



Military Cable



General Cable Military Shipboard Cable

General Cable's engineered military qualified wire and cable has a long and distinguished record of involvement in high-priority defense programs. Spanning all branches of the Armed Forces, our cables continue to provide the "ultimate in protection" for optical fiber signal and network communications cabling solutions.

As a long-term supplier to the military, General Cable has a strong tradition of dedicated leadership in the integration of research, design, engineering and manufacturing of generation after generation of MIL Spec cables.

With quality programs and certifications that include ISO 9001:2008, MIL-STD-790, MIL-I-45208, MIL-STD-45662, ISO 17025 for calibration services, and second party lab testing certification to IEC/ISO 17025 from UL and CSA, General Cable strives to provide value through innovation and product quality.

From network communications and signal low-smoke, zero-halogen fiber optic cables designed in accordance with M24643 to blown optical fiber systems qualified to M85045 and M49291, General Cable offers a wide selection of fiber optic solutions for military, shipboard and specialty applications.

M85045F Military Specification Low-Smoke, Zero-Halogen Shipboard Fiber Optic Cables

Fiber optic cables have replaced copper backbone and interconnect cables in U.S. Navy shipboard communications networks because of escalating demand for security, information integrity and increased bandwidth requirements. To further expand the cable solutions for U.S. Naval Vessels, the same jacketing systems that had been successfully utilized for copper cables have been incorporated into fiber optic cables.

A low-smoke, zero-halogen (LSZH) thermoset jacketing system was introduced under M85045F (previously M85045E). This approach ensured that fiber optic cables would not only maintain, but improve upon the overall system integrity previously achieved with copper control and signal/data cables. M85045F has made qualified fiber optic cable available to the U.S. Navy by setting the standard for this new generation of cables with performance capabilities never before accomplished. General Cable was, and remains to be an integral military partner in the development, qualification and manufacture of the various fiber optic cables described in M85045F. We take great pride in our participation in this significant technological accomplishment. General Cable's fiber optic cables meet the most stringent mission-critical demands with militarized LSZH designs that are suitable for data transmission and communication applications aboard any U.S. Navy platform — above or below the sea.

M85045F Military Specification

Low-Smoke, Zero-Halogen Shipboard Fiber Optic Cables

(cont'd)

M85045F CABLE, FIBER OPTIC, WATERTIGHT, LOW-SMOKE, ZERO-HALOGEN

- M85045/16 One Fiber, Thermoplastic, Multimode or Singlemode, Watertight, Low-Smoke
- M85045/17 Eight Fibers, Thermoset, Multimode or Singlemode, Watertight, Low-Smoke
- M85045/18 Four Fibers, Thermoset, Multimode or Singlemode, Watertight, Low-Smoke
- M85045/20 Thirty Six Fibers, Thermoset, Multimode or Singlemode, Watertight, Low-Smoke
- M85045/21 Eight Fiber, Outboard, Multimode or Singlemode, Watertight, Low-Smoke
- M85045/22 Eighteen Fibers, Thermoplastic, Multimode or Singlemode, Watertight, Low-Smoke
- M85045/23 Eighteen Fibers, Outboard, Multimode or Singlemode, Watertight, Low-Smoke
- M85045/24 Ninety Fibers, Thermoset, Multimode or Singlemode, Watertight, Low-Smoke

M85045F & M49291C Military Specifications

Blolite[®] Blown Optical Fiber Technology

General Cable was the first fiber manufacturer to become a Qualified Parts Listed (QPL) supplier of a militarized version of blown optical fiber technology (BOFT) in September of 2001.

General Cable's Blolite[®] blown optical fiber technology was first installed on the aircraft carrier USS Harry Truman in 1997. Early proof of successful use of this technology and its future-proof capabilities, for which it was designed, resulted in the formal development and qualification of the technology for the U.S. Navy. Expanding requirements for the use of optical fiber applications on U.S. Navy vessels has resulted in an increased use of General Cable's Blolite[®] high-performance technology that is the preferred solution which offers the only real future-proof infrastructure solution.

Key developments in military shipboard fiber optic technology have been the digitization of command, control and communication systems over a common infrastructure. This convergence has enabled significant savings in space and weight as well as greatly improved system functionality and damage tolerance. Blown optical fiber technology has furthered these advances by adding opportunities for cost savings, easy upgradeability and design flexibility.

General Cable's Blolite[®] blown optical fiber solution has proven to be **the SOLUTION** for the U.S. Navy fleet.

M85045F & M49291C Military Specifications Blolite[®] Blown Optical Fiber Technology (cont'd)

M85045F CABLE, BLOWN OPTICAL FIBER, LOW-SMOKE, ZERO HALOGEN

- M85045/25 Seven 8mm Tubes, Thermoset, Blown Optical Fiber
- M85045/26 One 8mm Tube, Thermoset, Blown Optical Fiber

M49291C FIBER, OPTICAL

- M49291/6-05 Multimode, 500µm, Blown Optical Fiber
- M49291/7-02 Singlemode, 500µm, Blown Optical Fiber

BLOWN OPTICAL FIBER ACCESSORIES

- AA-59731-U-8E — 8mm Tube Union
- Tube Union — 5mm
- AA-59731-T-8E — 8mm Tube (Small Bore) Tee
- Tube (Small Bore) Tee — 5mm
- AA-59731-EC-8E — 8mm Tube End Cap
- Tube End Cap — 5mm
- AA-59728-TFP-8 — 8mm Tube Fitting Plug
- Tube Fitting Plug — 5mm
- AA-59730-TTP-2 — Tapered Tube Plug (2 - 6 fibers)
- AA-59730-TTP-3 — Tapered Tube Plug (8 - 12 fibers)
- Tube Clips (TM-08) SMC
- Tube Cutter
- Tube Cutter Replacement Blades
- Tube End Caps (temporary) — 8mm
- Tube End Caps (temporary) — 5mm
- Reducing Tube Straight Coupler — 8mm to 5mm

BLOLITE is a registered trademark of Brand-Rex Limited and is used under license.

Navy Shipboard Communications Cables

Still in a class by itself, General Cable continues to meet the highest performance standards with a qualified Category 5e Naval Shipboard data communications cable. ShipLAN[®] Category 5e cable and patch cords combines high-performing electrical characteristics with low-toxicity, low-smoke, zero-halogen, and flame-retardant properties necessary for shipboard environments.

General Cable's ShipLAN[®] Category 5e cable and patch cords are constructed with a proprietary thermoset jacket system that provides flexibility for ease of installation and stripability for quicker preparation and termination time.

ShipLAN[®] — engineered to perform well into the future.

M24643 COPPER COMMUNICATIONS CABLE – THERMOSET, LOW-SMOKE, ZERO-HALOGEN

- M24643/59 – CAT 5e Non-Watertight, Shielded, Low-Smoke, Zero-Halogen Thermoset Cable
- M24643/61 – CAT 5e Non-Watertight, Shielded, Low-Smoke, Zero-Halogen Thermoset Patch Cable

Power Cable for Cold Ironing

When it comes to providing your at-berth vessels with safe, reliable shore-based power that maintains essential services and allows engines to be turned off to meet emission reduction regulations, look no further than our Shore2Ship[™] power cables.

Specifically designed and approved to U.S. Navy OPNAVINST 11310.3B, our Shore2Ship power cable is engineered to withstand the severe environmental conditions at naval ports and piers around the world, including exposure to sea water and direct sunlight, continuous motion of the ship, and repeated flexing of a portable power system.

POWER CABLE FOR COLD IRONING

- Shore2Ship[™] THOF-500E – Power Cable for Cold Ironing
- Shore2Ship[™] OPNAVINST 11310.3B – Power Cable for the U.S. Navy

Military Shipboard Cables Catalog

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- **Shore2Ship™ OPNAVINST 11310.3B** – Power Cable for the U.S. Navy

Section 2: M85045F & M49291C Military Shipboard Fiber Optic Cables and Accessories

M85045F CABLE, FIBER OPTIC, WATERTIGHT, LOW-SMOKE, ZERO-HALOGEN

- **M85045/16** One Fiber, Thermoplastic, Multimode or Singlemode, Watertight, Low- Smoke
- **M85045/17** Eight Fibers, Thermoset, Multimode or Singlemode, Watertight, Low-Smoke
- **M85045/18** Four Fibers, Thermoset, Multimode or Singlemode, Watertight, Low-Smoke
- **M85045/20** Thirty Six Fibers, Thermoset, Multimode or Singlemode, Watertight, Low-Smoke
- **M85045/21** Eight Fiber, Outboard, Multimode or Singlemode, Watertight, Low-Smoke
- **M85045/22** Eighteen Fibers, Thermoplastic, Multimode or Singlemode, Watertight, Low-Smoke
- **M85045/23** Eighteen Fibers, Outboard, Multimode or Singlemode, Watertight, Low-Smoke
- **M85045/24** Ninety Fibers, Thermoset, Multimode or Singlemode, Watertight, Low-Smoke
- **M85045/25** Seven 8mm Tubes, Thermoset, Blown Optical Fiber
- **M85045/26** One 8mm Tube, Thermoset, Blown Optical Fiber

Section 2: M85045F & M49291C Military Shipboard Fiber Optic Cables and Accessories (Cont'd)

M49291C FIBER, OPTICAL

- **M49291/6-05** Multimode, 500µm, Blown Optical Fiber
- **M49291/7-02** Singlemode, 500µm, Blown Optical Fiber

BLOWN OPTICAL FIBER ACCESSORIES

- **AA-59731-U-8E** — 8mm Tube Union
- **Tube Union** — 5mm
- **AA-59731-T-8E** — 8mm Tube (Small Bore) Tee
- **Tube (Small Bore) Tee** — 5mm
- **AA-59731-EC-8E** — 8mm Tube End Cap
- **Tube End Cap** — 5mm
- **AA-59728-TFP-8** — 8mm Tube Fitting Plug
- **Tube Fitting Plug** — 5mm
- **AA-59730-TTP-2** — Tapered Tube Plug (2 - 6 fibers)
- **AA-59730-TTP-3** — Tapered Tube Plug (8 - 12 fibers)
- **Tube Clips (TM-08) SMC**
- **Tube Cutter**
- **Tube Cutter Replacement Blades**
- **Tube End Caps (temporary)** — 8mm
- **Tube End Caps (temporary)** — 5mm
- **Reducing Tube Straight Coupler** — 8mm to 5mm

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Section 3: ShipLAN[®] — Navy Shipboard Communications Cables

M24643 COPPER COMMUNICATIONS CABLE – THERMOSET, LOW-SMOKE, ZERO-HALOGEN

- **M24643/59** – CAT5e Non-Watertight, Shielded, Low-Smoke, Zero-Halogen Thermoset Cable
- **M24643/61** – CAT5e Non-Watertight, Shielded, Low-Smoke, Zero-Halogen Thermoset Patch Cable
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Shore2Ship™ THOF-E

Shore-to-Ship Power Cable for Cold Ironing

With global warming and concerns for environmental degradation, new maritime regulations across the globe are calling for Cold Ironing – and General Cable is answering the call.

When a ship is left running at berth to maintain essential services, emissions can be equivalent to up to 400 cars on the road per day. That is why new at-berth regulations require container, passenger and cargo ships to shut off their engines and use shore-based power or face fines.

Following early regulations for the prevention of vessel air pollution from the International Maritime Organization (IMO), the California Environmental Protection Agency's Air Resources Board enacted the "At-Berth Ocean-Going Vessels Regulation" containing a clearly defined compliance. As of January 1, 2014, vessels docked in Long Beach, Los Angeles, Oakland, San Diego, San Francisco and Hueneme will be required to shut off their engines and use shore power for 50% of their visits. That compliance increases to 80% by 2020. From New York to Japan, Hong Kong and Rotterdam, ports around the world are rapidly following suit.

Cold Ironing, also referred to as Shore-to-Ship Power, is the preferred solution to these regulations. It provides vessels at berth with an on-shore power source to **maintain essential services while turning their engines off completely.**

The cable and connectors used for cold ironing are highly specialized to withstand the severe environmental conditions of

this application — exposure to sea water and direct sunlight, continuous motion, and the repeated flexing of a portable power system— among others.

