OPTICAL CABLE CORPORATION

INDUSTRY SOLUTIONS:

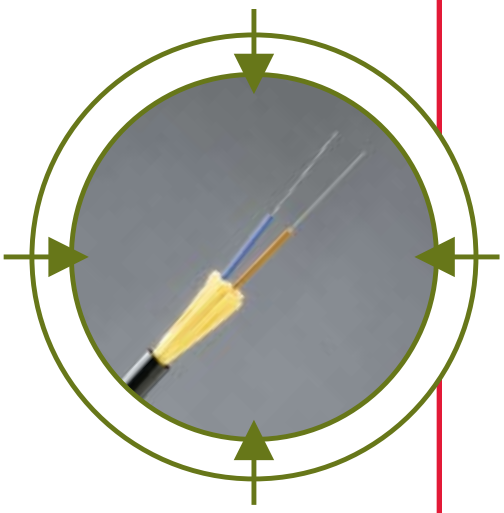
MILITARY

A tradition of leadership in technology, product performance for military applications

Optical Cable Corporation is a leading manufacturer of fiber optic cables primarily sold into the enterprise market, and the premier manufacturer of military ground tactical fiber optic cables for the U.S. military. Founded in 1983, Optical Cable Corporation pioneered the design and production of fiber optic cables for the most demanding military field applications, as well as fiber optic cables suitable for both indoor and outdoor use. The Company's current broad product offering is built on the evolution of these fundamental technologies, and is designed to provide end-users with fiber optic cables that are easy and economical to install, provide a high degree of reliability and offer outstanding performance characteristics. Optical Cable Corporation sells its products worldwide for uses ranging from commercial and campus installations to customized products for specialty applications and harsh environments, including military applications. The Company manufactures its high quality fiber optic cables at its ISO 9001:2000 registered and MIL-STD- 790F certified facility located in Roanoke, Virginia.

Industry Firsts for Optical Cable Corporation

- **First** to standardize on 100 kpsi proof-tested fiber
- **First** gel-free fiber optic cable for outdoor commercial applications
- **First** outdoor fiber optic cables not requiring fanout/breakout kits to terminate
- **First** Core-Locked™ outer cable jacket design
- **First** with UL listed indoor / outdoor cable
- **First** with dry water blocking
- **First** easy to dispense box with decreasing cable length markings, OptiReel™
- **First** with Delay Equalized cable



What differentiates Optical Cable Corporation from other companies?

- More than **25 years of history** in the military and harsh environment fiber optic cable business
- Designing products based on **what the military "really" needs** as opposed to making an existing product fit the mold.
- Our **certifications and approvals** by defense agencies and program offices

Optical Cable Corporation's military fiber optic cable has been qualified to the most demanding military specifications:

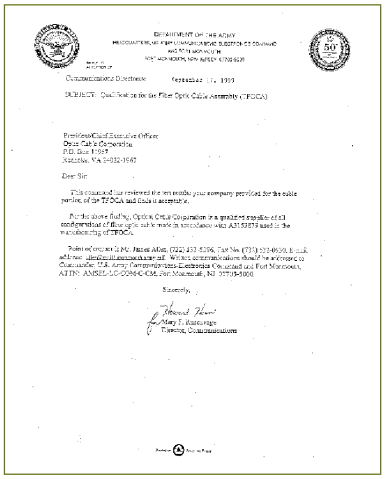
- MIL-PRF-85045/8A (US DOD)
- A3159879 (US Army CECOM)
- Def-Stan 60-1, Part 3 (UK MOD)
- DOD certified facility for MIL-STD-790, Product Assurance Program

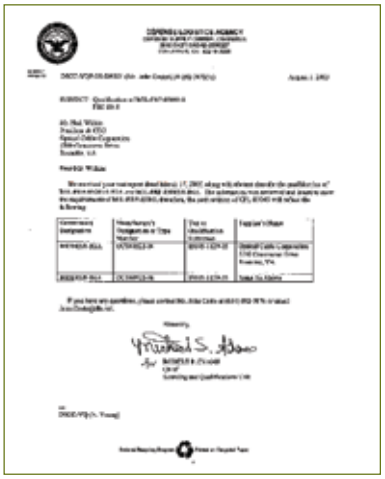

MIL-STD-790
PRODUCT ASSURANCE PROGRAM
CERTIFICATION
IS HEREBY AWARDED TO
OPTICAL CABLE CORPORATION

U.S. Army and Defense Logistics Agency Approvals

Ground Tactical Fiber Optic Cable also Qualified to MIL-PRF-85045/8A

Optical Cable Corporation is the only fiber optic cable manufacturer currently with MIL-PRF-85045/8A certification. Optical Cable Corporation's manufacturing facility is also certified by the U.S. Department of Defense as a MIL-STD-790F facility. This certification is considered one of the most respected in the defense industry as it requires compliance with stringent government requirements for product design, documentation, process control, and management practices.





