Caledonian

Waterproof
Fire Retardant
Low Smoke and Halogen Free
Fire Resistant

Fiber Optic Cables

www.caledonian-cables.co.uk
www.addison-cables.com

ADDISON

COMPANY PROFILE

Caledonian & Addison, established in 1978, produces a wide range of copper and fiber optic cables for communication, power and electronics in its primary plants in UK, Italy and Spain. To stay in front, we continually keep expanding our manufacturing capabilities in more low cost region such as China, Romania, Taiwan and Malaysia etc. This low-cost manufacturing facilities enables us provide execute a flexible, scalable global system that delivers superior operational performance and optimal results for our customers.

Our extensive global network of manufacturing facilities gives us significant scale and the flexibility to fulfill our customer requirements. This global presence provides design and consultancy solutions that are combined with core cable manufacturing and logistics services, and vertically integrated with our E commerce technologies, to optimize customer operations by lowering costs and reducing time to market.

Caledonian & Addison has been respected for its high standards of quality, excellent service level, competitive pricing and a unique and innovative spirit. With our latest technologies, we are both inspired and well-positioned to meet the changing needs of our customers. We have the resources to diversify and to enhance our product lines and services. We understand the need for change and with our accurate planning we are ready for the future and the promise of new marketing opportunities. Our tradition of growth through excellence is assured.

Our Design Centers work closely with customers to constantly improve its standard range of products and technologies and to develop customized, country and industry-specific solutions. Caledonian has established an extensive network of design, manufacturing, and logistics facilities in the world's major markets to serve the growing outsourcing needs of both multinational and regional customers.

Caledonian ADDISON

ISO 9001
REGISTERED FIRM

Registration Certificate

This document certifies that the administration systems of

Caledonian Cables Limited / Addison Technology Limited

Marchants Industrial Centre, Mill Lane, Laughton, Lewes, Sussex, BN8 6AJ, United Kingdom

have been assessed and approved by QAS International to the following management systems, standards and guidelines:

ISO 9001 : 2008

With the permitted exclusion of clauses 7.3 Design and Development

The approved administration systems apply to the following:

The manufacture and supply of electrical cables and ancillary power equipment to customers internationally.

Original Approval	6th September 1997
Current Certificate	7th February 2013
Certificate Expiry	7th February 2014
Certificate Number	A6211

On behalf of QAS International

www.qas-international.com

This certificate remains valid while the holder maintains their quality administration systems in accordance with the standards and guidelines stated above, which will be audited annually by QAS International. The holder is entitled to display the above registration mark for the duration of this certificate. This certificate must be returned to QAS International on reasonable request.

Issuing Office: QAS International, 20A Oxford Street, Malmesbury, Wiltshire, SN16 9AX

TABLE OF CONTENTS

TIGHT BUFFER PVC/LSZH JACKETED SIMPLEX / DUPLEX CORD

Application

This cable is mainly used for interconnecting cable for jumpers, patch cords or pigtails.

Description

Simplex

Simplex cable consists of single tight buffered fiber with aramid yarns as tensile strength members with jacket of either Flame Retardant PVC or LSZH compound. The cable is unconnectorized.

Duplex Flat

Duplex Flat Cable consists of two simplex units. Two simplex cords are placed side by side and jacketed with either Flame Retardant PVC or LSZH compound. The cable is unconnectorized.

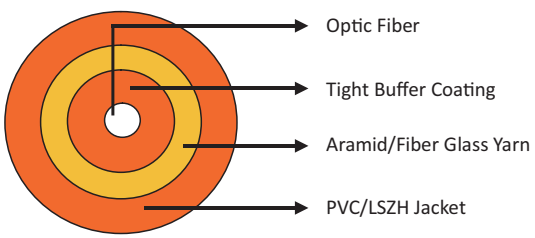
Duplex Round

Duplex Round Cable consists of two single fibers, each with a color-coded PVC tight buffer. They are reinforced with aramid yarn to provide physical and tensile strength. The fibers are jacketed with either Flame Retardant PVC or LSZH compound. The cable is unconnectorized.