General Cable's Shore2Ship™ THOF-E cable is designed with all of these challenges in mind. In every market we serve, General Cable is known as a leader in delivering solutions that provide maximum performance, reliability and service life. With a focus on innovation and continuous improvement, General Cable has applied its engineering expertise to the development of **Shore2Ship™ THOF-E** cables incorporating:

- ⚓ A physically tough jacket design to resist degradation from abrasion and tear
- ⚓ A 2-layer Chlorinated Polyethylene (CPE) jacket extruded under pressure to fill the cable's interstices for water resistance
- ⚓ Maximum flexibility to facilitate repeated use without causing harm to the cable core

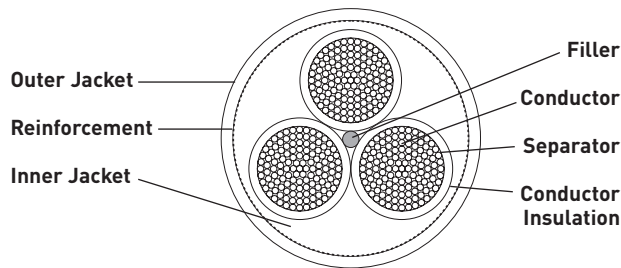
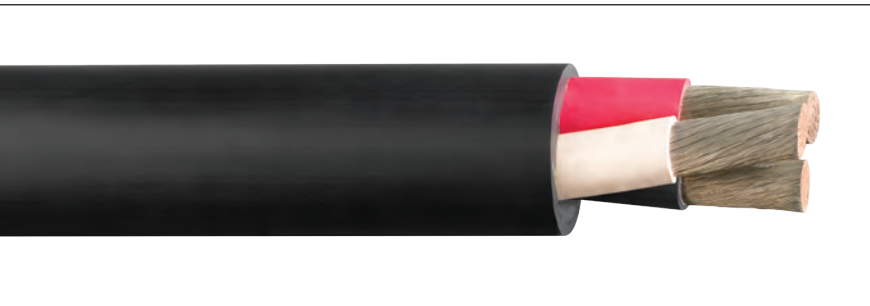


Photos feature cable on Cochran Marine's Cable Positioning Device, used to serve shore power

Shore2Ship™ Commercial THOF-E

Enhanced THOF-500 Shore-to-Ship Power Cable

600 V/2000 V, Three Conductor, 90°C



Product Construction:

Conductor:

- 500 kcmil tinned, coated copper, bunched wires, rope-lay-stranded per ASTM B33 and ASTM B172
- Class I per ASTM B172 – 1221 wires (37 bunches of 33 – .0201")
- Nominal Diameter: 0.895"

Separator:

- 2 mil white Mylar separator tape pulled longitudinally over the conductor

Insulation:

- Ethylene Propylene Rubber (EPR)
- 0.095" min average thickness
- Color-coded: black, white, red

Inner Jacket:

- Heavy-duty black Chlorinated Polyethylene (CPE) – approximate thickness 0.109"

Reinforcement:

- Two reverse/open wraps of Polypropylene filament

Outer Jacket:

- Extra-heavy-duty black Chlorinated Polyethylene (CPE) – approximate thickness 0.140"

Print:

- GENERAL CABLE® 3/C 500 KCMIL 600/2000 V ENHANCED THOF-E SHORE2SHIP™ POWER CABLE

Option:

- Other jacket colors available upon request

Features:

- Rated 90 °C
- Two-layer, extra-heavy-duty jacket reinforced for maximum protection from mechanical damage – the cause of most portable cable failures
- Pressure extruded jacket for water resistance
- Mold-cured jacket for maximum durability
- Flexible for easy handling and continuous reeling
- Flame- and sunlight-resistant

Compliances:

Industry:

- Meet requirements of RHH/RHW per UL 44
- Jacket duty rating and physical and aging tests for jacket and insulation per ICEA S-75-381

Packaging:

- Bulk lengths

CATALOG NUMBER	NO. OF COND.	COND. SIZE	MINIMUM AVG. INSULATION THICKNESS	NOMINAL JACKET THICKNESS	NOMINAL CABLE O.D.	NOMINAL CABLE WEIGHT	COPPER WEIGHT
		kcmil (STRAND)	INCHES (mm)	INCHES (mm)		INCHES (mm)	LBS/1000 FT (kg/km)
600 V/2000 V, THREE CONDUCTOR, 500 KCMIL, ENHANCED THOF-500							
13333.036500	3	500 (1221/24)	0.095 (2.41)	0.250 (6.35)	2.88 (73.15)	8147 (12124)	4761 (7085)



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Shore2Ship™ OPNAVINST 11310.3B

Shore-to-Ship Power Cable for the U.S. NAVY

With global warming and concerns for environmental degradation, naval ports around the world are providing means for Cold Ironing – and so is General Cable.

Cold Ironing, also referred to as Shore-to-Ship Power, is the preferred solution to emissions reduction regulations, providing naval vessels at berth with an on-shore power source to **maintain essential services while turning their engines off completely**. When it comes to the circuits needed to provide on-shore power, critical components such as cables and connectors must be designed and engineered for safe and reliable operation in challenging environments. General Cable's **Shore2Ship™** cable meets the stringent standards of OPNAVINST 11310.3B.

General Cable's Shore2Ship™ cables for cold ironing are highly specialized to withstand the severe environmental conditions of naval ports and piers around the world—exposure to sea water and direct sunlight, continuous motion of the ship, and the repeated flexing of a portable power system—among others.

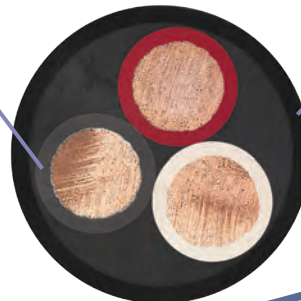
Specifically designed in accordance with OPNAVINST 11310.3B, General Cable's Shore2Ship™ power cable for cold ironing provides the U.S. Navy with the features and benefits shown in the adjacent illustration.



Use of military imagery does not imply or constitute endorsement of General Cable, its products, or services by the U.S. Department of Defense. Photography credits: U.S. Department of Defense.

Optimized cable construction enables safe, durable and reliable service

Maximum conductor flexibility to facilitate repeated use without causing harm to the cable core

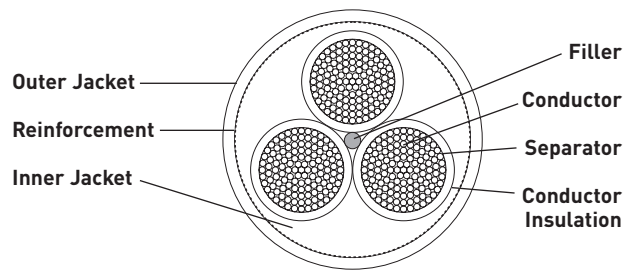
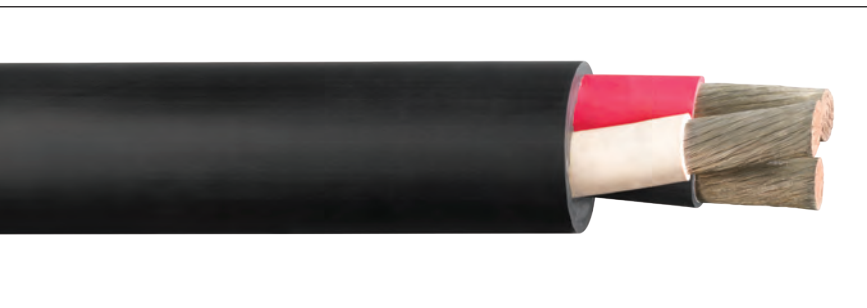


Reinforced, extra-heavy-duty dual layer jacket protects against environmental pier conditions

Shore2Ship™ OPNAVINST 11310.3B

Enhanced THOF-500 Shore-to-Ship Power Cable

600 V, Three Conductor, Non-Watertight, 90°C



Product Construction:

Conductor:

- 500 kcmil tinned copper
- Class I per ASTM B172 - 1221 wires (37 bunches of 33, unidirectional layup - .0201" wires)
- Nominal Diameter: 0.895"

Separator:

- 2 mil white Mylar separator tape pulled longitudinally over the conductor

Conductor Insulation:

- UV-Resistant Ethylene Propylene Rubber (EPR) - 90 mils (min avg)
- Phase ID: black, white, red

Filler:

- Rubber filler in the center of the cable

Inner Jacket:

- Heavy-duty black Chlorinated Polyethylene (CPE) - approximately 100 mils

Reinforcement:

- Two reverse/open wraps of Polypropylene filament

Outer Jacket:

- Extra-heavy-duty black Chlorinated Polyethylene (CPE) - approximately 135 mils, 90°C Rated

Print:

- GENERAL CABLE SHORE2SHIP™ 500 KCMIL 3/C 600 V ENHANCED SHORE-TO-SHIP POWER CABLE 90°C (YEAR OF MFG) PROPERTY OF U.S. NAVY

Features and Benefits:

- Rated 90°C
- Two-layer, extra-heavy-duty reinforced jacket for maximum protection from mechanical damage - the cause of most portable cable failures
- Pressure extruded jacket for water resistance
- Mold-cured jacket for maximum durability
- Flexible construction for easy handling and continuous reeling
- Flame- and sunlight-resistant to withstand the environmental conditions on the pier

Compliances:

- OPNAVINST 11310.3B
- Jacket duty rating and physical and aging tests for jacket and insulation per ICEA S-75-381
- Dielectric test per ICEA T-27-581

Packaging:

- Per Mil Spec

CATALOG NUMBER	MILITARY PART NO.	COND. SIZE	NO. OF COND.	MINIMUM AVG. INSULATION THICKNESS	NOMINAL JACKET THICKNESS	NOMINAL CABLE O.D.	NOMINAL CABLE WEIGHT	COPPER WEIGHT
		kcmil (STRAND)		INCHES (mm)	INCHES (mm)	INCHES (mm)	LBS/1000 FT (kg/km)	LBS/1000 FT (kg/km)
OPNAVINST 11310.3B, 600 V, THREE CONDUCTOR, 500 KCMIL, NON-WATERTIGHT ENHANCED THOF-500								
13333.936500	11310.3B	500 [1221/24]	3	0.090 [2.29]	0.235 [5.97]	2.731 [69.37]	7563 [11255]	4761 [7085]



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- **M85045/26** One 8mm Tube, Thermoset, Blown Optical Fiber

M49291C FIBER, OPTICAL

- **M49291/6-05** Multimode, 500 μ m, Blown Optical Fiber
- **M49291/7-02** Singlemode, 500 μ m, Blown Optical Fiber

BLOWN OPTICAL FIBER ACCESSORIES

- **AA-59731-U-8E** — 8mm Tube Union
- **Tube Union** — 5mm
- **AA-59731-T-8E** — 8mm Tube (Small Bore) Tee
- **Tube (Small Bore) Tee** — 5mm

M85045F & M49291C Military Shipboard Fiber Optic Cables and Accessories
(Cont'd)

BLOWN OPTICAL FIBER ACCESSORIES (Cont'd)

- **AA-59731-EC-8E** — 8mm Tube End Cap
- **Tube End Cap** — 5mm
- **AA-59728-TFP-8** — 8mm Tube Fitting Plug
- **Tube Fitting Plug** — 5mm
- **AA-59730-TTP-2** — Tapered Tube Plug (2 - 6 fibers)
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- **Tube End Caps (temporary)** — 5mm
- **Reducing Tube Straight Coupler** — 8mm to 5mm

BLOLITE is a registered trademark of Brand-Rex Limited and is used under license.

**QUALIFIED PRODUCTS LIST (QPL)
OF
PRODUCTS QUALIFIED UNDER PERFORMANCE SPECIFICATION
MIL-PRF-85045
CABLES, FIBER OPTICS
GENERAL SPECIFICATION**

GOVERNMENT DESIGNATION	MANUFACTURER'S DESIGNATION OR TYPE NUMBER	TEST OR QUALIFICATION REFERENCE	SPECIFICATION SHEET	SUPPLIER'S NAME (ADDRESS ON LAST PAGE)
M85045/16-01	OC-1468	85045-296-94, 85045-098-97	/16	General Cable Industries, Inc. (Willimantic, CT) General Cable Industries, Inc. (Franklin, MA)
M85045/16-02	OC-1571	85045-160-98	/16	General Cable Industries, Inc. (Willimantic, CT) General Cable Industries, Inc. (Franklin, MA)
M85045/17-01P	OC-1434P	85045-296-94, 85045-098-97	/17	General Cable Industries, Inc. (Willimantic, CT) General Cable Industries, Inc. (Franklin, MA)
M85045/17-02P	OC-1462P	85045-160-98	/17	General Cable Industries, Inc. (Willimantic, CT) General Cable Industries, Inc. (Franklin, MA)
M85045/18-01P	OC-1417P	85045-296-94, 85045-098-97	/18	General Cable Industries, Inc. (Willimantic, CT) General Cable Industries, Inc. (Franklin, MA)
M85045/18-02P	OC-1578P	85045-160-98	/18	General Cable Industries, Inc. (Willimantic, CT) General Cable Industries, Inc. (Franklin, MA)
M85045/20-01M	OC-1540	85045-098-98	/20	General Cable Industries, Inc. (Willimantic, CT) General Cable Industries, Inc. (Franklin, MA)
M85045/20-02M	OC-1673	85045-098-98	/20	General Cable Industries, Inc. (Willimantic, CT) General Cable Industries, Inc. (Franklin, MA)
M85045/21-01	OC-1651	85045-098-98	/21	General Cable Industries, Inc. (Willimantic, CT) General Cable Industries, Inc. (Franklin, MA)
M85045/21-02	OC-1679	85045-098-98	/21	General Cable Industries, Inc. (Willimantic, CT) General Cable Industries, Inc. (Franklin, MA)
M85045/22-01	OC-1680	85045-098-98	/22	General Cable Industries, Inc. (Willimantic, CT) General Cable Industries, Inc. (Franklin, MA)
M85045/22-02	OC-1652	85045-098-98	/22	General Cable Industries, Inc. (Willimantic, CT) General Cable Industries, Inc. (Franklin, MA)
M85045/23-01	OC-1681	85045-098-98	/23	General Cable Industries, Inc. (Willimantic, CT) General Cable Industries, Inc. (Franklin, MA)
M85045/23-02	OC-1653	85045-098-98	/23	General Cable Industries, Inc. (Willimantic, CT) General Cable Industries, Inc. (Franklin, MA)
M85045/24-01	OC-1682	85045-098-98	/24	General Cable Industries, Inc. (Willimantic, CT) General Cable Industries, Inc. (Franklin, MA)
M85045/24-02	OC-1654	85045-098-98	/24	General Cable Industries, Inc. (Willimantic, CT) General Cable Industries, Inc. (Franklin, MA)
M85045/25-01E	OC-1598, OC-1715	85045-043-99	/25	General Cable Industries, Inc. (Willimantic, CT)
M85045/26-01E	OC-1597, OC-1717	85045-577-03	/26	General Cable Industries, Inc. (Franklin, MA)

Manufacturer: General Cable Industries, Inc. (CAGE Code: 71124)
Location: 1600 West Main Street, Willimantic, CT 06226-1128, U.S.