U.K. MOD Def-Stan Certification

Ground Tactical Fibre Optic Cable Qualified to Def-Stan 60-1, Part 3

The U.K. Ministry of Defence (MoD) has certified Optical Cable Corporation as a fully qualified supplier of ground tactical fibre optic cable, meeting all military requirements. A government certified independent test laboratory subjected Optical Cable's military ground tactical fibre optic cable to a series of rigorous optical, environmental and mechanical tests as defined in Def-Stan 60-1, Part 3. The test results were reviewed by QinetiQ Batteries, Cables and Connectors at Sevenoaks, Kent, UK.

QinetiQ validated that the Company's submitted military ground tactical fibre optic cable design complied with the MoD's stringent test requirements. As a result, the MoD has added Optical Cable Corporation as a qualified supplier of Def-Stan 60-1, Part 3 ground tactical fibre optic cable.


QinetiQ

WHY USE FIBER OPTIC CABLE IN A TACTICAL ENVIRONMENT?

OPTICAL CABLE CORPORATION

The five primary advantages of fiber optic cable over conventional coax cable:

1. REPEATERLESS COMMUNICATIONS

- Fiber Optic – Repeaters every 16 kms (or more)
- Coax – Repeaters every 500 meters

2. WEIGHT

- Coax cable weighs approx. five times more than equivalent lengths of fiber optic cable
- 16 kilometers of coax cable weigh approx. 2,800 kgs
  16 kilometers of fiber optic cable weigh approx. 550 kgs

3. HIGHER BANDWIDTH

- Optimized for applications requiring mulitplexed voice, data, and video signals

4. SECURITY

- All dielectric. No signature
- Not affected by EMI or RFI
- Very difficult to tap. Reduces need for encryption

5. RUGGED

- More rugged than coax
- No memory

A fully qualified ground tactical fiber optic communications cable for military applications

ANNOUNCING MIL-PRF-85045/8A CERTIFIED FIBER OPTIC CABLES. FIELD PROVEN... AND CERTIFIED.

Optical Cable Corporation has always manufactured the most rugged and robust fiber optic cables for the military ground tactical market—field proven cables relied on by defense agencies around the world.

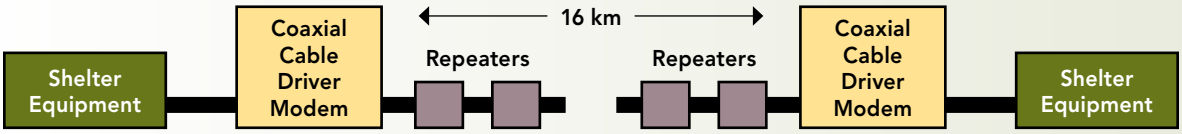
The United States Defense Logistics Agency has certified Optical Cable Corporation as an approved manufacturer of qualified ground tactical fiber optic cables in accordance with MIL-PRF-85045/8A.

This certification was granted after subjecting these fiber optic cable products to an exhaustive series of optical, mechanical, and environmental tests to ensure full compliance to the demanding requirements of the United States military.

Benefits of Optical Fiber Over Coax (traditional field communications media)

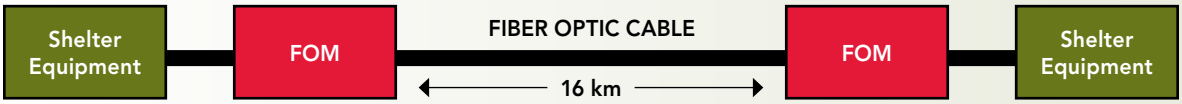
Coax Implementation

- 16-kilometer link weighs 2800 kgs
- 16-kilometer link requires 37 Repeaters
- Five links require five 2.5 ton trucks



Optical Fiber Implementation

- 16-kilometer link weighs 550 kgs
- 16-kilometer link is repeaterless
- Eliminates requirement for coax modems
- Five links require a single 2.5 ton truck



Benefits of Using Optical Cable Corporation Military Cables

Features	Benefit
Hard Elastomeric Secondary Buffer	Wide operating temperature / greater impact resistance
Helically Stranded Cable Core	Highly resistant to bend and flex
Tightbound	Pull and Tear Resistant
Core-Locked™	Higher Tension / Bend / Tear / Water / Crush / Impact Resistance

Optical Cable Corporation Military cables have been optimized for deployment and retrieval applications!

