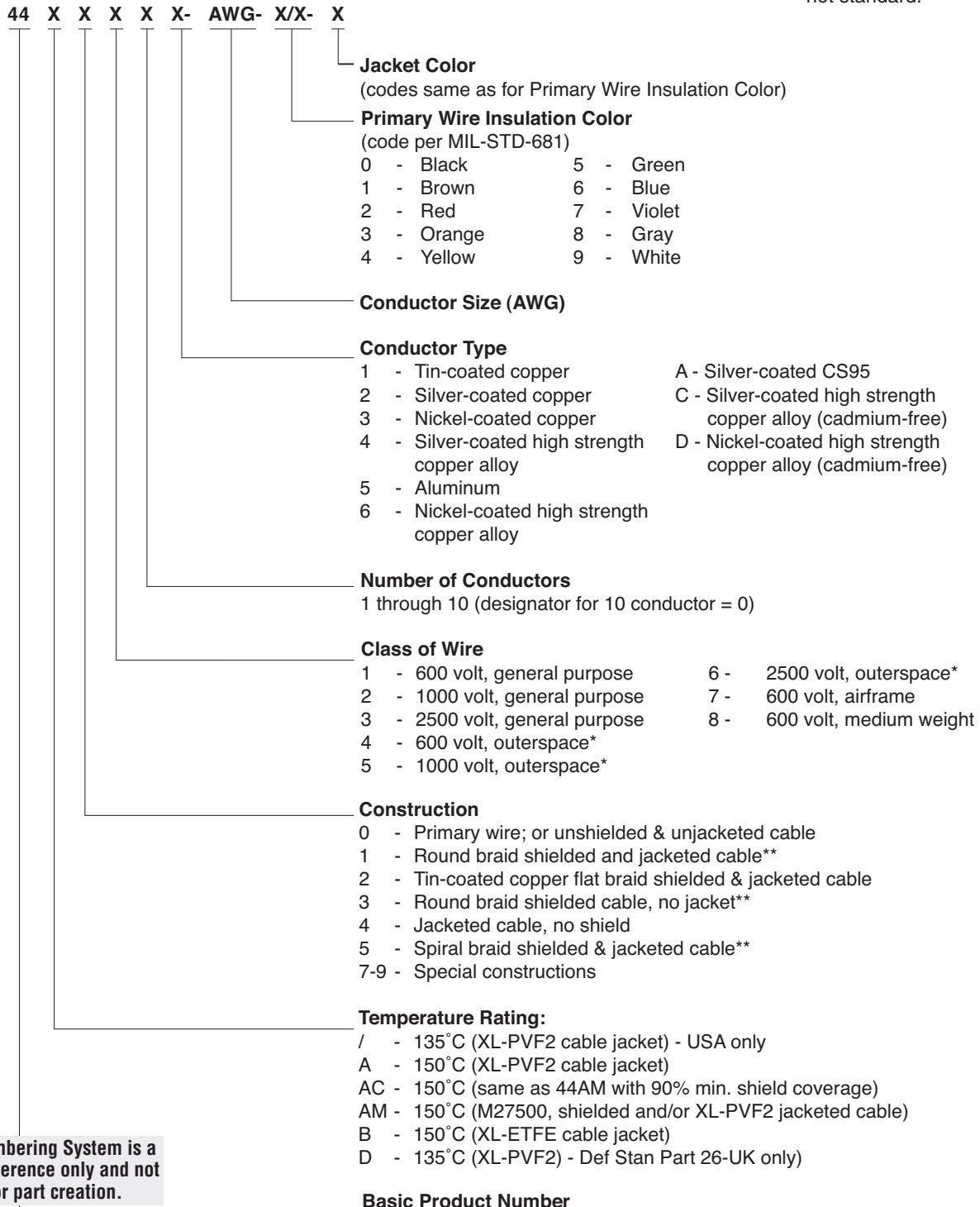
Fire Hazard Performance

Flammability	Federal Aviation Reg FAR-25	Pass
	BS EN 50265 Vertical Flammability	Pass
	S424 14751 (Swedish chimney)	Pass
	NFC 32070 (2) (French chimney)	Pass
	IEC 60332 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
	BS EN 150-4589 Part 2	30% Oxygen
	BS EN 150-4589 Part 3	
	Temperature Index, NES 715	>300°C [572°F]

SPEC 44 (Continued)

Part Numbering System

Cross items that are not standard.



* 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 for standard products

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.

SPEC 44 (Continued)

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
U	V

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
Non-standard color - defined by customer

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

Tyco Electronics Part No.

Military Part No.

**Part Numbering System is a
cross reference only and not
meant for part creation.**

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]	0.81 [0.032]	1.34 [0.9]
28	7/0.13	7/36	0.09	0.76 [0.030]	1.43 [0.96]	0.89 [0.035]	1.64 [1.1]
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	8.30	—	—	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

Wire Size (AWG)	Stranding		CSA (mm ²)	44A031X (2500 V)		44A081X (600 V)		44A012X (600 V)	
	(mm)	#/AWG		Nom. OD	Max. Weight (g/m) lb/kft	Nom. OD	Max. Weight (g/m) lb/kft	Nom. OD	Max. Weight (g/m) lb/kft
30	7/0.10	7/38	0.06	—	—	—	—	1.37 [0.054]	2.38 [1.6]
28	7/0.13	7/36	0.09	—	—	—	—	1.52 [0.060]	3.13 [2.1]
26	19/0.10	19/38	0.15	1.35 [0.053]	3.13 [2.1]	1.22 [0.048]	2.98 [2.0]	1.73 [0.068]	4.31 [2.9]
24	19/0.13	19/36	0.25	1.44 [0.057]	4.46 [3.0]	1.37 [0.054]	3.87 [2.6]	2.03 [0.080]	6.39 [4.3]
22	19/0.16	19/34	0.40	1.75 [0.069]	6.40 [4.3]	1.57 [0.062]	5.65 [3.8]	2.38 [0.094]	9.37 [6.3]
20	19/0.20	19/32	0.60	1.98 [0.078]	9.08 [6.1]	1.78 [0.070]	8.04 [5.4]	2.79 [0.110]	13.98 [9.4]
18	19/0.25	19/30	1.00	2.23 [0.088]	12.95 [8.7]	2.03 [0.080]	11.91 [8.0]	3.30 [0.130]	21.27 [14.3]
16	19/0.29	19/29	1.25	2.46 [0.097]	16.22 [10.9]	2.26 [0.089]	14.73 [9.9]	3.65 [0.144]	26.93 [18.1]
14	19/0.36	19/27	2.00	2.92 [0.115]	24.10 [16.2]	2.74 [0.108]	22.17 [14.9]	4.52 [0.178]	42.25 [28.4]
12	37/0.32	37/28	3.00	3.32 [0.131]	36.01 [24.2]	3.20 [0.126]	32.59 [21.9]	5.48 [0.216]	65.91 [44.3]
10	37/0.40	37/26	5.00	4.09 [0.161]	54.32 [36.5]	3.94 [0.155]	52.08 [35.0]	—	—
8	133/0.29	133/29	8.30	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 (1000 V)
1 Conductor

Wire Size (AWG)	Stranding		44A111X (600 V)		44A121X (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	1.54 [0.061]	5.21 [3.5]	—	—
28	7/0.13	7/36	1.61 [0.063]	5.80 [3.9]	—	—
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

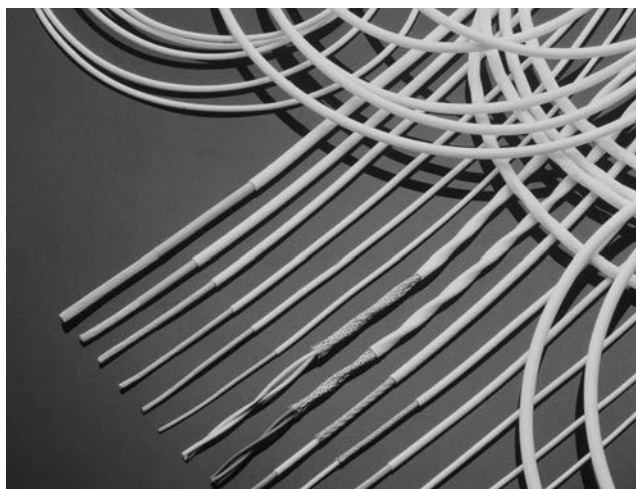
Wire Size (AWG)	44A181X (600 V)		44A112X (600 V)	
	Nom. OD	Max. Weight (g/m) lb/kft	Nom. OD	Max. Weight (g/m) lb/kft
30	—	—	2.23 [0.088]	8.20 [5.8]
28	—	—	2.38 [0.094]	9.40 [6.6]
26	—	—	2.59 [0.102]	12.05 [8.1]
24	2.26 [0.089]	11.76 [7.9]	2.99 [0.118]	16.82 [11.3]
22	2.57 [0.101]	15.48 [10.4]	3.35 [0.132]	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.

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

SPEC 55PC wire and cable systems feature an 8-mil air-frame 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.

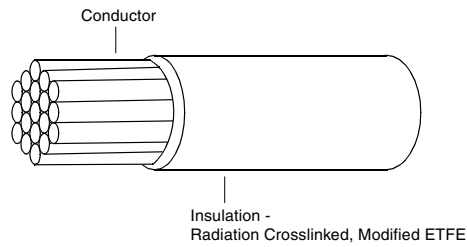
- Meets Boeing material standard BMS 13-48.
- Exceeds FAR 25 test requirements for flame resistance and smoke density.

Available in:

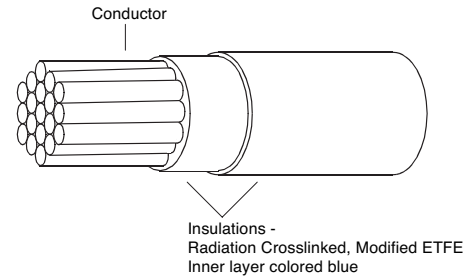
- | | |
|--------------|---|
| Americas | ■ |
| Europe | ■ |
| Asia Pacific | ■ |

SPEC 55 (Continued)

Specifications



SPEC 55 Insulation System - Single Wall



SPEC 55 Insulation System - Dual Wall

SAE AS22759/32-35 and /41 to /46 and NEMA-WC-27500 (Cables)

Defense Standard 61-12 Part 33 Issue 5

Part 1001 and Part 1002

VDE 9426, 9427, 9428

British Standard 3G233

Boeing BMS 13-48

Airbus ABS 0820 to 0826

NASA preferred product list

European Space Agency 3901/012, 3901/020 and 3901/022

TE Specification 55

Civil Aviation Authority Accessory Approval E11623

NOTE:

Please check with TE personnel to ensure the product you wish to purchase is manufactured and released to the specification required.

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, 1000V
Tensile strength + elongation (core only)	(Dual wall wire) 35 N/mm², 125% min.
Tensile strength + total elongation (core & primary jacket)	(Dual wall wire) 35 N/mm², 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	Ø
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 insulation.

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.

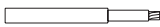



Flammability

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 and vertical test FAR25.

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

Conductor	Primary Wire	Twisted Pair	Shielded & Jacketed	
			Single	Pair
				

55PC - Extra Light Weight Constructions

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

SPEC 55 (Continued)

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

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)	Nom. OD	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]	8.03 [5.4]
28	1.59 [0.060]		5.80 [3.9]	2.27 [0.087]	9.37 [6.30]
26	1.71 [0.065]		6.85 [4.6]	2.53 [0.097]	11.75 [7.9]
24	1.84 [0.070]		8.19 [5.5]	2.80 [0.107]	14.58 [9.8]
22	1.99 [0.076]		10.27 [6.9]	3.07 [0.119]	18.15 [12.2]
20	2.20 [0.084]		13.40 [9.0]	3.50 [0.135]	24.10 [16.2]
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]	57.13 [38.4]
12	3.55 [0.137]		42.41 [28.5]	6.30 [0.243]	81.98 [55.1]
10	4.20 [0.161]		62.65 [42.1]	7.40 [0.291]	123.63 [83.1]
8	5.80 [0.223]		110.42 [74.2]	10.60 [0.417]	226.15 [152.0]

**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)	Nom. OD	55A181X		55A182X	
		Nom. OD	Max. Weight (g per m/lbs per kft)	Nom. OD	Max. Weight (g per m/lbs per kft)
26	1.854 [0.073]		7.89 [5.3]	2.870 [0.113]	14.29 [9.6]
24	1.981 [0.078]		9.37 [6.3]	3.124 [0.123]	16.37 [11.0]
22	2.134 [0.084]		11.76 [7.9]	3.429 [0.135]	20.68 [13.9]
20	2.337 [0.092]		14.88 [10.0]	3.853 [0.151]	27.08 [18.2]
18	2.616 [0.103]		19.79 [13.3]	4.394 [0.173]	36.46 [24.5]
16	2.819 [0.111]		23.81 [16.0]	4.801 [0.189]	42.86 [28.8]
14	3.251 [0.128]		33.03 [22.2]	5.715 [0.225]	61.61 [41.4]
12	3.683 [0.145]		45.09 [30.3]	6.578 [0.259]	85.42 [57.4]
10	4.192 [0.168]		66.97 [45.0]	7.797 [0.307]	127.54 [85.7]

SPEC 55 (Continued)

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

Wire Size (AWG)	Stranding (mm)	55PC021X		55PC022X	
		Nom. OD	Target Weight (g per m/lbs per kft)	Nom. OD	Target Weight (g per m/lbs per kft)
26	19/102	0.087 [0.035]	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 [62.99]

Wire Size (AWG)	55PC121X		55PC122X	
	Nom. OD	Target Weight (g per m/lbs per kft)	Nom. OD	Target 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 [0.243]	80.23 [53.45]
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.)

SPEC 55 (Continued)

Part Numbering System 55A and 55LF — General Purpose

55 A 1 1 2 1 * - AWG - 2/6 - 9

Jacket Color (code per MIL-STD-681)

Codes same as for Primary Wire Insulation Color

Primary Wire Insulation Color (code per 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)

*Optional Shield Material

H - High strength copper alloy, shield coating same as conductor coating (No designator defaults to coated "copper" shield, if any)

Conductor Type

- 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 - Silver-coated ultra high-strength copper alloy

Number of Conductors

1 through 10 (designator for 10 conductor = 0)

Class of Wire

- 1 - 600 volt, lightweight
- 2 - 600 volt, medium weight
- 4 - 450V (55M 20-30 AWG only)
- 7 - 1000 volt, heavy duty, airframe
- 8 - 600 volt, normal weight, airframe

Constructions

- 0 - Primary wire; or unshielded & unjacketed cable
- 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 braid shielded & jacketed cable
- 6-9- Special constructions

Product Type

- A - General purpose
- AC - General purpose, 90% min. shield coverage
- AF - General purpose, low fluoride
- D - Defense Standard 61-12 Part 33
- LF - General purpose, ultra low fluoride
- LFC - General purpose, ultra low fluoride, 90% min. shield coverage
- M - 450 Volt

Basic Product Number

Except for p/ns with Shield Material designation "H", shield coating same as conductor coating, **except:

- for Conductor Type 4, shield shall be tin-coated cooper
- for Conductor Types 6 and A, flat braid only, shield shall be tin-coated copper

The UK manufactures and supply large volumes of 55Mx4x4 (450 volt) construction wires and cables for Aerospace and Multisport applications.

Part Numbering System is a cross reference only and not meant for part creation.

SPEC 55 (Continued)

Part Numbering System

55/ — Outer Space

55 / 1 3 2 1 * - AWG - 0/9 - 9

Jacket Color (code per MIL-STD-681)

Codes same as for Primary Wire Insulation Color

Primary Wire Insulation Color (code per 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)

*Optional Shield Material

H - High strength copper alloy, shield coating same as conductor coating (No designator defaults to coated "copper" shield, if any)

Conductor Type

- 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 - Silver-coated ultra high-strength copper alloy

Number of Conductors

1 through 10 (designator for 10 conductor = 0)

Class of Wire

- 1 - 600 volt, lightweight
- 2 - 600 volt, medium weight
- 3 - 600 volt, ultra lightweight
- 4 - 300 volt (discontinued)
- 7 - 1000 volt, heavy duty
- 8 - 600 volt, normal weight

Constructions

- 0 - Primary wire; or unshielded & unjacketed cable
- 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 braid shielded & jacketed cable
- 6-9- Special constructions

Product Type

- / - Outer Space
- /F - Outer Space, low fluoride
- /LF- Outer Space, ultra low fluoride
- /P - Outer Space, shield coating same as conductor coating (valid with the following conductor types only: 4 for round braid; 4, 6 or A for flat braid)

Basic Product Number

For 55/: Except for p/ns with Shield Material designation "H", shield coating same as conductor coating, **except:
 - for Conductor Type 4, shield shall be tin-coated copper; - for Conductor Types 6 and A, flat braid only, shield shall be tin-coated copper. For 55/P, /LF: Shield coating same as conductor coating.
 For product released to ESCC 3901/012, 3901/020 and/or 3901/022, please refer to TE for product designation and construction.

Part Numbering System is a cross reference only and not meant for part creation.

SPEC 55 (Continued)

Part Numbering System 55PC and 55 PLF — Process Control

55 PC 1 1 2 4 * - AWG - 2/6 - 9

Jacket Color (code per MIL-STD-681)

Codes same as for Primary Wire Insulation Color

Primary Wire Insulation Color (code per 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)

*Optional Shield Material

H - High strength copper alloy, shield coating same as conductor coating (No designator defaults to coated "copper" shield, if any)

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 ultra high-strength copper alloy

Number of Conductors

- 1 through 10 (designator for 10 conductor = 0)
- 0 - 10 conductors

Class of Wire

- 1 - 600 volt, lightweight, general purpose, single wall
- 2 - 600 volt, medium weight, general purpose
- 5 - 600 volt, lightweight, general purpose, dual wall
- 7 - 1000 volt, heavy duty, airframe, general purpose
- 8 - 600 volt, normal weight, airframe, general purpose

Constructions

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

Product Type

- PC- Process Control
- PCF- Process Control, low fluoride
- PCFL-Process Control, low fluoride (lite)
- PCL - Process Control (lite)
- PCT- Process Control (stripping thread under jacket, and shield, if any)
- PLF - Process Control, ultra low fluoride
- PLFL-Process Control, ultra low fluoride (lite)

Basic Product Number

Except for p/ns with Shield Material designation "H", shield coating same as conductor coating, **except:
For 55PCL - for conductor type 6, flat braid only, shield shall be tin-coated copper
For 55PC and 55PCT - for conductor Type 4 and A, shield shall be tin-coated copper
for Conductor Type 6, flat braid only, shield shall be tin-coated copper

**Part Numbering System is a
cross reference only and not
meant for part creation.**

SPEC 55 (Continued)





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 TE.

SPEC 55 Part Numbering System — General

Temperature Rating	Conductor Material	AWG Range Available	Part Number	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 [302°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
1000-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 (Continued)

SPEC 55 Cable Constructions

Construction	Number of Components	Component Conductor ¹	Shield Material ¹	Part Number	
				Light Wt. ²	Medium Wt.
Unshielded, unjacketed		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		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*48X6-AWG-Y
Shielded (round braid), jacketed		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	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.

SPEC 55 (Continued)

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

B

F

G

K

L

P

S

D

E

H

J

M

N

R

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 (SAE-AS-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 = 55A1131-22-9/96/93-9

Tyco Electronics Part No.

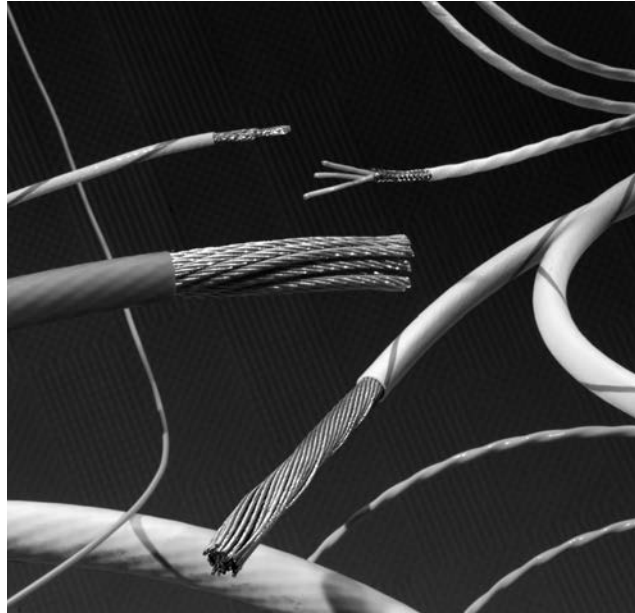
Military Part No.

**Part Numbering System is a
cross reference only and not
meant for part creation.**

FlexLine (SPEC 80)

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 +200°C [-85°F up to +395°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 SAE-AS-22759



Applications

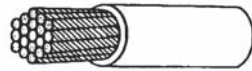
FlexLine wire (also known as SPEC 80) is insulated with a flexible modified radiation cross-linked ETFE polymer. It has a temperature rating of -65°C to +200°C [-85°F to +395°F] continuous using silver copper conductor, and combines the easy handling of our SPEC 55 wire and cable with additional flexibility. 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 SAE-AS-22759 products in Mechanical, Chemical and Thermal properties.

Available in:	Americas	Europe	Asia Pacific
	■	■	■

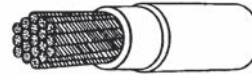
FlexLine (SPEC 80) (Continued)

FlexLine Insulation System



Single Wall

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



Dual Wall

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

Part Numbering System

81 & 82 —

General Purpose, Outer Space

82 A 1 1 2 1 - AWG - 0/9 - 9

Jacket Color (code per MIL-STD-681)

Codes same as for Primary Wire Insulation Color

Primary Wire Insulation Color (code per 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	
3 - Nickel-coated copper	6 - Nickel-coated high strength copper alloy

Number of Conductors

1 through 10 (designator for 10 conductor = 0)

Class of Wire

1 - 600 volt, lightweight
8 - 600 volt, normal weight

Construction

0 - Primary wire or unshielded & unjacketed cable
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- braid shielded & jacketed cable
6-9 Special constructions

Product Type

/ - Outer Space
A - General Purpose
AC- Same as A with 90% min. shield coverage
B - Discontinued

Basic Product Number

81 - Normal Stranding
82 - High Stranding

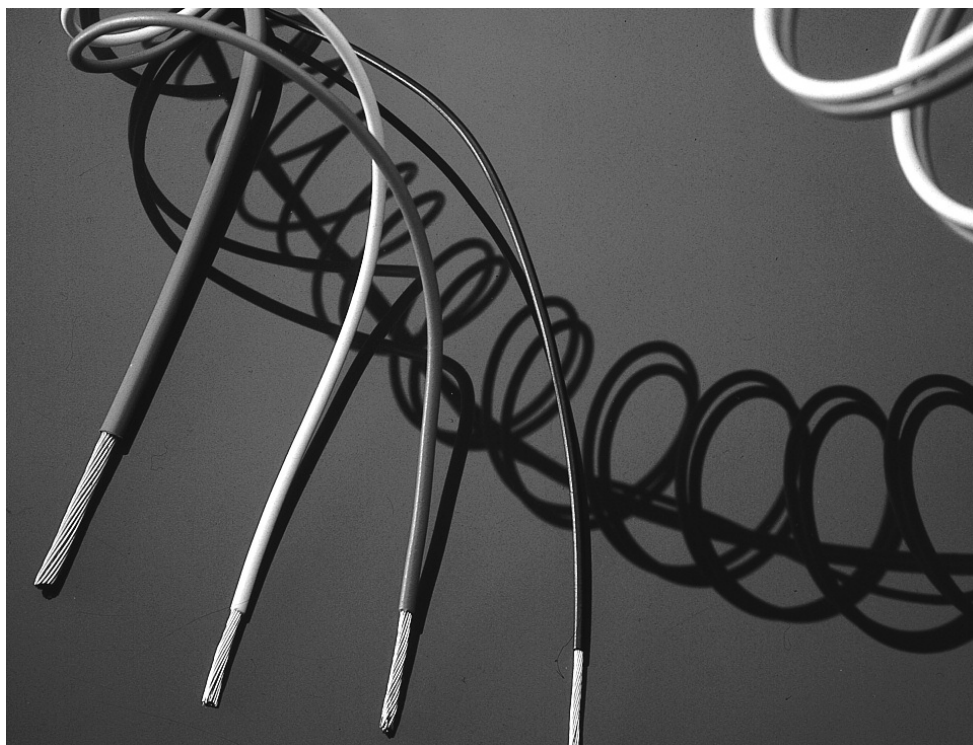
Part Numbering System is a cross reference only and not meant for part creation.

* Shield coating same as conductor coating except for the following:
- for conductor type 4, shield shall be tin-coated copper
- for conductor type 6, flat braid only, shield shall be tin-plated copper

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 the UK Naval Defense Standard Authority for ship wiring and cabling.

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.

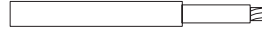
Available in:	Americas	Europe	Asia Pacific
	■	■	■

Type 99M (Continued)

Approvals

TE WCD 281
Defense Standard 61-12 Part 18 Issue 5 Type 1
Italian Navy STN-SR-01

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



99M011X (600 V)
Primary Wire



99M1111
Shielded & Jacketed



99M1121
Shielded & Jacketed

Primary Wires/Shielded and Jacketed Cables - 99M

Size	Stranding (mm)	99M011X (600 V)		99M1111		99M1121	
		OD	Weight (g/m)	OD	Weight (g/m)	OD	Weight (g/m)
26	19x0.10	0.88 [.035]	2.00	1.80 [.071]	7.5	2.91 [.115]	13.3
24	19x0.12	0.98 [.039]	3.00	1.90 [.075]	9.2	3.20 [.126]	16.6
22	19x0.15	1.13 [.044]	4.40	2.05 [.081]	11.1	3.52 [.139]	20.5
20	19x0.20	1.40 [.055]	6.50	2.30 [.091]	14.6	4.02 [.158]	27.7
18	19x0.25	1.65 [.065]	9.90	2.55 [.100]	19.3	4.57 [.180]	37.1
16	19x0.30	1.90 [.075]	14.15	2.95 [.116]	24.9	5.13 [.202]	48.5
14	37x0.25	2.25 [.089]	18.62	3.13 [.123]	30.9	5.72 [.225]	60.5
12	37x0.32	2.60 [.102]	25.70	3.48 [.137]	43.1	6.42 [.253]	81.3

Typical Properties (wire only)

Test	Method	Typical value
Temperature rating	BS 3G230	120°C [248°F]
Voltage rating	TE	600 V thin wall
Tensile strength/elongation of insulation	—	30 MPa/250%
Notch propagation (0.05 mm notch)	BS 3G230	Pass
Shrinkage 200°C [392°F]	BS 3G230	<1%
Low temperature bend	BS 3G230	-55°C [-67°F]
Voltage withstand	BS 3G230	2.5 kV
Insulation resistance (20°C [68°F])	BS 3G230	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 - (IRM 903)		Pass
Solvents		Pass

Type 99M (Continued)

Environmental Properties

Mechanical Performance

Type 99M wire has good scrape abrasion and cut through performance complying with the requirements of Def. Standard 61-12 Part 18.

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.

Voltage Ratings

Standard available voltage ratings for Type 99M wire is 600 V (0.2 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 5 of Def Stan 61-12 (Part 18), is met by Type 99M wire.

Flammability

Type 99M wire has passed the stringent flammability test requirements of Def. Standard 61-12 (Part 18).