Plant Locations:

1. Same address as manufacturer
2. General Cable Industries, Inc. (Franklin, MA), CAGE Code: 4AJA4, 20 Forge Park, Franklin, MA 02038-3134

M85045F Military Specification

Low-Smoke, Zero-Halogen (LSZH) Shipboard Fiber Optic Cables

General Cable has supplied military specification wire and cable for 40 years and has a distinguished list of participation in important programs.

Military qualified fiber optic cables (MIL-PRF-85045) are listed below:

M85045F Part Identifying #	General Cable Catalog Number	Cable Diameter in (mm)	Jacket Type	Number of Fibers	Fiber Type	Minimum Bend Diameter		Maximum Tensile Load		Nominal Weight	
						Installation in (cm)	In-Service in (cm)	Installation lbs (N)	In Service lbs (N)	lbs/1000'	kg/km
M85045/16-01	OC-1468	.078 (2.0)	Thermoplastic	1	Multimode	1.2 (3.0)	.62 (1.6)	60 (270)	22 (100)	3	4.5
M85045/16-02	OC-1571	.078 (2.0)	Thermoplastic	1	Singlemode	1.2 (3.0)	.62 (1.6)	60 (270)	22 (100)	3	4.5
M85045/17-01P	OC-1434P	.440 (11.2)	Thermoset	8	Multimode	7.0 (18)	3.5 (9.0)	605 (2700)	125 (560)	82	122
M85045/17-02P	OC-1462P	.440 (11.2)	Thermoset	8	Singlemode	7.0 (18)	3.5 (9.0)	605 (2700)	125 (650)	82	122
M85045/18-01P	OC-1417P	.320 (8.1)	Thermoset	4	Multimode	5.0 (12.7)	2.5 (6.4)	420 (1875)	92 (410)	42	62
M85045/18-02P	OC-1578P	.320 (8.1)	Thermoset	4	Singlemode	5.0 (12.7)	2.5 (6.4)	420 (1875)	92 (410)	42	62
M85045/20-01M	OC-1540	.850 (21.6)	Thermoset	36	Multimode	13.6 (34.5)	6.8 (17.3)	740 (3300)	245 (1080)	294	437
M85045/20-02M	OC-1673	.850 (21.6)	Thermoset	36	Singlemode	13.6 (34.5)	6.8 (17.3)	740 (3300)	245 (1080)	294	437
M85045/21-01	OC-1651	.560 (14.2)	Thermoset	8	Multimode	9.0 (23.0)	4.5 (11.4)	605 (2700)	160 (710)	146	217
M85045/21-02	OC-1679	.560 (14.2)	Thermoset	8	Singlemode	9.0 (23.0)	4.5 (11.4)	605 (2700)	160 (710)	146	217
M85045/22-01	OC-1680	.570 (14.5)	Thermoplastic	18	Multimode	9.0 (23.0)	4.5 (11.4)	740 (3300)	165 (725)	132	195
M85045/22-02	OC-1652	.570 (14.5)	Thermoplastic	18	Singlemode	9.0 (23.0)	4.5 (11.4)	740 (3300)	165 (725)	132	195
M85045/23-01	OC-1681	.700 (17.8)	Thermoset	18	Multimode	11.2 (28.5)	5.6 (14.0)	740 (3300)	200 (890)	217	323
M85045/23-02	OC-1653	.700 (17.8)	Thermoset	18	Singlemode	11.2 (28.5)	5.6 (14.0)	740 (3300)	200 (890)	217	323
M85045/24-01	OC-1682	1.53 (38.9)	Thermoset	90	Multimode	24.6 (62.5)	12.3 (31.2)	N/A	N/A	900	1340
M85045/24-02	OC-1654	1.53 (38.9)	Thermoset	90	Singlemode	24.6 (62.5)	12.3 (31.2)	N/A	N/A	900	1340

Cables are listed on Qualified Products List MIL-PRF-85045 (QPL) Defense Supply Center, Columbus-United States Department of Defense

M85045F & M49291C Military Specifications

Blolite[®] Blown Optical Fiber Technology (BOFT)

General Cable was the first fiber manufacturer to become a Qualified Products Listed (QPL) supplier of a militarized version of blown optical fiber technology in September of 2001. Today, we continue to remain the only qualified supplier of blown optical fiber fully engineered and tested to all the stringent requirements of M85045F and M49291C.

General Cable's Blolite blown optical fiber technology was first installed on the aircraft carrier USS Harry Truman in 1997. Early proof of successful use of this technology and its future-proof capabilities, for which it was designed, resulted in the formal development and qualification of the technology for the U.S. Navy. Key developments in military shipboard fiber optic technology have been the digitization of command, control and communication systems over a common infrastructure. This convergence has enabled significant savings in space and weight as well as greatly improved system functionality and damage tolerance. Blown optical fiber technology has furthered these advances by adding opportunities for cost savings, easy upgradeability and design flexibility.

General Cable's Blolite blown optical fiber solution has proven to be *the SOLUTION* for the U.S. Navy fleet.

M85045F PIN (see Note)	General Cable Catalog Number	QPL Status	Description	Jacket Material	Intended Use
M85045/25-01E	OC-1715 (Lt Blue Jkt)	QPL	7-8mm Tubes	Thermoset	Blolite [®] BOF System
M85045/25-01E	OC-1598 (Blk Jkt)	QPL	7-8mm Tubes	Thermoset	Blolite [®] BOF System
M85045/26-01E	OC-1717 (Lt. Blue Jkt)	QPL	1-8mm Tube	Thermoset	Blolite [®] BOF System
M85045/26-01E	OC-1597 (Blk Jkt)	QPL	1-8mm Tube	Thermoset	Blolite [®] BOF System

Note: 'E' indicates enhanced thermoset jacket
BOF = Blown Optical Fiber

M85045F & M49291C Military Specifications

Blolite[®] Blown Optical Fiber Technology (BOFT)

M49291C PIN	General Cable Catalog Number	Outer Diameter	Fiber Type	Intended Use
M49291/6-05	OC-062H-BF-XXXX* (QPL)	500 +/- 25um	Multimode	Blolite [®] BOF System
M49291/7-02	OC-009S-BF-XXXX* (QPL)	500 +/- 25um	Singlemode	Blolite [®] BOF System

XXXX indicates color of blown optical fiber outer coating

*Blown optical fiber outer coating is available in standard colors: Blue, Orange, Green, Brown, Slate, White, Red, Black, Yellow, Violet, Rose, Aqua

Fiber Characteristics	MIL-PRF-49291C/7-02 Singlemode	Mil-PRF-49291C/6-05 Multimode 62.5/125
Intended use	Blown Optical Fiber	Blown Optical Fiber
Type	Matched Clad	Graded Index
Mode Field Diameter	9.2 ± .4 @ 1310 nm	N/A
Core Diameter	8.3 μm nominal	62.5 ± 3 μm
Cladding Diameter	125 ± 1 μm	125 ± 1 μm
Coating Diameter # 1	250 ± 15 μm	250 ± 15 μm
Coating Diameter # 2	500 ± 25 μm	500 ± 25 μm
Coating Clad. Conc. Error	<10.5 μm	<10.5 μm
Overall Core-Clad Ratio	>0.84 μm	>0.84 μm
Attenuation:		
850 nm	N/A	3.5 dB/km
1300 nm	N/A	1.0 dB/km
1310 nm	.4 dB/km	N/A
1550 nm	.3 dB/km	N/A
Bandwidth (overfill):		
850 nm	N/A	>300 MHz-km
1300 nm	N/A	>600 MHz-km
Bandwidth (RML/EMB _c):		
850 nm	N/A	>385 MHz-km
1300 nm	N/A	>700 MHz-km
Dispersion	≤3.2 ps/nm – km @ 1310	N/A
	≤22 ps/nm – km @ 1550	N/A
Radiation Resistance	Refer to Specification	Refer to Specification
Proof Test	100 kpsi (690MPa)	100 kpsi (690MPa)



Phone: (866) 248-7060
 Fax: (859) 572-8463
www.generalcable.com



General Cable Shipboard Blown Optical Fiber (BOF) Parts List

Description	General Cable Part Number	Gov't/Military Part Number
8mm Tube Union 5mm Tube Union	77-7225 77-7224	AA-59731-U-8E N/A
8mm Tube (Small Bore) Tee 5mm Tube (Small Bore) Tee	77-7229 77-7228	AA-59731-TS-8E N/A
8mm Tube End Cap 5mm Tube End Cap	705620 705630	AA-59731-EC-8E N/A
8mm Tube Fitting Plug 5mm Tube Fitting Plug	77-7231 77-7230	AA-59728-TFP-8 N/A
Tapered Tube Plug:		
8mm (2-6 fibers) 8mm (8-12 fibers)	706920 706930	AA-59730-TTP-2 AA-59730-TTP-3
Tube Clips (TM-08) SMC	706940	N/A
Tube Cutter	707050	N/A
Tube Cutter Replacement Blades	707060	N/A
8mm Tube End Caps (temporary) 5mm Tube End Caps (temporary)	77-7222 77-7223	N/A N/A
8mm to 5mm Reducing Tube Straight Coupler	77-7227	AA-59731-R-E



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Military Shipboard Cables Catalog

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Section 3: ShipLAN® — Navy Shipboard Communications Cables

M24643 COPPER COMMUNICATIONS CABLE – THERMOSET, LOW-SMOKE, ZERO-HALOGEN

- **M24643/59** – CAT5e Non-Watertight, Shielded, Low-Smoke, Zero-Halogen Thermoset Cable
- **M24643/61** – CAT5e Non-Watertight, Shielded, Low-Smoke, Zero-Halogen Thermoset Patch Cable
- **ShipLAN® Cross-Reference**

General Cable's QPL Listed ShipLAN® Non-Watertight Category 5e Is Now On Board Engineered to Perform Well Into the Future

General Cable is proud to have a long and distinguished history of participation in military programs that span over four decades. In partnership with Lockheed Martin, General Cable qualified the first Category 5e data cable for use in Naval Shipboard applications to a Naval Sea Systems Command (NAVSEA) specification prior to the existence of MIL-DTL-24643/59-03UO.

Still in a class by itself, General Cable continues to meet the highest performance standards with a MIL-DTL-24643/59-03UO-qualified Category 5e Naval Shipboard data communications cable. ShipLAN® Category 5e cable combines high-performing electrical characteristics with low-toxicity, low-smoke, zero-halogen, and flame-retardant properties necessary for shipboard environments. General Cable's ShipLAN® Category 5e cable is constructed with a proprietary thermoset jacket system that provides flexibility for ease of installation and stripability for quicker preparation and termination time.

ShipLAN® Category 5e electrical characteristics are subjected to a mechanical stress resistance test. This test simulates the stress imposed on the cable during shipboard installation. Real-life installations challenge a cable's resistance to such stresses as tensile strain imposed by pulling; crushing forces imposed by cable clamps, straps, and stuffing tubes; bending forces imposed by routing; and twisting due to re-spooling. The cable's ability to resist the rigors of this environment is confirmed after stress testing when its electrical performance is still in compliance with MIL-DTL-24643/59-03UO and ANSI/TIA 568-C.2 2009. ShipLAN® Category 5e cable meets the following mechanical stress resistance qualifications:

- Operating Tensile Load
- Long Term Minimum Bend
- Cable Compression

As a preferred supplier to the military, General Cable continues its participation as a technical member of and key contributor to the National Electrical Manufacturers Association (NEMA) 7HW Shipboard Technical Committee, responsible for the generation and maintenance of MIL-DTL-24643 and associated slash sheets.