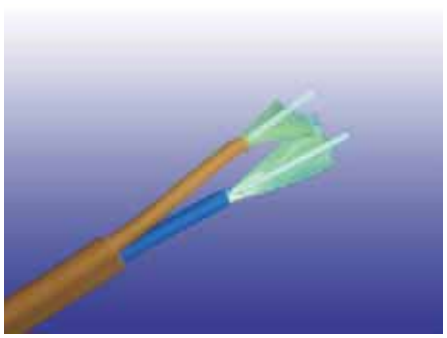
Duplex Zip

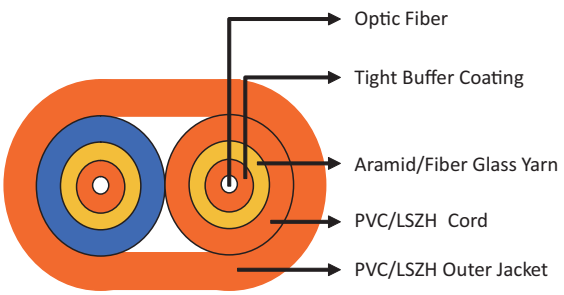
Duplex Zipcord Cable consists of two single fibers, each with a color-coded PVC tight buffer. They are reinforced with aramid yarn to provide physical and tensile strength. The fibers have either Flame Retardant PVC or LSZH compound jackets connected by a web to form a "zipcord" construction. The cable is unconnectorized.