Smoke Generation

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

Corrosivity

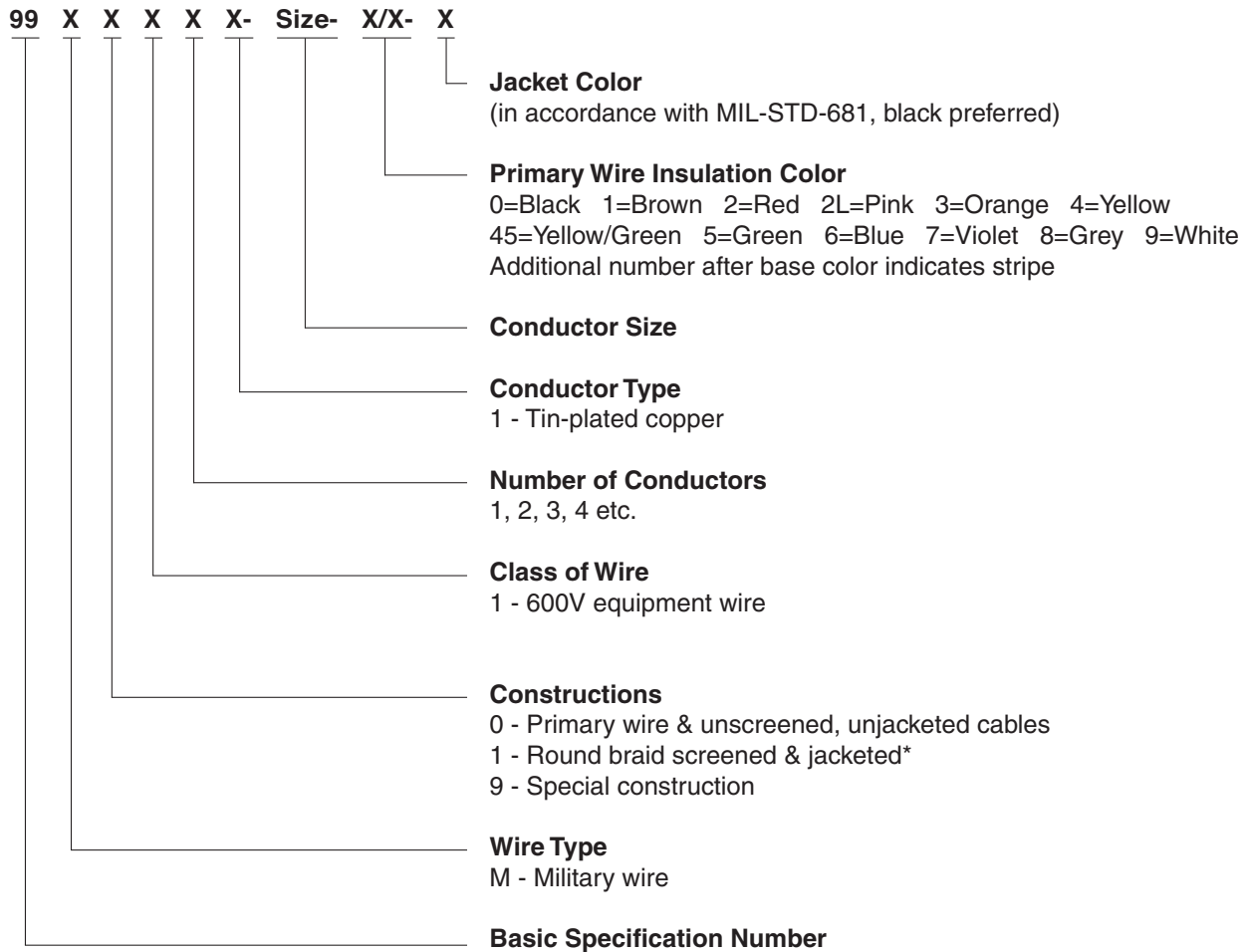
Type 99M wire has a low corrosive gas emission, demonstrated by its low acid gas value, sufficient to pass the requirements of Def. Standard 61-12 Part 18.

Fire Hazard Properties

Test	Method	Typical value
Flammability	BS 3G230	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%

Type 99M (Continued)

Part Numbering System



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

Part Numbering System is a cross reference only and not meant for part creation.

Zerohal 100A

Product Facts

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



Applications

TE'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.

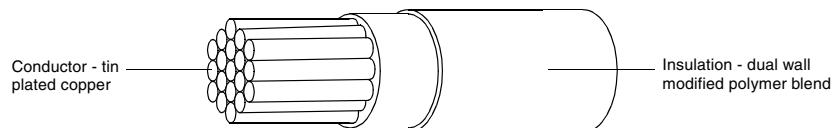
The construction is a dual wall combination of TE formulated polymer blends developed to meet the specification requirements while maintaining the desirable features of small size, lightweight, flexibility, non-wrinkling, ease of stripping, compatibility with standard

stripping equipment, lack of recoil and mechanical robustness.

Physical Characteristics

Handleability

Zerohal 100A 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
	■	■	■

Zerohal 100A (Continued)

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	NATO code	Temp (°C)	Time (hr)
Fluid Immersion	ASTM D3032	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

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

Conductor				Finished Wire Maximum Resistance at 20°C /kft/km	Diameter		Maximum Weight lbs/kft kg/km	Part No.
Wire Size AWG	Stranding No x AWG Dia (mm)	Diameter						
		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 wire 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 wire 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

100 A X X X X- Size- X/X - X

Jacket Color

- 0 - Black
- 2 - Red

Primary Wire Insulation Color

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

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

Part Numbering System is a cross reference only and not meant for part creation.

Zerohal 100G

Product Facts

- Meets requirements of 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 was originally developed to meet the requirements of German Specification VG 95218-20, Type E primary wire.

The construction is a dual wall combination of TE 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.

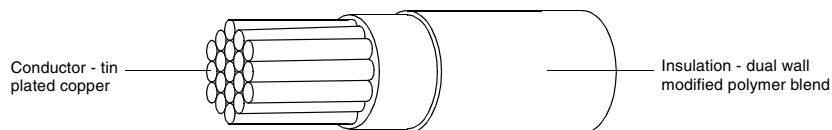
System

- 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
	■	■	■

Zerohal 100G (Continued)

Approvals

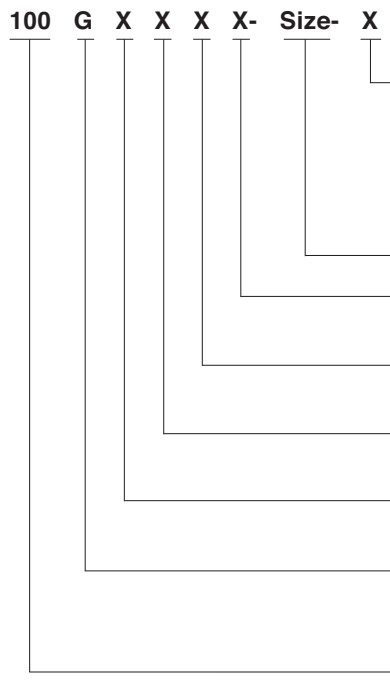
TE Specification WSD912 (Electrical cables and insulated wires for signals and power.
- Part 20: Single core insulated wires.)

Typical Properties

Test	Method	Typical Value
Max. operating temperature	VG 95218-20, ASTM D 3032	125°C [257°F] (20,000 h)
Insulation shrinkage (150°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	3 - Orange	7 - Violet
1 - Brown	4 - Yellow	8 - Gray
2 - Red	5 - Green	9 - White
2L - Pink	6 - Blue	

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

Part Numbering System is a cross reference only and not meant for part creation.

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

Fire Hazard Properties

Test	Method	Typical value
Toxicity	Def. Standard 02-713	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

Part Description	Nominal Cross Sectional Area mm ²	Nominal Conductor Stranding No./Dia (mm)	Equivalent AWG Size	Conductor Diameter (mm)		Minimum Insulation Thickness (mm)	Maximum Resistance @ 20° C (ohm/km)	Diameter (mm)			Maximum Weight (kg/km)
				Min.	Max.			Lower Spec Limit	Target	Upper Spec Limit	
100G0111-0.15-*	0.15	19/0.10	26	0.45	0.50	0.20	133.0	0.98	1.03	1.08	2.59
100G0111-0.25-*	0.25	19/0.13	24	0.55	0.63	0.20	83.30	1.09	1.14	1.19	3.59
100G0111-0.40-*	0.40	19/0.16	22	0.73	0.79	0.20	50.50	1.28	1.33	1.38	5.18
100G0111-0.50-*	0.50	19/0.18	—	0.82	0.90	0.20	40.10	1.37	1.40	1.45	6.60
100G0111-0.60-*	0.60	19/0.20	20	0.95	1.01	0.20	31.10	1.47	1.52	1.57	7.40
100G0111-0.75-*	0.75	19/0.23	—	1.04	1.15	0.20	24.70	1.59	1.60	1.65	8.90
100G0111-1.00-*	1.00	19/0.25	18	1.17	1.26	0.20	20.00	1.69	1.75	1.80	10.7
100G0111-1.20-*	1.20	19/0.29	16	1.32	1.42	0.20	15.30	1.88	1.93	1.98	13.6
100G0111-1.50-*	1.50	37/0.23	15	1.46	1.58	0.20	12.90	2.03	2.08	2.13	16.0
100G0111-2.00-*	2.00	37/0.25	14	1.68	1.82	0.20	9.80	2.31	2.36	2.41	20.3
100G0111-2.50-*	2.50	37/0.29	13	1.85	2.01	0.25	8.01	2.50	2.55	2.63	25.7
100G0111-3.00-*	3.00	37/0.32	12	2.12	2.24	0.25	6.40	2.70	2.78	2.86	31.0
100G0111-4.00-*	4.00	56/0.30	—	2.41	2.57	0.25	4.89	3.01	3.09	3.17	43.6

C-Lite Low Fire Hazard Lightweight Cables

Product Facts

- 30% lighter than standard commercial cable for weight savings reductions
- Reduced diameter means that smaller bend radius can be used during installation
- Reduced and easier cable pulling time



Applications

TE materials technology and expertise in processing allows the use of thinwall insulation systems. The use of Zerohal-EN cross-linked cable jacket completes this product offering.

C-Lite cable products can offer significant size and weight reduction, when compared to conventional insulation systems, while at the same time meeting key criteria such as low fire hazard performance and mechanical robustness.

Crosslinked Molecular Chain

TE Raychem was the first company to commercialize radiation cross-linking of insulation, initially for aerospace applications.

To achieve crosslinking a polymer product is exposed to high-energy radiation. This is generally done by exposure to beta radiation (high-energy electrons) using an electron beam.

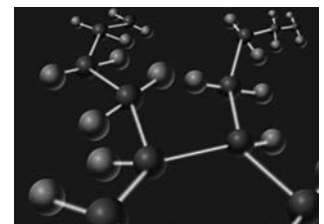
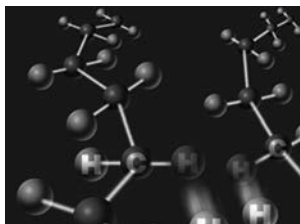
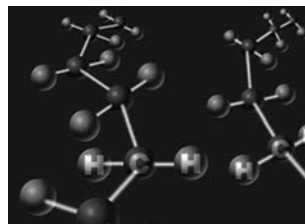
Crosslinked insulations in wire and cable products are lightweight, mechanically tough and thermally stable.

Radiation Crosslinking

Molecular Chain

Crosslinking

Crosslinked Molecular Chain



Available in:

- Americas ■
- Europe ■
- Asia Pacific ■

C-Lite CL105-SU

Multicore Unscreened Cables

Field of application

Instrumentation and
communication control
General power and lighting

Voltage class

0.6/1kV

Temperature class

90°C

Flame retarded

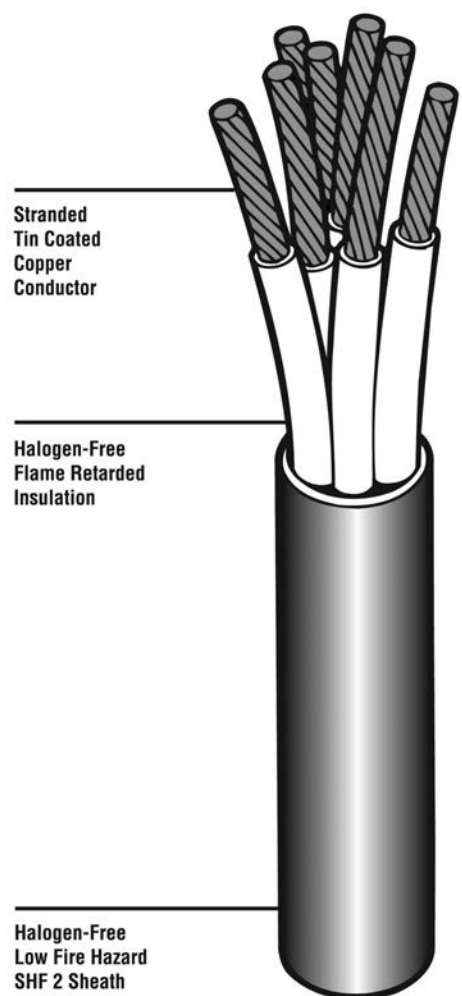
IEC 60332-1,-3

Cable jacket

Zerohal

The new C-Lite cable range is constructed from flame retarded halogen free primary wire and crosslinked sheath materials.

Offering size and weight savings over traditional cables. The new C-Lite cable range is suitable for use in general power, lighting, communication, control and instrumentation applications.



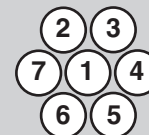
Core Identification

Standard
2 Core

Light Blue White



Others



Additional cores numbered sequentially

Color Coded
2G

Brown Light Blue



3G

Brown

Yellow w/
green stripe Light Blue



5G

Yellow w/
green stripe Black
Brown Light Blue
Gray



Approvals

DNV, LR, GL, ABS, KR, CCS,
RMRS, NK, BV

Pending

RINA

C-Lite CL105-SU (Continued)

Ordering Description	OD Under jacket (mm)	Nom Wall (mm)	Nom OD (mm)	Tolerance (mm)	Nom weight (kg/km)
STANDARD					
CL105-2x0.5 - SU	2.9	0.9	4.7	0.3	33
CL105-3x0.5 - SU	3.1	0.9	4.9	0.3	39
CL105-4x0.5 - SU	3.5	0.9	5.3	0.3	48
CL105-5x0.5 - SU	3.9	1.0	5.9	0.4	59
CL105-7x0.5 - SU	4.3	1.0	6.3	0.4	75
CL105-12x0.5 - SU	5.9	1.0	7.9	0.5	117
CL105-19x0.5 - SU	7.1	1.1	9.3	0.6	176
CL105-27x0.5 - SU	8.7	1.1	10.9	0.7	239
CL105-2x0.75 - SU	3.3	0.9	5.1	0.3	40
CL105-3x0.75 - SU	3.6	0.9	5.4	0.4	48
CL105-4x0.75 - SU	4	1.0	6.0	0.4	62
CL105-5x0.75 - SU	4.4	1.0	6.4	0.4	75
CL105-7x0.75 - SU	4.9	1.0	6.9	0.4	95
CL105-12x0.75 - SU	6.8	1.1	9.0	0.6	155
CL105-19x0.75 - SU	8.1	1.1	10.3	0.7	226
CL105-27x0.75 - SU	10	1.2	12.4	0.8	316
CL105-2x1.0 - SU	3.6	0.9	5.4	0.4	45
CL105-3x1.0 - SU	3.9	1.0	5.9	0.4	58
CL105-4x1.0 - SU	4.3	1.0	6.3	0.4	72
CL105-5x1.0 - SU	4.8	1.0	6.8	0.4	87
CL105-7x1.0 - SU	5.4	1.0	7.4	0.5	110
CL105-12x1.0 - SU	7.4	1.1	9.6	0.6	180
CL105-19x1.0 - SU	8.9	1.2	11.3	0.7	271
CL105-27x1.0 - SU	10.9	1.2	13.3	0.9	372
CL105-2x1.5 - SU	4.3	1.0	6.3	0.4	64
CL105-3x1.5 - SU	4.6	1.0	6.6	0.4	82
CL105-4x1.5 - SU	5.1	1.0	7.1	0.5	97
CL105-5x1.5 - SU	5.7	1.0	7.7	0.5	119
CL105-7x1.5 - SU	6.3	1.1	8.5	0.6	158
CL105-12x1.5 - SU	8.8	1.2	11.2	0.7	259
CL105-14x1.5 - SU	9.3	1.2	11.7	0.8	295
CL105-19x1.5 - SU	10.5	1.2	12.9	0.8	385
CL105-24x1.5 - SU	12.6	1.3	15.2	1.0	488
CL105-27x1.5 - SU	12.9	1.3	15.5	1.0	540
CL105-37x1.5 - SU	14.7	1.4	17.5	1.1	725
CL105-2x2.5 - SU	5.2	1.0	7.2	0.5	91
CL105-3x2.5 - SU	5.6	1.0	7.6	0.5	118
CL105-4x2.5 - SU	6.3	1.1	8.5	0.6	153
CL105-5x2.5 - SU	7	1.1	9.2	0.6	181
CL105-7x2.5 - SU	7.8	1.1	10.0	0.7	235
CL105-12x2.5 - SU	10.7	1.2	13.1	0.9	391
CL105-19x2.5 - SU	12.9	1.3	15.5	1.0	597
CL105-27x2.5 - SU	15.8	1.4	18.6	1.2	838
CL105-37x2.5 - SU	18	1.5	21.0	1.4	1129
COLOR CODED					
CL105-2Gx0.5 - SU	2.9	0.9	4.7	0.3	33
CL105-3Gx0.5 - SU	3.1	0.9	4.9	0.3	39
CL105-5Gx0.5 - SU	3.9	1.0	5.9	0.4	59
CL105-2Gx0.75 - SU	3.3	0.9	5.1	0.3	40
CL105-3Gx0.75 - SU	3.6	0.9	5.4	0.4	48
CL105-5Gx0.75 - SU	4.4	1.0	6.4	0.4	75
CL105-2Gx1.0 - SU	3.6	0.9	5.4	0.4	45
CL105-3Gx1.0 - SU	3.9	1.0	5.9	0.4	58
CL105-5Gx1.0 - SU	4.8	1.0	6.8	0.4	87
CL105-2Gx1.5 - SU	4.3	1.0	6.3	0.4	64
CL105-3Gx1.5 - SU	4.6	1.0	6.6	0.4	82
CL105-5Gx1.5 - SU	5.7	1.0	7.7	0.5	119
CL105-2Gx2.5 - SU	5.2	1.0	7.2	0.5	91
CL105-3Gx2.5 - SU	5.6	1.0	7.6	0.5	118
CL105-5Gx2.5 - SU	7.0	1.1	9.2	0.6	181

C-Lite CL105-S0

Multicore Overall Screened Cables

The new C-Lite cable range is constructed from flame retarded halogen free primary wire and crosslinked sheath materials.

Offering size and weight savings over traditional cables. The new C-Lite cable range is suitable for use in general power, lighting, communication, control and instrumentation applications.

Field of application

Instrumentation and
communication control
General power and lighting

Voltage class

0.6/1kV

Temperature class

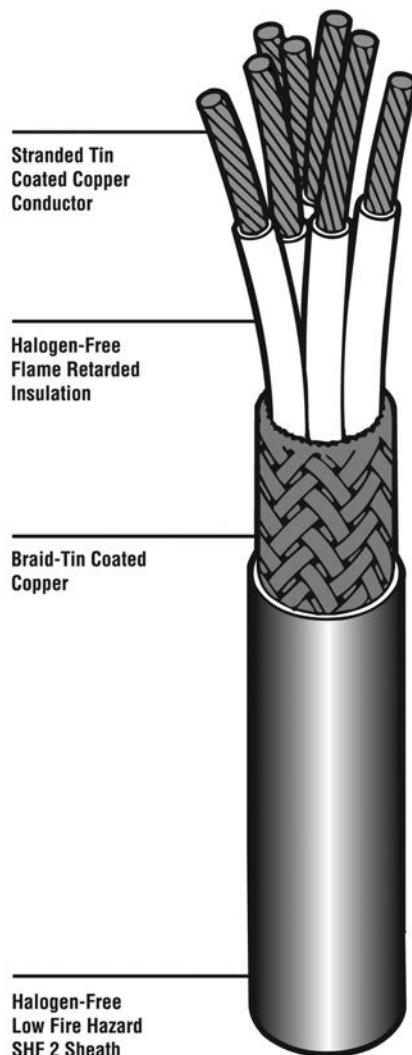
90°C

Flame retarded

IEC 60332-1,-3

Cable jacket

Zerohal



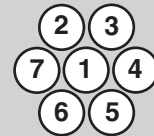
Core Identification

Standard
2 Core

Light Blue White



Others



Additional cores numbered sequentially

Color Coded
2G

Brown Light Blue



3G

Brown

Yellow w/
green stripe Light Blue



5G

Yellow w/
green stripe Black
Gray Brown Light Blue



Approvals

DNV, LR, GL, ABS, KR, CCS,
RMRS, NK, BV

Pending

RINA

C-Lite CL105-SO (Continued)

Ordering Description	OD Under jacket (mm)	Nom Wall (mm)	Nom OD (mm)	Tolerance (mm)	Nom weight (kg/km)
STANDARD					
CL105-2x0.5 - SO	3.5	0.9	5.3	0.3	48
CL105-3x0.5 - SO	3.7	0.9	5.5	0.4	55
CL105-4x0.5 - SO	4.1	1.0	6.1	0.4	68
CL105-5x0.5 - SO	4.5	1.0	6.5	0.4	79
CL105-7x0.5 - SO	4.9	1.0	6.9	0.4	96
CL105-12x0.5- SO	6.5	1.1	8.7	0.6	149
CL105-19x0.5 - SO	7.7	1.1	9.9	0.6	208
CL105-27x0.5 - SO	9.3	1.2	11.7	0.8	284
CL105-2x1.0 - SO	4.2	1.0	6.2	0.4	66
CL105-3x1.0 - SO	4.5	1.0	6.5	0.4	78
CL105-4x1.0 - SO	4.9	1.0	6.9	0.4	93
CL105-5x1.0 - SO	5.4	1.0	7.4	0.5	110
CL105-7x1.0 - SO	6	1.0	8	0.5	135
CL105-12x1.0 - SO	8	1.1	10.2	0.7	214
CL105-19x1.0 - SO	9.5	1.2	11.9	0.8	311
CL105-27x1.0 - SO	11.5	1.3	14.1	0.9	427
CL105-2x1.5 - SO	4.9	1.0	6.9	0.4	85
CL105-3x1.5 - SO	5.2	1.0	7.2	0.5	104
CL105-4x1.5 - SO	5.7	1.0	7.7	0.5	122
CL105-5x1.5 - SO	6.3	1.1	8.5	0.6	150
CL105-7x1.5 - SO	6.9	1.1	9.1	0.6	187
CL105-12x1.5 - SO	9.4	1.2	11.8	0.8	299
CL105-14x1.5 - SO	9.9	1.2	12.3	0.8	337
CL105-19x1.5 - SO	11.1	1.2	13.5	0.9	432
CL105-24x1.5 - SO	13.3	1.3	15.9	1.0	558
CL105-27x1.5 - SO	13.6	1.3	16.2	1.1	611
CL105-37x1.5 - SO	15.6	1.4	18.4	1.2	828
CL105-2x2.5 - SO	5.8	1.0	7.8	0.5	116
CL105-3x2.5 - SO	6.2	1.0	8.2	0.5	145
CL105-4x2.5 - SO	6.9	1.1	9.1	0.6	183
CL105-5x2.5 - SO	7.6	1.1	9.8	0.6	214
CL105-7x2.5 - SO	8.4	1.1	10.6	0.7	271
CL105-12x2.5 - SO	11.3	1.3	13.9	0.9	446
CL105-19x2.5 - SO	13.6	1.3	16.2	1.1	668
CL105-27x2.5 - SO	16.7	1.5	19.7	1.3	958
CL105-37x2.5 - SO	18.9	1.6	22.1	1.4	1264
COLOR CODED					
CL105-2Gx0.5 - SO	3.5	0.9	5.3	0.3	48
CL105-3Gx0.5 - SO	3.7	0.9	5.5	0.4	55
CL105-5Gx0.5 - SO	4.5	1.0	6.5	0.4	79
CL105-2Gx1.0 - SO	4.2	1.0	6.2	0.4	66
CL105-3Gx1.0 - SO	4.5	1.0	6.5	0.4	78
CL105-5Gx1.0 - SO	5.4	1.0	7.4	0.5	110
CL105-2Gx1.5 - SO	4.9	1.0	6.9	0.4	85
CL105-3Gx1.5 - SO	5.2	1.0	7.2	0.5	104
CL105-5Gx1.5 - SO	6.3	1.1	8.5	0.6	150
CL105-2Gx2.5 - SO	5.8	1.0	7.8	0.5	116
CL105-3Gx2.5 - SO	6.2	1.0	8.2	0.5	145
CL105-5Gx2.5 - SO	7.6	1.1	9.8	0.6	214

Note: For installation guidelines refer to TE installation guidelines document WT1189

C-Lite CL105-PF/C-Lite CL105-TF

Multipair and Multitriple Unscreened Cables

The new C-Lite cable range is constructed from flame retarded halogen free primary wire and crosslinked sheath materials.

Offering size and weight savings over traditional cables. The new C-Lite cable range is suitable for use in general power, lighting, communication, control and instrumentation applications.