Why Choose General Cable's ShipLAN® MIL-DTL-24643/59-03UO Type LSC50S-4 Cable?

- General Cable qualified the first Category 5e shipboard data communications cable
- General Cable has more than four decades of experience specific to shipboard cables, including our industry-leading fiber optic shipboard cables
- QPL listed
- Product availability
- Flexible packaging options



Shiplan® Non-Watertight Category 5e Cable

**M24643/59-03UO, Type LSC50S-4 Non-Watertight
4 Pair, 24 AWG – Twisted Pair, Foil/Braid Shielded Cat 5e, Low-Smoke, Zero-Halogen Cable**

CATALOG NUMBER	PRODUCT DESCRIPTION TYPE/SIZE	MILITARY PART NO. M24643/59	# OF PAIRS	CONDUCTOR SIZE	NOMINAL INSULATION O.D.	NOMINAL CABLE DIAMETER	NOMINAL CABLE WEIGHT	BEND RADIUS
				AWG	INCHES	INCHES	LBS/1000'	
LO24P0045438A	LSC50S-4	-03UO	4	24 AWG Solid	0.042	0.310	65	10X Cable O.D.

PRODUCT CONSTRUCTION:

Conductor:

24 AWG solid bare copper

Insulation:

High Density Polyethylene (HD-PE)

Color code:

Pair 1: White-Blue/Blue
Pair 2: White-Orange/Orange
Pair 3: White-Green/Green
Pair 4: White-Brown/Brown

Screen:

Longitudinal aluminum/polyester 25% min. overlap (alum. side out)

Shield:

36 AWG tin-coated copper—optimized coverage

Jacket:

Cross-linked polyolefin (low-smoke, zero-halogen) – black (BLK)

PRINT:

Including but not limited to:
GENERAL CABLE (F) LSC50S-4 M24643/59-03UO XLPOLYO LO24P0045438A SHIPLAN SHIELDED MARINE CABLE CAT5E 4/24 PAT 5767441 AAAAA* MO/YR** XXXXXX FT***
*Order Number **Date ***Footage Marking

APPLICATIONS:

For the requirements of M24643 for high speed data transmission. Tested to 100 MHz.

IEEE 802.3: 1000 BASE-T (Gigabit Ethernet);
100 BASE-TX; 10 BASE-T, PoE, PoE+

155 Mp/s, 622 Mp/s ATM

ANSI X3.263: 100 Mb/s

4/16 Mb/s Token Ring

Broadband and Baseband analog video

FEATURES AND BENEFITS:

Shielding system protects signals from electromagnetic interference (EMI) and radio frequency interference (RFI). Extremely tough cross-linked jacket provides excellent mechanical and environmental protection.

COMPLIANCES:

M24643/59

ANSI/TIA 568-C.2 2009

ISO/IEC 11801

QUALITY PROGRAMS AND CERTIFICATIONS:

MIL-STD-790

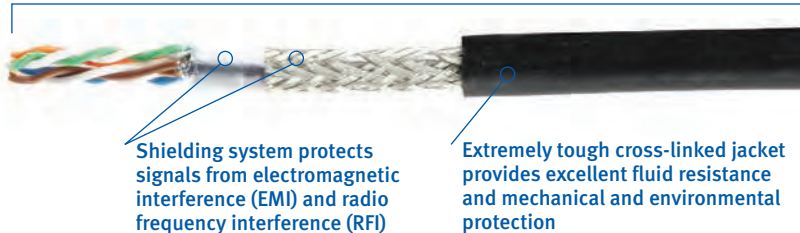
ISO 9001:2000

PACKAGING:

1000' put-ups on wooden reels

DC Resistance	9.38 Ω/100m (28.6 Ω/Mft.) Max.
DCR Unbalanced	5% Max.
Mutual Capacitance	5.6 nf/100m
Capacitance Unbalance	330 pF/100m (1 pF/ft.) Max
Characteristic Impedance	100 Ω +/- 15% (1-100 MHz)
Input Impedance	100 Ω +/- 15% (1-100 MHz)
Prop. Delay (Skew)	45 ns/100m Max.
Velocity of Propagation	69% Nom.
Temperature & Voltage Rating	-20°C to +75°C/300 V Max.

Easy interface with shielded RJ45 connectors



ELECTRICAL PERFORMANCE:

FREQ. (MHz)	INSERTION LOSS (dB/100m)	NEXT (dB/100m)	PSNEXT (dB/100m)	ACR (dB/100m)	PSACR (dB/100m)	ACRF (dB/100m)	PSACRF (dB/100m)	RL (dB)
	MAX.	MIN.	MIN.	MIN.	MIN.	MIN.	MIN.	MIN.
0.772	1.8	67.0	64.0	65.2	62.2	66.0	63.0	—
1	2.0	65.3	62.3	63.3	60.3	63.8	60.8	20.0
4	4.1	56.3	53.3	52.2	49.2	51.7	48.7	23.0
8	5.8	51.8	48.8	46.0	43.0	45.7	42.7	24.5
10	6.5	50.3	47.3	43.8	40.8	43.8	40.8	25.0
16	8.2	47.3	44.3	39.1	36.1	39.7	36.7	25.0
20	9.3	45.8	42.8	36.5	33.5	37.7	34.7	25.0
25	10.4	44.3	41.3	33.9	30.9	35.8	32.8	24.3
31.25	11.7	42.9	39.9	31.2	28.2	33.9	30.9	23.6
62.5	17.0	38.4	35.4	21.4	18.4	27.8	24.8	21.5
100	22.0	35.3	32.3	13.3	10.3	23.8	20.8	20.1



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Form No. INS-0101-R0915
49441

ShipLAN® Non-Watertight Category 5e Patch Cable

M24643/61-02UD, Type LSC5POS-4 Non-Watertight

4 Pair, 24 AWG – Twisted Pair, Foil/Braid Shielded Cat 5e, Low-Smoke, Zero-Halogen Patch Cable

CATALOG NUMBER	PRODUCT DESCRIPTION TYPE/SIZE	MILITARY PART NO. M24643/61	# OF PAIRS	CONDUCTOR SIZE	NOMINAL INSULATION O.D.	NOMINAL CABLE DIAMETER	NOMINAL CABLE WEIGHT	BEND RADIUS
				AWG	INCHES	INCHES	LBS/1000'	
LO24P0045638A	LSC5POS-4	-02UD	4	24 AWG Stranded	0.049	0.330	53	10X Cable O.D.

PRODUCT CONSTRUCTION:

Conductor:

24 AWG stranded tin copper

Insulation:

High Density Polyethylene (HD-PE)

Color code:

Pair 1: White-Blue/Blue

Pair 2: White-Orange/Orange

Pair 3: White-Green/Green

Pair 4: White-Brown/Brown

Screen:

Longitudinal aluminum/polyester 25% min. overlap (alum. side out)

Shield:

Tin-coated copper—optimized coverage

Jacket:

Cross-linked polyolefin (low-smoke, zero-halogen) – black (BLK)

PRINT:

Including but not limited to:

GENERAL CABLE (F) LSC5POS-4 M24643/61
-02UD XLPOLYO LO24P0045638A SHIPLAN
SHIELDED MARINE PATCH CABLE CAT5E 4/24
AAAAA* MO/YR** XXXXXX FT***
*Order Number **Date ***Footage Marking

APPLICATIONS:

For the requirements of M24643 for high speed data transmission. Tested to 100 MHz.

IEEE 802.3: 1000 BASE-T (Gigabit Ethernet);
100 BASE-TX; 10 BASE-T

155 Mp/s, 622 Mp/s ATM

ANSI X3.263: 100 Mb/s

4/16 Mb/s Token Ring

Broadband and Baseband analog video

FEATURES AND BENEFITS:

Shielding system protects signals from electromagnetic interference (EMI) and radio frequency interference (RFI). Extremely tough cross-linked jacket provides excellent mechanical and environmental protection.

COMPLIANCES:

M24643/61

ANSI/TIA 568-C.2 2009

ISO/IEC 11801

QUALITY PROGRAMS AND CERTIFICATIONS:

MIL-STD-790

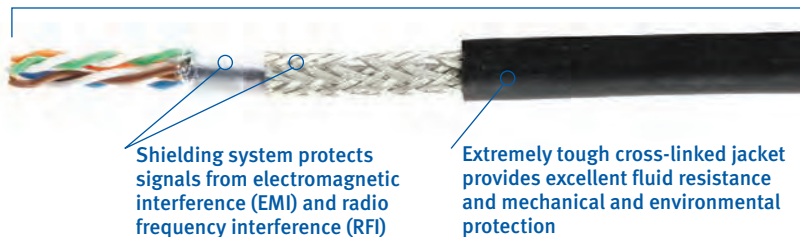
ISO 9001:2000

PACKAGING:

1000' put-ups on wooden reels

DC Resistance	14.0 Ω/100m (42.6 Ω/Mft.) Max.
DCR Unbalanced	5% Max.
Mutual Capacitance	5.6 nf/100m
Capacitance Unbalance	330 pF/100m (1 pF/ft.) Max
Characteristic Impedance	100 Ω +/- 15% (1-100 MHz)
Input Impedance	100 Ω +/- 15% (1-100 MHz)
Prop. Delay (Skew)	45 ns/100m Max.
Velocity of Propagation	69% Nom.
Temperature & Voltage Rating	-20°C to +75°C/300 V Max.

Easy interface with shielded RJ45 connectors



ELECTRICAL PERFORMANCE:

FREQ. (MHz)	INSERTION LOSS (dB/100m)	NEXT (dB/100m)	PSNEXT (dB/100m)	ACR (dB/100m)	PSACR (dB/100m)	ACRF (dB/100m)	PSACRF (dB/100m)	RL (dB)
	MAX.	MIN.	MIN.	MIN.	MIN.	MIN.	MIN.	MIN.
0.772	2.2	67.0	64.0	64.8	61.8	66.0	63.0	—
1	2.4	65.3	62.3	62.9	59.9	63.8	60.8	20.0
4	4.9	56.3	53.3	51.4	48.4	51.7	48.7	23.0
8	7.0	51.8	48.8	44.8	41.8	45.7	42.7	24.5
10	7.8	50.3	47.3	42.5	39.5	43.8	40.8	25.0
16	9.8	47.3	44.3	37.5	34.5	39.7	36.7	25.0
20	11.2	45.8	42.8	34.6	31.6	37.7	34.7	25.0
25	12.5	44.3	41.3	31.8	28.8	35.8	32.8	24.2
31.25	14.0	42.9	39.9	28.9	25.9	33.9	30.9	23.3
62.5	20.4	38.4	35.4	18.0	15.0	27.8	24.8	20.7
100	26.4	35.3	32.3	8.9	5.9	23.8	20.8	19.0



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Form No. INS-0103-R0915
49441

ShipLAN Cross Reference

General Cable Part Number	MIL-DTL-24643 Specification	MIL-DTL-24643 Spec Part Number	Conductor Size and Stranding	Insulation OD	Shielding	Water-blocked	Outer Jacket	RJ-45 Connector Recommendation (Sentinel Connectors Part Number) ⁽¹⁾	Amphenol RJ Field Ethenet Connection For Harsh Environment ⁽³⁾	BTR IP20 RJ45 Field Plug P/N 1401405012-1
LO24P0045238X	--	--	24 AWG Solid BC	0.042	Foil Shield (ScTP)	No	Thermoplastic, Black	106S080800C34 or 111S08080056C34 ⁽²⁾	Yes	Yes
LO24P0045438A	/59	LSC5OS-4	24 AWG Solid BC	0.042	Double Shielded: TC Braid and Foil (SFTP)	No	Thermoset, Black	106S080800C34 or 111S08080056C34 ⁽²⁾	Yes	Yes
LO24P0045638A	/61	LSC5POS-4	24 AWG Stranded TC	0.047	Double Shielded: TC Braid and Foil (SFTP)	No	Thermoset, Black	106S08080058C34	-	Yes
LO24P0045838X	--	--	24 AWG Solid BC	0.042	Foil Shield (ScTP)	No	Thermoset, Black	106S080800C34 or 111S08080056C34 ⁽²⁾	Yes	Yes

⁽¹⁾Please visit www.sentinelconn.com to view Sentinel Data Sheets on these specific part numbers.

⁽²⁾Sentinel Connector part number 111S08080056C34 was jointly developed by Sentinel & Lockheed-Martin for applicable General Cable Part Number.