Construction



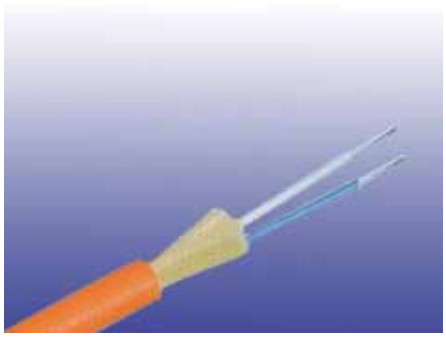
Simplex –PVC/LSZH Cable

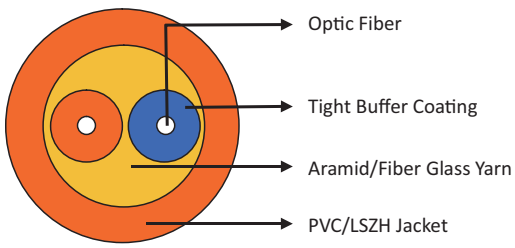




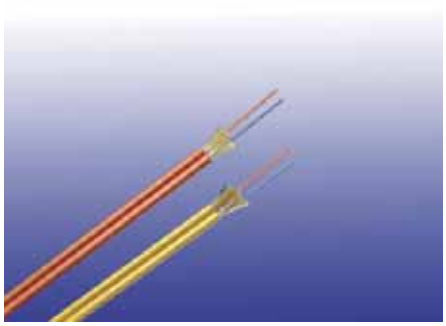
Duplex Flat-PVC/LSZH Cable

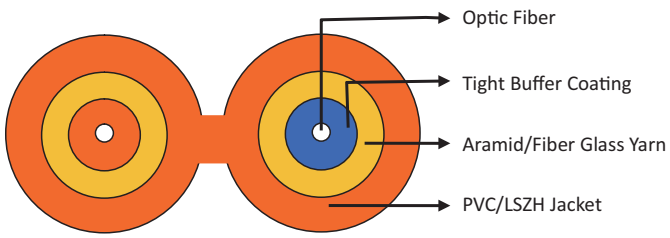
TIGHT BUFFER PVC/LSZH JACKETED SIMPLEX / DUPLEX CORD





Duplex Round-PVC/LSZH Cable





Duplex Zip-PVC/LSZH Cable

▶ Physical Properties

Fiber Count	Cable Type	Nominal Weight (kg/km)	Nominal Weight (lb/kft)	Nominal Outer Diameter (mm)	Nominal Outer Diameter (in)	Maximum Pulling Load	
						Installation (N/lb)	In Service (N/lb)
1	Simplex 2.0mm	7.6	5.10	2.0	0.079	490/110	290/65
1	Simplex 2.5mm	7.8	5.23	2.5	0.098	490/110	290/65
1	Simplex 2.8mm	8.0	5.37	2.8	0.110	490/110	290/65
1	Simplex 3.0 mm	8.2	5.50	3.0	0.118	490/110	290/65
2	Duplex Flat	28.0	18.79	4.0×6.8	0.157×0.267	980/220	580/130
2	Duplex Round	18.4	12.35	4.2	0.165	980/220	580/130
2	Duplex Zip	15.0	10.07	2.4×4.8	0.094×0.188	980/220	580/130

TIGHT BUFFER PVC/LSZH JACKETED SIMPLEX / DUPLEX CORD

Mechanical Properties

Minimum Bending Radius:

Under installation: 20×OD

During operation: 10×OD

Temperature Range:

Operating Temperature Range: -40℃(-40℉) to +70℃(+158℉)

Storage Temperature Range: -50℃(-58℉) to +70℃(+158℉)

Maximum Compressive Load:2000N

Repeated Impact: 2.9 N.m (J) 3×2 impacts

Twist (Torsion): 180×10 times, 125×OD

Cyclic Flexing: 25 cycles for armoured cables.; 100 cycles for unarmoured cables.

Crush Resistance: 875N/cm (500lb/in)

Fiber Compliance

Temperature Cycling	IEC60794-1-2-F2	**Repeated Bending**	IEC60794-1-2-E6
Tensile Strength	IEC60794-1-2-E1A	**Torsion**	IEC60794-1-2-E7
Crush	IEC60794-1-2-E3	**Kink**	IEC60794-1-2-E10
Impact	IEC60794-1-2-E4	**Cable Bend**	IEC60794-1-2-E11
		Cool Bend	IEC60794-1-2-E11

Safety Compliance

General Purpose Grade	Flammability Test: OFN (UL1581)
Riser Grade	Flammability Test: OFNR/FT4 (UL1666)
Plenum Grade	Flammability Test: OFNP/FT6 (UL 910)
FRPVC Grade	Flammability Test: IEC60332-1
LSZH Grade	Halogen Content Test: IEC 60754-1
	Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2
LSFROH Grade	Halogen Content Test: IEC 60754-1
	Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2
	Flammability Test: IEC60332-1 & IEC 60332-3C/A
FR Grade	Fire Resistance Test: IEC 60331 / BS 6387 CWZ

Standard Compliance

GR409-CORE TIA/EIA 568B.3 ICEA-S-83-596

Features

- Suitable for indoor use, such as routing connections in patching systems
- Short "patch cord" cables ideal for links between electronic equipment and fiber panels
- Compatible with wide variety of fiber optic connectors
- High quality tight-buffer coating on fiber for environmental and mechanical protection
- Customized jacket colors available for matching connectors.
- Private labeling on the cable outer jacket is also available.

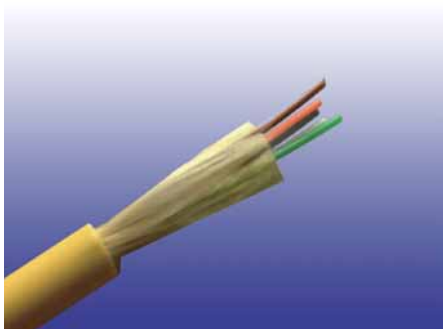
TIGHT BUFFER DISTRIBUTION PVC/LSZH JACKETED CABLE

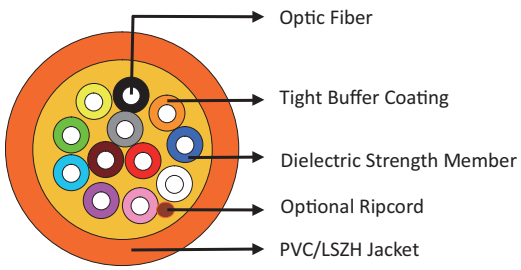
Application

This cable is used for interconnection of the distribution boxes and end devices. The cable is very suitable for various indoor and outdoor applications, including routing between buildings within ducts and inside building up to riser shafts.