Field of application

Instrumentation and
communication control
General power and lighting

Voltage class

0.6/1kV

Temperature class

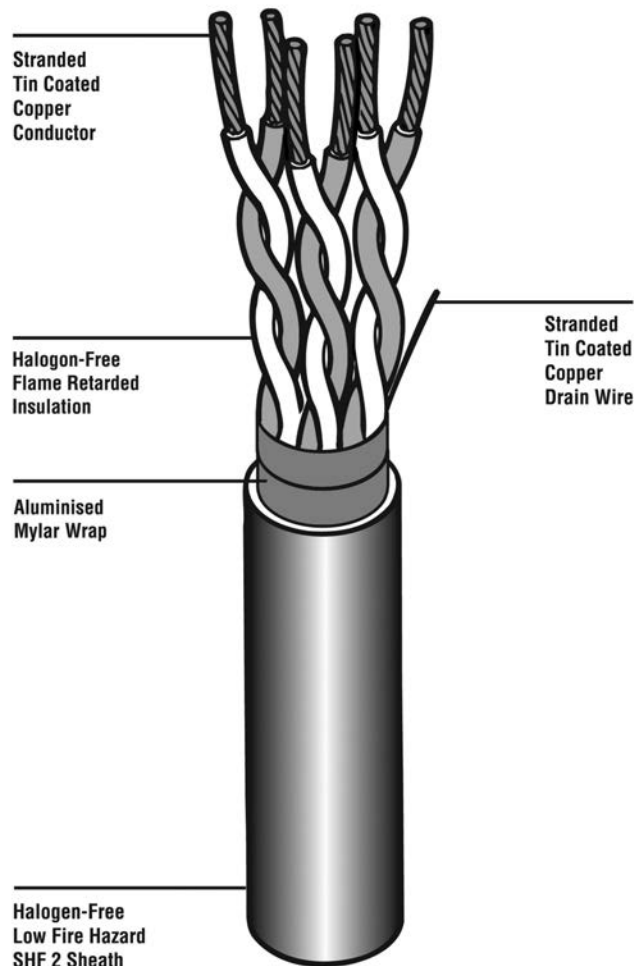
90°C

Flame retarded

IEC 60332-1,-3

Cable jacket

Zerohal



Core Identification

Pairs

	Light Blue	White
1	1	2
2	3	4
3	5	6

Additional pairs numbered sequentially

Triples

	Red	Light Blue	White
1	1	2	3
2	4	5	6
3	7	8	9

Additional triples numbered sequentially

Approvals

DNV, LR, GL, ABS, KR, CCS,
RMRS, NK, BV

Pending

RINA

C-Lite CL105-PF/C-Lite CL105-TF (Continued)

Ordering Description	OD Under jacket (mm)	Nom Wall (mm)	Nom OD (mm)	Tolerance (mm)	Nom weight (kg/km)
PAIRS					
CL105-2x2x0.5 - PF	3.7	0.9	5.5	0.4	51
CL105-3x2x0.5 - PF	5.7	1.0	7.7	0.5	85
CL105-4x2x0.5 - PF	6.3	1.1	8.5	0.6	106
CL105-7x2x0.5 - PF	7.8	1.1	10	0.7	152
CL105-10x2x0.5 - PF	9.9	1.2	12.3	0.8	210
CL105-14x2x0.5 - PF	11.5	1.3	14.1	0.9	281
CL105-19x2x0.5 - PF	13.3	1.3	15.9	1.1	360
CL105-24x2x0.5 - PF	14.8	1.4	17.6	1.2	446
CL105-37x2x0.5 - PF	18.1	1.5	21.1	1.4	655
CL105-2x2x0.75 - PF	4.1	1.0	6.1	0.4	70
CL105-3x2x0.75 - PF	6.5	1.1	8.7	0.6	112
CL105-4x2x0.75 - PF	7.2	1.1	9.4	0.6	133
CL105-7x2x0.75 - PF	8.9	1.2	11.3	0.7	204
CL105-10x2x0.75 - PF	11.2	1.2	13.6	0.9	271
CL105-14x2x0.75 - PF	13	1.3	15.6	1.0	365
CL105-19x2x0.75 - PF	15	1.4	17.8	1.2	481
CL105-24x2x0.75 - PF	16.7	1.5	19.7	1.3	597
CL105-37x2x0.75 - PF	20.6	1.6	23.8	1.5	881
CL105-2x2x1.0 - PF	4.4	1.0	6.4	0.4	79
CL105-3x2x1.0 - PF	7.1	1.1	9.3	0.6	128
CL105-4x2x1.0 - PF	7.9	1.1	10.1	0.7	154
CL105-7x2x1.0 - PF	9.8	1.2	12.2	0.8	239
CL105-10x2x1.0 - PF	12.1	1.3	14.7	1.0	326
CL105-14x2x1.0 - PF	14.2	1.4	17	1.1	440
CL105-19x2x1.0 - PF	16.3	1.5	19.3	1.3	580
CL105-24x2x1.0 - PF	18.2	1.5	21.2	1.4	709
CL105-37x2x1.0 - PF	22.4	1.7	25.8	1.7	1064
CL105-2x2x1.5 - PF	5.2	1.0	7.2	0.5	105
CL105-3x2x1.5 - PF	8.4	1.1	10.6	0.7	181
CL105-4x2x1.5 - PF	9.3	1.2	11.7	0.8	218
CL105-7x2x1.5 - PF	11.6	1.3	14.2	0.9	332
CL105-10x2x1.5 - PF	14.2	1.4	17	1.1	452
CL105-14x2x1.5 - PF	16.6	1.5	19.6	1.3	613
CL105-19x2x1.5 - PF	19.2	1.6	22.4	1.5	810
CL105-24x2x1.5 - PF	21.4	1.7	24.8	1.6	1006
CL105-37x2x1.5 - PF	26.4	1.9	30.2	2.0	1511
TRIPLES					
CL105-2x3x0.75 - TF	7.1	1.1	9.3	0.6	126
CL105-4x3x0.75 - TF	8.5	1.1	10.7	0.7	182
CL105-7x3x0.75 - TF	10.5	1.2	12.9	0.8	283
CL105-10x3x0.75 - TF	15	1.4	17.8	1.2	412
CL105-15x3x0.75 - TF	17.5	1.5	20.5	1.3	601
CL105-2x3x1.5 - TF	9.1	1.2	11.5	0.7	191
CL105-4x3x1.5 - TF	10.9	1.2	13.3	0.9	290
CL105-7x3x1.5 - TF	13.5	1.3	16.1	1.0	453

Note: For installation guidelines refer to TE installation guidelines document WT1189

C-Lite CL105/PI/C-Lite CL105-TI

Multipair and Multitriples Individually Screened Cables

Field of application

Instrumentation and
communication control
General power and lighting

Voltage class

0.6/1kV

Temperature class

90°C

Flame retarded

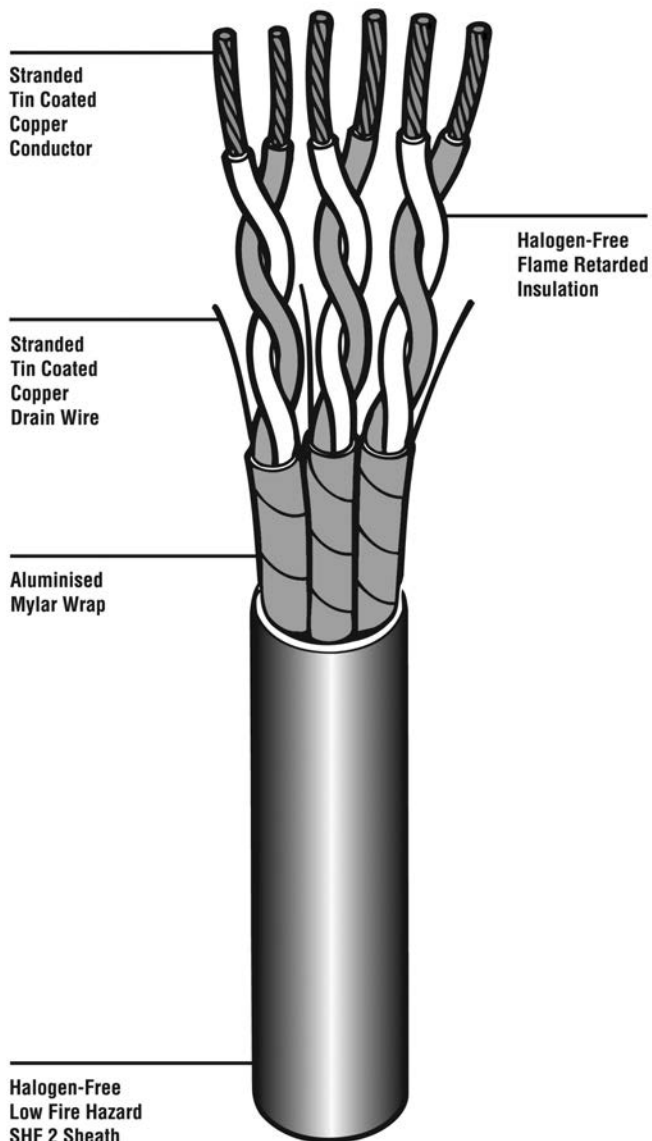
IEC 60332-1,-3

Cable jacket

Zerohal

The new C-Lite cable range is constructed from flame retarded halogen free primary wire and crosslinked sheath materials.

Offering size and weight savings over traditional cables. The new C-Lite cable range is suitable for use in general power, lighting, communication, control and instrumentation applications.



Core Identification

Pairs	Light Blue	White
1	1	2
2	3	4
3	5	6

Additional pairs numbered sequentially

Triples	Red	Light Blue	White
1	1	2	3
2	4	5	6
3	7	8	9

Additional triples numbered sequentially

Approvals

DNV, LR, GL, ABS, KR, CCS,
RMRS, NK, BV

Pending

RINA

C-Lite CL105/PI/C-Lite CL105-TI (Continued)

Ordering Description	OD Under jacket (mm)	Nom Wall (mm)	Nom OD (mm)	Tolerance (mm)	Nom weight (kg/km)
PAIRS					
CL105-1x2x0.5 - PI	3.2	0.9	5	0.3	41
CL105-2x2x0.5 - PI	6.1	1.0	8.1	0.5	87
CL105-3x2x0.5 - PI	6.3	1.1	8.5	0.6	103
CL105-4x2x0.5 - PI	7	1.1	9.2	0.6	126
CL105-7x2x0.5 - PI	8.7	1.1	10.9	0.7	185
CL105-10x2x0.5 - PI	10.1	1.2	12.5	0.8	255
CL105-14x2x0.5 - PI	11.9	1.3	14.5	0.9	347
CL105-19x2x0.5 - PI	13.8	1.4	16.6	1.1	462
CL105-24x2x0.5 - PI	15.5	1.4	18.3	1.2	566
CL105-37x2x0.5 - PI	19.2	1.6	22.4	1.5	856
CL105-1x2x0.75 - PI	3.4	0.9	5.2	0.3	46
CL105-2x2x0.75 - PI	6.9	1.1	9.1	0.6	112
CL105-3x2x0.75 - PI	7.1	1.1	9.3	0.6	132
CL105-4x2x0.75 - PI	7.9	1.1	10.1	0.7	164
CL105-7x2x0.75 - PI	9.9	1.2	12.3	0.8	250
CL105-10x2x0.75 - PI	11.4	1.3	14	0.9	344
CL105-14x2x0.75 - PI	13.4	1.3	16	1.0	462
CL105-19x2x0.75 - PI	15.7	1.4	18.5	1.2	616
CL105-24x2x0.75 - PI	17.5	1.5	20.5	1.3	769
CL105-37x2x0.75 - PI	21.8	1.7	25.2	1.6	1164
CL105-1x2x1.0 - PI	3.7	0.9	5.5	0.4	55
CL105-2x2x1.0 - PI	7.5	1.1	9.7	0.6	133
CL105-3x2x1.0 - PI	7.7	1.1	9.9	0.6	159
CL105-4x2x1.0 - PI	8.6	1.1	10.8	0.7	198
CL105-7x2x1.0 - PI	10.7	1.2	13.1	0.9	306
CL105-10x2x1.0 - PI	12.4	1.3	15	1.0	423
CL105-14x2x1.0 - PI	14.6	1.4	17.4	1.1	579
CL105-19x2x1.0 - PI	17.1	1.5	20.1	1.3	773
CL105-24x2x1.0 - PI	19.1	1.6	22.3	1.4	965
CL105-37x2x1.0 - PI	23.7	1.7	27.1	1.8	1448
CL105-1x2x1.5 - PI	4.4	1.0	6.4	0.4	73
CL105-2x2x1.5 - PI	8.8	1.2	11.2	0.7	179
CL105-3x2x1.5 - PI	9.1	1.2	11.5	0.7	211
CL105-4x2x1.5 - PI	10.1	1.2	12.5	0.8	265
CL105-7x2x1.5 - PI	12.6	1.3	15.2	1.0	406
CL105-10x2x1.5 - PI	14.6	1.4	17.4	1.1	562
CL105-14x2x1.5 - PI	17.2	1.5	20.2	1.3	769
CL105-19x2x1.5 - PI	20.1	1.6	23.3	1.5	1027
CL105-24x2x1.5 - PI	22.5	1.7	25.9	1.7	1283
CL105-37x2x1.5 - PI	27.9	1.9	31.7	2.1	1943
TRIPLES					
CL105-1x3x0.75 - TI	3.7	0.9	5.5	0.4	54
CL105-2x3x0.75 - TI	7.4	1.1	9.6	0.6	132
CL105-4x3x0.75 - TI	8.9	1.2	11.3	0.7	209
CL105-7x3x0.75 - TI	11.1	1.2	13.5	0.9	309
CL105-10x3x0.75 - TI	14.7	1.4	17.5	1.1	449
CL105-15x3x0.75 - TI	17.3	1.5	20.3	1.3	664
CL105-1x3x1.5 - TI	4.7	1.0	6.7	0.4	88
CL105-2x3x1.5 - TI	9.5	1.2	11.9	0.8	213
CL105-4x3x1.5 - TI	11.4	1.3	14	0.9	337
CL105-7x3x1.5 - TI	14.2	1.4	17	1.1	521

Note: For installation guidelines refer to TE installation guidelines document WT1189

C-Lite CL105/PO/C-Lite CL105-TO

Multipair and Multitriples Overall Screened Cables

Field of application

Instrumentation and
communication control
General power and lighting

Voltage class

0.6/1kV

Temperature class

90°C

Flame retarded

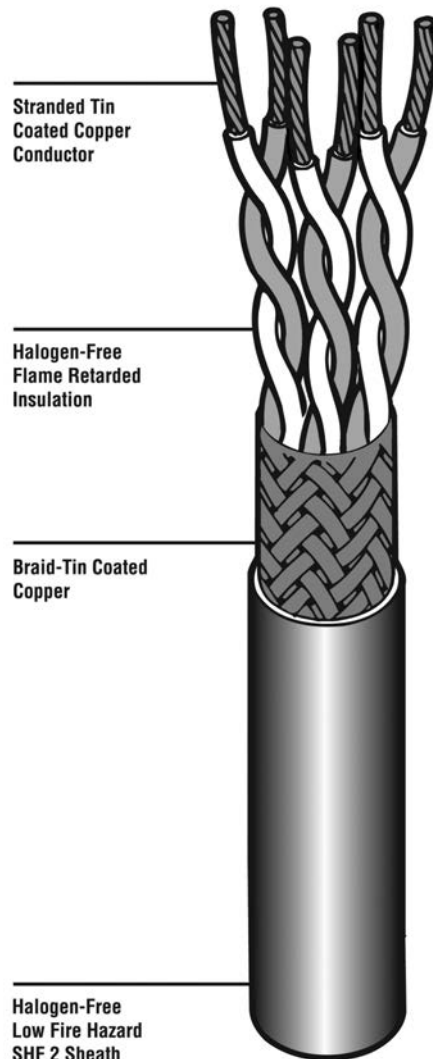
IEC 60332-1,-3

Cable jacket

Zerohal

The new C-Lite cable range is constructed from flame retarded halogen free primary wire and crosslinked sheath materials.

Offering size and weight savings over traditional cables. The new C-Lite cable range is suitable for use in general power, lighting, communication, control and instrumentation applications.



Core Identification

Pairs

	Light Blue	White
1	1	2
2	3	4
3	5	6

Additional pairs numbered sequentially

Triples

	Red	Light Blue	White
1	1	2	3
2	4	5	6
3	7	8	9

Additional triples numbered sequentially

Approvals

DNV, LR, GL, ABS, KR, CCS,
RMRS, NK, BV

Pending

RINA

C-Lite CL105/PO/C-Lite CL105-TO (Continued)

Ordering Description	OD Under jacket (mm)	Nom Wall (mm)	Nom OD (mm)	Tolerance (mm)	Nom weight (kg/km)
PAIRS					
CL105-1x2x0.5 - PO	3.5	0.9	5.3	0.3	48
CL105-2x2x0.5 - PO	4.1	1.0	6.1	0.4	68
CL105-3x2x0.5 - PO	6.2	1.1	8.4	0.6	109
CL105-4x2x0.5 - PO	6.9	1.1	9.1	0.6	130
CL105-7x2x0.5 - PO	8.3	1.1	10.5	0.7	178
CL105-10x2x0.5 - PO	9.6	1.2	12	0.8	236
CL105-14x2x0.5 - PO	11.2	1.3	13.8	0.9	312
CL105-19x2x0.5 - PO	13	1.3	15.6	1.0	412
CL105-24x2x0.5 - PO	14.5	1.4	17.3	1.2	504
CL105-37x2x0.5 - PO	18.1	1.5	21.1	1.4	754
CL105-1x2x0.75 - PO	3.9	1.0	5.9	0.4	60
CL105-2x2x0.75 - PO	4.6	1.0	6.6	0.4	82
CL105-3x2x0.75 - PO	7	1.1	9.2	0.6	134
CL105-4x2x0.75 - PO	7.7	1.1	9.9	0.6	162
CL105-7x2x0.75 - PO	9.4	1.2	11.8	0.8	232
CL105-10x2x0.75 - PO	10.8	1.2	13.2	0.9	301
CL105-14x2x0.75 - PO	12.8	1.3	15.4	1.0	416
CL105-19x2x0.75 - PO	14.8	1.4	17.6	1.1	541
CL105-24x2x0.75 - PO	16.7	1.5	19.7	1.3	688
CL105-37x2x0.75 - PO	20.7	1.6	23.9	1.6	1029
CL105-1x2x1.0 - PO	4.2	1.0	6.2	0.4	66
CL105-2x2x1.0 - PO	4.9	1.0	6.9	0.4	93
CL105-3x2x1.0 - PO	7.6	1.1	9.8	0.6	154
CL105-4x2x1.0 - PO	8.4	1.1	10.6	0.7	186
CL105-7x2x1.0 - PO	10.3	1.2	12.7	0.8	269
CL105-10x2x1.0 - PO	11.8	1.3	14.4	0.9	360
CL105-14x2x1.0 - PO	13.9	1.4	16.7	1.1	496
CL105-19x2x1.0 - PO	16.3	1.5	19.3	1.3	669
CL105-24x2x1.0 - PO	18.2	1.5	21.2	1.4	809
CL105-37x2x1.0 - PO	22.5	1.7	25.9	1.7	1226
CL105-1x2x1.5 - PO	4.9	1.0	6.9	0.4	85
CL105-2x2x1.5 - PO	5.7	1.0	7.7	0.5	122
CL105-3x2x1.5 - PO	8.9	1.2	11.3	0.7	206
CL105-4x2x1.5 - PO	9.9	1.2	12.3	0.8	251
CL105-7x2x1.5 - PO	12.1	1.3	14.7	1.0	367
CL105-10x2x1.5 - PO	14	1.4	16.8	1.1	508
CL105-14x2x1.5 - PO	16.6	1.5	19.6	1.3	703
CL105-19x2x1.5 - PO	19.1	1.6	22.3	1.4	915
CL105-24x2x1.5 - PO	21.6	1.7	25	1.6	1161
CL105-37x2x1.5 - PO	26.5	1.9	30.3	2.0	1703
TRIPLES					
CL105-1x3x0.75 - TO	4.2	1.0	6.2	0.4	69
CL105-2x3x0.75 - TO	7.7	1.1	9.9	0.6	152
CL105-4x3x0.75 - TO	9.1	1.2	11.5	0.7	223
CL105-7x3x0.75 - TO	11.2	1.2	13.6	0.9	318
CL105-10x3x0.75 - TO	14.8	1.4	17.6	1.1	472
CL105-15x3x0.75 - TO	17.4	1.5	20.4	1.3	697
CL105-1x3x1.5 - TO	5.2	1.0	7.2	0.5	104
CL105-2x3x1.5 - TO	9.7	1.2	12.1	0.8	231
CL105-4x3x1.5 - TO	11.5	1.3	14.1	0.9	342
CL105-7x3x1.5 - TO	14.3	1.4	17.1	1.1	520

Note: For installation guidelines refer to TE installation guidelines document WT1189

C-Lite CL105-PIO/C-Lite CL105-TIO

Multipair and Multitriples Individually and Overall Screened Cables

Field of application

Instrumentation and
communication control
General power and lighting

Voltage class

0.6/1kV

Temperature class

90°C

Flame retarded

IEC 60332-1,-3

Cable jacket

Zerohal

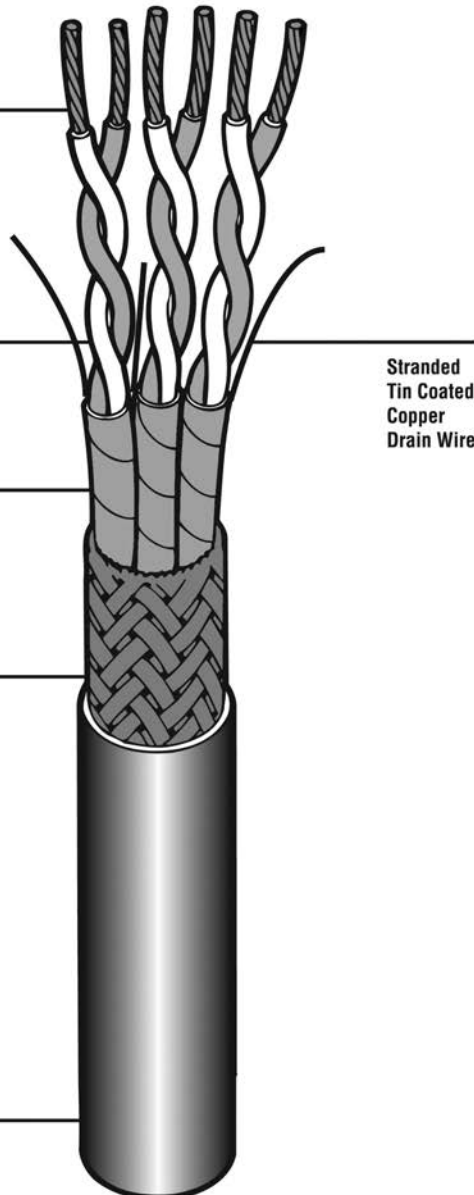
Stranded
Tin Coated
Copper
Conductor

Halogen-Free
Flame Retarded
Insulation

Aluminised
Mylar Wrap

Braid-Tin
Coated Copper

Halogen-Free
Low Fire Hazard
SHF 2 Sheath



The new C-Lite cable range is constructed from flame retarded halogen free primary wire and crosslinked sheath materials.

Offering size and weight savings over traditional cables. The new C-Lite cable range is suitable for use in general power, lighting, communication, control and instrumentation applications.

Core Identification

Pairs	Light Blue	White
1	1	2
2	3	4
3	5	6

Additional pairs numbered sequentially

Triples	Red	Light Blue	White
1	1	2	3
2	4	5	6
3	7	8	9

Additional triples numbered sequentially

Approvals

DNV, LR, GL, ABS, KR, CCS,
RMRS, NK, BV

Pending

RINA

C-Lite CL105-PIO/C-Lite CL105-TIO (Continued)

Ordering Description	OD Under jacket (mm)	Nom Wall (mm)	Nom OD (mm)	Tolerance (mm)	Nom weight (kg/km)
PAIRS					
CL105-1x2x0.5 - PIO	3.7	0.9	5.5	0.4	56
CL105-2x2x0.5 - PIO	6.7	1.1	8.9	0.6	117
CL105-3x2x0.5 - PIO	6.9	1.1	9.1	0.6	132
CL105-4x2x0.5 - PIO	7.6	1.1	9.8	0.6	155
CL105-7x2x0.5 - PIO	9.3	1.2	11.7	0.8	230
CL105-10x2x0.5 - PIO	10.7	1.2	13.1	0.9	300
CL105-14x2x0.5 - PIO	12.6	1.3	15.2	1.0	413
CL105-19x2x0.5 - PIO	14.5	1.4	17.3	1.1	538
CL105-24x2x0.5 - PIO	16.4	1.5	19.4	1.3	684
CL105-37x2x0.5 - PIO	20.3	1.6	23.5	1.5	1023
CL105-1x2x0.75 - PIO	4.1	1.0	6.1	0.4	68
CL105-2x2x0.75 - PIO	7.5	1.1	9.7	0.6	144
CL105-3x2x0.75 - PIO	7.7	1.1	9.9	0.6	165
CL105-4x2x0.75 - PIO	8.5	1.1	10.7	0.7	200
CL105-7x2x0.75 - PIO	10.5	1.2	12.9	0.8	294
CL105-10x2x0.75 - PIO	12	1.3	14.6	0.9	395
CL105-14x2x0.75 - PIO	14.1	1.4	16.9	1.1	544
CL105-19x2x0.75 - PIO	16.6	1.5	19.6	1.3	735
CL105-24x2x0.75 - PIO	18.4	1.5	21.4	1.4	891
CL105-37x2x0.75 - PIO	22.9	1.7	26.3	1.7	1352
CL105-1x2x1.0 - PIO	4.4	1.0	6.4	0.4	78
CL105-2x2x1.0 - PIO	8.1	1.1	10.3	0.7	167
CL105-3x2x1.0 - PIO	8.3	1.1	10.5	0.7	194
CL105-4x2x1.0 - PIO	9.2	1.2	11.6	0.8	243
CL105-7x2x1.0 - PIO	11.3	1.3	13.9	0.9	360
CL105-10x2x1.0 - PIO	13.1	1.3	15.7	1.0	492
CL105-14x2x1.0 - PIO	15.5	1.4	18.3	1.2	682
CL105-19x2x1.0 - PIO	18	1.5	21	1.4	891
CL105-24x2x1.0 - PIO	20.2	1.6	23.4	1.5	1131
CL105-37x2x1.0 - PIO	24.8	1.8	28.4	1.8	1665
CL105-1x2x1.5 - PIO	5.1	1.0	7.1	0.5	96
CL105-2x2x1.5 - PIO	9.4	1.2	11.8	0.8	219
CL105-3x2x1.5 - PIO	9.7	1.2	12.1	0.8	252
CL105-4x2x1.5 - PIO	10.7	1.2	13.1	0.9	310
CL105-7x2x1.5 - PIO	13.3	1.3	15.9	1.0	476
CL105-10x2x1.5 - PIO	15.5	1.4	18.3	1.2	664
CL105-14x2x1.5 - PIO	18.1	1.5	21.1	1.4	889
CL105-19x2x1.5 - PIO	21.2	1.6	24.4	1.6	1200
CL105-24x2x1.5 - PIO	23.6	1.7	27	1.8	1476
CL105-37x2x1.5 - PIO	29	2.0	33	2.1	2197
TRIPLES					
CL105-1x3x0.75 - TIO	4.4	1.0	6.4	0.4	62
CL105-2x3x0.75 - TIO	8	1.1	10.2	0.7	166
CL105-4x3x0.75 - TIO	9.5	1.2	11.9	0.8	249
CL105-7x3x0.75 - TIO	11.7	1.3	14.3	0.9	365
CL105-10x3x0.75 - TIO	15.6	1.4	18.4	1.2	552
CL105-15x3x0.75 - TIO	18.2	1.5	21.2	1.4	784
CL105-1x3x1.5 - TIO	5.4	1.0	7.4	0.5	113
CL105-2x3x1.5 - TIO	10.1	1.2	12.5	0.8	255
CL105-4x3x1.5 - TIO	12	1.3	14.6	0.9	388
CL105-7x3x1.5 - TIO	14.9	1.4	17.7	1.2	599

Note: For installation guidelines refer to TE installation guidelines document WT1189

C-Lite Cables

Primary Wire (Switchboard Cable)

Field of application

Instrumentation and
communication control
General power and lighting

Voltage class

0.6/1kV

Temperature class

90°C

Flame retarded

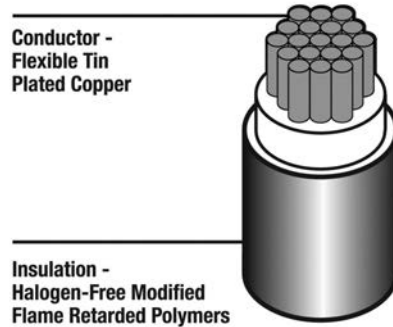
IEC 60332-1,-3

Cable jacket

Zerohal

The new C-Lite cable range is constructed from flame retarded halogen free primary wire and crosslinked sheath materials.

Offering size and weight savings over traditional cables. The new C-Lite cable range is suitable for use in general power, lighting, communication, control and instrumentation applications.