Optical Cable Corporation's Excellent Tight-buffered Technology offers:

Proven materials that are:

- UV inhibited
- Fungus resistant
- Water resistant for outdoor use
- Impervious to fluids
- Tear resistant

Air Defense

Fire Support

Fiber Optic Cable

Fiber Optic Cable

Fiber Optic Cable

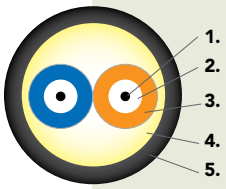
Command Post

Troop Movement

Harsh Environments

Overview

- Ground-tactical cables are ideal for use in harsh environments where deployment and retrieval for reuse is required.



1. Optical Fiber
2. Acrylate Fiber Coating
3. Color-Coded 900 µm Diameter Tight-Buffer
4. Aramid Strength Member
5. Core-Locked™ Tactical Polyurethane Jacket (standard)

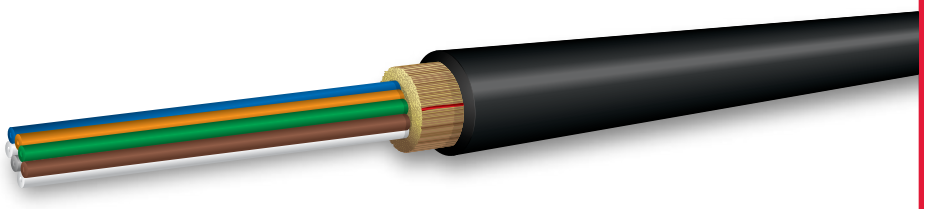
Features

- Extremely strong, lightweight, rugged, survivable tight-buffered cables designed for military tactical field use and commercial applications
- Compact, round cable design for ease of transportation and deployment
- Designed for use in adverse environments where reduced size and weight are important
- Helically stranded cable core for flexibility, deployment survivability and exceptional mechanical protection for the optical fibers
- Cables have been tested and are in use in military data communications applications worldwide
- Can be used outdoors for temporary deployment directly on the ground in all terrains, including severe environments
- Suitable for industrial, mining and petrochemical environments – chemical resistant
- Crush-resistant and resilient with a thick layer of aramid strength members
- Polyurethane jacketed for abrasion, cut and chemical resistance

Mechanical and Environmental Performance

Impact Resistance:	200 Impacts (EIA/TIA-455-24 mil. requirement)
Crush Resistance:	440 N/cm (EIA/TIA-455-41 mil. requirement)
Flex Resistance:	2,000 Cycles (EIA/TIA-455-104 mil. requirement
Operating Temperature:	-55°C to +85°C
Storage Temperature:	-70°C to +85°C

- Most commonly used with ruggedized multiway military tactical field connectors, for maximum connector retention (400 lbs)
- Tactical Polyurethane (C) outer jacket material is standard. Flame retardant (E), Flame retardant tactical (V) and low smoke zero halogen (G) outer jacket materials are available



Cable Characteristics: D-Series Distribution Mil-Tac Cables

Fiber Count	Diameter mm (in)	Weight kg/km (lbs/1,000')	Installation Tensile Load N (lbs)	Operational Tensile Load N (lbs)	Minimum Bend Radius Installation cm (in)	Minimum Bend Radius Operational cm (in)
2	5.0 (0.20)	21 (14)	1,800 (400)	600 (130)	8.0 (3.1)	4.0 (1.6)
4	5.5 (0.22)	27 (18)	1,800 (400)	600 (130)	8.8 (3.5)	4.4 (1.7)
6	6.0 (0.24)	32 (22)	1,800 (400)	600 (130)	9.6 (3.8)	4.8 (1.9)
8	6.5 (0.26)	37 (25)	1,800 (400)	600 (130)	10.4 (4.1)	5.2 (2.0)
10	6.5 (0.26)	37 (25)	2,100 (470)	700 (160)	10.4 (4.1)	5.2 (2.0)
12	6.5 (0.26)	36 (24)	2,100 (470)	700 (160)	10.4 (4.1)	5.2 (2.0)
18	7.5 (0.30)	49 (33)	2,400 (540)	800 (180)	12.0 (4.7)	6.0 (2.4)
24	8.5 (0.33)	56 (38)	3,000 (670)	1,000 (220)	13.6 (5.4)	6.8 (2.7)

"Mil-Tac" designated and tested cables available to 24 fibers.
Other fiber counts available with Polyurethane outer jacket.
Installation loads in excess of 2,700 N (600lbs.) are not recommended.