Description

The Distribution Cable consists of color-coded PVC tight buffered fibers. The fibers are reinforced with aramid yarn for superior strength and contains no metallic elements. The fibers are jacketed with Flame Retardant PVC or LSZH compound.





Physical Properties

Fiber Count	Nominal Weight (kg/km)	Nominal Weight (lb/kft)	Nominal Outer Diameter (mm)	Nominal Outer Diameter (in)	Maximum Pulling Load	
					Installation (N/lb)	In Service (N/lb)
2-6	26.0	17.45	5.0	0.197	1000/225	290/65
8-12	50.0	33.56	7.5	0.296	1425/320	500/112
14-24	140.0	93.96	13.0	0.512	2670/600	890/200
26-36	200.0	134.23	16.5	0.650	4448/1000	1490/335
38-48	300.0	201.34	18.0	0.709	4448/1000	1490/335

Mechanical Properties

Minimum Bending Radius:

Under installation: 20×OD

During operation: 10×OD

Temperature Range:

Operating Temperature Range: -40℃(-40℉) to +70℃(+158℉)

Storage Temperature Range: -50℃(-58℉) to +70℃(+158℉)

Maximum Compressive Load: 2000N

Repeated Impact: 2.9 N.m (J) 3×2 impacts

Twist (Torsion): 180×10 times, 125×OD

Cyclic Flexing: 25 cycles for armoured cables.;
100 cycles for unarmoured cables.

Crush Resistance: 1485N/cm (850lb/in)

TIGHT BUFFER DISTRIBUTION PVC/LSZH JACKETED CABLE

Fiber Compliance

Temperature Cycling	IEC60794-1-2-F2
Tensile Strength	IEC60794-1-2-E1A
Crush	IEC60794-1-2-E3
Impact	IEC60794-1-2-E4
Repeated Bending	IEC60794-1-2-E6
Torsion	IEC60794-1-2-E7
Kink	IEC60794-1-2-E10
Cable Bend	IEC60794-1-2-E11
Cool Bend	IEC60794-1-2-E11

Safety Compliance

General Purpose Grade	Flammability Test: OFN(UL1581)
Riser Grade	Flammability Test: OFNR/FT4 (UL1666)
Plenum Grade	Flammability Test: OFNP/FT6(UL 910)
FRPVC Grade	Flammability Test: IEC60332-1
LSZH Grade	Halogen Content Test: IEC 60754-1
	Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2
LSFROH Grade	Halogen Content Test: IEC 60754-1
	Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2
	Flammability Test: IEC60332-1 & IEC 60332-3C/A
FR Grade	Fire Resistance Test: IEC 60331 / BS 6387 CWZ

Standard Compliance

GR409-CORE TIA/EIA 568B.3 ICEA-S-83-596

Features

- Used in LAN and distribution applications where compact size and lightweight are required
- Suitable for both indoor and outdoor use - no need for splicing at the building entrance
- Flame-retardant or LSZH version for indoor installations
- Fungus-resistant, water-resistant, and UV-resistant for outdoor installations
- Cable can be armoured for additional protection in direct burial and aerial installations
- Highest specific strength-to-weight ratio for limited conduit space
- Economical for longer distance runs where cable cost is significant
- High quality tight-buffered coating on fiber for environmental and mechanical protection