Approvals

DNV, LR, GL, ABS, KR, CCS,
RMRS, NK, BV

Pending

RINA

Part Number (CL105-)	Conductor		Finished Wire		
	Standing No' Dia (mm)	Max Diameter (mm)	Maximum Resistance @ 20°C (ohm/km)	Nominal Diameter (mm)	Nominal Weight (kg/km)
Metric Cross Section					
0111-0.50-*	19/0.18	0.90	40.1	1.40	6.60
0111-0.75-*	19/0.23	1.15	26.7	1.60	8.90
0111-1.00-*	19/0.25	1.26	20.0	1.75	10.7
0111-1.50-*	37/0.23	1.58	13.7	2.08	16.0
0111-2.50-*	37/0.29	2.01	8.21	2.55	25.7
0111-4.00-*	56/0.30	2.57	4.89	3.09	43.6
0111-6.00-*	84/0.31	3.05	3.16	3.95	58.3
0111-10.00-*	80/0.41	4.00	1.95	4.95	100.0
AWG Cross Section					
0111-0.25-*(24AWG)	19/0.13	0.63	84.32	1.14	3.59
0111-0.40-*(22AWG)	19/0.16	0.79	50.5	1.33	5.20
0111-0.60-*(20AWG)	19/0.20	1.01	31.1	1.52	7.40
0111-1.00-*(18AWG)	19/0.25	1.26	20.0	1.75	10.7
0111-1.20-*(16AWG)	19/0.29	1.42	15.3	1.93	13.6
0111-2.00-*(14AWG)	37/0.25	1.82	10.5	2.36	20.3
0111-3.00-*(12AWG)	37/0.32	2.24	6.58	2.78	31.0

Color Code: The *in the part number shall be replaced by a standard color code designator in accordance with Mil-Std-681

White preferred other colors available on request e.g. CL105-0111-0.5-9 White Insulation

Performance Requirements: To be tested to and meet the requirements of the issue in effect of DNV Type Approval Programme No. 6-827.11-1 (excluding sizes less than 0.5mm²) Note: For installation guidelines refer to TE installation guidelines document WT1189.

C-Lite Approvals

Approval Body

Det Norske Veritas (DNV)

Lloyds Register (LR)
Germanischer Lloyd (GL)
American Bureau of Shipping (ABS)
Korean Register (KR)
Russian Register of Shipping (RMRS)

China Classification Society (CCS)
Nippon Kaiji Kyokai (NK)

Pending

Bureau Veritas (BV)
Registro Italiano Navale (RINA)

Approval System

Type Approval
Program No. 6-827.11.1
2002 Type Approval System
Type Approval System
Type Approval Program
Type Approval
Type Approval

Type Approval
Type Approval

Certificate Numbers

E-7276, E-7277, E-7278,
E-7279, E-7280, E-7281
99/0154(E1)
33 106-6 HH, 33 108-6 HH
06-LB158945-PDA
LDN20867-EL001
07.04389.260, 07.04390.260,
07.04392.260, 07-04393.260
07.04394.260, 07-04395.260
LD07W00001
TA07631M; TA07630M

Additional Type Approvals on request

C-Lite Cables (Continued)

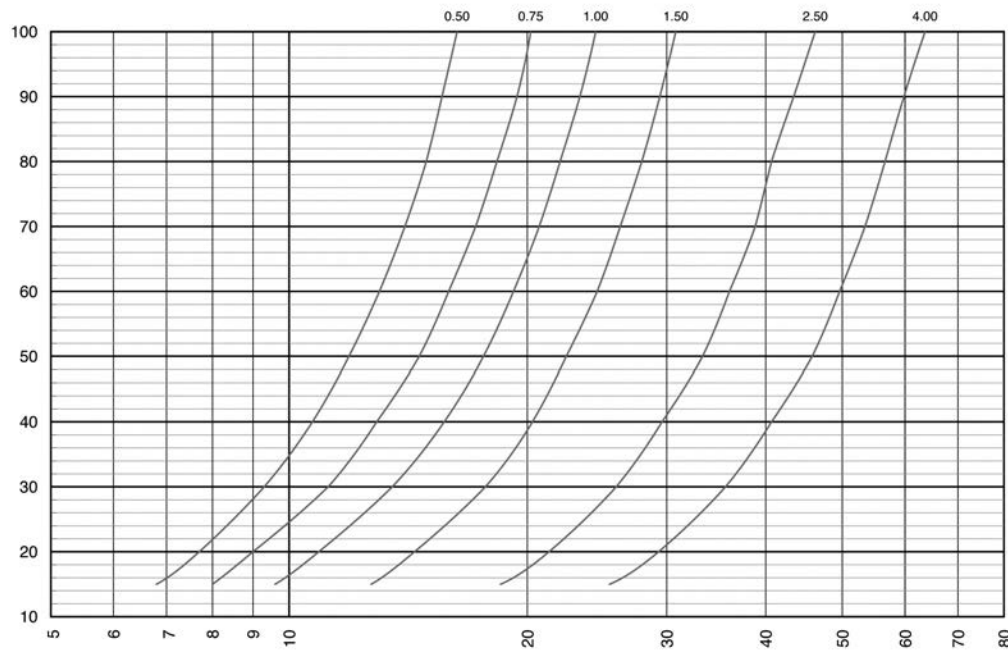
Technical Information

Current Carrying Capacity

Current carrying capacity is defined as the continuous current which when passed through a wire will increase the temperature of the conductor from a specific ambient temperature to the maximum temperature rating of the insulation/sheath.

Temperature Rise v Current Guide

For Type CL105 in free air (single core)



No of cores	Derating Factor
2	0.825
3	0.73
4	0.66
7	0.54
9	0.49
12	0.43
15	0.39
18	0.36
21	0.33
24	0.31
27	0.29
30	0.28
37	0.26

Short Circuit Current

The short circuit current is based on the material the wire is made of, the cross sectional area of the wire and the maximum temperature rating of the insulation material. The short circuit current for a given wire size is provided in the table as constant current for a given amount of time.

Cross-Section of the conductor in mm²	Duration of short circuit in seconds.				
	0.2	0.5	1.0	2.0	3.0
0.5	122	77	54	38	31
0.75	183	115	82	58	47
1.0	243	154	109	77	63
1.5	365	231	163	115	94
2.5	609	385	272	192	157
4.0	974	616	435	308	251
	Short circuit current in Amps				

C-Lite Cables (Continued)

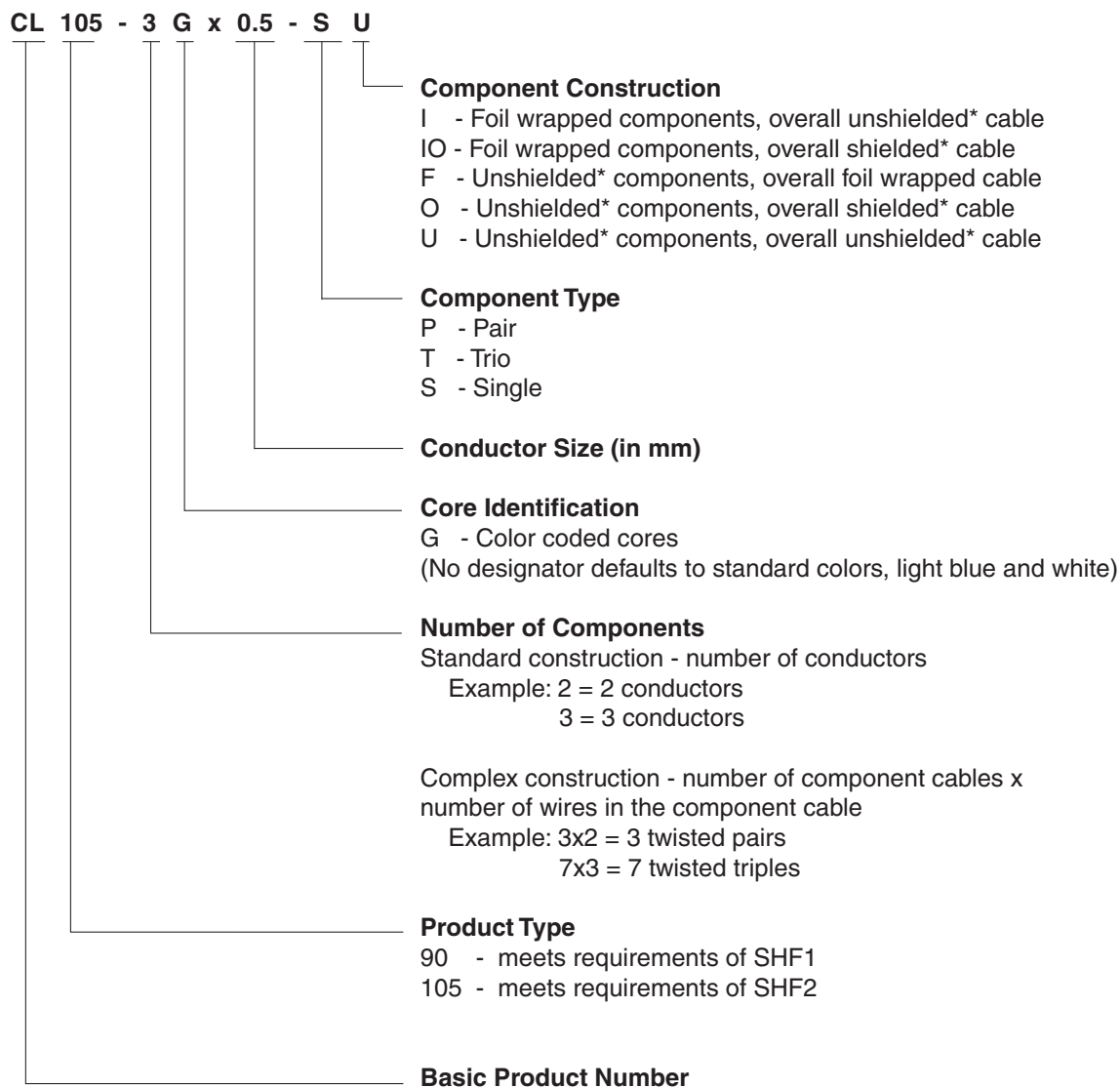
Specification Summary

Examination or test	Test basis	Requirements	Test on
General properties			
Braid coverage	IEC 60092-350	90% minimum coverage density	Cable
Metallic coating of copper conductors	IEC 60092-350 by inspection	Conductor surface will be smooth and uniform. Insulation will not adhere to the conductor.	Conductor
Physical properties			
Tensile strength and ultimate elongation	IEC 60811-1-1	20MPa minimum, 150% minimum (insulation) (speed 50±10 mm/min)	Insulation
Scrape abrasion resistance	NF F 63-808	500 cycles minimum (5N load, 0.45 mm diameter rod, 20°C, 55 cycles/minute)	Core
Dynamic cut through	NF F 63-808	50N minimum (90° 0.13 mm radius blade, 20°C, 100g/s load)	Core
Notch propagation	NF F 63-808	No dielectric breakdown (0.05 mm notch, 6X mandrel, 1.5kV ac for 1 minute)	Core
Mechanical/particular characteristic of sheathing compounds	IEC 60092-350, 12.4 IEC 60092-359 Table II & III	SHF1 or SHF2	Sheath
Thermal properties			
Lifetime	BS 3G230	>20000h @ 120°C	Core
Accelerated ageing	IEC 60811-1-2	No cracks, no dielectric breakdown (168h @ 150°C, 1.5kV ac for 5 minutes)	Core
Insulation blocking	NF F 63-808	Coresh must be easily separated (6h @ 150°C)	Core
Cold bend (Where outer diameter <12.5 mm)	IEC 60811-1-4	No cracks, no dielectric breakdown (-30°C, 10X mandrel, 1.5kV ac for 5 mins for 1m core) (-30°C, 10X mandrel, 3.5kV ac for 5 min. Sample of cable)	Core Cable
Current overload	BS 3G230	No cracks, no dielectric breakdown (30s @ 250°C, 6X mandrel, wind as in lifetime test, 1.5kV ac for 5 minutes)	Core
Electrical properties			
AC and DC voltage tests	IEC 60092-350	No dielectric breakdown (3.5kV ac/8.4kV dc for 5 minutes for 1m of core) (3.5kV ac/8.4kV dc for 5 minutes for each delivery length of cable)	Core Cable
Insulation – continuity proof test	IEC 60092-350 Clause 10.3b	No dielectric breakdown At least 8kV impulse, 8kV dc or 3.5kV ac	Core
Insulation resistance at 20°C	IEC 60092-350	500MΩkm min. @ 20°C (5m length, quote actual IR)	Core
Insulation resistance at 90°C	IEC 60092-350	1.5MΩkm min @ 90°C (5m length, quote actual IR)	Core
Increase in a.c. capacitance after immersion in water	IEC 60092-350	C ₁₄ -C ₁ ≤0.15 C ₁ , C ₁₄ -C ₇ ≤0.05C ₇ (14 days @ 50°C in tap water)	Core
Environmental properties			
Ozone resistance	IEC 60092-350 IEC 60811-2-1	No crazing or cracking (250-300ppm, 25°C, 30h)	Core
Fluid immersion: 72h @ 70°C – IRM 902, IRM 903, Diesel (F-76), 3.5% salt water	BS 3G230	No cracking or dielectric breakdown 5% max, swell (6X mandrel, soak in water, 1.5kV ac for 5 minutes)	Core
Fire hazard properties			
Flammability – small scale	IEC 60332-1	Charring confined between 50mm and 540mm from lower edge of top support (Single vertical wire)	Core
Flammability – large scale	IEC 60332-3	Category A, designation F	Cable
Halogen content	IEC 60684-2 cl. 45	Less than 0.5% for each non metallic component	Cable
Toxicity index	IMO FTPC Appendix 3	It of less than 2, report Lc value	Cable
Smoke emission – small scale	ISO 5659-2 Appendix 3	Ds4 150 max. and Dmax 150 max. VOF4 300 max.	Core
Smoke emission – Large scale	IEC 61034-2	70% minimum transmittance	Cable

Note: For installation guidelines refer to TE installation guidelines document WT1189

C-Lite Cables (Continued)

Part Numbering System



*also referred to as screened or unshielded

C-Lite F (Fire Resistant) Cables

Product Facts

- Halogen free
- Small size
- Lightweight
- Tough flexible construction
- Resistant to hot diesel fuels, oils, grease, drilling fluids, and mechanical abuse
- Meets flame retardant requirements of IEC 60332-3
- Controlled dimensions
- Mud resistant to NEK 606
- Fire resistant to IEC 60331-31 (1000°C)



Applications

TE is a major supplier in high performance cable systems to the offshore and industrial markets. Offshore applications include telecommunications, instrumentation and small power cables which represent approximately 80% of the total cable length on a platform.

Easy Design

C-Lite F cable consists of Raychem brand primary C-Lite FR Wire with a Zerohal-EN jacket and can be used throughout an offshore platform, simplifying the selection of cables for designers and electrical engineers.

Zerohal-EN Cables Generate Less Smoke

Zerohal-EN is a halogen-free cable jacket material, developed by TE and combines the good mechanical, environmental and electrical features of some conventional cables, with good fire hazard performance.

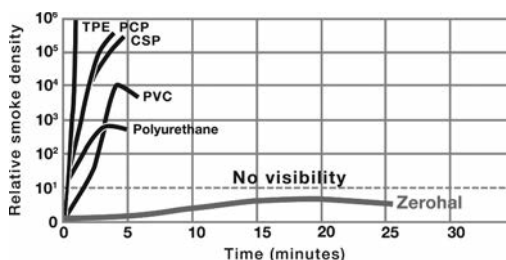
Until recently the flame retardance of cable jackets was achieved by the use of halogenated flame retardants that are effective fire suppressants, but which unfortunately produce dense smoke and corrosive acid gases when burned.

These effects are highly undesirable in a fire, causing corrosion damage to expensive and vital equipment, hindering evacuation and fire fighting and above all, endangering life.

Benefits of Zerohal-EN cable

- Highly flame retarded
- Low smoke generation
- Low toxicity index
- Low acid gas generation
- Operating temperature -40°C up to +120°C
- Low water uptake
- Compatible with Raychem brand heat-shrink components - heat-shrink tubing, molded parts and adhesives.

Smoke generation with time

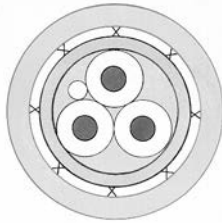


The 10% visibility line on the graph indicates the density of smoke (measured in the NBS smoke chamber) which would cause human disorientation and confusion.

Available in:	Americas	Europe	Asia Pacific

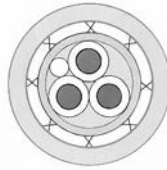
C-Lite F (Fire Resistant) Cables (Continued)

Traditional Fire Resistant Cable

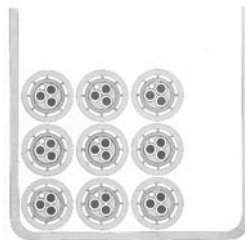
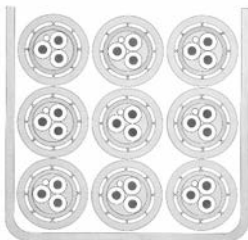


The illustration above shows a TE light weight cable on the right compared with a traditional offshore cable having the same cross-sectional area of copper. Both cables have the same number of conductors. A saving in size has been made on the insulation material, but without sacrificing the mechanical or electrical characteristics of the cable.

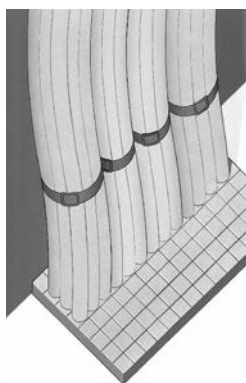
C-Lite F Cable



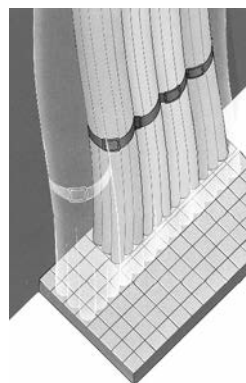
Cable trays



A typical saving in the cable tray volume can exceed 40%



Transits



Over 40% savings in area

With more than 475 km of cabling on a typical large platform, there are potential savings of up to 105 tons topside by using C-Lite throughout the platform. The total cabling system, together with smaller cable glands, trays and transits can lead to overall weight savings of approximately 165 tons and cost savings in excess of 15%.

Designing Platforms

Platforms are becoming smaller and more sophisticated with an ever increasing complexity of electronic systems, sensors, communications and safety equipment. More cables are therefore required to fit into smaller spaces.

C-Lite F small size cable can be a distinct advantage over conventional cables.

Space saving when refurbishing platforms

As technology advances, engineers are called upon to update and modify existing systems or fit completely new ones.

To provide all the necessary interconnections, hundreds of multicore cables have to run throughout the platform. These, along with cables for power, lighting and instrumentation, create a severe space problem on cable trays, cable transits through fire walls, marshalling boxes and gland plates.

Using C-Lite F cable installation is easier because the cable is smaller, lighter, more flexible and has a reduced bend radius than conventional cables.

Lower total installed cost on new platforms

Weight is one of the key factors to consider when designing new platforms.

Reduced size and weight in cables allow for smaller and lighter gauge racking needing less support. Also, smaller transits and cable glands reduce material and installation costs. C-Lite F cable is easier to specify as it meets all the industry's essential requirements in one cable.

Benefits of using TE C-Lite F cable

- Cable can be used throughout the platform
- Smaller tray work/more cables per tray
- Lighter supports
- Smaller cable glands/gland plate optimization
- More cables through transit blocks
- Time saving on installation
- Less cable accessories
- Less inventory
- Lower total installed cost
- Wide size range: 0.50-10.00mm²

FlexLite Commercial Wire

Available in:

Americas	■
Europe	■
Asia Pacific	■



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 ■ Excellent shop handling 	FlexLite TW
General purpose commercial and industrial	150°C	<ul style="list-style-type: none"> ■ Excellent chemical resistance ■ Non-melting insulation ■ Insulation does not melt and flow at high temperature 	FlexLite CW
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

UL Marking and Labeling

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

Primary Wire

Product	UL Style	Temperature Rating	Voltage Rating	AWG Range	Part Description
FlexLite DW*	3584	125°C [257°F]	600 volts	14-26	FLDWX031X
FlexLite TW	10208	135°C [275°F]	600 volts	10-28	FLTWX031X
FlexLite CW	10916	150°C [302°F]	600 volts	0.35mm ² –2.50mm ²	FLCW0219& 0211
FlexLite HT*	3557	200°C [392°F]	600 volts	12-26	FLHTX031X
FlexLite TX	10297	250°C [482°F]	600 volts	10-26	FLTX031X

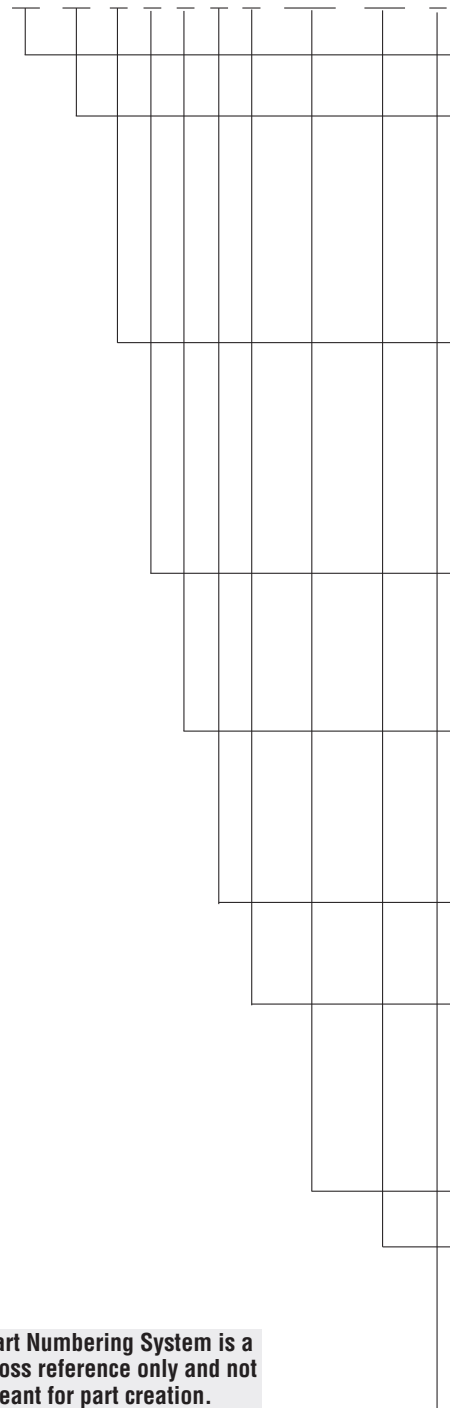
Note: Additional UL-recognized cable constructions are available. Please contact TE for details.

*Available in both metric and imperial sizes.

FlexLite (Continued)

Part Numbering System

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



Basic Product Number

Product Type (UL Style - Temperature Rating)

CW - UL Style 3751 - 150°C
DW - UL Style 3584 - 125°C
TW - UL Style 10208 - 135°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)

Part Numbering System is a cross reference only and not meant for part creation.

*Shield coating same as conductor coating

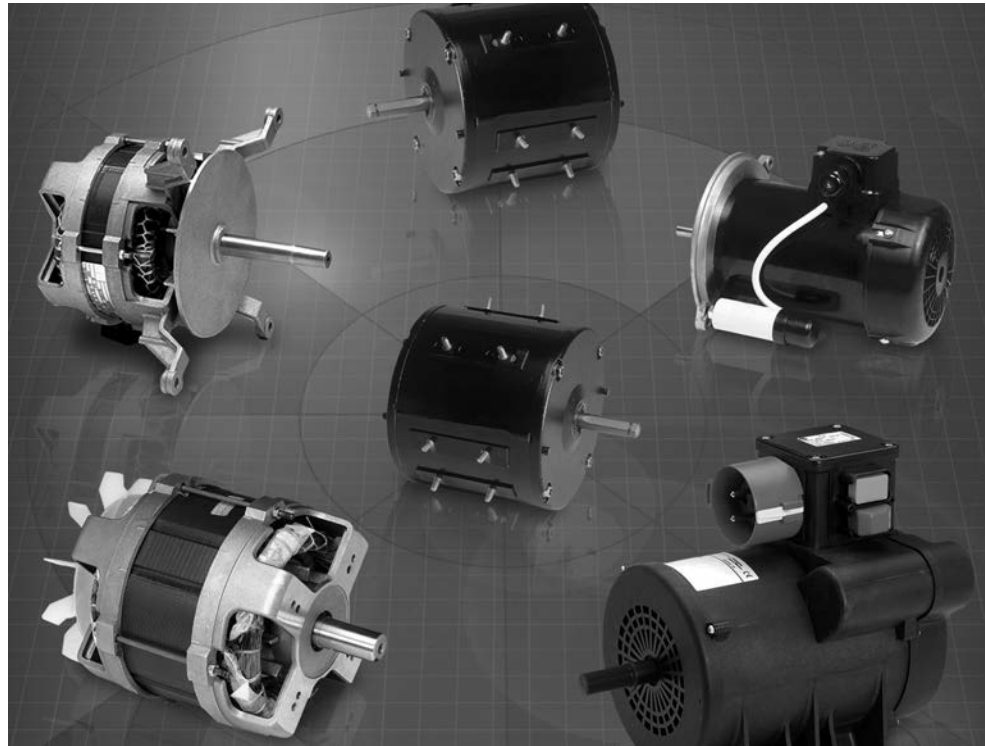
Typical ordering example	19 strand, 20 AWG tin-coated copper, two component, shielded and jacketed cable, 600 volt, blue and white components, white jacket; part number FLDWC1321-20-6/9-9.
Ordering information	For product requiring CUR (Canadian UL) or CSA marking part numbering descriptions above MIGHT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

FlexLite CW

General Purpose and Motor Lead Wire

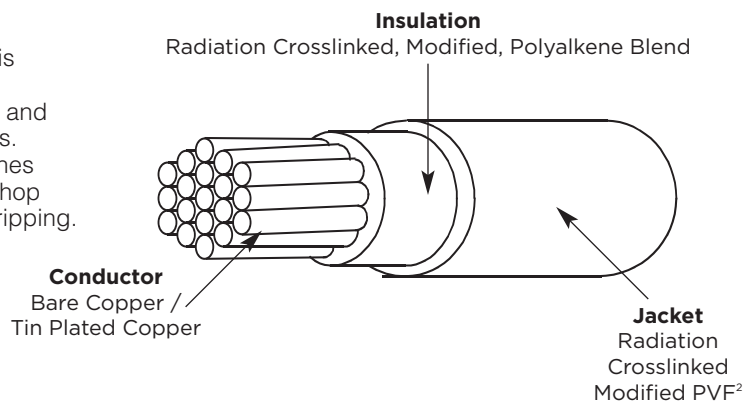
Product Facts

- UL rated operating temperature to 150°C [302°F]
- Non melting cross-linked insulation material provides current overload and resistance to short term thermal excursions
- Insulation offers excellent performance against most fluids, including lubricating oils, hydraulic fluids, cleaning fluids, acids and alkalis
- Varnish resistant for motor lead applications
- Excellent shop floor handling enables ease of termination and full compatibility with automatic cutting and stripping machines
- 600 volt rating exceeds most application needs
- Full range of sizes and colors available
- Thin wall product improves packaging possibilities



Applications

FlexLite CW (FLCW) is designed for general purpose Commercial and Industrial applications. This dual wire combines excellent flexibility, shop floor handling and stripping.