Ordering Information

	D	**–**								**5**	**K**	**M**
Digit No:	1	2	3	4	5	6	7	8	9	10	11	12

1 – 2 Mil-Tac Distribution Series Ultra-Fox Plus™= **D –**
3 – 5 Fiber count: (See Cable Characteristics Chart) = **002 – 024**
6 Jacket type:
- Tactical Polyurethane = **C**
- Flame Retardant Polyurethane = **E**
- Low Smoke Zero Halogen Polyurethane = **G**
- Tactical Flame Retardant Polyurethane = **V**

7 – 9 Fiber type: (See Ultra-Fox™ Plus Fiber Performance Table - Pg. MC 12)
- 62.5 µm multimode = **WST**
- 50 µm multimode = **AST**
- Single-mode = **SLS**

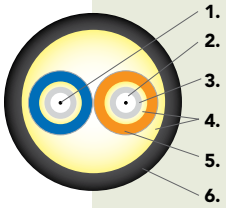
10 500 micron fiber with 900 micron tight buffer = **5**
11 Jacket Color: Black = **K**
12 Rating: Mil = **M**

Example: 12 fiber mil-tac distribution cable using 62.5 µm fiber, tactical polyurethane black jacket –

D	**–**	**0**	**1**	**2**	**C**	**W**	**S**	**T**	**5**	**K**	**M**

Overview

- Ground-tactical cables are ideal for use in harsh environments where deployment and retrieval for reuse is required.



1. Optical Fiber
2. Acrylate Fiber Coating
3. 900 µm Diameter Tight-Buffer
4. Aramid Strength Member
5. Color-coded Elastomeric Subcable Jacket
6. Core-Locked™ Polyurethane Jacket

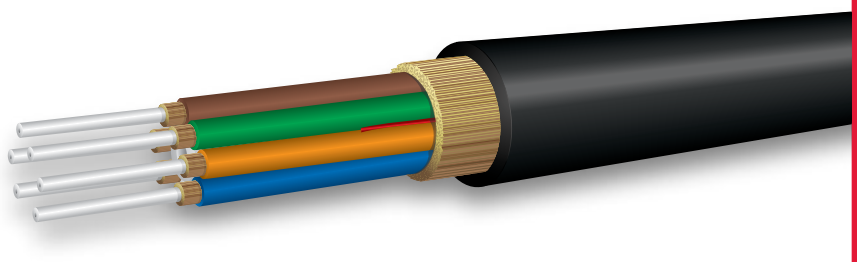
Features

- Extremely strong, lightweight, rugged, survivable tight-buffered cables designed for military tactical field use and commercial applications
- Polyurethane jacketed for abrasion, cut, crush, impact, and chemical resistance
- Breakout cable design with individual color-coded subcables protecting each optical fiber
- Crush resistant and resilient
- Helically stranded cable core for flexibility, deployment survivability and exceptional mechanical protection for the optical fibers
- Cables have been tested and are in use in military data communications applications worldwide
- Excellent for use in deployment/retrieval applications
- Can be used outdoors for temporary deployment directly on the ground in all terrains, including severe environments
- Suitable for industrial, mining and petrochemical environments – chemical resistant
- Round cable design for easy installation and survivability
- Ideally suited for use with MIL-C-38999 style military connectors – subcables terminate to individual pins and overall aramid strength member terminates to backshell

Mechanical and Environmental Performance

Impact Resistance:	200 Impacts (EIA/TIA-455-24 mil. requirement)
Crush Resistance:	440 N/cm (EIA/TIA-455-41 mil. requirement)
Flex Resistance:	2,000 Cycles (EIA/TIA-455-104 mil. requirement
Operating Temperature:	-55°C to +85°C
Storage Temperature:	-70°C to +85°C

- 2.0 mm subcables standard
- Tactical Polyurethane (C) outer jacket material is standard. Flame retardant (E), Flame retardant tactical (V) and low smoke zero halogen (G) outer jacket materials are available