TIGHT BUFFER DISTRIBUTION PVC/LSZH JACKETED CABLE

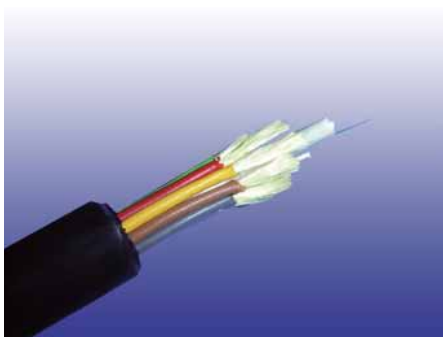
Application

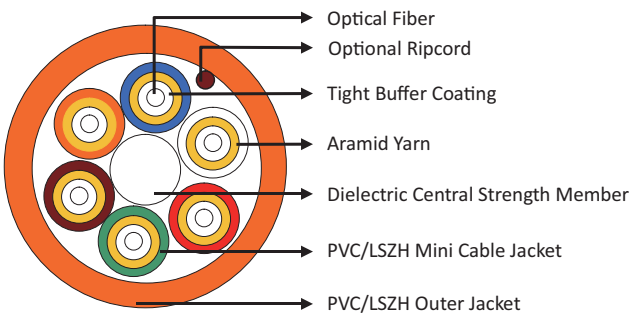
Breakout Cable is designed for routing to different locations and direct termination of fibers in the field. The cable is mostly suitable for pre-terminated cable assemblies.

Description

The cable contains 2 to 36 fibers which are individually buffered tight or semi-tight construction. Each fiber is individually protected in a mini cable. Aramid yarn will be applied either inside the mini cable or within the inner jacket of the cable. The color coded mini cable may be stranded around a central strength member which can be either FRP or flexible all-dielectric. Outer Jacket may be PVC or LSZH.

Construction





Physical Properties

Fiber Count	Nominal Weight (kg/km)	Nominal Weight (lb/kft)	Nominal Outer Diameter (mm)	Nominal Outer Diameter (in)	Maximum Pulling Load	
					Installation (N/lb)	In Service (N/lb)
2	50.0	33.56	5.5	0.217	1200/270	490/110
6	110.0	73.83	12.5	0.493	2000/450	800/180
12	160.0	107.38	13.0	0.512	3515/790	1200/270
24	230.0	154.36	15.5	0.611	5470/1230	2000/450

Mechanical Properties

Minimum Bending Radius:

Under installation: 20×OD

During operation: 10×OD for unarmoured cables
20×OD for armoured cables

Temperature Range:

Operating Temperature Range: -40℃(-40℉) to +70℃(+158℉)

Storage Temperature Range: -50℃(-58℉) to +70℃(+158℉)

Maximum Compressive Load:3000N for unarmoured
5000N for armoured

Repeated Impact: 2.9 N.m (J) 3×2 impacts

Twist (Torsion): 180×10 times, 125×OD

Cyclic Flexing: 25 cycles for armoured cables.
100 cycles for unarmoured cables.

Crush Resistance: 1750N/cm (1000lb/in)

TIGHT BUFFER DISTRIBUTION PVC/LSZH JACKETED CABLE

Fiber Compliance

Temperature Cycling	IEC60794-1-2-F2
Tensile Strength	IEC60794-1-2-E1A
Crush	IEC60794-1-2-E3
Impact	IEC60794-1-2-E4
Repeated Bending	IEC60794-1-2-E6
Torsion	IEC60794-1-2-E7
Kink	IEC60794-1-2-E10
Cable Bend	IEC60794-1-2-E11
Cool Bend	IEC60794-1-2-E11

Safety Compliance

General Purpose Grade	Flammability Test: OFN(UL1581)
Riser Grade	Flammability Test: OFNR/FT4 (UL1666)
Plenum Grade	Flammability Test: OFNP/FT6(UL 910)
FRPVC Grade	Flammability Test: IEC60332-1
LSZH Grade	Halogen Content Test: IEC 60754-1
	Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2
LSFROH Grade	Halogen Content Test: IEC 60754-1
	Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2
	Flammability Test: IEC60332-1 & IEC 60332-3C/A
FR Grade	Fire Resistance Test: IEC 60331 / BS 6387 CWZ