Specifications/Approvals

Series	UL
CW	Style 3751

Available in:	Americas	Europe	Asia Pacific
	■	■	■

FlexLite CW (Continued)

Construction Details

Bare Copper Conductor -FLCW0219

Part Number	Conductor			Finished Wire				Approx. Weight per Unit Length kg/km
	Cross Sectional Area mm2	Nominal Stranding No / Dia mm	Diameter mm max	Conductor Resistance at 20°C Ω/km max	Diameter mm		Upper Spec Limit	
					Lower Spec Limit	Target		
FLCW0219-0.35-*	0.35	7/0.26	0.78	51.7	1.59	1.63	1.67	5.16
FLCW0219-0.50-*	0.50	19/0.19	0.95	36.9	1.76	1.80	1.84	6.9
FLCW0219-0.75-*	0.75	19/0.23	1.15	24.6	1.96	2.00	2.04	10.9
FLCW0219-1.00-*	1.00	19/0.26	1.30	18.40	2.11	2.15	2.19	11.6
FLCW0219-1.50-*	1.50	19/0.32	1.60	12.60	2.41	2.45	2.49	16.3
FLCW0219-2.50-*	2.5	19/0.41	2.05	7.56	2.86	2.94	2.94	25.70

Tin Plated Conductor -FLCW0211

Part Number	Conductor			Finished Wire						
	Cross Sectional Area mm ²	Nominal Stranding No / Dia mm	Diameter mm max	Conductor Resistance at 20°C Ω/km max	Insulation Thickness		Diameter mm			Nominal Weight per Unit Length kg/km
					Absolute Minimum mm	Minimum Average mm	Lower Spec Limit	Target	Upper Spec Limit	
FLCW0211-0.35-*	0.35	7/0.25	0.79	50.9	0.28	0.36	1.60	1.64	1.68	5.22
FLCW0211-0.50-*	0.50	19/0.18	0.88	40.1	0.28	0.36	1.69	1.73	1.77	6.51
FLCW0211-0.75-*	0.75	19/0.23	1.08	24.7	0.28	0.36	1.89	1.93	1.97	8.99
FLCW0211-1.00-*	1.00	19/0.25	1.21	20.0	0.28	0.36	2.02	2.06	2.10	10.7
FLCW0211-1.50-*	1.50	19/0.32	1.51	12.5	0.28	0.36	2.32	2.36	2.40	15.8
FLCW0211-2.50-*	2.50	19/0.41	1.94	7.88	0.28	0.36	2.75	2.79	2.83	25.0

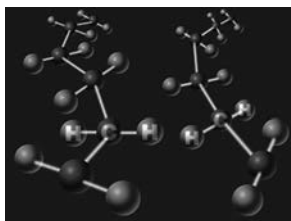
Ballis Resistor



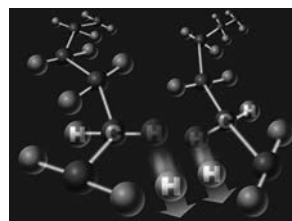
Coil



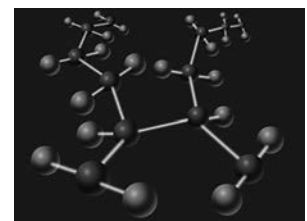
Radiation Cross-Linking



Molecular Chain



Crosslinking



Crosslinked Molecular Chain

FlexLite DW

Dual-Wall Primary Wire

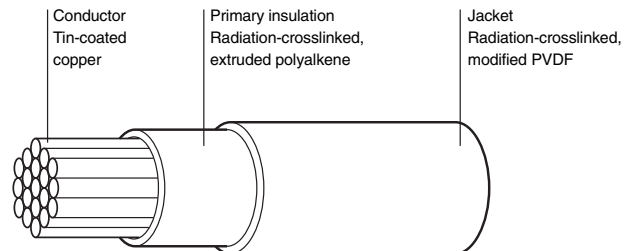
Product Facts

- 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	TE
DW	Style 3584 Flammability VW-1 Temperature rating 125°C [257°F]	Recognized	Certified AWMIA	WCD-3106

Available in:	Americas	Europe	Asia Pacific
	■	■	■

FlexLite DW (Continued)

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]

* 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 (mm²)	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]	83.3 [25.5]	1.12 [.044]	1.17 [.046]	1.22 [.048]	3.45 [2.32]
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]	4.79 [3.21]
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]	6.46 [4.34]
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]	8.93 [5.99]
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]	10.90 [7.31]
FLDWC0311-1.50*	1.50	19 x 0.32	1.35 [.053]	1.58 [.062]	13.7 [4.2]	2.19 [.086]	2.27 [.089]	2.34 [.092]	17.90 [12.01]
FLDWC0311-2.00*	2.00	19 x 0.36	1.66 [.065]	1.79 [.070]	9.7	2.42 [.095]	2.52 [.099]	2.62 [.103]	21.30 [14.29]
FLDWC0311-2.50*	2.50	19 x 0.41	1.85 [.074]	2.01 [.080]	8.2	2.63 [.104]	2.73 [.108]	2.83 [.112]	27.40 [18.39]

* 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 16-10 AWG, stranded conductors only, the part numbering descriptions above **MIGHT NOT** apply. Please contact TE for further information.

FlexLite TW

Thin-Wall Hookup Wire and Cable

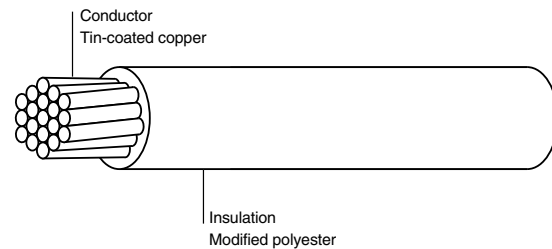
Product Facts

- 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.



Specifications/Approvals

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

Available in:	Americas	Europe	Asia Pacific
	■	■	■

FlexLite TW (Continued)

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 [$\Omega/1000\text{ ft}$]	Diameter			Nominal Weight in kg/km [lb/1000 ft]
					Minimum mm [inch]	Nominal mm [inch]	Maximum mm [inch]	
FLTWC0311-26-*	26	19 x 38	.483 [0.19]	150.0 [45.8]	.813 [.032]	.864 [.034]	.914 [.036]	1.93 [1.3]
FLTWC0311-24-*	24	19 x 36	.610 [0.24]	94.2 [28.7]	.965 [.038]	1.02 [.040]	1.07 [.042]	2.83 [1.9]
FLTWC0311-22-*	22	19 x 34	.762 [.030]	59.4 [18.1]	1.14 [.045]	1.19 [.047]	1.24 [.049]	4.17 [2.8]
FLTWC0311-20-*	20	19 x 32	.965 [.038]	37.4 [11.4]	1.35 [.053]	1.40 [.055]	1.45 [.057]	6.25 [4.2]
FLTWC0311-18-*	18	19 x 30	1.19 [.047]	23.5 [7.15]	1.60 [.063]	1.65 [.065]	1.70 [.067]	9.52 [6.4]
FLTWC0311-16-*	16	19 x 29	1.35 [.053]	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 [.066]	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 [.085]	6.59 [2.01]	2.64 [.104]	2.74 [.108]	2.84 [.112]	28.87 [19.4]
FLTWD0311-10-*	10	37 x 26	2.72 [.107]	4.13 [1.26]	3.23 [1.27]	3.33 [.131]	3.43 [1.35]	45.39 [30.5]

* 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 16-10 AWG, stranded conductors only, the part numbering descriptions above **DO NOT** apply. Please contact TE for further information.

FlexLite HT

High-Temperature Hookup Wire

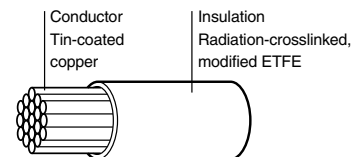
Product Facts

- 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



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, wireless tools and small high-end appliances where space and temperature are issues.



Specifications/Approvals

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

Available in:	Americas	Europe	Asia Pacific
	■	■	■

FlexLite HT (Continued)

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	.483 [.019]	150.0 [45.8]	.765 [.0301]	.800 [.0315]	.836 [.0329]	1.89 [1.27]
FLHTC0311-24-*	24	19 x 36	.610 [.024]	94.2 [28.7]	.892 [.0351]	.927 [.0365]	.963 [.0379]	2.75 [1.85]
FLHTC0311-22-*	22	19 x 34	.762 [.030]	59.4 [18.1]	1.04 [.0411]	1.08 [.0425]	1.12 [.0439]	4.08 [2.74]
FLHTC0311-20-*	20	19 x 32	.965 [.038]	37.4 [11.4]	1.25 [.0491]	1.28 [.0505]	1.32 [.0519]	6.21 [4.17]
FLHTC0311-18-*	18	19 x 30	1.19 [.047]	23.5 [7.15]	1.48 [.0583]	1.52 [.0600]	1.57 [.0617]	9.43 [6.34]
FLHTC0311-16-*	16	19 x 29	1.35 [.053]	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 [.066]	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 [.085]	6.59 [2.01]	2.50 [.0984]	2.57 [.1010]	2.63 [.1036]	28.7 [19.3]
FLHTD0311-10-*	10	37 x 26	2.72 [.107]	4.13 [1.26]	3.07 [.1210]	3.18 [.1250]	3.28 [.1290]	30.7 [45.7]

Construction Details

Part No.	Nominal CSA (mm²)	Conductor Stranding No/Dia. (mm)	Diameter		Finished Wire Maximum Resistance at 20°C (68°F) (ohms/km)	Lower Spec. Limit mm [inch]	Diameter		Nominal Weight (kg/km)
			(min.) mm [inch]	(max.) 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]	83.3	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]	52.2	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.

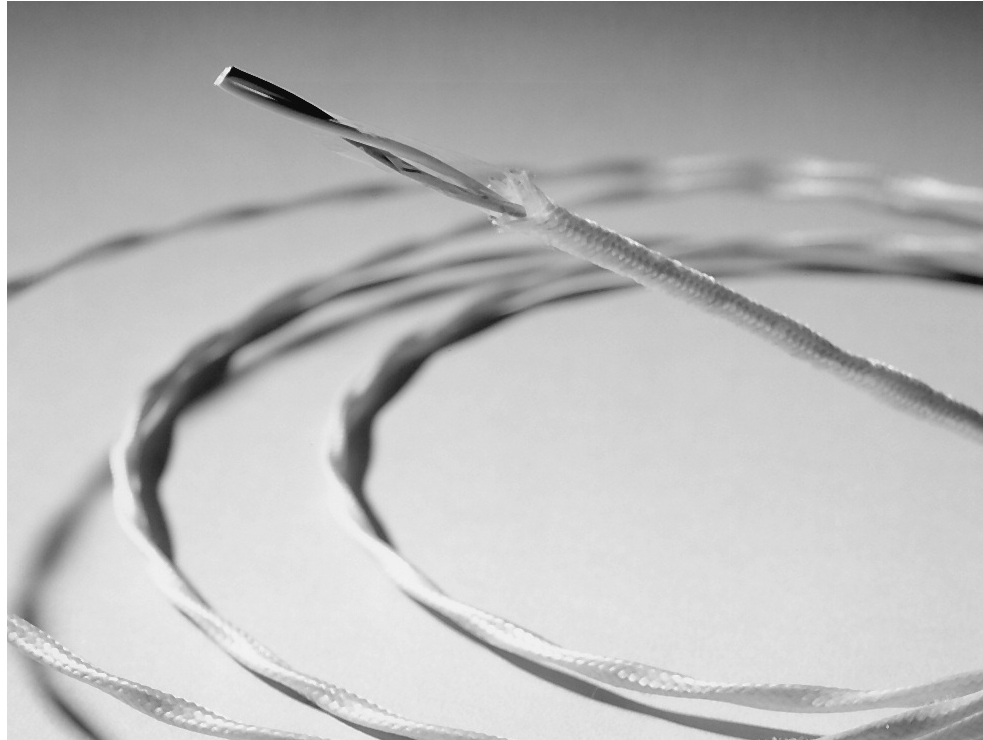
FLHTC0311-0.50-9 = Size 0.50mm², white.

For product requiring CUR (Canadian UL) or CSA marking in 16-10 AWG, stranded conductors only, the part numbering descriptions above **DO NOT** apply. Please contact TE for further information.

Thermocouple Extension Cable

Product Facts

- 19-strand conductor for flexibility
- All 4 types available in different combinations
- Custom designs with different insulation systems are available
- Lightweight, small size thermocouple extension cables



Applications

TE manufactures a broad range of Raychem brand Thermocouple extension cables in four thermoelement combinations. Each provides accurate transmission of electro-motive 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 TE 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
	■	■	■

Thermocouple Extension Cable (Continued)

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 five standards: MIL-STD-687, ANSI-MC-96.1, British Standard Code BS 1843, Japanese JIS-C-1602 and IEC 584-3 color coding system (see below) (International Standard)

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 TE 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
IEC 584-3	Violet	White	Violet	7/9	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
IEC 584-3	Black	White	Black	0/9	0
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
IEC 584-3	Green	White	Green	5/9	5
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
IEC 584-3	Brown	White	Brown	1/9	1

Thermocouple Extension Cable (Continued)

**Part Number
Selection Table**

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

TE 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
KX	55A8002	CTC-0012	T	CTC-0018
			N	CTC-0015
			S	CTC-0057
TX	CTC-0078	CTC-0081	T	CTC-0073

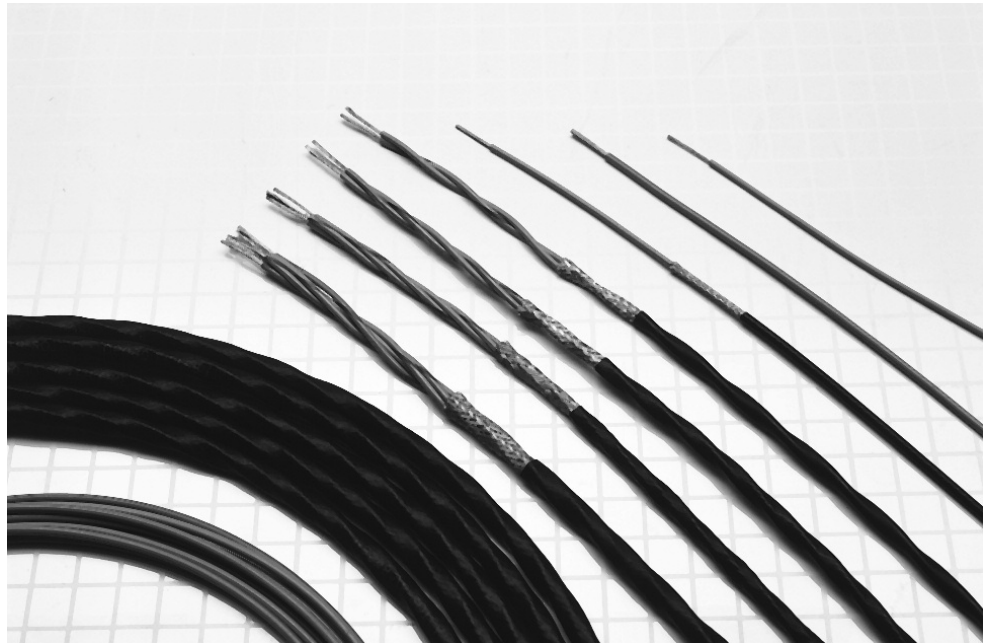
*T = Tin-coated copper.
N = Nickel-coated copper.
S = Silver-coated copper.

ElectroLoss Filterline

Lightweight, Ruggedized Filterline Wire and Cable

Product Facts

- Suppresses EMI above 100 MHz
- Light weight, small size
- SPEC 55 insulation
- 600 volt
- -65°C up to 200°C
[-85°F to 392°F]



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 brand of 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 ElectroLoss FilterLine wire and cable meets the performance requirements of SAE AS85485 originally 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.

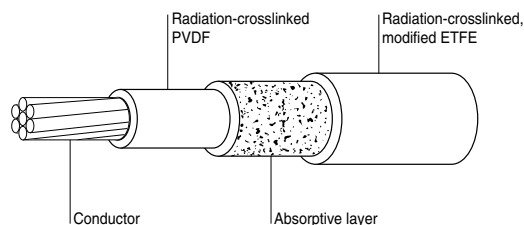
Radiation-crosslinked, modified conductive EFTE jackets are used over shielded filter line cables to eliminate pathways between adjacent cable shields.

Application-driven alternative ElectroLoss FilterLine constructions built to the same rigorous standards demanded of the military requirements 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.

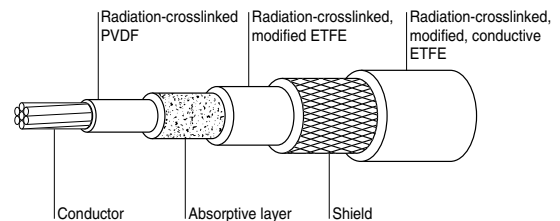
Available in:

Americas	■
Europe	■
Asia Pacific	■

55FA0511



55FB1511



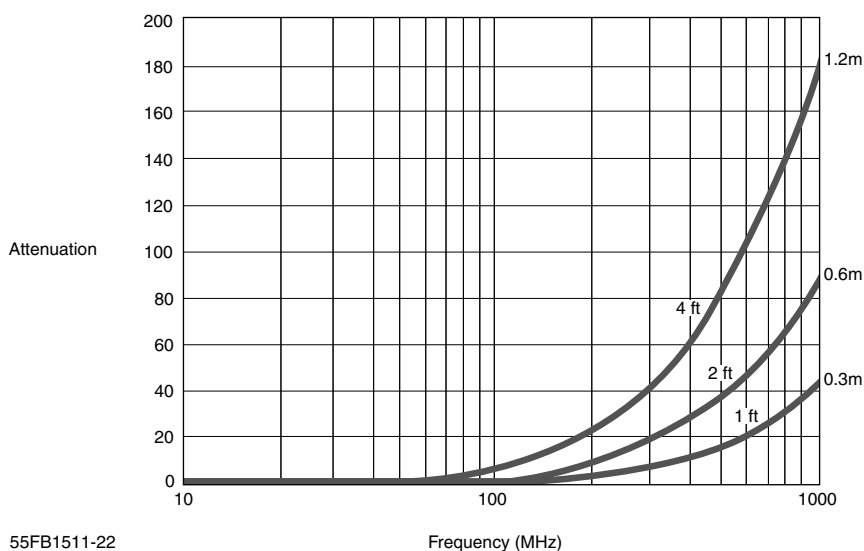
ElectroLoss Filterline (Continued)

Performance

Effective against conducted EMI ElectroLoss FilterLine wire and cable systems attenuate high-frequency EMI and allow low 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



Temperature rating	-65°C up to 200°C [-85°F to 392°F]
Voltage rating	600V r.m.s

ElectroLoss Filterline (Continued)

Lightweight, Ruggedized Filterline Wire and Cable

Single Conductor Wire Specifications 150°C Rated Wire

AWG Size	Conductor Stranding (Number x AWG)	Maximum Outside Diameter mm (in)	Maximum Weight Kg/Km (lb/1000 ft)	MIL-SPEC Part Number	TE 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

Low Fluoride Specifications 200°C Rated Wire

AWG Size	Conductor Stranding (Number x AWG)	Maximum Outside Diameter mm (in)	Maximum Weight Kg/Km (lb/1000 ft)	TE Part Number
24	19 x 36 silver coated high strength copper alloy	1.19 [.047]	4.46 [3.0]	55FAF7128-24-*
22	19 x 34 silver coated copper	1.37 [.054]	5.95 [4.0]	55FAF0512-22-*
20	19 x 32 silver coated copper	1.57 [.062]	8.63 [5.8]	55FAF0512-20-*
18	19 x 30 silver coated copper	1.85 [.073]	12.95 [8.7]	55FAF0512-18-*
16	19 x 29 silver coated copper	2.08 [.082]	16.67 [11.2]	55FAF0512-16-*
14	19 x 27 silver coated copper	2.51 [.099]	23.96 [16.1]	55FAF0512-14-*
12	37 x 28 silver coated copper	2.95 [.116]	35.71 [24.0]	55FAF0512-12-*
10	37 x 26 silver coated copper	3.58 [.141]	55.06 [37.0]	55FAF0512-10-*

The color of the component wire shall be light yellow designated by 4L. The designated colors for components shall be light yellow for component 1 and light yellow with stripe designators for remaining component wires as follows:

Component Wire	1	2	3	4	5
Color Designation	4L	4L6	4L3	4L5	4L2

ElectroLoss Filterline (Continued)

Lightweight, Ruggedized Filterline Wire and Cable

(Continued)

Unshielded, Unjacketed 2-5 Conductor Cable Specifications 150°C Rated Wire

AWG Size	Number of Conductor	Maximum Outside Diameter mm [in.]	Maximum Weight Kg/Km (lb/1000 ft)	MIL-SPEC Part Number	TE 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

ElectroLoss Filterline (Continued)

Low Fluoride Specifications 200°C Rated Wire

AWG Size	Number of Conductor	Maximum Outside Diameter mm [in.]	Maximum Weight Kg/Km (lb/1000 ft)	TE Part Number
24	2	2.39 [.094]	9.08 [6.1]	55FAF7134-24-*
22	2	2.74 [.108]	12.20 [8.2]	55FAF0522-22-*
20	2	3.15 [.124]	17.56 [11.8]	55FAF0522-20-*
18	2	3.71 [.146]	26.34 [17.7]	55FAF0522-18-*
16	2	4.17 [.164]	33.93 [22.8]	55FAF0522-16-*
14	2	5.03 [.198]	48.81 [32.8]	55FAF0522-14-*
24	3	2.59 [.102]	13.69 [9.2]	55FAF7135-24-*
22	3	2.97 [.117]	18.15 [12.2]	55FAF0532-22-*
20	3	3.40 [.134]	26.34 [17.7]	55FAF0532-20-*
18	3	4.01 [.158]	39.58 [26.6]	55FAF0532-18-*
16	3	4.50 [.177]	51.03 [34.3]	55FAF0532-16-*
14	3	5.44 [.214]	73.36 [49.3]	55FAF0532-14-*
24	4	3.28 [.129]	18.15 [12.2]	55FAF7136-24-*
22	4	3.78 [.149]	24.25 [16.3]	55FAF0542-22-*
20	4	4.34 [.171]	35.27 [23.7]	55FAF0542-20-*
18	4	5.11 [.201]	52.82 [35.5]	55FAF0542-18-*
16	4	5.74 [.226]	68.00 [45.7]	55FAF0542-16-*
14	4	6.91 [.272]	97.76 [65.7]	55FAF0542-14-*
24	5	3.58 [.141]	22.77 [15.3]	55FAF7137-24-*
22	5	4.11 [.162]	30.36 [20.4]	55FAF0552-22-*
20	5	4.72 [.186]	44.04 [29.6]	55FAF0552-20-*
18	5	5.56 [.219]	66.07 [44.4]	55FAF0552-18-*
16	5	6.25 [.246]	84.96 [57.1]	55FAF0552-16-*
14	5	7.54 [.297]	122.16 [82.1]	55FAF0552-14-*

The color of the component wire shall be light yellow designated by 4L. The designated colors for components shall be light yellow for component 1 and light yellow with stripe designators for remaining component wires as follows:

Component Wire	1	2	3	4	5
Color Designation	4L	4L6	4L3	4L5	4L2

ElectroLoss Filterline (Continued)

Lightweight, Ruggedized Filterline Wire and Cable

(Continued)

Shielded, Jacketed 1-5 Conductor Cable Specifications

ElectroLoss Filterline Wire and Cable Light Weight Ruggedized Constructions —

150°C

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	TE 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

ElectroLoss Filterline (Continued)

Lightweight, Ruggedized Filterline Wire and Cable (Continued)

Electroloss Filterline Wire and Cable Light Weight Ruggedized Constructions — 200°C (Flat Braid)

AWG Size	Number of Conductors	Shield Size AWG Tin Coated Copper	Maximum Outside Diameter mm (in)	Maximum Weight Kg/Km (lb/1000 ft)	TE Part Number
24	1	38	2.13 [.084]	10.86 [7.3]	55FBF7129-*
22	1	38	2.31 [.091]	13.09 [8.8]	55FBF2512-22-*
20	1	38	2.51 [.099]	16.67 [11.2]	55FBF2512-20-*
18	1	38	2.79 [.110]	22.17 [14.9]	55FBF2512-18-*
16	1	38	3.02 [.119]	26.78 [18.0]	55FBF2512-16-*
14	1	38	3.45 [.136]	35.86 [24.1]	55FBF2512-14-*
12	1	38	3.89 [.153]	49.40 [33.2]	55FBF2512-12-*
10	1	38	4.55 [.179]	71.57 [48.1]	55FBF2512-10-*
24	2	38	3.33 [.131]	19.34 [13.0]	55FBF7130-*
22	2	38	3.68 [.145]	23.81 [16.0]	55FBF2522-22-*
20	2	38	4.09 [.161]	30.50 [20.5]	55FBF2522-20-*
18	2	38	4.65 [.183]	41.37 [27.8]	55FBF2522-18-*
16	2	38	5.11 [.201]	50.59 [34.0]	55FBF2522-16-*
14	2	38	6.02 [.237]	69.49 [46.7]	55FBF2522-14-*
24	3	38	3.53 [.139]	25.30 [17.0]	55FBF7131-*
22	3	38	3.91 [.154]	31.10 [20.9]	55FBF2532-22-*
20	3	38	4.34 [.171]	41.07 [27.6]	55FBF2532-20-*
18	3	38	4.95 [.195]	56.54 [38.0]	55FBF2532-18-*
16	3	38	5.44 [.214]	69.94 [47.0]	55FBF2532-16-*
14	3	38	6.43 [.253]	96.87 [65.1]	55FBF2532-14-*
24	4	38	4.19 [.165]	31.69 [21.3]	55FBF7132-*
22	4	38	4.67 [.184]	39.58 [26.6]	55FBF2542-22-*
20	4	38	5.23 [.206]	52.68 [35.4]	55FBF2542-20-*
18	4	38	5.99 [.236]	72.91 [49.0]	55FBF2542-18-*
16	4	38	6.68 [.263]	91.36 [61.4]	55FBF2542-16-*
14	4	38	7.85 [.309]	125.59 [84.4]	55FBF2542-14-*
24	5	38	4.52 [.178]	37.80 [25.4]	55FBF7133-*
22	5	38	5.05 [.199]	47.32 [31.8]	55FBF2552-22-*
20	5	38	5.66 [.223]	63.39 [42.6]	55FBF2552-20-*
18	5	38	6.55 [.258]	89.43 [60.1]	55FBF2552-18-*
16	5	38	7.24 [.285]	111.00 [74.6]	55FBF2552-16-*
14	5	38	8.53 [.336]	153.26 [103.0]	55FBF2552-14-*

The color of the component wire shall be light yellow designated by 4L.
The designated colors for components shall be light yellow for component 1 and light yellow with stripe designators for remaining component wires as follows:

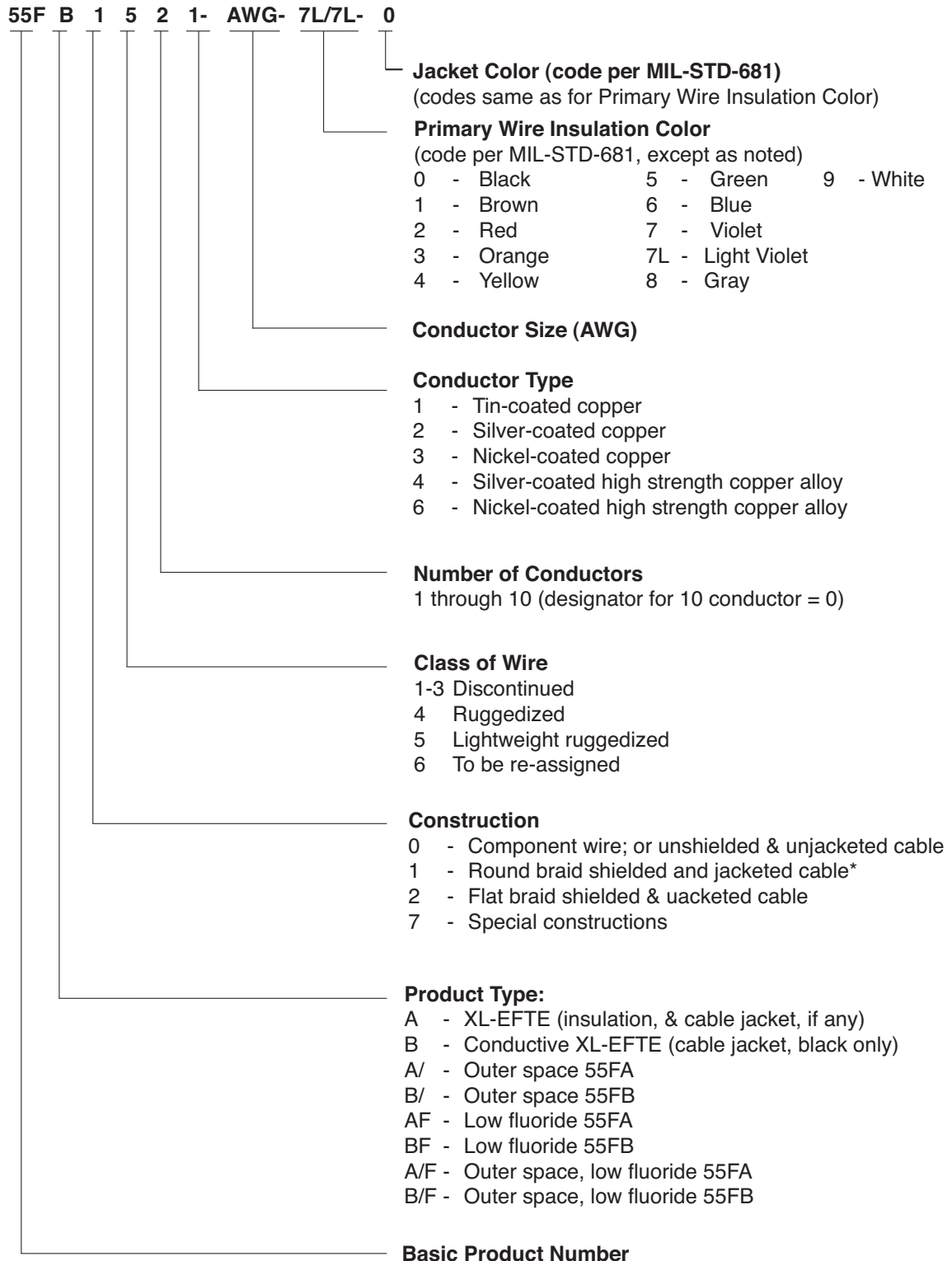
Component Wire Color Designation	1	2	3	4	5
	4L	4L6	4L3	4L5	4L2

Fluid Resistance

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

ElectroLoss Filterline (Continued)

Part Numbering System



Cheminax Coaxial Cables

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



Applications

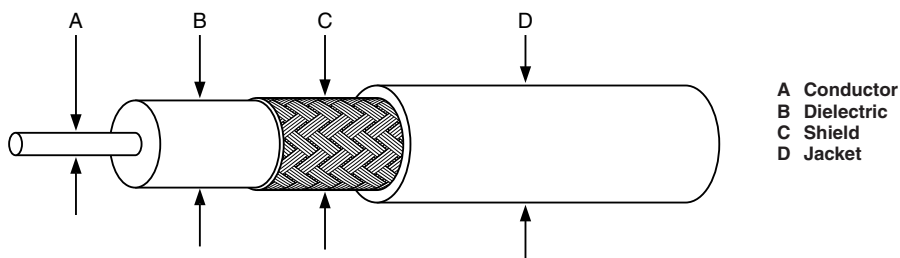
Cheminax controlled electrical cables are used in the aircraft and aerospace industries. They have a wide range of applications in missiles, avionics, radio-frequency and microwave systems, computers, security and surveillance systems, and communications. Cheminax coaxial cables were designed to solve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

TE's advanced materials technology has allowed the design and development of 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 cables or provide significantly lower attenuation and capacitance with no significant increase in size.



Available in:	Americas	Europe	Asia Pacific
	■	■	■

Cheminax Coaxial Cables (Continued)

Part Numbering System

95 27 A 1 3 1 7 - 0
XX XX X X X X X - X

Example: 9527A1317-0

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

Outer Jacket Material

- 1 - General purpose PVF²
- 2 - Outerspace PVF²
- 3 - Thermorad F & S
- 4 - Modified FEP
- 5 - ETFE (Uncrosslinked)
- 6 - Modified XL-ETFE (SPEC 55)
- 7 - Flex XL-ETFE (SPEC 80)
- 8 - Zerohal & Thermorad Low Smoke
- 9 - None
- 0 - Other

Construction

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

Variation

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

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

Part Numbering System is a cross reference only and not meant for part creation.

Cheminax Coaxial Cables (Continued)

Specifications/Approvals

Series	TE
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 Conductor Diameter	B Dielectric Diameter	C Shield Diameter	D Jacket Diameter	Weight in kg/km (lb/1000ft)
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			
Type Value of Jacket Material						
Physical	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 TE specification WCD-1200 for details.

Solvents

Fluid category	A	B***	C
Fluid resistance	All	Hydrocarbons	Hydrocarbons 50°C
		All fuels and lubes	Petroleum base fuels and lubes ≤50°C
		Alcohols	Alcohols
		Cleaning fluids	Cleaning fluids
		Glycols	Synthetic fuels and lubes
			Glycols
			Ketones

**Test method per TE Specification 1200.

***Use caution with ketones.

Cheminax — High Performance Alternatives to Standard Cables (Continued)

TE Alternatives to RG Cables

RG/U	TE 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
	5020A3311-0	Small/light
55	5018D3311-0	Improved electricals
	5021D1331-0	Dimensionally similar
58	5020A1311-0	Small/light
	5018A1311-0	Improved electricals
	7523D1331-0	Dimensionally similar
59	7524A1311-0	Small/light
	7520A1311-0	Improved electricals
62	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	TE 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
	5019D3318-0	Small/light
223	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
	5026A1311-0	Small/light
316	5024A1311-0	Improved electricals
393	5012A3311-0	Small/light
	5020A3311-0	Small/light
400	5018D3311-0	Improved electricals
403	5030A5314-0	Small/light

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

Cheminax Twin Axial Cable

Small, Lightweight Twin Axial Cables

Product Facts

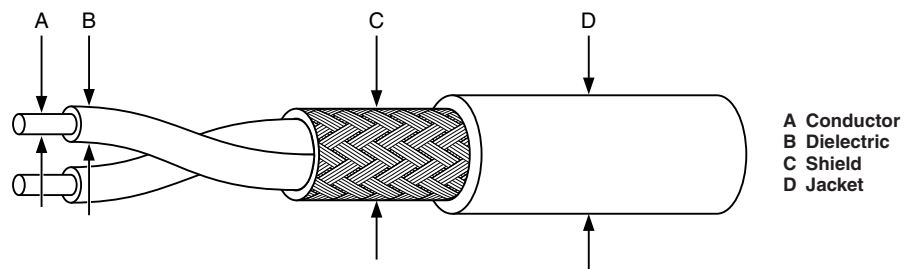
- Light weight, small size
- Temperature range of
-65°C to 200°C
[-85°F to 392°F]
- Low capacitance
- High data rates
- Excellent shop handling



Applications

These small, lightweight cables are specially designed for use in MIL-STD-1553 CANBUS, and other high speed data bus applications. TE 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 Cables (Continued)

Specifications/Approvals

Series	TE
Cheminax cables	1200

Product Dimensions*

Typical Product Part No.	Impedance (ohms)	Capacitance pF/m(pF/ft)	A Conductor Diameter	B Dielectric Diameter	C Shield Diameter	D Jacket Diameter	Weight in kg/km (lb/1000ft)
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 solvent Page 9-79 for details.

SeaLAN Ethernet Cables

Product Facts

- Low smoke, zero halogen
- Waterblocked cables tested using ASTM D1411 sea water solution
- Humidity resistant designs
- Lightweight
- Flexible



Applications

TE SeaLAN family of waterblocked and non-waterblocked Ethernet cables, as described in MIL-DTL-24643/59 through /61, are qualified to meet the rigorous requirements of flammability, smoke emissions and halogen content. Waterblocked constructions meet severe waterblocking and humidity resistance requirements.

Cables are used in Ethernet applications for:

- Military vessels
MIL-DTL-24643/59, /60 and /61
- Freighters
- Tankers
- Cruise Ships

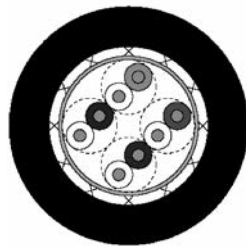
Available in:	Americas	Europe	Asia Pacific
	■	■	■

SeaLAN Ethernet Cables (Continued)

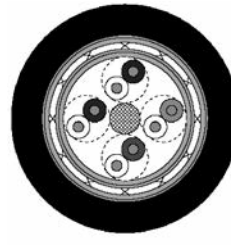
Product Offering

MIL Spec Part Description	Type	TE Description	Cable Description
M24643/59-01UO	LSC5FS-4	CEC-RWC-18982	24 AWG, solid bc, Al/polyester and drain wire
M24643/59-02UO	LSC5FSW-4	CEC-RWC-18983	Waterblocked, 24 AWG, solid bc, Al/polyester and drain wire
M24643/59-03UO	LSC5OS-4	CEC-RWC-18700	24 AWG, solid bc, Al/polyester and woven braid
M24643/59-04UO	LSC50SW-4	CEC-RWC-18600	Waterblocked, 24 AWG, solid bc, Al/polyester and woven braid
M24643/60-01UN	LSC5-4	CEC-RWC-18709	24 AWG, solid bc
M24643/60-02UN	LSC5W-4	CEC-RWC-18710	Waterblocked, 24 AWG, solid bc
M24643/61-01UN	LSC5P-4	CEC-RWC-19043	24 AWG, stranded tc
M24643/61-02UD	LSC5POS-4	CEC-RWC-18886	24 AWG, stranded tc, Al/polyester and woven braid
M24643/61-03UD	LSC5POSR-4	CEC-RWC-19172	26 AWG, stranded tc, Al/polyester and woven braid

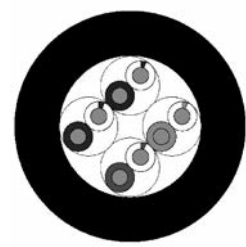
Cable Constructions



CEC-RWC-18700



CEC-RWC-18600



CEC-RWC-18709

SHF-260 Highly Flexible Wire

Product Facts

- Currently available in sizes from 24 to 1/0 AWG
- Highly flexible small bend radius allows for fitting into complex routing
- Extreme temperature resistance for a wide range of applications
- Extruded polymer notch and abrasion resistant — mechanically tough
- Chemical and fluid resistance when tested to SAE-AS-22759/41
- Vibration stability allows a long life cycle in engine compartments



TE Connectivity is pleased to announce the introduction of its new SHF-260 highly flexible wire. The need for a combination of high temperature and high performance in wire insulation has become a critical factor in today's platforms. This is especially true in large diameter power feeder applications where temperature and durability are key.

Its highly flexible characteristic allows the cable to be bent and routed in extremely tight areas with no wrinkling or cracking of the insulation. This results in being able to run shorter distances, reducing the stress on the contact, and reducing the mating and demating forces normally associated with large shell diameter circular connectors, such as MIL-C-5015 and MIL-C-83723 connectors.

Its ability to route in tight spaces may allow the user to go "up" in AWG sizes and eliminate the need to split power, where routing and bending previously prevented the user from doing so.

Applications

Typical uses include both primary and secondary power distribution aerospace, defense and marine applications where high amperage pass through is needed

Materials

Fluoropolymer based material

Standards & Specifications

TE Specification WCD3111

Application Spec SAE-AS-22759ASTM D1868FAR Part 25 - Flammability

Ordering Information

Contact TE

Thermal Properties

Temperature Rating:
-65°C to +260°C

Life Cycle:
290°C for 500 hours

Cold Bend:
-65°C for 4 hours

Thermal Shock Resistance:
Accordance with ASS22759 using an oven temperature of 260°C

Physical Properties

Weight and Dimensions:
See TE Specification Control Drawings

Insulation Elongation:
150% elongation minimum

Tensile Strength:
2000 lbf/inch² minimum

Minimum Bend Radius:
290°C for 500 hours around a mandrel having a diameter as specified in the applicable specification sheet

Wrap Test:
Accordance with ASS22759 using an oven temperature of 290°C

Fire Hazard Properties

Flammability – 60° Flame:
Exceeds test requirements

Smoke:
Smoke resistance test specified in ASS22759 using an oven temperature of 290°C

Electrical Properties

Voltage:
1000 volts (rms)

Insulation Resistance:
Minimum 50,000 Mohms/kft

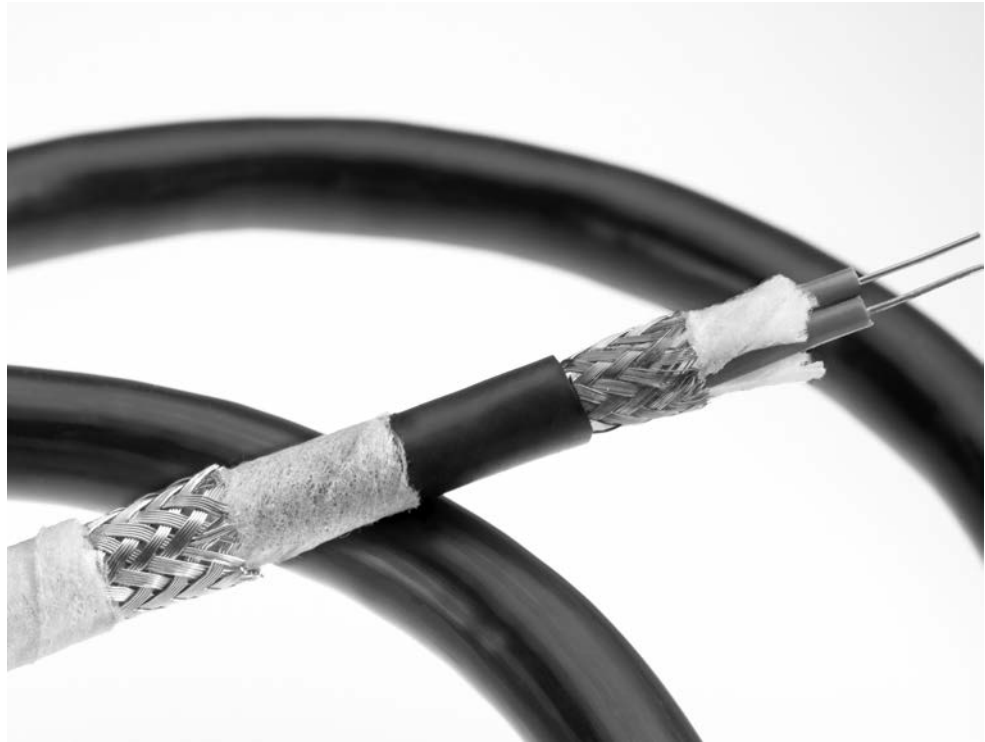
Wire Printing

UV Laser Marking:
Excellent mark contrast

Raychem MIL-DTL-24643 ZEROHAL PROFIBUS Cables

Product Facts

- MIL-DTL-24643/62 qualified
- Waterblocked and non-waterblocked constructions
- Meets water tightness requirements when tested with ASTM D1411 synthetic sea water solution
- Suitable for transmission rates up to 12 megabits per second (Mbits/S)
- Compatible with commercially available Profibus connectors



MIL-DTL-24643 has been the governing specification for low smoke, zero halogen insulated and jacketed shipboard cables used by the United States Navy and other military marine applications.

TE RAYCHEM brand ZEROHAL cables meeting the PROFIBUS standard as described in MIL-DTL-24643/62, are qualified to meet the rigorous requirements to flame, smoke emissions, halogen content and severe water-blocking requirements.

Applications

Cables are used in communications, machinery control monitoring and instrumentation for:

- Military vessels - MIL-DTL-24643/62
- Cruise ships
- Freighters
- Tankers
- Industrial Automation

Electrical

150 ohm impedance
 Transmission rates up to 12 Mbits/s
 Attenuation (dB/100m maximum)

2 MHz:	1.0 dB
4 MHz:	2.5 dB
16 MHz:	5.0 dB
100 MHz:	13.5 dB
300 MHz:	24.0 dB

Materials

Foamed polyethylene components
 Low smoke, Zerohal jacket

Standards & Specs

Raychem Specification 1200
 Raychem Specification 345 MIL-DTL-26463/62

Available in:	Americas	Europe	Asia Pacific
	■	■	■

Raychem MIL-DTL-24643 ZEROHAL PROFIBUS Cables (Continued)

Product Offering

Military Part Number	Type	TE Part Number	Description
M24643/62-01	LSPB2SD-1	5022M1809	22 AWG, bare copper, non-water blocked, shield and jacket
M24643/62-02	LSPB2SDW-1	5022W1809	22 AWG, bare copper, water blocked, shield and jacket
M24643/62-03	LSPB2SDOS-1	5022M5809	22 AWG, bare copper, non-water blocked, two shields and two jackets
M24643/62-04	LSPB2SDOSW-1	5022W0809	22 AWG, bare copper, water blocked, two shields and two jackets

Cable Constructions

5022M1809



5022M5809



5022W0809



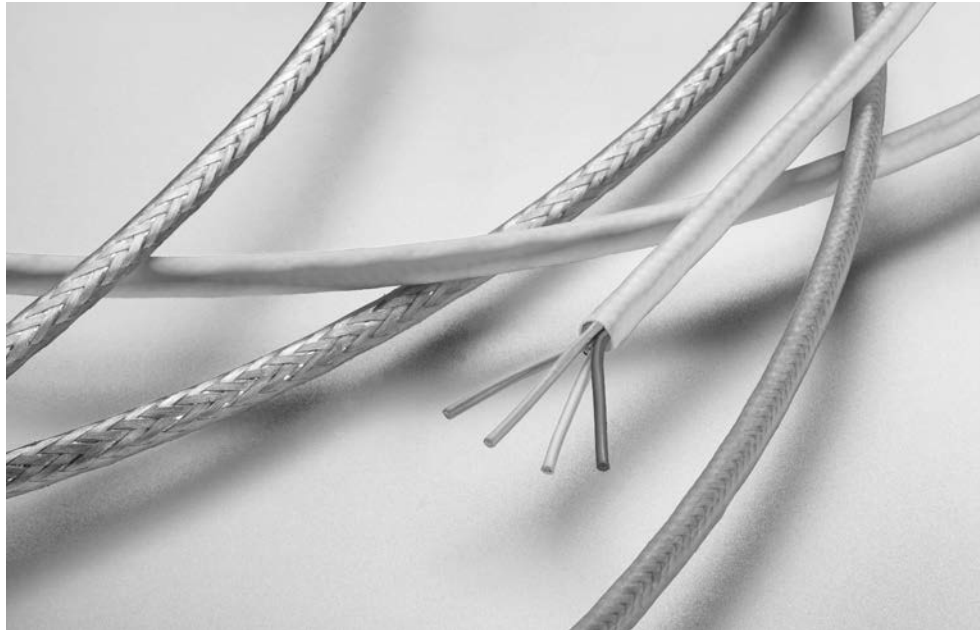
5022W1809



QUADLITE Quadraxial Cables

Product Facts

- 100 Ohm and 150 Ohm cables
- Materials rated from -65°C to +200°C [-85°F to +392°F]
- Low outgassing materials (PTFE, FEP)
- Custom design capabilities
- Proven technologies and materials
- Lightweight
- Low smoke and low toxicity
- Available in 150°C and 200°C rated construction



TE Quadlite family of lightweight, fluoropolymer cables are for use in high speed, high bandwidth applications such as 100Base-T, Gigabit Ethernet, IEEE 1394 and Fiber Channel employed in commercial avionics systems, aircraft data networks, in-flight entertainment systems and military communications.

The Quadlite cables are designed to meet the flammability requirements of FAR Part 25 and the rigorous smoke and toxicity requirements found in commercial aerospace standards such as EN3475.

Quadlite cables are to be used with the Quadrax contacts and connectors.

Applications

Cables are used in communications, control and instrumentation for:

- In-Flight Entertainment
- Satellite TV
- Flight Subsystems
- Military Communications

Materials

Dielectrics — Foamed FEP

Jacket — FEP

Standards and Specifications

TE Specification 1200

ANSI/TIA-568-B.2

IEEE 1394

ARINC 664

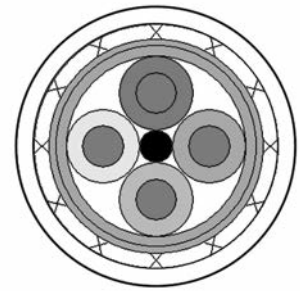
Available in:	Americas	Europe	Asia Pacific
	■	■	■

QUADLITE Quad coaxial Cables (Continued)

100 Base T Ethernet Cables
100 Ohms - 150°C

TE Part Number	CEC-RWC-18634	CEC-RWC-18664	CEC-RWC-18666
Conductor AWG Size (19 Strand)	26	24	22
Conductor Material:	SCCA	SCCA	SCC
Nom. Conductor Diameter (in.):	0.0185	0.0235	0.0295
Insulation Material:	Formed FEP	Formed FEP	Formed FEP
Nom. Insulation OD± 0.002 (in.):	0.037	0.042	0.057
Nom. Cable OD (in.):	0.145	0.154	0.195
Nom. Cable Weight (lbs/1 kft):	17.7	20.3	32.0
Shield Material:	TCC	TCC	TCC
Jacket Material:	FEP	FEP	FEP
Impedance ± 10% (Ω):	100	100	100
Temp. Rating:	150°C	150°C	150°C
Nom. Capacitance (pF/ft):	13.5	13.0	12.9
Nom. Attenuation (dB/100 m):			
1 MHz	4.0	2.2	1.6
10 MHz	10.5	6.8	5.9
100 MHz	36.0	24.8	21.0
	10 MHz 100 MHz	10 MHz 100 MHz	10 MHz 100 MHz
Min. NEXT (dB)	50 35	50 35	50 35
Min. SRL (dB)	23 16	23 16	23 16

TE Part Number	CEC-RWC-20555	CEC-RWC-20333
Conductor AWG Size (19 Strand)	26	24
Conductor Material:	SCCA	SCCA
Nom. Conductor Diameter (in.):	0.0185	0.0235
Insulation Material:	Formed FEP	Formed FEP
Nom. Insulation OD± 0.002 (in.):	0.037	0.042
Nom. Cable OD (in.):	0.144	0.153
Nom. Cable Weight (lbs/1 kft):	18.7	22.2
Shield Material:	TCC	TCC
Jacket Material:	FEP	FEP
Impedance ± 10% (Ω):	100	100
Temp. Rating:	150°C	150°C
Nom. Capacitance (pF/ft):	13.5	13.0
Nom. Attenuation (dB/100 m):		
1 MHz	4.0	2.2
10 MHz	10.5	6.8
100 MHz	36.0	24.8
	10 MHz 100 MHz	10 MHz 100 MHz
Min. NEXT (dB)	50 35	50 35
Min. SRL (dB)	23 16	23 16


100BASE-T Ethernet

QUADLITE Quad coaxial Cables (Continued)

100 Base T Ethernet Cables
100 Ohms - 200°C

TE Part Number	CEC-RWC-18658	CEC-RWC-18687	CEC-RWC-18665
Conductor AWG Size (19 Strand)	26	24	22
Conductor Material:	SCCA	SCCA	SCC
Nom. Conductor Diameter (in.):	0.0185	0.0235	0.0295
Insulation Material:	Formed FEP	Formed FEP	Formed FEP
Nom. Insulation OD± 0.002 (in.):	0.037	0.042	0.057
Nom. Cable OD (in.):	0.144	0.153	0.194
Nom. Cable Weight (lbs/1 kft):	18.7	22.2	34.3
Shield Material:	SCC	SCC	SCC
Jacket Material:	FEP	FEP	FEP
Impedance ± 10% (Ω):	100	100	100
Temp. Rating:	200°C	200°C	200°C
Nom. Capacitance (pF/ft):	13.5	13.0	12.9
Nom. Attenuation (dB/100m):			
1 MHz	4.0	2.2	1.6
10 MHz	10.5	6.8	5.9
100 MHz	36.0	24.8	21.0
	<u>10 MHz</u> <u>100 MHz</u>	<u>10 MHz</u> <u>100 MHz</u>	<u>10 MHz</u> <u>100 MHz</u>
Min. NEXT (dB)	50 35	50 35	50 35
Min. SRL (dB)	23 16	23 16	23 16

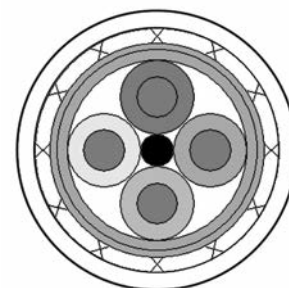
QUADLITE Quad coaxial Cables (Continued)

Fiber Channel Cables
150 Ohms - 150°C

TE Part Number	CEC-RWC-18680	CEC-RWC-18681	CEC-RWC-18682
Conductor AWG Size (19 Strand)	26	24	22
Conductor Material:	SCCA	SCCA	SCC
Nom. Conductor Diameter (in.):	0.0185	0.0235	0.0295
Insulation Material:	Formed FEP	Formed FEP	Formed FEP
Nom. Insulation OD± 0.002 (in.):	0.058	0.077	0.094
Nom. Cable OD (in.):	0.193	0.224	0.281
Nom. Cable Weight (lbs/1 kft):	23.4	38.3	57.2
Shield Material:	TCC	TCC	TCC
Jacket Material:	FEP	FEP	FEP
Impedance ± 10% (Ω):	150	150	150
Temp. Rating:	150°C	150°C	150°C
Nom. Capacitance (pF/ft):	6.0	6.0	6.0
Nom. Attenuation (dB/100m):			
531 MHz	13	11	9
1062 MHz	21	17	13

150 Ohms - 200°C

TE Part Number	CEC-RWC-18684	CEC-RWC-18685	CEC-RWC-18686
Conductor AWG Size (19 Strand)	26	24	22
Conductor Material:	SCCA	SCCA	SCC
Nom. Conductor Diameter (in.):	0.0185	0.0235	0.0295
Insulation Material:	Formed FEP	Formed FEP	Formed FEP
Nom. Insulation OD± 0.002 (in.):	0.058	0.077	0.094
Nom. Cable OD (in.):	0.192	0.247	0.284
Nom. Cable Weight (lbs/1 kft):	25.8	38.3	57.2
Shield Material:	SCC	SCC	SCC
Jacket Material:	FEP	FEP	FEP
Impedance ± 10% (Ω):	150	150	150
Temp. Rating:	200°C	200°C	200°C
Nom. Capacitance (pF/ft):	6.0	6.0	6.0
Nom. Attenuation (dB/100m):			
531 MHz	13	11	9
1062 MHz	21	17	13


Fiber Channel

QUADLITE Quad coaxial Cables (Continued)

4-Pair Cat 5E Constructions
100 Ohms - 150°C/200°C

TE Part Number	CEC-RWC-20412	CEC-RWC-21064	CEC-RWC-20638
Conductor AWG Size (19 Strand)	24	24	26 (7 strand)
Conductor Material:	SCHSCA	SCC	SCC
Nom. Conductor Diameter (in.):	0.0235	0.0235	0.019
Insulation Material:	Formed FEP	Formed FEP	Formed FEP
Nom. Insulation OD± 0.002 (in.):	0.046	0.046	0.036
Nom. Cable OD (in.):	0.279	0.249	0.204
Nom. Cable Weight (lbs/1 kft):	46.2	39.5	29.8
Shield Material:	TCC	TCC	SCC
Jacket Material:	FEP	XL-ETFE	FEP
Impedance ± 10% (Ω):	100	100	100
Temp. Rating:	150°C	150°C	200°C
Nom. Capacitance (pF/ft):	13.5	13.5	13.5
Nom. Attenuation (dB/100m):			
1 MHz	2.4	2.2	2.4
100 MHz	7.5	6.8	8.8
100 MHz	26.4	24.8	30.5
	<u>10 MHz</u> <u>100 MHz</u>	<u>10 MHz</u> <u>100 MHz</u>	<u>10 MHz</u> <u>100 MHz</u>
Min. NEXT (dB)	50 35	50 35	50 35
Min. SRL (dB)	25 19	25 19	23 16

Cat 6 Constructions
100 Ohms - 100°C/90°C

TE Part Number	CEC-RWC-20837	CEC-RWC-21088
Conductor AWG Size (19 Strand)	23	23
Conductor Material:	Bare Copper	Bare Copper
Nom. Conductor Diameter (in.):	0.021	0.021
Insulation Material:	Foamed PE	PE
Nom. Insulation OD± 0.002 (in.):	0.046	0.046
Nom. Cable OD (in.):	0.350	0.249
Nom. Cable Weight (lbs/1 kft):	52.6	39.5
Shield Material:	TCC	TCC
Jacket Material:	FDR-25	Raythane
Impedance ± 10% (Ω):	100	100
Temp. Rating:	100°C	90°C
Nom. Capacitance (pF/ft):	13.5	13.5
Nom. Attenuation (dB/100m):		
1 MHz	1.8	1.8
100 MHz	5.5	5.5
100 MHz	18.3	18.3
250 MHz	30.4	30.4
	<u>10 MHz</u> <u>250 MHz</u>	<u>10 MHz</u> <u>250 MHz</u>
Min. NEXT (dB)	70 52	70 52
Min. SRL (dB)	36 24	36 24

High Speed Copper Cable Assemblies

Product Facts

- End-to-end best performance systems solutions provider
- Quick design turnaround using in-house software
- Full electrical and environmental testing capability
- Certified test processes and equipment ensures optimal signal integrity
- Qualified assembly experts
- Complete lot traceability
- Reliability in harsh environments
- ISO 9001; AS 9100 certified



TE supplies proven technology for high bandwidth data links to customers in the aerospace, ground systems and marine industries. Military cable requirements are designed, manufactured and tested to perform reliably in harsh environments.