⁽³⁾Please visit www.amphenol-socapex.com to view Amphenol Data Sheet on this specific product.

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- **MIL-DTL-M24643C** Alphabetical Listing
- **MIL-DTL-M24643C** ASTM Definitions
- **MIL-DTL-M24643C** Conductor Identification Methods
- **MIL-DTL-M24643C** Navy Standard Sizes
- **MIL-DTL-M24643C** Standard Identification Code
- **MIL-DTL-M24643C** QPL Approval Listing – Active Products

MIL-DTL-M24643C

Alphabetical Listing

Type	Slant Sheet	Type	Slant Sheet
LSDCOP	M24643/2	LSTPSN	M24643/26
LSSHOF	M24643/3	LSTSGA	M24643/16
LSDPSN	M24643/26	LSTSGU	M24643/16
LSDSGU	M24643/15	LSTTSU	M24643/23
LSFPSN	M24643/26	LS2OW	M24643/66
LSFSGU	M24643/17	LS3OW	M24643/67
LSMDU	M24643/5	LS2SJ	M24643/43
LSPI	M24643/25	LS3SJ	M24643/43
LSSSGA	M24643/14	LS4OW	M24643/68
LSSSGU	M24643/14	LS4SJ	M24643/43
LSTCJX	M24643/24	LS5KVTSGA	M24643/22
LSTCKXN	M24643/24	LS5KVTSGU	M24643/22
LSTCOP	M24643/2	LS7PSN	M24643/26
LSTCTX	M24643/24	LSTCTXN	M24643/24

MIL-DTL-24643C

ASTM Definitions

- B3 Soft or Annealed Copper Wire (DoD adopted)
- B8 Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard or Soft (DoD adopted)
- B33 Tinned Soft or Annealed Copper Wire for Electrical Purposes (DoD adopted)
- B172 Rope-Lay-Stranded Copper Conductors Having Bunch-Stranded Members for Electrical Conductors (DoD adopted)
- B173 Rope-Lay-Stranded Copper Conductors Having Concentric-Stranded Members for Electrical Conductors (DoD adopted)
- B174 Bunch-Stranded Copper Conductors for Electrical Conductors (DoD adopted)
- B193 Resistivity of Electrical Conductor Materials (DoD adopted)
- B228 Concentric-Lay-Stranded Copper Clad Steel Conductors (DoD adopted)
- B258 Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors (DoD adopted)
- B286 Copper Conductors for Use in Hookup Wire for Electronic Equipment (DoD adopted)
- B355 Nickel Coated Soft or Annealed Copper Wire (DoD adopted)
- D297 Rubber Products – Chemical Analysis (DoD adopted)
- D470 Standard Methods of Testing Crosslinked Insulation and Jackets for Wire and Cable
- D1248 Standard Specification for Polyethylene Plastics Molding and Extrusion Materials
- D2240 Rubber Property Durometer Hardness (DoD adopted)
- D2565 Standard Practice for Operating Xenon Arc Type (Water Cooled) Light-Exposure Apparatus Wire and Without Water for Exposure of Plastics
- G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

MIL-DTL-M24643C

Conductor Identification Methods

Method 1. Identification Method 1 shall be surface printing of both number and color designations. The legend shall be printed in contrasting color: preferably white ink on black or dark background or black ink on white or light background. The printing can be on the conductor insulation provided the jacket is transparent or on the jacket if the jacket is not transparent. The legend shall be repeated at intervals not exceeding 3 inches and alternate legends shall be inverted. The character type shall be block and shall have a height in accordance with the diameter over which it is applied as follows:

<u>Diameter Range (inch)</u>	<u>Height of Character Approximate (inch)</u>
0.045 to 0.070	0.025
0.070 to 0.095	0.031
0.095 to 0.115	0.047
0.115 to 0.200	0.062
0.190 to 0.250	0.078
0.235 to 0.325	0.094
0.330 and larger	0.125

Method 2. Identification Method 2 shall be the use of translucent (opaque) polyester tapes which have been printed with both the number and the color designation. The legend shall be printed with black ink and shall be repeated at intervals not exceeding 3 inches and alternate legends shall be inverted. The character type shall be block and shall be approximately 3/32 inch height.

Method 3. Identification Method 3 shall be the use of solid base colors or solid base colors with tracers as required. The base color may be either the color or the insulation or the color of a coating applied to the insulation. The tracers shall be approximately 1/32 inch wide ink stripes of the required color applied helically with 1-1/2 + 1/4 inch lay. If two tracers are required, the second shall be half the width of the first.

Method 4. Identification Method 4 shall be the use of colored braids. Tracers shall consist of the required colors applied by three adjacent carriers. Where two tracers are required, they shall be applied with reverse lay.

Method 5. Identification Method 5 shall be the use of the printed letter on the outermost insulating tape or the printed letter on a polyester binder tape over the insulating tapes. The letters shall be approximately 3/16 inch high and shall have been printed at intervals not exceeding 3 inches prior to the application of the tape to the conductor. If the insulating tapes are white, no printing is required on the B (white) conductor.

Method 6. Identification Method 6 shall consist of numerals printed in ink on the conductor insulation. For conductors having a jacket directly over the insulation, the numerals may be printed in ink on the jacket, at the manufacturer's option. White ink shall be used for a red or black background; black ink shall be used for a white background. Numerals shall be perpendicular or parallel to the longitudinal axis of the conductor (see figure 1). Numeral width shall be proportional to conductor outside diameter (o.d.) as shown in Method 1 (see 3.4.12.2.1).

Numeral width shall be 1/3 numeral height. Each numeric legend shall be underlined. Two digit legends which are parallel to the longitudinal axis shall have the bottom numeral underlined. Legends shall be alternately inverted and shall repeat at intervals not greater than 1½ inches.

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Navy Standard Sizes

Conductor Size Navy Standard	No. of Stds. (Min.)	Std. Dia. Nom. (Inch)	Cond. Dia. Nom. (Inch)	Conductor Cross Sectional Area (Circular Mils)		Maximum Conductor Resistance D.C. per 1000 ft at 25°C		Wt. Per 1000 ft – lbs. Appr.
				Nom. ^{1/}	Min.	Bare	Coated	
<u>Concentric Lay Stranded</u>								
30 (19)	19	0.040	0.202	30,860	30,240	0.358	0.365	95
400 (127)	127	0.057	0.742	413,600	405,400	0.0268	0.0273	1,300
<u>Bunch Lay Stranded</u>								
9 (90)	90	0.010	0.120	9,045	8,864	1.22	1.28	28
14 (140)	140	0.010	0.145	14,070	13,790	0.786	0.823	43
<u>Rope Lay Stranded</u>								
42 (209)	209	0.014	0.260	42,100	41,280	0.272	0.284	130
60 (304)	304	0.014	0.310	61,200	60,040	0.187	0.196	190
83 (418)	418	0.014	0.380	84,230	82,560	0.136	0.142	270
133 (684)	684	0.014	0.480	137,800	135,100	0.0830	0.0867	440
150 (760)	760	0.014	0.510	153,100	150,100	0.0747	0.0780	490
200 (988)	988	0.014	0.580	199,100	195,100	0.0575	0.0600	630
250 (1254)	1254	0.014	0.680	252,700	247,700	0.0453	0.0472	800
400 (2052)	2052	0.014	0.850	413,500	405,300	0.0277	0.0289	1,300
800 (4033)	4033	0.014	1.150	812,700	796,500	0.0141	0.0148	2,600

^{1/} Values are for information only.

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Standard Identification Code

Color, Conductor or Group No.	Background or Base Color	First Tracer Color	Second Tracer Color
1	Black	----	----
2	White	----	----
3	Red	----	----
4	Green	----	----
5	Orange	----	----
6	Blue	----	----
7	White	Black	----
8	Red	Black	----
9	Green	Black	----
10	Orange	Black	----
11	Blue	Black	----
12	Black	White	----
13	Red	White	----
14	Green	White	----
15	Blue	White	----
16	Black	Red	----
17	White	Red	----
18	Orange	Red	----
19	Blue	Red	----
20	Red	Green	----
21	Orange	Green	----
22	Black	White	Red
23	White	Black	Red
24	Red	Black	White
25	Green	Black	White
26	Orange	Black	White
27	Blue	Black	White
28	Black	Red	Green
29	White	Red	Green
30	Red	Black	Green
31	Green	Black	Orange
32	Orange	Black	Green
33	Blue	White	Orange
34	Black	White	Orange
35	White	Red	Orange
36	Orange	White	Blue
37	White	Red	Blue
38	Brown	----	----
39	Brown	Black	----
40	Brown	White	----
41	Brown	Red	----
42	Brown	Green	----



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Standard Identification Code

Color, Conductor or Group No.	Background or Base Color	First Tracer Color	Second Tracer Color
43	Brown	Orange	----
44	Brown	Blue	----
45	White	Black	Blue
46	Red	White	Blue
47	Green	Orange	Red
48	Orange	Red	Blue
49	Blue	Red	Orange
50	Black	Orange	Red
51	White	Black	Orange
52	Red	Orange	Black
53	Green	Red	Blue
54	Orange	Black	Blue
55	Blue	Black	Orange
56	Black	Orange	Green
57	White	Orange	Green
58	Red	Orange	Green
59	Green	Black	Blue
60	Orange	Orange	Blue
61	Blue	Green	Orange
62	Black	Red	Blue
63	White	Orange	Blue
64	Red	Black	Blue
65	Green	Orange	Blue
66	Orange	White	Red
67	Blue	White	Red
68	Black	Green	Blue
69	White	Green	Blue
70	Red	Green	Blue
71	Green	White	Red
72	Orange	Red	Black
73	Blue	Red	Black
74	Black	Orange	Blue
75	Red	Orange	Blue
76	Green	Red	Black
77	Orange	White	Green
78	Blue	White	Green
79	Red	White	Orange
80	Green	White	Orange
81	Blue	Black	Green
82	Orange	White	----
83	Green	Red	----
84	Black	Green	----
85	White	Green	----

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Standard Identification Code

Color, Conductor or Group No.	Background or Base Color	First Tracer Color	Second Tracer Color
86	Blue	Green	----
87	Black	Orange	----
88	White	Orange	----
89	Red	Orange	----
90	Green	Orange	----
91	Blue	Orange	----
92	Black	Blue	----
93	White	Blue	----
94	Red	Blue	----
95	Green	Blue	----
96	Orange	Blue	----
97	Yellow	----	----
98	Yellow	Black	----
99	Yellow	White	----
100	Yellow	Red	----
101	Yellow	Green	----
102	Yellow	Orange	----
103	Yellow	Blue	----
104	Black	Yellow	----
105	White	Yellow	----
106	Red	Yellow	----
107	Green	Yellow	----
108	Orange	Yellow	----
109	Blue	Yellow	----
110	Black	Yellow	Red
111	White	Yellow	Red
112	Green	Yellow	Red
113	Orange	Yellow	Red
114	Blue	Yellow	Red
115	Black	Yellow	White
116	Red	Yellow	White
117	Green	Yellow	White
118	Orange	Yellow	White
119	Blue	Yellow	White
120	Black	Yellow	Green
121	White	Yellow	Green
122	Red	Yellow	Green
123	Orange	Yellow	Green
124	Blue	Yellow	Green
125	Black	Yellow	Blue
126	White	Yellow	Blue
127	Red	Yellow	Blue

MIL-DTL-M24643C
QPL Approval Listing**CABLES AND CORDS, LOW-SMOKE, ELECTRIC, FOR SHIPBOARD USE**
GENERAL SPECIFICATION FOR SPECIFICATION SHEETS

MIL-DTL-24643/2	Cord, Electrical, 300 Volts, Types LSDCOP and LSTCOP
MIL-DTL-24643/3	Cable, Electrical, 600 Volts, Type LSSHOF
MIL-DTL-24643/5	Cable, Electrical, 600 Volts, Type LSMDU
MIL-DTL-24643/14	Cable, Electrical, 1000 Volts, Type LSSSGU (Including Variation LSSSGA)
MIL-DTL-24643/15	Cable, Electrical, 1000 Volts, Type LSDSGU
MIL-DTL-24643/16	Cable, Electrical, 1000 Volts, Type LSTSGU (Including Variation LSTSGA)
MIL-DTL-24643/17	Cable, Electrical, 1000 Volts, Type LSFSGU
MIL-DTL-24643/22	Cable, Electrical, 5000 Volts, Type LS5KVTSGU (Including Variation LS5KVTSGA)
MIL-DTL-24643/23	Cable, Electrical, 300 Volts, Type LSTTSU
MIL-DTL-24643/24	Cable, Electrical, Types LSTCJX, LSTCKX and LSTCTX
MIL-DTL-24643/25	Cable, Electrical, Type LSPI
MIL-DTL-24643/26	Cable, Electrical, 600 Volts, Types LSDPS, LSFPS, LSTPS and LS7PS
MIL-DTL-24643/43	Cable, Electrical, Types LS2SJ, LS3SJ, LS4SJ
MIL-DTL-24643/66	Cable, Electrical, 1000 Volts, Type LS2OW
MIL-DTL-24643/67	Cable, Electrical, 1000 Volts, Type LS3OW
MIL-DTL-24643/68	Cable, Electrical, 1000 Volts, Type LS4OW

Military Shipboard Cables Catalog

Table of Contents

Section 5:

TECHNICAL INFORMATION

- Glossary
- Metric Conversion
- Temperature Conversion Table

Glossary

Abrasion Resistance: Ability of a wire, cable or material to resist surface wear.