Standard Compliance

GR-409-CORE TIA/EIA 568B.3 ICEA-S-83-596

Features

- Most rugged and "user friendly" cable design for Local Area Networks
- For installations where ease of termination and termination costs are important factors
- Short and moderate distance links between buildings or within a building, where multiple termination points are needed
- Breakout cables are designed for direct termination with standard connectors
- Cable ideal for direct pulling with wire mesh grips
- Suitable for both indoor and outdoor use -- no need to for splicing at the building entrance
- Flame-retardant or LSZH version for indoor installations
- Fungus-resistant, water-resistant, and UV-resistant for outdoor use
- High quality tight-buffered coating on each fiber for environmental and mechanical protection

CENTRAL LOOSE TUBE CABLE

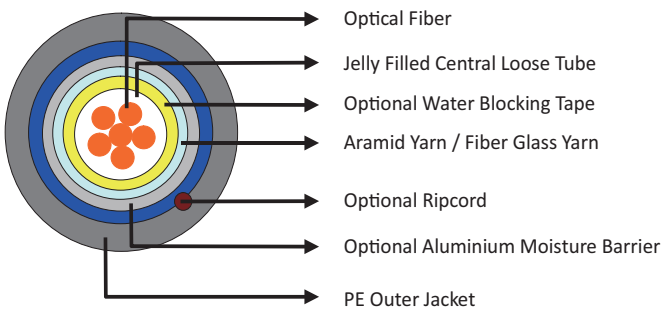
Application

This cable is characterized by light weight and small diameter, suitable for both aerial and duct installation. The cable can also be used for direct burial for armoured option.

Description

Central loose tube cable contains one tube with 2 - 24 fibers, which is filled with water blocking gel. Either aramid yarn or fiber glass is wound around the tube to provide physical protection and tensile strength. The cable can be jacketed with either PE or LSZH. PE is the preferred option in outdoor environment for water protection purpose. For direct burial, either steel wire armour or corrugated steel tape armour is applied with an optional inner jacket of either PVC, PE or LSZH. An Aluminium moisture tape can be incorporated under the jacket for water blocking and shielding purpose. A ripcord is located under the jacket to facilitate jacket removal.

Construction



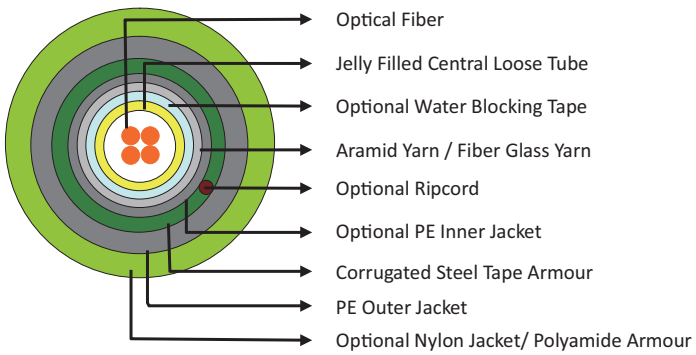
Unarmoured Type

Physical Properties

Fiber Count	Nominal Weight (kg/km)	Nominal Weight (lb/kft)	Nominal Outer Diameter (mm)	Nominal Outer Diameter (in)	Maximum Pulling/Tensile Load	
					Installation (N/lb)	In Service (N/lb)
2-12	60.0	40.27	7.5	0.296	1500/337	445/100
14-24	65.0	43.62	8.5	0.335	1500/337	445/100