Cable Characteristics: B-Series Breakout Mil-Tac Cables

Fiber Count	Diameter mm (in)	Weight kg/km (lbs/1,000')	Installation Tensile Load N (lbs)	Operational Tensile Load N (lbs)	Minimum Bend Radius Installation cm (in)	Minimum Bend Radius Operational cm (in)
2	6.5 (0.26)	36 (24)	2,200 (490)	550 (120)	10.4 (4.1)	5.2 (2.0)
4	7.5 (0.30)	47 (32)	2,200 (490)	550 (120)	12.0 (4.7)	6.0 (2.4)
6	8.5 (0.33)	56 (37)	2,400 (540)	600 (130)	13.6 (5.4)	6.8 (2.7)
8	10.0 (0.39)	75 (51)	3,200 (720)	800 (180)	16.0 (6.3)	8.0 (3.1)
10	11.5 (0.45)	100 (67)	4,000 (900)	1,000 (220)	18.4 (7.2)	9.2 (3.6)
12	11.0 (0.43)	88 (59)	4,800 (1,080)	1,200 (270)	17.6 (6.9)	8.8 (3.5)
18	13.5 (0.53)	138 (93)	7,200 (1,620)	1,800 (400)	21.6 (8.5)	10.8 (4.3)
24	14.5 (0.57)	150 (101)	9,600 (2,160)	2,400 (540)	23.2 (9.1)	11.6 (4.6)

"Mil-Tac" designated and tested cables available to 24 fibers.
Other fiber counts available with Polyurethane outer jacket.
Installation loads in excess of 2,700 N (600 lbs.) are not recommended.

Ordering Information

	B	**–**								**5**	**K**	**M**
Digit No:	1	2	3	4	5	6	7	8	9	10	11	12

1 – 2 Mil-Tac Breakout Series Ultra-Fox Plus™= **B –**
3 – 5 Fiber count: (See Cable Characteristics Chart) = **002 – 024**
6 Jacket type:
- Tactical Polyurethane = **C**
- Flame Retardant Polyurethane = **E**
- Low Smoke Zero Halogen Polyurethane = **G**
- Tactical Flame Retardant Polyurethane = **V**

7 – 9 Fiber type: (See Ultra-Fox™ Plus Fiber Performance Table - Pg. MC 12)
- 62.5 µm multimode = **WST**
- 50 µm multimode = **AST**
- Single-mode = **SLS**

10 500 micron fiber with 900 micron tight buffer = **5**
11 Jacket Color: Black = **K**
12 Rating: Mil = **M**

Example: 12 fiber mil-tac breakout cable using 62.5 micron fiber, tactical polyurethane black jacket –

B	**–**	**0**	**1**	**2**	**C**	**W**	**S**	**T**	**5**	**K**	**M**

Ultra-Fox™ Plus Fiber Performance*

Fiber Code	Core/Cladding/Coating Diameter (µm)	Wavelength (nm)	Industry Standard Designation	Gigabit Ethernet Distance (m)	10-Gigabit Ethernet Distance (m)	Maximum Cabled Attenuation (dB/km)	Minimum Laser Bandwidth (MHz-km)	Minimum LED Bandwidth (MHz-km)
WST	62.5/125/500	(850/1310)	OM1 ISO/IEC 11801	275/550	33/300	3.5/1.5	—	200/500
AST	50/125/500	(850/1310)	OM2 ISO/IEC 11801	550/550	82/300	3.5/1.5	—	500/500
SLS	9/125/500[1] Single-mode	(1310/1550)	ITU-T G.652.A	5 km[2]	10 km[3]	0.5/0.5	—	—

Custom Cables

Optical Cable Corporation offers extreme flexibility in providing customers with customized tight-buffered fiber optic cables for their special requirements— not just standard off-the-shelf items. If you need a custom cable, please call Optical Cable Corporation at 1-800-622-7711 or (540) 265-0690.

[1] Typical Mode Field Diameter at 1310 nm = 9 microns

[2] 10 km for 1310 nm 1000BASE-LH, and 5 km for 1310 nm 1000BASE-LR

[3] 10 km for 1310 nm 10GBASE-LR, and 40 km for 1550 nm 10GBASE-ER

Note: Other fiber bandwidth, and attenuation performances are available. Laser optimized fiber types available as special order. Contact Optical Cable Corporation for details.