Accelerated Aging: A test in which voltage, temperature, etc. are increased above normal operating values to obtain observable deterioration in a relatively short period of time. The plotted results give expected service life under normal conditions.

ACM: Aluminum conductor material.

Accelerator: A chemical additive that hastens a chemical reaction under specific conditions.

Admittance: The measure of the ease with which an alternating current flows in a circuit. The reciprocal of impedance.

AEIC: Association of Edison Illuminating Companies

Aerial Cable: A cable suspended in the air on poles or another overhead structure.

Aging: The change in properties of a material with time under specific conditions.

AIA: Aluminum Interlocked Armor.

Alloy: A metal formed by combining two or more different metals to obtain desirable properties.

Alternating Current: Electric current that continually reverses its direction. It is expressed in cycles per second (hertz or Hz).

Ambient Temperature: The temperature of the medium surrounding an object. Generally a lower temperature than the temperature at which the cable is operating.

American Wire Gauge (AWG): A standard North American system for designating wire diameter

Ampacity: See Current Carrying capacity.

Ampere: The unit of current. One ampere is the current flowing through one ohm of resistance at one volt potential.

Analog: A data format using continuous physical variables such as voltage amplitude or frequency variations.

Anneal (Soften): Relief of mechanical stress through heat and gradual cooling. Annealing copper renders it less brittle.

Armor: A protective metal covering commonly in the form of flexible interlocking aluminum, bronze, or steel tape steel wires, or aluminum sheath.

ASTM: American Society for Testing and Materials.

Attenuation: The general term used to denote the decrease of power from one point to another. In fiber optics, the optical power loss per unit length is expressed logarithmically in decibels per kilometer (dB/km) at a specific wavelength.

Audio Frequency: The range of frequencies audible to the human ear. Usually 20-20,000 Hz.

AWM: Designation for appliance wiring material.

Balanced Circuit: One utilizing cables having two or more identical conductors with the same electromagnetic characteristics in relation to each other and to ground.

Band Marking: A continuous circumferential band applied to a conductor at regular intervals for identification.

Bandwidth: (1) The difference between the upper and lower limits of a given band of frequencies. Expressed in Hertz. (2) A measure of the maximum frequency range over which light intensity exiting a waveguide one kilometer in length can be varied before the attenuation varies 3dB from the mean. The greater the bandwidth, the greater the information carrying capacity. Bandwidth is expressed in Megahertz (MHZ)=DOKilometer (km).

Bending Radius: Radius of curvature that a cable can be safely bent without any adverse effects.

Binder: A spirally served tape used for holding assembled cable components in place awaiting subsequent manufacturing operations.

Bonding Conductor: An insulated or uninsulated conductor forming part of the cable assembly which is used for the purpose of connecting non-current carrying parts of electrical equipment to a system grounding conductor.

Braid: A fibrous or metallic group of filaments interwoven in cylindrical shape to form a covering over one or more wires.

Braid Angle: The smaller of the two angles formed by the shielding strand and the axis of the cable being shielded.

Braid Carrier: A spool or bobbin on a braider that holds one group of strands or filaments consisting of a specific number of ends. The carrier revolves during braiding operations

Braid Ends: The number of strands used to make up one carrier. The strands are wound side-by-side on the carrier bobbin and lie parallel in the finished braid.



Glossary

- Breakdown Voltage:** The voltage at which the insulation between two conductors breaks down.
- B & S Gauge:** The same as American Wire Gauge (AWG).
- Buffer:** A protective coating over an optical fiber.
- Building Wire:** A general term used for light and power wiring products, 1000 volts or less.
- Bunch Stranding:** A group of wires of the same diameter twisted together without a predetermined pattern. Used in flexible cords and cables.
- Buried Cable:** A cable installed directly in the earth without use of underground conduit. Also called direct burial cable.
- Butyl Rubber:** A synthetic rubber with good insulating properties (i.e. low voltage cords).
- Cable:** An insulated conductor, or group of individually insulated conductors in one assembly.
- Cabling:** The twisting together of two or more insulated conductors to form a cable.
- Capacitance:** The ratio of the electrostatic charge on a conductor to the potential difference between the conductors required to maintain that charge. Units expressed in Farads.
- Capacitive Coupling:** Electrical interaction between two conductors caused by the capacitance between them.
- Capacitive Reactance (Xc):** The opposition to alternating current due to the capacitance of the cable or circuit. Measured in ohms.
- CE Code, CEC:** Canadian Electrical Code
- Certified Test Report (CTR):** A report providing actual test data on a cable. Tests are normally conducted by the Quality Control Department to confirm that the product being shipped conforms to specifications
- Characteristic Impedance:** The impedance that, when connected to the output terminals of a transmission line of any length, makes the line appear infinitely long. The ratio of voltage to current at every point along a transmission line on which there are no standing waves.
- Circular Mil (cmil):** The area of a circle one mil (.001=D3) in diameter (7.854 x 10⁻⁷ sq in). Used in expressing wire cross-sectional area.
- Circuit Sizes:** A popular term for building wire sizes 14 through 10 AWG.
- Cladding:** (1) A method of applying a layer of metal over another metal whereby the junction of the two metals is continuously welded. (2) A low refractive index material that surrounds the core of an optical fiber causing the transmitted light to travel down the core and protects against surface contaminant scattering.
- Coaxial Cable:** A cable consisting of two cylindrical conductors with a common axis, separated by a dielectric.
- Cold Flow:** Permanent deformation of the insulation or jacket due to mechanical force or pressure, (not due to heat softening).
- Color Code:** A system for circuit identification through use of solid colors and contrasting tracers.
- Composite Cable:** One containing more than one type or gauge size of conductors (e.g. power and control conductors in one assembly).
- Compound:** An insulating or jacketing material made by mixing two or more polymeric ingredients.
- Concentric Stranded Conductors:** Manufactured to ASTM, ICEA, and CSA standards. The most common fixed installation type conductors are: 1) Round no diameter reduction; 2) Compressed approximately 3% diameter reduction; 3) Compact approximately 10% diameter reduction.
- Concentric Stranding:** A central wire surrounded by one or more layers of helically wound strands in a fixed round geometric arrangement.
- Concentricity:** The measurement of the location of the center of the conductor with respect to the geometric center of the surrounding insulation.
- Conductivity:** The capacity of a material to carry electrical current usually expressed as a percentage of copper conductivity (copper being 100%).
- Conductor:** An uninsulated wire suitable for carrying electrical current.
- Conductor Shield:** An extrusion of black semi-conducting thermoset material over the conductor to provide a smooth interface with the insulation for even distribution of electrical stress.
- Conduit (Electrical Raceway):** A tube or pipe in which insulated wires and cables are run
- Connector:** A device used to physically and electrically connect two or more conductors. Also used to physically connect cable to equipment.
- Continuity Check:** A test to determine whether electrical current flows continuously throughout the length of a single wire or individual wires in a cable.

Glossary

- Continuous Vulcanization:** Simultaneous extrusion and vulcanization of rubber-like (thermoset) coating materials. Often referred to as CV.
- Control Cable:** A multi-conductor cable made for operation in control of signal circuits.
- Copolymer:** A compound resulting from the polymerization of two different monomers.
- Copperweld:** The trade name of Flexo Wire Division (Copperweld Steel Corp.) for its copper-clad steel conductors.
- Cord:** A small, flexible, insulated wire or cable.
- Core:** In cables, a component or assembly of components over which additional components (shield, sheath, etc.) are applied.
- Corona:** A discharge due to ionization of air around a conductor due to a potential gradient exceeding a certain critical value.
- Coverage:** The percent of completeness with which a metal serving covers the underlying surface.
- CPE:** Chlorinated polyethylene can be used as either a thermoplastic or thermoset. It is a tough chemical and oil-resistant material and makes an excellent jacket for industrial control cable. As a thermoset, it can be used as an oil-resistant cord jacket. Typical temperature ratings range from -35°C to 90°C. Other outstanding properties include low water absorption and super crush resistance which are important attributes in industrial control applications.
- Creep:** The dimensional change with time of a material under a mechanical load.
- Cross-linked:** Inter-molecular bonds between long chain thermoplastic polymers by chemical or electron bombardment means. The properties of the resulting thermosetting material are usually improved (e.g XLPE).
- Crosstalk:** Signal interference between nearby conductors caused by pickup of stray energy.
- CSA:** Canadian Standards Association
- Current Carrying Capacity (Ampacity):** The maximum current an insulated conductor can safely carry without exceeding its insulation and jacket temperature limitations.
- Cut-Through Resistance:** The ability of a material to withstand cutting from a sharp edge or small radius under pressure.
- Decibel (dB):** A unit to express differences of power level. Used to express power gain in amplifiers or power loss in passive circuits or cables. The units in which the ratio of two power levels, P1 and P2, are expressed. The ratio in dB is given as (P1/P2).
- Delay Line:** A cable made to provide very low velocity of propagation with long electrical delay for transmitted signals.
- Derating Factor:** A factor used to reduce the current carrying capacity of a wire when used in environments other than that for which the value was established.
- Dielectric:** Any insulating material between two conductors that permits electrostatic attraction and repulsion to take place across it.
- Dielectric Constant (K):** The ratio of the capacitance of a condenser with dielectric between the electrodes to the capacitance when air is between the electrodes. Also called Permittivity and Specific Inductive Capacity (SIC).
- Dielectric Strength:** The voltage which an insulation can withstand before breakdown occurs. Usually expressed as a voltage gradient (such as volts per mil).
- Dielectric Test:** A test in which a voltage higher than the rated voltage is applied for a specified time to determine the adequacy of the insulation under normal conditions. Sometimes called a D2Hi-Pot test (high potential).
- Digital:** A data format that uses discrete or separate physical levels to contain information.
- Direct Burial Cable:** A cable installed directly in the earth.
- Direct Current:** An electric current that flows in only one direction.
- Direction of Lay:** The lateral direction in which the strands of a conductor run over the top of the cable conductor as they recede from an observer looking along the axis of the conductor or cable. Also applies to twisted cable.
- Dissipation Factor:** The tangent of the loss angle of the insulating material. (Also referred to as loss tangent, tan d, and approximate power factor.)
- Drain Wire:** The uninsulated wire in contact with an electrostatic shield throughout its length, in an instrumentation or control cable used to discharge unwanted signals. Also provides a means of terminating laminated shields. Sometimes used to describe the metallic shielding wires of a power cable insulation shield.