Proper cable assembly is critical to realizing the full potential of the cable and connector technologies. TE's lightweight military cables and connector solutions are designed to reduce size and remove weight from your application, leading to benefits that include reduced fuel consumption and increased payload capacity.

Data assemblies can be developed for the following high speed protocols:

- Military Fiber Channel
- Ethernet (Fast Ethernet, GigE, 10GigE)
- 1394b Military Firewire
- USB 3.0

and many other serial communication architectures.

Applications

Unmanned aerial vehicles (UAV), Helicopters, Fighters, Transport, Trainers, Missiles, Satellites, and Ground Vehicles

Applications include:

- Surveillance equipment, ground computing
- Communications
- Collision Avoidance, Navigation
- Cockpit Instrumentation
- Broadband Networks
- Command and Control

Electrical

Testing capabilities include:

- DWV/IR
- Characteristic Impedance
- Return Loss/VSWR
- Insertion Loss
- Crosstalk
- Attenuation
- Eye Diagrams
- etc.

Mechanical Tests Available:

- Vibration
- Mechanical Shock
- Mechanical Durability

Environmental Tests Available:

- Salt Spray
- Thermal Shock / Temperature Life
- Humidity / Fluid Immersion

Available in:

- Americas ■
- Europe ■
- Asia Pacific ■

High Speed Copper Cables

Product Facts

- Reduced engineering time
- Compatibility with numerous TE contacts and TE termination devices
- Integrated solution
- Cost savings
- Custom solutions available
- Complexity reduction for straight forward installation
- Increased bandwidth
- EMI protection
- Lightning protection
- Ruggedized to survive in harsh environments
- Reduced size and weight



Description

TE Connectivity offers a large and growing range of High Speed Copper Cables for commercial and military aerospace, as well as ground systems and marine applications. Increased usages of high speed protocol such as Ethernet, Firewire, Fiber Channel and USB have become a necessity to be able to deliver information from one point to the next.

TE's high speed copper solutions along with TE's matched impedance contacts and connectors can provide a total solution. TE's total solution can increase the performance and the signal integrity while maintaining robustness in today's Aerospace, Defense and Marine applications.

TE's expansive research and development programs

in material sciences are continually developing unique polymer solutions that will reduce weight and size while increasing robustness of our products

Applications

Military Aerospace: Situation Awareness Systems (radar); Weapons Systems (missiles); Communications (radio and intercoms)

Commercial Aerospace: In-Flight Entertainment; Glass Cockpit; In-flight Wireless

Military Ground Systems: Glass Dashboard; Integrated Computer System; Remote Weapons System; Radio and Intercom Communications; Situational Awareness (thermal imaging, vision systems);

Smart Soldier Systems: Live health monitoring; Real Time Soldier Movement; Portable computers

Materials

Conductor: Tin, Silver, Nickel or Copper

Also available in High Strength Alloys.

Electrical

Matched impedance connectors and cables

Electro-magnetic interferences protection

150-Ohm FiberChannel

100-Ohm Gigabit Ethernet

Mechanical

Small size, reduced complexity and weight

Design Flexibility

CAD for quick response

High product performance

Optimum layout

Rapid quotations

Size and weight details

Dielectric Solutions

TE has designed a new process for extruding Foamed FEP and other various jacket materials, allowing us the advantage of providing relatively uniform bubbles (void spaces) along the entire length of our cables.

This solution has a number of benefits which include increased electrical performance and integrity while maintaining mechanical robustness.

Excellent uniformity (void spaces); Excellent electrical performance; More robust product

High Speed Copper Cables (Continued)

HSC - part numbering system "high-speed conductor"

Example:

C5E - 26 B 1 2 4 - 7 1 4 - 9X

Variation Code (3-digits):

3EA	IEEE1394a	C6X	CAT6	DSP	Display Port	LVD	LVD
3EB	IEEE1394b	C7E	CAT7e	DVI	DVI	TGX	1000B-T Quad
C5E	CAT5e	C7X	CAT7	FBC	Fiber Channel	THX	100B-T Quad
C6A	CAT6a	CBS	Canbus	HDM	HDMI	UB2	USB 2.0
						UB3	USB 3.0

Conductor AWG Size (Data Pair):

Conductor Stranding (Data Pair):

A	Solid	B	7 Strand	C	19 Strand
---	-------	---	----------	---	-----------

Conductor Material (Data Pair):

1	Tin-coated copper	9	Bare copper
2	Silver-coated copper	0	Other
3	Nickel-coated copper	A	Silver-coated ultra high-strength copper alloy
4	Silver-coated high-strength copper alloy		
6	Nickel-coated high-strength copper alloy		

Dielectric Material (Data Pair):

1	Rayfoam L	5	UXL-ETFE	0	Other
2	Rayfoam H	6	XL-ETFE	L	Low Fluoride XL-ETFE
3	Rayolin F	7	Flexible XL-ETFE		
4	Modified FEP	8	Rayfoam FS		

Number of Data Pairs:

1 - 10 (designator for 10 conductor = 0)

Special Construction (P-Line = Power Line):

-	Standard	C	26 AWG (P-Line)	F	20 AWG (P-Line)	W	Waterblocked
A	30 AWG (P-Line)	D	24 AWG (P-Line)	G	18 AWG (P-Line)	X	Special construction
B	28 AWG (P-Line)	E	22 AWG (P-Line)	S	Space rated		

Shield Type:

See page 2.

Shield Material (each, when more than one shield):

1	Tin-coated copper	4	Silver-coated high-strength copper alloy
2	Silver-coated copper	U	Unshielded
3	Nickel-coated copper		

Jacket Material (each, when more than one jacket):

1	Thermorad K	8	Zerohal	M	Laser Markable FEP
3	Thermorad F & S	9	None	N	Thermorad NTFR
4	Modified FEP	0	Other	R	Raythane FR
5	UXL-ETFE	C	Raythane C	T	Thermorad O
6	Thermorad HT	F	FDR-25	W	PET wrap
7	Thermorad FL	L	Low Fluoride XL-ETFE		

Outer Jacket Color (code per MIL-STD-681, except as noted):

(For translucent colors, an "X" is added to the end of the color.

Example: 9X = Translucent White)

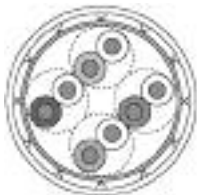
0	Black	3	Orange	6	Blue	9	White
1	Brown	4	Yellow	7	Violet	X	Clear
2	Red	5	Green	8	Gray		

Rayfoam, Rayolin, Raythane, Thermorad, and Zerohal are trademarks.

High Speed Copper Cables (Continued)

Description

Ethernet



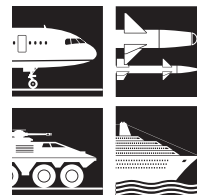
Ethernet Category Cables

Markets: Commercial and MIL Aero, Marine, Military Ground Systems

Speeds: 10 Mbits/s to 10 Gbit/s

Common Names: Quadrax, Cat5e, Cat6, Cat 6a, Cat7

Primary Usage: Generalized Data Communications



Firewire



FireWire/IEEE 1394

Markets: Aerospace Commercial and Military

Speeds: 100 Mbits/s to 3.2 Gbit/s

Primary Usage: High Data Rate Communication; Bus Independent



DVI



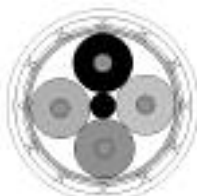
Digital Video Interface (DVI)

Markets: Marine and Ground Systems

Primary Usage: Video Displays, Uni-Directional Data Transfer



Fiber Channel



Fiber Channel

Markets: Aerospace

Speeds: 200 MB/s to 1.6 GB/s

Primary Usage: Storage Technologies and Long Distance Communications



USB-2.0

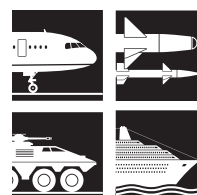


Universal Serial Bus (Hi-Speed)

Markets: Aerospace, Ground Systems, Marine, Missiles

Speeds: up to 480 Mbit/s

Primary Usage: Universal Data Transfer- requires computing system to function



USB-3.0

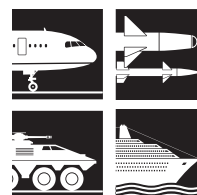


Universal Serial Bus (Super-Speed)

Markets: Aerospace, Ground Systems, Marine, Missiles

Speeds: 5 Gbit/s

Primary Usage: Universal Data Transfer- requires computing system to function



High Speed Copper Cables (Continued)

Compatible Products

The listing below is an “example” only of compatible products. For additional information, contact TE.



CeeLok FAS-T Connector



Molded Shapes



Band Straps



Solder Sleeve Termination Devices



Gigabit Ethernet Connectors



EN4165



Quadrx Contacts



Twinax Contacts

Jacket Materials

Jacket Materials	Temperature Range (°C)	Abrasion Resistance	Flexibility	Typical Industry Use
Thermorad K (Modified PVDF)	-65 to +150	Very Good	Fair	Aerospace, Ground and Marine
Thermorad F & S	-55 to +125	Good	Good	Ground Systems
Modified FEP	-65 to +200	Good	Good	Aerospace
UXL-ETFE	-65 to +150	Good	Fair	Aerospace and Ground Systems
Thermorad HT (Modified ETFE)	-65 to +200	Very Good	Fair	Aerospace
Thermorad FL	-55 to +200	Very Good	Good	Aerospace
Zerohal	-30 to +105	Good	Good	Marine
FDR-25	-40 to +105	Fair	Excellent	Ground Systems
Low Fluoride XL-ETFE	-65 to +200	Very Good	Fair	Aerospace
Laser Markable FEP	-65 to +200	Good	Good	Aerospace
Thermorad NTFR	-55 to +110	Good	Excellent	Ground Systems and Marine
Raythane FR	-65 to +90	Excellent	Excellent	Marine
Thermorad O	-55 to +125	Good	Good	Ground Systems and Marine

Custom-designed and standard Multiconductor (Multicore) Cables

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 for extended flex-life and increased flexibility
- Fire-resistance; circuit integrity (IEC60331), enhanced 950°C [1742°F, 3 hours]
- Small size, lightweight, low fire-hazard for modern high-speed vessels



Applications

TE is the leading manufacturer of Raychem custom-designed, small-size, lightweight, high-performance multi-conductor (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.

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

jacket materials to meet the requirements of demanding environments.

Established as the leading manufacturer of special purpose Raychem cables, TE 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.

Available in:

- Americas ■
- Europe ■
- Asia Pacific ■

Specifications/Approvals

Agency	Industry	Military	TE
Underwriters' Laboratories	Lloyd's Register of Shipping	Def. Stan 61-12 Pt 25	WCD series
CSA (Canadian Standards Assn.)	Det Norske Veritas	MIL-DTL-24640	
ISO9001:2000		MIL-DTL-24643	
MSV 34410-34413; 34435; 34436		VG 95218 Pts 27 and 28	
ANSI/ISO/ASQ Q9001-2000			

Multicore Cables



Design Flexibility

Components

- SPEC 44 wire and cable
- SPEC 55 wire and cable
- Type 99 wire and cable
- 100 wire and cable
- ElectroLoss FilterLine cables
- Flexible power cables
- Optical fibers
- Controlled electrical cables

Wraps and Braids

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

Jacket Materials

- FDR 25 - Fluid resistant, flexible, high temperature
- Thermorad/ Thermorad F - 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
- NT/ Thermorad NTFR - Low-temperature flexibility
- Zerohal - LFH (Low Fire Hazard)

How to Build a Multicore Cable

This guide is designed to help you identify the building blocks necessary to create a custom multicore cable design.

1. What is your application/end-use?

2. What temperature rating is required (in degrees C)?

3. How many components are needed?

4. What is each component used for (data, signal or power)?

5. What would be the size of each of the components (in AWG)?

6. Are there any electrical shielding (EMI) requirements? If so, please list specifics (ex: component shielding, cable shielding)?

7. Are there specific flexibility, mechanical, or fluid resistance requirements? If so, please list specifics and rank the order of importance.

8. Do you require special lengths?

9. Is there a customer specification involved? If so, please provide a copy.

10. Please list any timelines and annual usage estimates.

Computer Aided Design

Custom Design Capability



Applications

Every year, TE 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.

TE 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 competitor's 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. TE 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	■

Custom Shipboard Cables

Product Facts

- Waterblocked cables are available using tapes and yarns vs. silicone, which improves size and flexibility
- Low smoke, zero halogen jackets compliant with current MIL Spec applications
- Small order quantities available on most designs
- Lightweight state-of-the-art cable insulation technology
- TE design specialists work directly with customers
- RoHS products available



Applications

TE offers a full range of customized shipboard cables that can save users time, money and weight by packaging multiple cables into a single zero-halogen jacket per MIL-DTL-24640 specification.

Cables can be used for a variety of applications including control, lighting, signal and power.

Consolidation of individual cables for various applications including weapons and communications systems.

Data and power cables can be combined in the same bundle to decrease weight and size on cable runs.

Available in:

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

RayBraid Tubular Braiding

Tubular Braiding for the Electrical Screening of Wire Bundles

Product Facts

- Screening for military harnesses
- Easy removal from former
- Minimum 90% optical coverage
- Ray 101 and Ray 103 super flexible with high expansion ratios

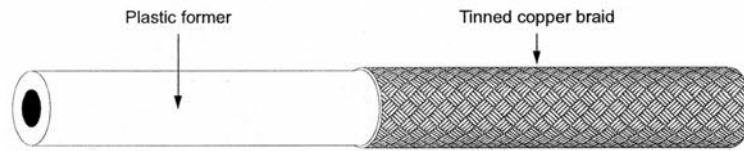
To ease the assembly of hand built harnesses, TE manufactures a range of braids for the electrical screening of wire bundles. RayBraid is supplied on a tube former which facilitates assembly and is more robust than braid supplied in flattened form.

TE also supplies connectors suitable for braid terminations.

Applications

When stored under typical conditions of less than 30°C and less than 70% relative humidity, the shelf life of the wire is effectively unlimited. Where the product contains a standard tin plated or bare copper conductor or braid there will be a progressive reduction in the solderability with increasing storage time. Under the conditions mentioned above, excellent solderability should be retained for about one year from manufacturing date, but if this is an important property, it should be checked before use. The suitability of the tin plated or bare copper conductor for use with crimped or welded termination techniques will not be affected by storage time.

Silver and nickel plated conductors are essentially unaltered by normal storage.



Types

Ray 90 (Tinned Copper Braid):

- Minimum 90% optical coverage available in 10 different sizes from 3.0 to 30.0 mm supplied diameter.

Ray 101 (Tinned Copper Braid):

- Minimum 93% maximum 100% optical coverage possess high usable expansion ratio (minimum 2:1).
- Available in a wide range of sizes to cover 2.5 to 38.0 mm diameters.
- Fully compatible with Tinel-Lock adapters for termination of the braid to associated connectors.

Ray 103 (Nickel Copper Braid):

- Minimum 93% maximum 100% optical coverage possess high usable expansion ratio (minimum 2:1).
- Available in a wide range of sizes to cover 2.5 to 38.0 mm diameters.
- Fully compatible with Tinel-Lock adapters for termination of the braid to associated connectors.

Operating Temperature Range

Ray 90:
up to 150°C [302°F]
Ray 101:
up to 150°C [302°F]
Ray 103:
above 150°C [302°F]

RayBraid Tubular Braiding (Continued)

Characteristics

Part Number	Diameter of former (mm)	Tinned Copper Wire				Cable Bundle Tolerance	
		No. of Carriers	No. of Ends per Carrier	Individual Strand Size (AWG/mm)	Minimum Coverage (%)	Maximum (mm)	Minimum (mm)
Ray 90	-3.0	16	5	36/0.13	90	3.5	2.0
	-4.0	16	7	36/0.13	90	5.0	3.0
	-5.0	24	6	36/0.13	90	6.0	4.0
	-6.0	24	7	36/0.13	90	7.0	5.0
	-10.0	24	9	34/0.16	90	12.0	7.0
	-12.5	24	10	34/0.16	90	13.0	11.0
	-15.0	24	11	32/0.20	90	18.0	13.0
	-20.0	36	7	32/0.20	90	23.0	17.0
	-25.0	36	9	30/0.25	90	28.0	22.0
	-30.0	36	9	28/0.32	90	36.0	27.0
Ray 10X	-3.0	16	10	38/0.10	93	5.0	2.5
	-4.0	24	7	36/0.13	93	7.5	3.5
	-6.0	24	9	36/0.13	93	9.5	4.5
	-7.5	24	14	36/0.13	93	14.0	7.0
	-10.0	36	12	36/0.13	93	22.0	8.0
	-12.5	36	15	36/0.13	93	24.0	11.0
	-20.0	48	16	36/0.13	93	38.0	16.0

The X in the part number shall be replaced with the plating type.

Weight

Part Number	Ray -90	Ray -101
	Weight (excluding former) kg/km (nom)	Weight (excluding former) kg/km (nom)
-3.0	13	10.3
-4.0	17	17.0
-5.0	21	—
-6.0	25	25.0
-7.5	52	31.0
-10.0	52	41.0
-12.5	65	51.0
-15.0	100	—
-20.0	165	81.0
-25.0	207	—
-30.0	310	—

Resistance

The following current ratings are to be used as general guidelines. Ratings based on an ambient temperature of 20°C and a temperature rise above ambient of 40°C.

Part Number	Ray -90			Ray 101			Ray 103
	CSA mm2	Resistance @ 20°C in ohms/km	Current (amps)	CSA mm2	Resistance @ 20°C in ohms/km	Current (amps)	Resistance @ 20°C in ohms/km
-3.0	1.0	28.0	17	1.3	17.0	18	17.3
-4.0	1.4	18.3	21	2.1	10.3	28	10.5
-5.0	1.8	13.8	25	—	—	—	—
-6.0	2.1	12.2	28	2.7	8.0	34	8.1
-7.5	—	—	—	4.3	5.2	42	5.23
-10.0	4.3	6.0	42	5.5	3.96	52	4.02
-12.5	4.8	6.1	48	6.8	3.23	57	3.28
-15.0	8.3	3.0	67	—	—	—	—
-20.0	12.8	2.2	81	9.7	2.32	69	2.35
-25.0	16.4	1.6	98	—	—	—	—
-30.0	26.0	1.0	125	—	—	—	—

Properties and Specifications

Properties and Specifications

Specifications and Approvals (Components and Jacket Materials)

Specifications UK Designation	FDR 25	Zerohal	Fluoro- elastomer	Thermorad	Rayolin	Raythane C	AFR	NT	44 Wire	55 Wire	100 Wire	99 Wire	Hytrek
US Designation	FDR 25	Zerohal	Thermorad HTF	Thermorad F		Raythane FR		Thermorad NTFR	44 Wire	55 Wire	100 Wire		
Def Stan 61-12 Part 31		X											
Def Stan 61-12 Part 25		X							X			X	
Def Stan 61-12 Part 18 type 1 (issue in effect)		X										X	
Def Stan 61-12 Part 26									X				
34435, 34436		X							X				
VG 95218 Part 20, 21, 22 and 23									X	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-DTL-24640 (PMS 400/MII-C-915)		X							X				
SAE-AS-81044/NEMA WC27500									X				
SAE-AS-22759/NEMA WC27500										X			
A014000		X										X	
O2-517		X			X				X				
MIL-DTL-24643		X											
Approvals													
Lloyds Register of Shipping		X		X		X			X			X	
Bureau Veritas	X	X	X	X		X	X	X	X	X			
UL				X		X (FR)	X		X	X			
CSA									X	X			
BWB	X			X					X	X			
VDE	X			X					X	X			
Germanischer Lloyd		X									X		
American Bureau of Shipping		X									X		

* Please check with your TE representative to ensure the product required has the correct approval.

Properties and Specifications (Continued)

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/MIL-C-915)	Navy specification covering limited fire hazard thin-wall insulated electric cables for signal, control and light power circuits. Wire to SAE-AS81044.	Zerohal
USA	MIL-DTL-24643	Navy specification covering low smoke, watertight, and non-watertight electric cables for signal, control, and light power circuits for shipboard applications.	Zerohal

Summary of Typical Cable Jacket Properties

UK Designation	US Designation	Property					Chemical Resistance			
		Temperature Range °C*	Abrasion Resistance	Flexibility	Tensile Strength (MPa)	Elongation %	Flame Resistance	Acid	Alkaline	Hydrocarbon
FDR25	FDR25	-40 to 105	Fair	Very Good	20	500	Self-ext;ing	Good	Good	Very Good
Zerohal	Zerohal UK & US	-30 to 105	Good	Good	10	200	Self-ext;ing	Good	Good	Good
Fluoroelastomer	Thermorad HTF	-20 to 200	Good	Good	12	400	Nonburning	Excellent	Excellent	Excellent
Thermorad	Thermorad F	-55 to 125	Good	Good	22	400	Self-ext;ing	Good	Good	Good
Raythane C	—	-25 to 80	Excellent	Excellent	40	500	Self-ext;ing	Fair	Fair	Excellent
—	Raythane FR	-65 to 90	Excellent	Excellent	28	500	Self-ext;ing	Fair	Fair	Excellent
NT	Thermorad NTFR	-55 to 110	Very Good	Excellent	17	300	Self-ext;ing	Good	Good	Good
Rayolin	—	-55 to 95	Very Good	Fair	19	250	Self-ext;ing	Good	Good	Good
AFR	—	-40 to 105	Excellent	Good	10	150	Self-ext;ing	Good	Good	Good
—	Thermorad O	-55 to 125	Good	Good	15	400	Self-ext;ing	Good	Good	Good
—	Thermorad 770	-55 to 175	Very Good	Good	35	500	Nonburning	Excellent	Excellent	Excellent
—	Thermorad 780	-55 to 200	Very Good	Good	24	350	Nonburning	Excellent	Excellent	Excellent
—	Thermorad 790	-55 to 250	Very Good	Good	30	350	Nonburning	Excellent	Excellent	Excellent
Modified PVDF	Thermorad K	-65 to 150	Very Good	Fair	20	400	Nonburning	Excellent	Excellent	Excellent
Modified ETFE	Thermorad HT	-65 to 200	Very Good	Fair	34	100	Self-ext;ing	Excellent	Excellent	Excellent
Modified Flexible ETFE	Thermorad FL	-55 to 200	Very Good	Excellent	20	100	Self-ext;ing	Excellent	Excellent	Excellent
—	Thermorad HTOS	-65 to 200	Very Good	Very Good	34	100	Self-ext;ing	Excellent	Excellent	Excellent
—	Thermorad HTLF	-65 to 200	Very Good	Very Good	34	100	Self-ext;ing	Excellent	Excellent	Excellent
—	Thermorad HTASLF	-65 to 200	Very Good	Very Good	34	100	Self-ext;ing	Excellent	Excellent	Excellent
—	Thermorad VPB	-65 to 200	Very Good	Very Good	23	500	Self-ext;ing	Excellent	Excellent	Excellent

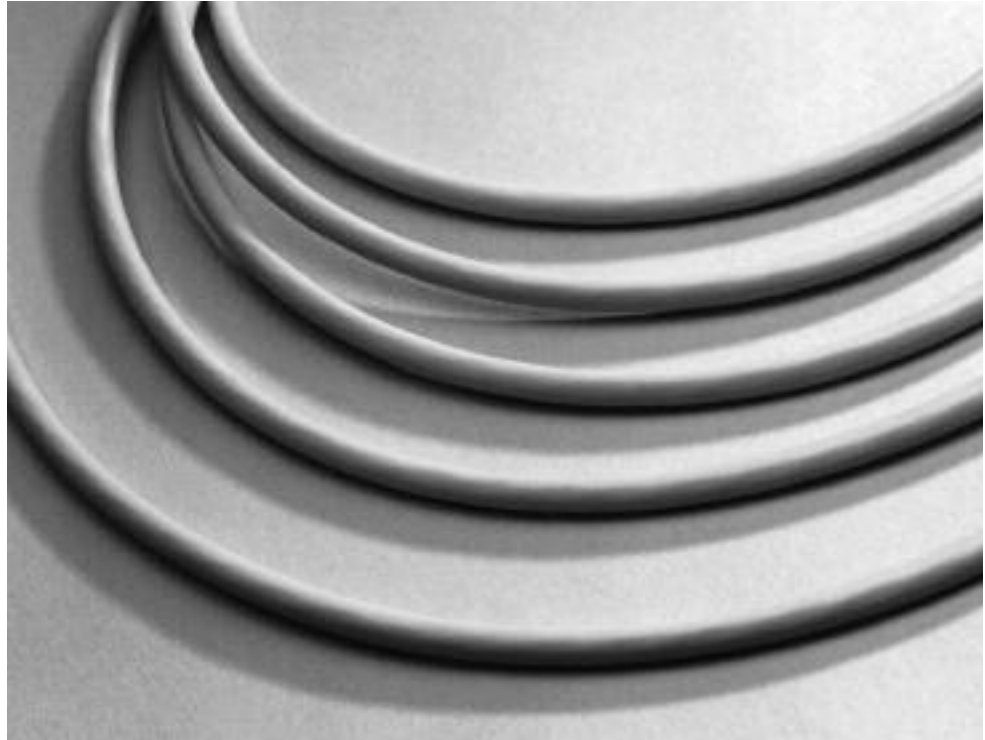
*Operating temperatures for cables are application dependent. Figures shown are for guidance only. In many cases the limits shown may be extended at both ends of the temperature range. Consult TE for guidance.