Glossary

- Drawing:** In wire manufacturing, pulling the metal through a die or series of dies to reduce diameter to a specified size.
- Earth:** British terminology for zero-reference ground.
- Eccentricity:** Like concentricity, a measure of the center of a conductor's location with respect to the circular cross section of the insulation. Expressed as a percentage of displacement of one circle within the other.
- EEMAC:** Electrical and Electronic Manufacturers Association of Canada (U.S. counterpart is NEMA).
- Elastomer:** A rubber-like substance. Any material that will return to its original dimensions after being stretched or distorted.
- Electrostatic Shield:** A copper or laminated aluminum/mylar tape wrap around a signal or instrumentation circuit (pair, triad, etc.) to protect from the electric field radiated by a voltage source. The grounded shield intercepts static interference and carries it off to ground.
- Elongation:** The fractional increase in length of material stressed in tension.
- EMI:** Abbreviation for electromagnetic interference.
- EMRC:** Energy Mines and Resources Canada
- EPDM:** Ethylene-propylene-diene monomer rubber. A material with good electrical insulating properties.
- EPR:** Ethylene-propylene copolymer rubber. A material with good electrical insulating properties.
- Equal Load Sharing:** An even distribution of current between the parallel cables in a power circuit.
- Equilay:** See Unilay: More than one layer of helically laid wires with the length of the lay the same for each layer.
- Farad:** A unit of electrical capacity.
- Fatigue Resistance:** Resistance to metal crystallization which leads to conductors or wires breaking from flexing.
- Ferrous:** Composed of and/or containing iron. A ferrous metal exhibits magnetic characteristics (e.g. steel armor).
- FEP:** Fluorinated ethylene propylene insulated wire (see Teflon).
- Fiber:** A single, separate optical transmission element characterized by core and cladding.
- Fiber Optics:** Light transmission through optical fibers communication and signaling.
- Filled Cable:** Cable construction in which the cable core is filled with a material that will prevent moisture or gasses from entering or passing through the cable.
- Filler:** 1) A material used in multi-conductor cables to occupy large interstices formed by the assembled conductors; 2) An inert substance added to a compound to improve properties.
- Flat Cable:** A cable with two essentially flat surfaces (e.g. NMD90).
- Flat Conductor:** A wire having a rectangular cross section as opposed to round or square conductors.
- Flame Resistance:** The ability of a material not to propagate flame once the heat source is removed (see FT1).
- Flammability:** The measure of the materials ability to support combustion.
- Flex Life:** The measurement of the ability of a conductor or cable to withstand repeated bending before breaking.
- Flexibility:** The ease with which a cable may be bent without sustaining damage.
- FT1:** One of several CSA flame test designations for wires and cables which pass the C22.2 No. 0.3 test requirements. (Other designations include FT2, FT4, etc.).
- Fusion Splice:** A splice accomplished by the application of localized heat sufficient to fuse or melt the ends of two lengths of optical fiber, forming a continuous single fiber.
- Gauge:** A term used to denote the physical size of a wire.
- GND:** Abbreviation for ground.
- Graded-Index:** A type of optical fiber in which the refractive index of the core is in the form of a parabolic curve, decreasing toward the cladding. This type of fiber provides high bandwidth capabilities.
- Ground (GND):** 1) A conducting connection between an electrical circuit and the earth, or other large conducting body, to serve as an earth thus making a complete electrical circuit; 2) Term used for non-current carrying conductor in a cable (see Bonding Conductor).
- Halogen:** A term used to identify any of the four elements chlorine, fluorine, bromine and iodine, grouped together because their chemical properties are similar.
- Hard Drawn Copper Wire:** Copper wire that has not been annealed after drawing.

Glossary

Heat Shock: A test to determine stability of a material by sudden exposure to a high temperature for a short period of time.

Henry: The unit of inductance.

Hertz (Hz): A term replacing cycles-per-second as an indication of frequency.

Hi-Pot (High Potential): A test designated to determine the highest voltage that can be applied to a conductor without breaking down the insulation (see Dielectric Test).

High Voltage (HV): Generally, a wire or cable with an operating voltage of over 600 volts.

Hook-Up Wire: A wire used for low current, low voltage (under 1000 volts) applications within enclosed electronic equipment.

Hygroscopic: A material capable of absorbing moisture from the air.

Hypalon: Dupont's trade name for their chlorosulfonated polyethylene, an ozone resistant synthetic rubber.

ICEA (formerly IPCEA): Insulated Cable Engineers Association.

IEEE: Institute of Electrical and Electronics Engineers.

Impact Strength: A test for determining the mechanical punishment a cable can withstand without physical or electrical breakdown by impacting with a given weight, dropped a given distance, in a controlled environment.

Impedance: The total opposition that a circuit offers to the flow of alternating current or any other varying current at a particular frequency. It is a combination of resistance R and reactance X, measured in ohms.

Inductance: The property of a circuit or circuit element that opposes a change in current flow, thus causing current changes to lag behind voltage changes. It is measured in henrys.

Insulation: A material having good dielectric properties permitting close assembly of conductors in cable and equipment.

Insulation Level: A designation used to identify the insulation thickness required to protect a high voltage cable under ground fault conditions. Expressed as a percentage (e.g. 100% level, 133% level).

Insulation Shield (HV Cable): A two part shield consisting of a non-metallic component and a metallic component. The first component is an extrusion of black semi-conducting thermoset material over the insulation which provides uniform radial stress distribution across the insulation. The second component is a metallic shield which is typically copper tape or wire that functions as a bonding (grounding) conductor and/or a neutral conductor. The metallic shield also serves to conduct ground fault current in the event of insulation failure. See also drain wire.

Insulation Stress: High voltage stress which causes molecular separation in the insulation at sharp projections in the conductor. Controlled by conductor and insulation shielding, called a stress relief shield. Measured in volts per mil.

Interaxial Spacing: Center to center conductor spacing.

Interstices: Voids or valleys between individual strands in a conductor or between insulated conductors in a multi-conductor cable, (interstitial spaces).

Irradiation: In insulations, the exposure of the material to high energy emissions for the purpose of favorably altering the molecular structure by crosslinking.

Jacket: An outer covering, usually non-metallic, mainly used for protection against the environment.

kcmil: One thousand circular mils (MCM).

KILO: A prefix denoting 1000 (10³).

kV: Kilovolt (1000 volts).

Laminated Tape: A tape consisting of two or more layers of different materials bonded together (e.g. aluminum/Mylar). **Lay:** The length measured along the axis of a wire or cable required for a single strand (in stranded wire) or conductor (in cable) to make one complete turn about the axis of the conductor or cable.

Lay Direction: The twist in the cable as indicated by the top strands while looking along the axis of the cable away from the observer. Described as right hand or left hand.

Leakage Current: The undesirable flow of current through or over the surface of an insulation.

Line Drop (Voltage Drop): A voltage loss occurring between any two points in a power circuit. Such loss, or drop, is due to the resistance, reactance, or leakage of the circuit, type of cable and configuration.

Line Voltage: The value of the potential existing on a supply or power line. Rated voltage of cables.

LOCA: Abbreviation for loss of coolant accident, a system malfunction associated with nuclear generating stations.



Glossary

Loss Factor: The product of the dissipation and dielectric constant of an insulating material.

Longitudinal Shield: A tape shield, flat or corrugated, applied longitudinally with the axis of the core being shielded.

Microampere: One-millionth of an ampere (10-6).

Milliampere: One-thousandth of an ampere (10-3).

Magnetic Noise: Caused by current frequency. An AC powerline creates a magnetic field around that cable, this magnetic field causes the magnetic noise in neighboring control or instrumentation circuits.

MCM: One thousand circular mils (kcmil).

Meg or Mega: A prefix denoting 1,000,000.

Megarad: A unit for measuring radiation dosage.

Messenger: The linear supporting member, usually a high strength steel wire, used as the supporting element of a suspended aerial cable. The messenger may be an integral part of the cable, or exterior to it.

Mho: The unit of conductivity. The reciprocal of an ohm.

Micro: A prefix denoting one-millionth.

Micron: (m) Millionth of a meter.

Mil: A unit of length equal to one-thousandth of an inch (.001). Common unit for insulation thickness.

Milli: A prefix denoting one-thousandth (10-3).

Modulus of Elasticity: The ratio of stress to strain in an elastic material.

Moisture Absorption: The amount of moisture, in percentage, that a material will absorb under specified conditions.

Moisture Resistance: The ability of a material to resist absorbing moisture from the air or when immersed in water.

Multi-Conductor Cable: A cable consisting of two or more conductors, either cabled or laid in a flat parallel construction, with or without a common overall covering.

Mutual Capacitance: Capacitance between two conductors when all other conductors including ground are connected together.

Mylar: DuPont trade name for a polyester material.

Nano: A numerical prefix denoting one-billionth (10-9).

National Electrical Code (NEC): A U.S. consensus standard published by the National Fire Protection Association (NFPA) and incorporated in OSHA regulations. (Canadian Counterpart is the CE Code).

NEMA: National Electrical Manufacturers Association. (Canadian counterpart is EEMAC).

Neoprene: A synthetic rubber with good resistance to oil, chemicals and flame. Also called polychloroprene.

Nomex: Dupont trademark for a temperature resistant, flame-retardant nylon.

Non Hygroscopic: A material incapable of taking up or absorbing moisture from the air.

Nylon: An abrasion-resistant thermoplastic with good chemical resistance. A DuPont registered trademark.

OHM: The electrical unit of resistance.

OSHA: Abbreviation for the U.S. Occupational Safety and Health Act.

Overlap: The amount the trailing edge laps over the leading edge of a spiral tape wrap.

Oxygen Index: Percentage of oxygen necessary to support combustion in a gas mixture. Flame retardant materials have a higher oxygen index.

Pair: Two insulated wires of a single circuit twisted together or laid parallel.

Parallel Cable: Two or more cables used to share the current in heavily loaded power circuits which permits the use of smaller conductors.

Percentage Conductivity: Conductivity of a material expressed as a percentage of that of copper. Also used to indicate ratio of conductance between the phase conductor and the neutral in power cables.

Pick: Distance between two adjacent crossover points of braid filaments. The measurement in picks per inch indicates the degree of coverage.

PICO: A prefix denoting one-millionth of one-millionth (10-12).

Pitch: In flat cable, the nominal distance between the index edges of two adjacent conductors.

Pitch Diameter: Diameter of a circle passing through the center of the conductors in any layer of a multi-conductor cable.



Glossary

- Plastic Deformation:** Change in dimensions under load that is not recovered when the load is removed.
- Plasticizer:** A chemical agent added to plastics to make them softer and more pliable.
- Plenum Cable:** Cable approved for installation in plenums, (e.g. suspended ceiling) without the need for conduit.
- Polyester:** Polyethylene terephthalate which is used extensively in the production of a high strength moisture resistant film used as a cable core wrap (see Mylar).
- Polyethylene (PE):** A thermoplastic material having excellent electrical and physical properties.
- Polymer:** A material of high molecular weight formed by the chemical union of monomers.
- Polyolefin:** A family of thermoplastics based upon the unsaturated hydrocarbons known as olefins. When combined with butylene or styrene polymers they form compounds such as polyethylene and polypropylene.
- Polypropylene (PPE):** A thermoplastic similar to polyethylene but stiffer and having a higher softening point (temperature).
- Polyurethane/PUR:** This thermoplastic material is used primarily as a cable jacket material. It has excellent oxidation, oil, and ozone resistance. Some formulations also have good flame resistance. It is a hard material with excellent abrasion resistance. It has outstanding memory properties, making it an ideal jacket material for retractile cords.
- Polyvinyl Chloride (PVC):** A general purpose thermoplastic used for low voltage wire and cable insulation, and for jackets.
- Power Factor:** The ratio of resistance to impedance. The ratio of the actual power of an alternating current to apparent power. Mathematically, the cosine of the angle between the voltage applied and the current resulting.
- Primary Insulation:** The first layer of non-conductive material applied over a conductor, whose prime function is to act as electrical insulation.
- Pulling Eye:** A device fastened to a cable to which a hook may be attached in order to pull the cable.
- Quad:** Four insulated wires of a single circuit.
- REA:** Rural Electrification Administration. A branch of the U.S. Department of Agriculture.
- Reactance:** The opposition offered to the flow of alternating current by inductance or capacitance of a component or circuit.
- Reel Drum Diameter:** Diameter of the drum (or hub) of the reel.
- Reel Flange Diameter (Reel Height):** Diameter of the reel flanges.
- Reel Traverse:** Width of space between reel flanges.
- Reel Width:** Overall width of reel.
- Ridge Marker:** One or more ridges running laterally along the outer surface of a insulated wire or cable for purposes of identification.
- Root Mean Square (RMS):** The effective value of an alternating current or voltage.
- Rope Lay Conductor:** A conductor composed of a central core surrounded by one or more layers of helically laid groups of wires used in portable cables.
- Rubber:** A general term used to describe wire insulation and jackets made of thermosetting elastomers, such as natural or synthetic rubbers, EPR, neoprene, Hypalon, butyl rubber and others.
- SBR:** A copolymer of styrene and butadiene. Also GR-S or Buna-S. Most commonly used type of synthetic rubber.
- Self Extinguishing:** The characteristic of a material whose flame is extinguished after the igniting flame is removed.
- Semi-Conductor:** In wire industry terminology, a material possessing electrical conductivity that falls somewhere between that of conductors and insulators. Usually made by adding carbon particles to an insulator (e.g. conductor shield and insulation shield). Not the same as semi-conductor materials such as silicon, germanium, etc used for making transistors and diodes.
- Separator:** Pertaining to wire and cable, a layer of insulating material such as textile paper, Mylar, etc. which is placed between a conductor and its dielectric, between a cable jacket and the components it covers, or between various components of a multi-conductor cable. It can be utilized to improve stripping qualities, flexibility, or can offer additional mechanical or electrical protection to the components it separates.

Glossary

Served Wire Armor (SWA): Spiral wrap of galvanized steel wires applied around a cable to afford mechanical protection and increase the cable pulling tension characteristics, (mineshaft, submarine cable, etc.). Also used to denote steel wire armor.

Sheath: The outer covering or jacket of a multi-conductor cable. Usually non-metallic.

Shield (Electrostatic): In cables, a metallic layer placed around a conductor or group of conductors to prevent electrostatic interference between the enclosed wires and external fields. Also see Insulation Shield.

Shrink Tubing: Tubing which has been extruded, crosslinked, and mechanically expanded which when reheated will return to its original diameter.

SIA: Steel Interlocked Armor.

Side Wall Bearing Pressure (SWBP): A term used in reference to the pressure on a cable which is being pulled around a curved surface under tension. If excessive, SWBP can damage cable components and reduce the life of the cable.

Signal Cable: A cable designed to carry current of usually less than one ampere per conductor to operate signal circuit devices.

Silicone: A material made from silicone and oxygen. Can be in thermosetting elastomer or liquid form. The thermosetting elastomer form is noted for high heat resistance.

Skin Effect: The tendency of alternating current to concentrate and to travel only on the surface of a conductor. Tendency increases with increase in frequency.

Sleeving: An extruded tube.

Spark Test: A test designed to locate imperfections (usually pin-holes) in the insulation of a wire or cable by application of voltage for a very short period of time while the wire is being drawn through the electrode field.

Specific Gravity: The ratio of the density (mass per unit volume) of a material to that of water.

Specific Inductive Capacity (SIC): Same as dielectric constant (See Dielectric Constant).

Tank Test: A voltage insulation test in which the insulated wire or cable is submerged in water and voltage is applied between the conductor and water serving as ground. Shielded cables are generally not tank tested due to the possibility of introducing contaminants on the outer surface of the insulation.

Teflon: DuPont Company trademark for fluorocarbon resins. (See FEP and TFE.)

Temperature Rating: The maximum temperature at which an insulating material may be used in continuous operation without loss of its basic properties (i.e. operating, overload, short circuit). The minimum temperature for safe handling.

Tensile Strength: The pull stress required to break a given specimen Measured in pounds per square inch. Also referred to as Ultimate Tensile Strength.

TFE: Tetrafluoroethylene. A thermoplastic material with good electrical insulating properties and chemical and heat resistance.

Thermoplastic: A material that can be softened repeatedly by heating and hardened by cooling through a temperature range characteristic of the plastic, and that in the softened state can be shaped by molding or extrusion.

Thermoset: A material that has been vulcanized by heat or other means and is substantially infusible and insoluble.

Three Conductor Cable: Three insulated conductors assembled with other necessary cable components (shield, filler, etc.) to form a core, protected by an overall jacket.

Tinned Copper: Tin coating added to copper to aid in soldering and inhibit corrosion.

Tray: A cable tray system is a unit or assembly of units or sections, and associated fittings, made of non-combustible materials forming a rigid structural system used to support cables. Cable tray systems (previously termed continuous rigid cable supports) include ladders troughs, channels, solid bottom trays, and similar structures.

Tray Cable: A factory assembled multi-conductor or multi-pair control, signal or power cable specifically approved under the Canadian Electrical Code for installation in trays.

Glossary

Triad: Three insulated wires of a single circuit forming a unit. (Two or more units are cabled to form a multi-triad cable.)

Triplexed Cable: Three individual cables twisted together.

UL: Underwriters Laboratories. A non-profit independent organization, which operates a listing service for electrical and electronic materials and equipment. (Canadian counterpart is CSA).

UHF: Abbreviation for ultra high frequency, 300 to 3,000 MH

Metric Conversion

	To Convert From	To	Multiply By
Length	Inches	Millimeters	25.4
	Millimeters	Inches	0.03937
	Inches	Centimeters	2.54
	Centimeters	Inches	0.3937
	Feet	Meters	0.3048
	Meters	Feet	3.2808
	Kilofeet (1000 ft)	Kilometers	0.3048
	Kilometers	Kilofeet (1000 ft)	3.2808
	Square Inches	Square Millimeters	645.16
	Square Millimeters	Square Inches	0.00155
Area	Square Inches	Square Centimeters	6.4516
	Square Centimeters	Square Inches	0.155
	Square Inches	Circular Mils	1,273,240
	Circular Mils	Square Inches	7.854×10^{-7}
	Circular Mils	Square Millimeters	2.066×10^4
	Square Millimeters	Circular Mils	1973.51
Weight	Square Feet	Square Meters	0.0929
	Square Meters	Square Feet	10.764
	Pounds	Kilograms	0.4536
	Kilograms	Pounds	2.2046
Electrical	Pound/Kilofeet	Kilograms/Kilometer	1.4882
	Kilograms/Kilometer	Pounds/Kilofeet	0.6720
	Ohms/Kilofeet	Ohms/Kilometer	3.2808
	Ohms/Kilometer	Ohms/Kilofeet	0.3048
	Microfarads/Kilofeet	Microfarads/Kilometer	3.2808
	Microfarads/Kilometer	Microfarads/Kilofeet	0.3048
Mechanical	Insulation Resistance: Megohms--Kilofeet	Megohms—Kilometer	0.3048
	Megohms—Kilometer	Megohms—Kilofeet	3.2808
	Pounds/Square Inch	Kilo Pascal*	6.895
	Kilo Pascal*	Pounds/Square Inch	0.1432
	Pounds (force)	Newtons	4.448
Newtons	Pounds (force)	0.2248	

* 1 Pascal = 1 newton/m²

Temperature Conversion Table

Read known temperature in bold face type. Corresponding temperature in degrees Fahrenheit will be found in column to the right. Corresponding temperature in degrees Centigrade will be found in column to the left.

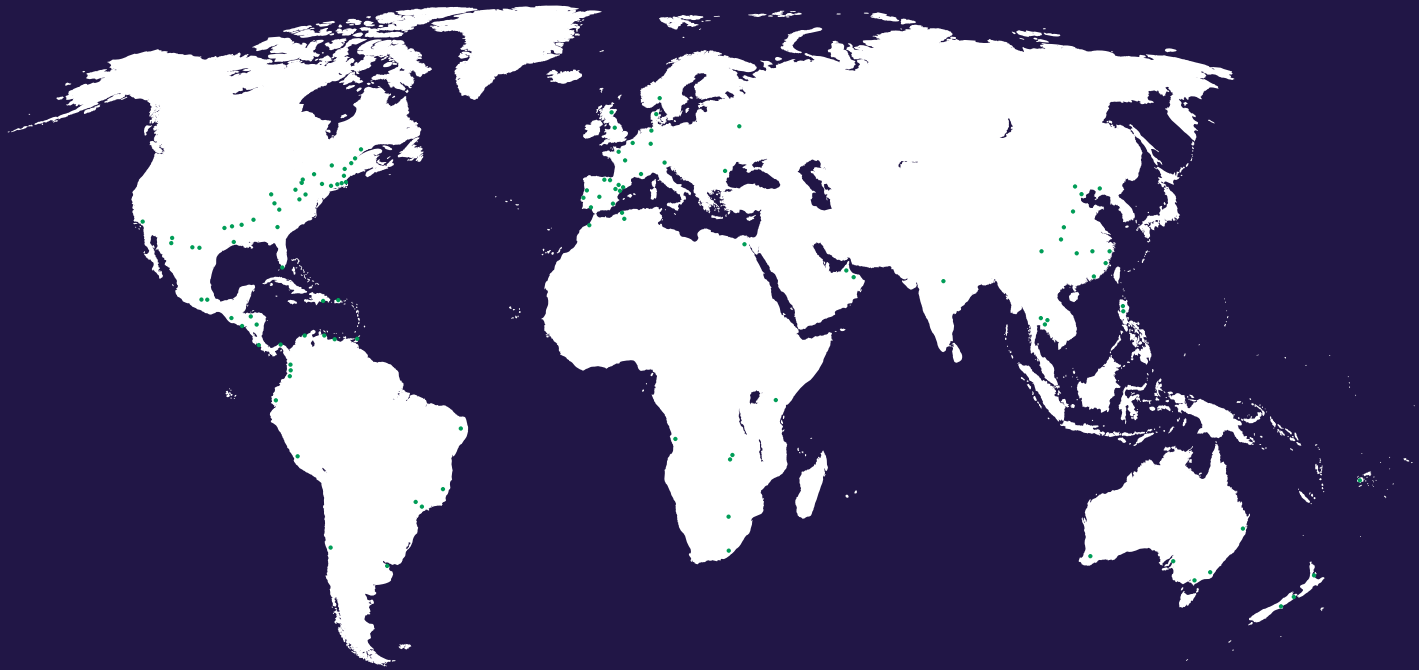
-5 to -100			0 TO 100						100 TO 500		
°C		°F	°C		°F	°C		°F	°C		°F
-73.3	-100	-148	-17.8	0	32.0	10.0	50	122.0	38	100	212
-70.5	- 95	-139	-17.2	1	33.8	10.6	51	123.8	43	110	230
-67.8	- 90	-130	-16.7	2	35.6	11.1	52	125.6	49	120	248
-65.0	- 85	-121	-16.1	3	37.4	11.7	53	127.4	54	130	266
-62.2	- 80	-112	-15.6	4	39.2	12.2	54	129.2	60	140	284
-59.5	- 75	-103	-15.0	5	41.0	12.8	55	131.0	66	150	302
-56.7	- 70	- 94	-14.4	6	42.8	13.3	56	132.8	71	160	320
-53.9	- 65	- 85	-13.9	7	44.6	13.9	57	134.6	77	170	338
-51.1	- 60	- 76	-13.3	8	46.4	14.4	58	136.4	82	180	356
-48.3	- 55	- 67	-12.8	9	48.2	15.0	59	138.2	88	190	374
-45.6	- 50	- 58	-12.2	10	50.0	15.6	60	140.0	93	200	392
-42.8	- 45	- 49	-11.7	11	51.8	16.1	61	141.8	99	210	410
-40.0	- 40	- 40	-11.1	12	53.6	16.7	62	143.6	100	212	413
-37.2	- 35	- 31	-10.6	13	55.4	17.2	63	145.4	104	220	428
-34.4	- 30	- 22	-10.0	14	57.2	17.8	64	147.2	110	230	446
-31.6	- 25	- 13	-9.44	15	59.0	18.3	65	149.0	116	240	464
-28.9	- 20	- 4	-8.89	16	60.8	18.9	66	150.8	121	250	482
-26.1	- 15	5	-8.33	17	62.6	19.4	67	152.6	127	260	500
-23.3	- 10	14	-7.78	18	64.4	20.0	68	154.4	132	270	518
-20.5	- 5	23	-7.22	19	66.2	20.6	69	156.2	138	280	536
			-6.67	20	68.0	21.1	70	158.0	143	290	554
			-6.11	21	69.8	21.7	71	159.8	149	300	572
			-5.56	22	71.6	22.2	72	161.6	154	310	590
			-5.00	23	73.4	22.8	73	163.4	160	320	608
			-4.44	24	75.2	23.3	74	165.2	166	330	626
			-3.89	25	77.0	23.9	75	167.0	171	340	644
			-3.33	26	78.8	24.4	76	168.8	177	350	662
			-2.78	27	80.6	25.0	77	170.6	182	360	680
			-2.22	28	82.4	25.6	78	172.4	188	370	698
			-1.67	29	84.2	26.1	79	174.2	193	380	716
			-1.11	30	86.0	26.7	80	176.0	199	390	734
			-0.56	31	87.8	27.2	81	177.8	204	400	752
			0	32	89.6	27.8	82	179.6	210	410	770
			0.56	33	91.4	28.3	83	181.4	216	420	788
			1.11	34	93.2	28.9	84	183.2	221	430	806
			1.67	35	95.0	29.4	85	185.0	227	440	824
			2.22	36	96.8	30.0	86	186.8	232	450	842
			2.78	37	98.6	30.6	87	188.6	238	460	860
			3.33	38	100.4	31.1	88	190.4	243	470	878
			3.89	39	102.2	31.7	89	192.2	249	480	896
			4.44	40	104.0	32.2	90	194.0	254	490	914
			5.00	41	105.8	32.8	91	195.8	260	500	932
			5.56	42	107.6	33.3	92	197.6			
			6.11	43	109.4	33.9	93	199.4			
			6.67	44	111.2	34.4	94	201.2			
			7.22	45	113.0	35.0	95	203.0			
			7.78	46	114.8	35.6	96	204.8			
			8.33	47	116.6	36.1	97	206.6			
			8.89	48	118.4	36.7	98	208.4			
			9.44	49	120.2	37.2	99	210.2			
						37.8	100	212.0			

Interpolation Factors

°C		°F	°C		°F	°C		°F
0.56	1	1.8	2.22	4	7.2	3.89	7	12.6
1.11	2	3.6	2.78	5	9.0	4.44	8	14.4
1.67	3	5.4	3.33	6	10.8	5.00	9	16.2



Global Reach



General Cable, a leading wire and cable innovator for over 170 years, serves customers through a global network of manufacturing facilities in our core markets and has worldwide sales representation and distribution. The Company is dedicated to the production of high-quality aluminum, copper and fiber optic wire and cable and systems solutions for the energy, construction, industrial, specialty and communications sectors. In addition to our strong brand recognition and strengths in technology and manufacturing, General Cable is also competitive in such areas as distribution and logistics, marketing, sales and customer service. This combination enables General Cable to better serve its customers as they expand into new geographic markets.

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