FDR25

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



Applications

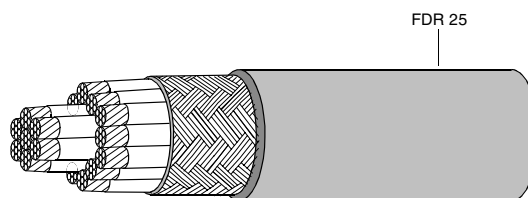
FDR 25 cable jacket was originally developed for the Leopard II main battle tank to provide an exceptional range of properties. Used in compartments exposed to hot diesel fuels and vibration, FDR 25 resists a wide range of aggressive fluids and offers excellent low temperature flexibility. These properties 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 the Raychem System 25 high performance harnessing system.

Operating Temperature Range

-40°C to 150°C
[-40°F to 302°F]

Available in:

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



FDR25 (Continued)
Typical Characteristics when Tested in Accordance with TE 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)	40 scrapes min.	
Thermal aging	Cold bend	-40°C [-40°F]	
	Endurance IEC 60216-1	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 70°C [158°F]	70	80
	Cleaning fluids 23°C [73°F]	90	95
Electrical	Deicing fluids 23°C [73°F]	90	95
	Insulation resistance 20°C [68°F] M ohm.km min.	2	
Other	45° flammability	30 s (max) afterburn 100 mm (max) burn length	
	Vertical flammability	Self extinguishing	
	Acid gas	4% HCl equivalent (max.)	

Zerohal

Low Fire Hazard Performance Wire and Cable Jacket Material

Product Facts

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



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 TE 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.

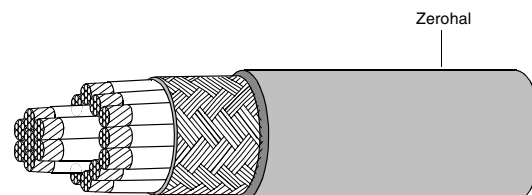
Zerohal jacket material is fully compatible with the low fire hazard harnessing system - System 100.

System

- System 100

Available in:

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



Zerohal (Continued)

Typical Characteristics when Tested in Accordance with TE Specification WCD 2015 and WC 2001

(Zerohal with Fungicide)

Mechanical	Tensile strength (MPa)	9
	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 20°C [68°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	4% weight uptake (max)
	Insulation resistance 20°C [68°F]	1
	M ohms km (min)	
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. The most common

flammability tests for a single wire specimen is the 60° flame test as defined by AS81044 and FAR Part 25. More recent evidence and thinking places significantly greater importance on large scale flammability tests, such as IEC IEEE 383 or UL1685, in which the sample consists of a tray 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. IEEE 383 or UL1685). 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 MIL-DTL-24640 Acid Gas Generation 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. Standard 61-12

Part 31 specification requirement for a cable jacket is <5.

Smoke

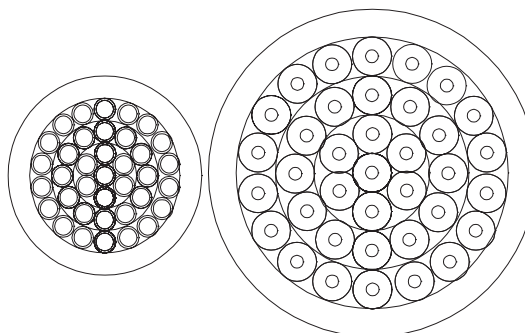
The problems of classifying flammability and corrosive gas generation equally apply to measuring smoke generation. The method accepted by most authorities involves the use of the NBS smoke chamber where optical density of the chamber's atmosphere is constantly measured during pyrolysis.

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 Def. Standard 02-711, to give a smoke index for a material and thus offers simple comparison of materials performance.

Zerohal (Continued)

Navy Applications

37 Component Cable Comparison



TE

Competition

	TE 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 shipboard 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.

TE lightweight, small size cables are giving reliable service in frigates, corvette's, fast patrol boats, hydrofoils and submarines in many major Navies.

Due to recent improvements in manufacturing, TE 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, MIL-DTL-24640/24643, 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.

Thermorad HTF/ Fluoroelastomer

High Temperature Performance Wire and Cable Jacket Material

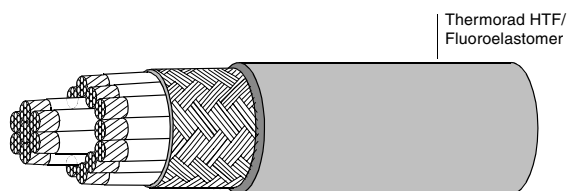
Product Facts

- 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 ■



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 TE Specification WSD 51/1637

Mechanical	Tensile strength	12 MPa	
	Elongation	400%	
	Abrasion resistance (1.6 kg load)	40 scrapes min.	
	Cold bend -25°C ± 3°C [-13°F]	No cracking	
Thermal aging	Heat age	168 h 250°C [482°F]	
	Heat shock 4 h at 300°C ± 3°C [572°F]	No cracks, drips or flowing, 6 mm total shrinkage in 300 mm	
Fluid resistance	24 h immersion	% Retention	
		Tensile strength	Elongation
	Diesel fuel 100°C [212°F]	60	60
	IRM902 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	

Thermorad/Thermorad F

General Purpose Wire and Cable Jacket Material

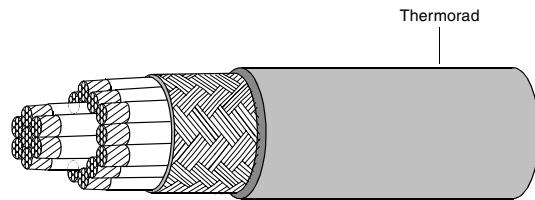
Product Facts

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



Available in:

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



Applications

Thermorad is a general purpose jacket material which is unaffected by most common chemicals and solvents. 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.

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

Mechanical	Tensile strength	22 MPa	
	Elongation	400%	
	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	72 hour immersion, 50°C [122°F]	% Retention of properties	
		Tensile strength	Elongation
		IRM 902	60
		Skydrol®	60
Electrical	Insulation resistance 20°C [68°F] M ohms km (min)	20	
Other	45° flammability	30 s (max.) afterburn 75 mm (max.) burn length	
	Acid gas	4% HCl equivalent (max.)	

Raythane, NT/Thermorad NTFR, Rayolin and AFR

Specialized Wire and Cable Jacket Material

Product Facts

Modified Polyurethanes 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

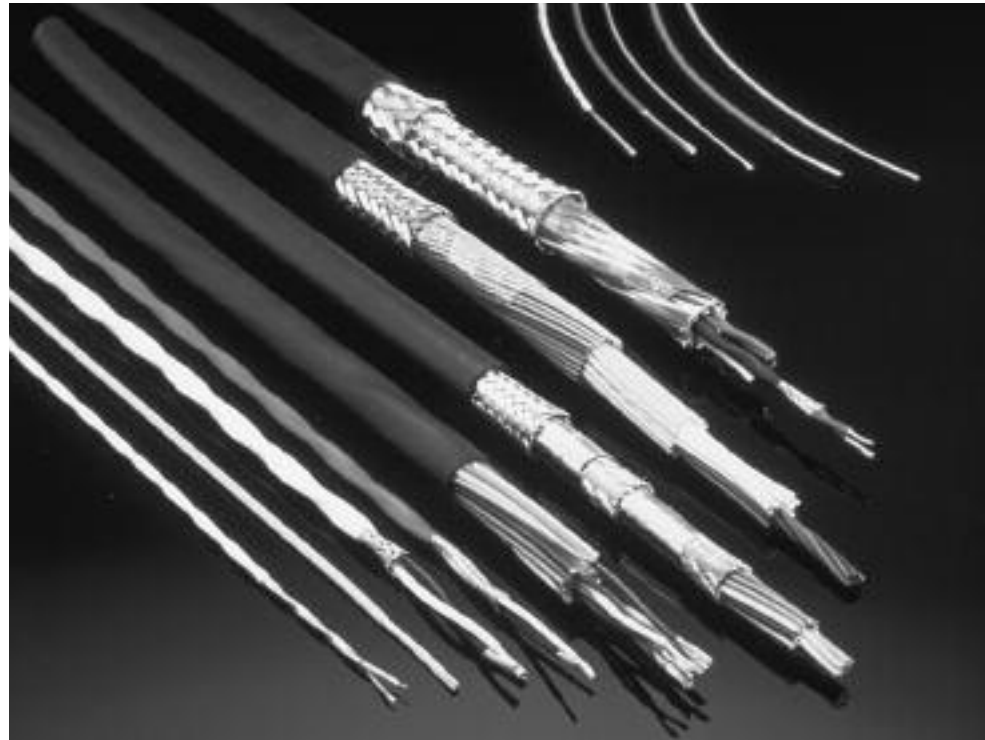
- -55°C to +95°C
[-67°F to +203°F]
- XL or U-XL are available
- Excellent long term water immersion
- Can be overmolded
- Compatible with TE under-water cable splices

NT (US designation Thermorad NTFR)

- -55°C to +90°C
[-67°F to +194°F]
- Extreme flexibility
- Highly flexible at low temperatures

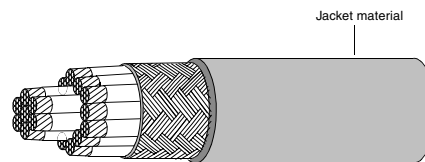
AFR

- -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, TE 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.



Jacket material

Available in:

- Americas
- Europe
- Asia Pacific

Typical Characteristics when Tested in Accordance with TE Specification WCD

		WCD51/1625 Raythane C	WCD3310 Raythane FR	WCD51/147/WCD3314 NT/Thermorad NTFR	WCD51/1601 Rayolin	WCD51/1619 AFR	SPEC 44/ ASC 15865 Thermorad K	SPEC 55 Thermorad HT
Mechanical	Tensile strength (MPa)	40	28	17	19	11	20	34
	Elongation (%)	500	500	300	250	150	400	100
	Abrasion resistance (1.6 kg load)	500 scrapes	500 scrapes	30 scrapes	300 scrapes	200 scrapes	Very good	Very good
	Cold bend	-25°C [-13°F]	-15°C [5°F]	-55°C [-67°F]	-55°C [-67°F]	-40°C [-40°F]	Pass	Pass
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]	N/A	N/A
Fluid resistance	24 h immersion Diesel fuels 50°C [122°F]	Excellent	Excellent	Good	—	Good	Excellent	Excellent
	Skydrol® 50°C [122°F]	—	—	Excellent	Excellent	Excellent	—	—
	Lubricating Oil 50°C [122°F]	—	—	—	—	—	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	Pass	Pass

NBC**Product Facts**

- **Temperature rating:**
Thermorad 770:
-55°C to 150°C
Thermorad 780:
-55°C to 175°C
Thermorad 790:
-65°C to 200°C
- **Tested in live agent test with HD, VX and TGD for interior and exterior exposure**
- **Tested in accordance with Army TOP 8-2-510 for NBC contamination survivability**
- **Tested to SC-X15111 and SC-X15112 fluid resistance requirements for commonly used military vehicle fluids**
- **Super Tropical Bleach (STB) and Decontamination Standard #2 (DS2), were used per TOP 8-2-511 to decontaminate specimens at interior (1 g/m²) and exterior (10 g/m²) exposure levels, respectively**

**Applications**

Thermorad 770/780/790 Jacket Material for applications requiring Nuclear Biological and Chemical contamination survivability (NBCCS).

Thermorad 770/780/790 is a revolutionary new fluoroelastomer material that is resistant to nuclear, chemical, and biological threats. This material has undergone testing and show resistance to levels as listed above.

Thermorad 770/780/790 cables are ideal for military ground vehicle applications, communication equipment, and any other equipment that may be at risk of exposure while in theater.

They are ideal for use in NBC decontamination stations. Thermorad 770/780/790 jackets are compatible with TE Raychem brand tubing and molded parts.

System

System 700

NBC (Continued)

Typical Characteristics when Tested in Accordance with:

		RT 770 Thermorad 770	RT 780 Thermorad 780	RT 790 Thermorad 790
Mechanical	Tensile strength (MPa)	35	24	30
	Elongation (%)	500	350	350
	Abrasion resistance	Very Good	Very Good	Very Good
	Cold bend -55°C [122°F]	Pass	Pass	Pass
Thermal aging	Endurance 250°C [482°F] for 336 hrs.	Pass	Pass	Pass
Fluid resistance	24 h immersion			
	Diesel fuels 23°C [73°F]	Excellent	Excellent	Excellent
	Lubricating oils 50°C [122°F]	Excellent	Excellent	Excellent
	Decontaminating agent 23°C [73°F]	Excellent	Excellent	Excellent
	JP-8 23°C [73°F]	Excellent	Excellent	Excellent
Electrical	Volume Resistivity (ohms-cm)	21.50E+15	6.20E+15	1.20E+16
Other	45° flammability	Pass	Pass	Pass

Electrical Shielding

Interference — Designing for the Threat



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 polyester film that provides electrostatic shielding to progressively more complex shielding that can be designed incorporating plated copper braids and Mu metal wraps.

Optimization




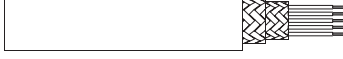

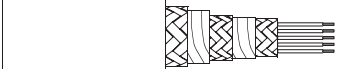
Performance of conventional braiding can be significantly improved by computer optimization. This tightly controlled

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 in:

Americas	■
Europe	■
Asia Pacific	■

Available Shields

Shield type	Construction	Typical Application
Aluminized Polyester		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

Electrical Shielding (Continued)

Measuring Shielding Efficiency

Surface Transfer Impedance (Zt)

To assess the effectiveness of a shield, TE 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 TE to design cables with guaranteed minimum Zt values for the desired operating environment.

Supershielding

EMP Hardened Cables

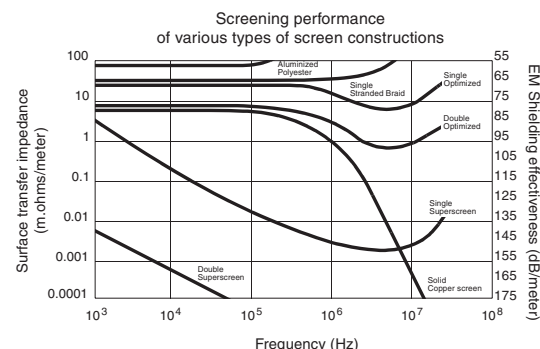
The requirements for nuclear hardened cables present the engineer with a range of problems. The waveform of the EMP is such that the majority of power is dissipated in a frequency band between 1 KHz and 5 MHz, where little protection is given by conventionally shielded cables. TE has solved this problem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

shielded cables which give shielding performance at these frequencies by incorporating materials which change the inductance of the shield and lower the transfer impedance. TE 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, TE has the capability to solve the most difficult shielding problems. Shielding of cables without degrading cable flexibility can be provided for coaxial and multi-conductor cables for all EMC and EMP conditions. To complement this range of cables, TE manufactures Raychem cable terminations and connector back fittings to give total interconnection system shielding performance.

Shielded Cables Controlling the Threat



Testing

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

Power Cables

Product Facts

- Choice of jacket materials
- -65°C to +260°C
[-85°F to +500°F]
- Size and weight savings
- Excellent flexibility
- Resistance to solvents and chemicals
- Corona resistance
- Increased flexibility in installation
- Arc-resistance of materials



Each power cable offers particular advantages for specific applications and 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.

Applications

TE 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. Five 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 TE specification WCD 2015.

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

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 TE specification WCD 2002. (US Alternative Type 10603)

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 TE Specification WSD 1265. (US Alternative Type 2HPC06XT and 2HPC20XT)

Type 80 Flexible Light Weight Aluminum Power Feeders are designed with a dual wall flexible ETFE ($\pm 175^\circ\text{C}$) insulation based system to allow the cable to be bent and routed in extremely tight areas with no wrinkling or cracking of the insulation. The design has been tested to verify

that it meets key aerospace industry requirements of flexibility, corona resistance and wrinkling in high voltage applications. TE also has the facilities to test corona resistance or production wire and cable at 400 Hz and various altitudes. (Contact TE for more information)

Type Superflex is a 260°C rated fluoropolymer insulation based system. The need for a combination of high temperature and high performance in wire insulation has become a critical factor in today's platforms. This is especially true in large diameter power feeder applications where temperature and durability are key. TE new product line offering comes rated at 200°C for 10 K hours. (Contact TE for more information)

Available in:

Americas	■
Europe	■
Asia Pacific	■

Power Cables (Continued)

Specifications/Approvals*

Series	Military	TE
TR	—	WCD 2003, WSD51/1602
ZHI	Def. Standard 61-12 Part 31 (jacket material)	WSD 2015
FTR	BWB VG 95218 Types G, H, and K	WSD 2002
AFR	—	WCD 2011, WSD51/1619
ZHPCG	—	WSD 1265
80	—	SPEC 80
Superflex	—	WCD 3111

*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 Nom. Dia.	IEC Class 6 Nom. Dia.	
1.5	1.49 [.05]	1.53 [.06]	13.20 [4.02]
2.5	1.90 [.07]	2.40 [.09]	7.82 [2.38]
4.0	2.49 [.10]	2.90 [.11]	4.85 [1.48]
6.0	3.00 [.12]	3.60 [.14]	3.23 [0.98]
10.0	4.60 [.18]	4.55 [.18]	1.88 [0.57]
16.0	5.70 [.22]	5.50 [.22]	1.19 [0.36]
25.0	7.10 [.28]	7.30 [.29]	0.78 [0.24]
35.0	8.50 [.33]	8.55 [.34]	0.55 [0.17]
50.0	10.30 [.41]	10.15 [.40]	0.39 [0.12]
70.0	12.40 [.49]	12.00 [.47]	0.27 [0.08]
95.0	14.50 [.57]	14.05 [.55]	0.20 [0.06]
120.0	16.00 [.63]	16.30 [.64]	0.15 [0.05]
150.0	18.00 [.71]	17.40 [.68]	0.13 [0.04]
185.0	20.00 [.79]	20.00 [.79]	0.10 [0.030]
240.0	23.00 [.91]	—	0.08 [0.024]
300.0	26.00 [1.0]	—	0.06 [0.018]
400.0	30.00 [1.2]	—	0.05 [0.015]

*For Type 80 and Superflex, contact TE for conductor details.

Materials Performance Summary

Material	Tensile Strength N/mm ² typical	Abrasion Resistance	Cut Through	Temperature Rating °C 10000 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	9	Good	Good	115	Black
80	-21	Very Good	Very Good	175	White
Superflex	-14	Very Good	Very Good	260	White

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

Power Cables (Continued)

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]	72.0 [48.4]
6.0	-6	5.2 [.20]	73.0 [48.9]	-6	6.3 [.25]	95.0 [63.8]
10.0	-10	6.2 [.24]	117.0 [78.4]	-10	7.5 [.29]	151.0 [101.5]
16.0	-16	7.4 [.29]	182.0 [121.9]	-16	8.8 [.35]	228.0 [153.2]
25.0	-25	9.3 [.37]	274.0 [183.6]	-25	10.7 [.42]	335.0 [225.1]
35.0	-35	10.6 [.42]	383.0 [256.6]	-35	12.1 [.48]	463.0 [311.1]
50.0	-50	12.5 [.49]	542.0 [363.1]	-50	14.0 [.55]	631.0 [424.0]
70.0	-70	14.6 [.57]	765.0 [512.6]	-70	16.2 [.64]	878.0 [589.9]
95.0	-95	17.0 [.67]	1020.0 [683.4]	-95	18.8 [.74]	1170.0 [786.1]
120.0	—	—	—	-120	21.3 [.84]	1481.0 [995.1]

Table 2. Nominal Diameters and Maximum Weights

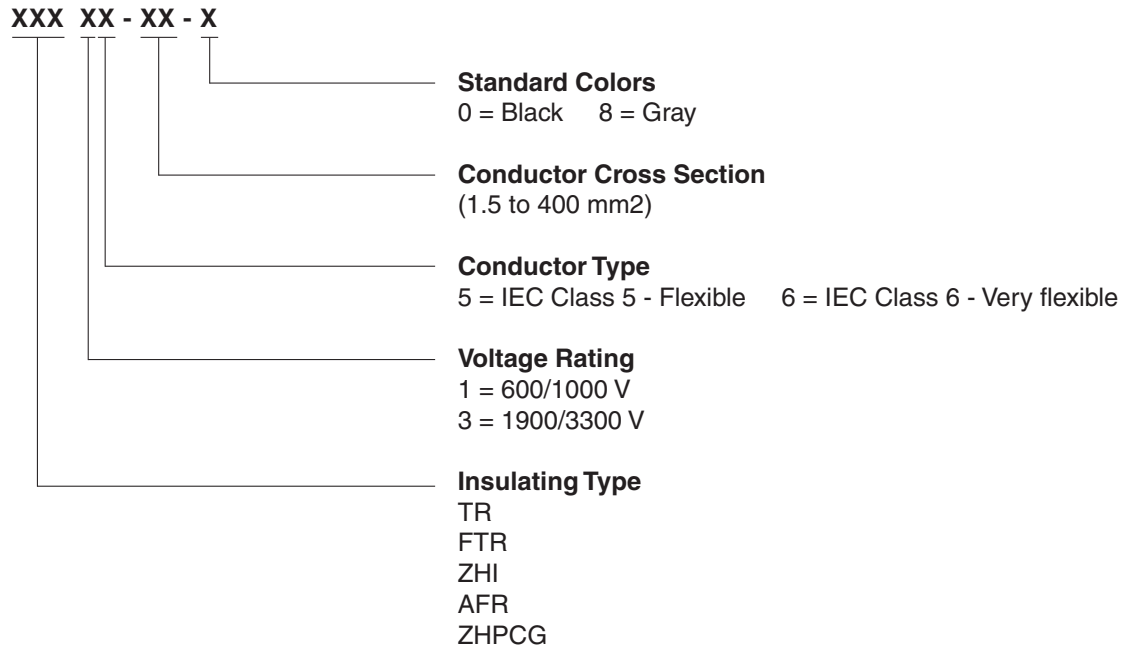
Conductor Size (mm ²)	ZHI 15			AFR 35		
	Part No.	Nom. OD in mm (in)	Max. Weight in kg/km (lb/1000 ft)	Part No.	Nom. OD in mm (in)	Max. Weight in kg/km (lb/1000 ft)
1.5	ZHI 15 -1.5	4.09 [.16]	33.5 [22.4]	AFR 35-1.5	2.7 [.11]	21.6 [14.5]
2.5	-2.5	4.69 [.18]	48.8 [32.7]	-2.5	3.7 [.15]	38.6 [25.9]
4.0	-4	5.49 [.22]	72.1 [48.3]	-4	4.7 [.18]	61.1 [41.1]
6.0	-6	6.16 [.24]	99.8 [66.9]	-6	5.6 [.22]	90.1 [60.5]
10.0	-10	8.20 [.32]	159.0 [106.5]	-10	7.0 [.28]	153.5 [103.1]
16.0	-16	9.30 [.37]	223.0 [149.4]	-16	8.1 [.32]	211.2 [141.9]
25.0	-25	10.90 [.43]	331.0 [221.8]	-25	10.4 [.41]	336.1 [225.8]
35.0	-35	12.30 [.48]	448.0 [300.2]	-35	11.6 [.46]	455.4 [305.7]
50.0	-50	14.70 [.58]	631.0 [422.8]	-50	13.7 [.54]	638.3 [428.9]
70.0	-70	16.80 [.66]	852.0 [570.8]	-70	16.0 [.63]	834.9 [561.0]
95.0	-95	19.10 [.75]	1108.0 [742.4]	-95	18.3 [.72]	1148.0 [771.4]
120.0	-120	21.00 [.83]	1438.0 [963.5]	-120	20.4 [.80]	1501.9 [1009.1]
150.0	-150	23.00 [.91]	1748.0 [1171.2]	-150	22.6 [.89]	1834.0 [1233.0]
185.0	-185	25.60 [1.01]	2088.0 [1399.0]	-185	24.8 [.98]	2177.0 [1463.0]
240.0	-240	28.60 [1.13]	2705.0 [1812.4]	-240	27.8 [1.10]	2817.0 [1892.0]
300.0	-300	32.00 [1.26]	3363.0 [2253.2]	-300	32.0 [1.20]	3579.0 [2405.0]
400.0	-400	36.40 [1.43]	4396.0 [2945.3]	-400	36.0 [1.40]	4636.0 [3115.0]

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]	37.9 [25.5]
2.5	-2.5	4.27 [.17]	45.0 [30.2]	-2.5	5.07 [.20]	52.9 [35.5]
4.0	-4	4.64 [.18]	60.0 [40.3]	-4	5.66 [.22]	72.7 [48.9]
6.0	-6	5.31 [.21]	85.0 [57.1]	-6	6.15 [.24]	96.7 [65.0]
10.0	-10	6.53 [.26]	135.0 [90.7]	-10	7.33 [.29]	141.0 [94.7]
16.0	-16	8.03 [.32]	195.0 [131.0]	-16	8.83 [.35]	214.0 [143.8]
25.0	-25	9.70 [.38]	300.0 [201.6]	-25	10.50 [.41]	316.0 [212.3]
35.0	-35	11.30 [.44]	443.0 [297.7]	-35	11.70 [.46]	425.0 [285.6]
50.0	-50	13.50 [.53]	623.0 [418.6]	-50	13.48 [.53]	582.0 [391.0]
70.0	-70	15.60 [.61]	847.0 [569.1]	-70	15.33 [.60]	802.0 [538.9]
95.0	-95	18.10 [.71]	1119.0 [751.9]	-95	17.93 [.71]	1051.0 [706.2]
120.0	-120	19.80 [.78]	1445.0 [970.9]	-120	19.80 [.78]	1308.0 [878.8]
150.0	-150	22.00 [.87]	1775.0 [1192.7]	-150	21.44 [.84]	1601.0 [1075.7]
185.0	-185	24.40 [.96]	2115.0 [1421.2]	-184	23.28 [.92]	1966.0 [1321.0]
240.0	-240	27.80 [1.09]	2762.0 [1856.0]	-240	27.33 [1.08]	2542.0 [1708.0]
300.0	-300	31.20 [1.23]	3452.0 [2320.0]	-300	32.50 [1.28]	3568.0 [2397.3]
400.0	-400	35.20 [1.39]	4474.0 [3006.4]	-400	37.00 [1.46]	4652.0 [3125.7]

Power Cables (Continued)

Part Numbering System



*For Type 80 and Superflex, contact TE for conductor details.

Part Numbering System is a cross reference only and not meant for part creation.