CENTRAL LOOSE TUBE CABLE

Construction

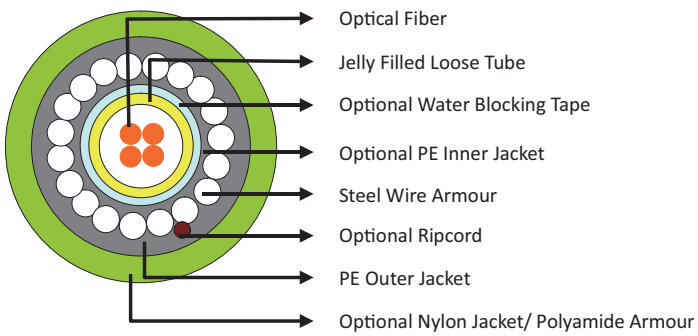


Corrugated Steel Tape Armoured Type

Physical Properties

Fiber Count	Nominal Weight (kg/km)	Nominal Weight (lb/kft)	Nominal Outer Diameter (mm)	Nominal Outer Diameter (in)	Maximum Pulling/Tensile Load	
					Installation (N/lb)	In Service (N/lb)
2-12	125.0	83.89	10.5	0.414	2670/600	890/200
14-24	145.0	97.32	12.0	0.473	2670/600	890/200

Construction



Steel Wire Armoured Type

Physical Properties

Fiber Count	Nominal Weight (kg/km)	Nominal Weight (lb/kft)	Nominal Outer Diameter (mm)	Nominal Outer Diameter (in)	Maximum Pulling/Tensile Load	
					Installation (N/lb)	In Service (N/lb)
2-12	170.0	114.09	10.5	0.414	8000/1800	2650/595
14-24	245.0	164.43	12.0	0.473	8000/1800	2650/595

CENTRAL LOOSE TUBE CABLE

Mechanical Properties

Minimum Bending Radius:

Under installation:	20×OD
During operation:	10×OD for unarmoured cables; 20×OD for armoured cables.

Temperature Range:

Operating Temperature Range:	-40℃(-40℉) to +70℃(+158℉)
Storage Temperature Range:	-50℃(-58℉) to +70℃(+158℉)

Maximum Compressive Load:3000N

Repeated Impact: 4.4 N.m (J)

Twist (Torsion): 180×10 times, 125×OD

Cyclic Flexing: 25 cycles for armoured cables; 100 cycles for unarmoured cables.

Crush Resistance: 263N/cm (150lb/in)

Fiber Compliance

Temperature Cycling	IEC60794-1-2-F2
Tensile Strength	IEC60794-1-2-E1A
Crush	IEC60794-1-2-E3
Impact	IEC60794-1-2-E4
Repeated Bending	IEC60794-1-2-E6
Torsion	IEC60794-1-2-E7
Kink	IEC60794-1-2-E10
Cable Bend	IEC60794-1-2-E11
Cool Bend	IEC60794-1-2-E11

Safety Compliance

General Purpose Grade	Flammability Test: OFN(UL1581)
Riser Grade	Flammability Test: OFNR/FT4 (UL1666)
Plenum Grade	Flammability Test: OFNP/FT6(UL 910)
FRPVC Grade	Flammability Test: IEC60332-1
LSZH Grade	Halogen Content Test: IEC 60754-1 Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2
LSFROH Grade	Halogen Content Test: IEC 60754-1 Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2 Flammability Test: IEC60332-1 & IEC 60332-3C/A
FR Grade	Fire Resistance Test: IEC 60331 / BS 6387 CWZ

Standard Compliance

Telcordia GR-20 RUS 7 CFR 1755.900 (REA PE-90) ICEA S 87-640

Features

- Loose Tube construction provides environmental protection
- Loose tube jelly filled for superior fiber protection
- Colored coded fibers and binders for quick and easy identification during installation.
- Very lightweight and flexible design allows for easy installation
- UV or moisture resistant for outdoor application
- Compact design with small cable diameter
- All Dielectric strength member
- Anti-termite and rodent protection as options
- Optional Aluminium moisture barrier for EMI protection

MULTI LOOSE TUBE CABLE

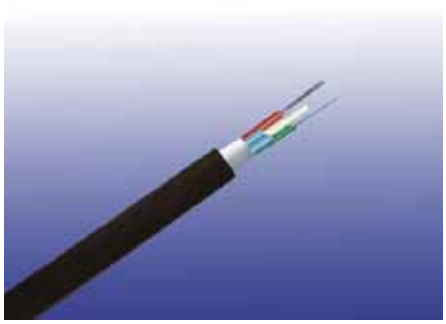
Application

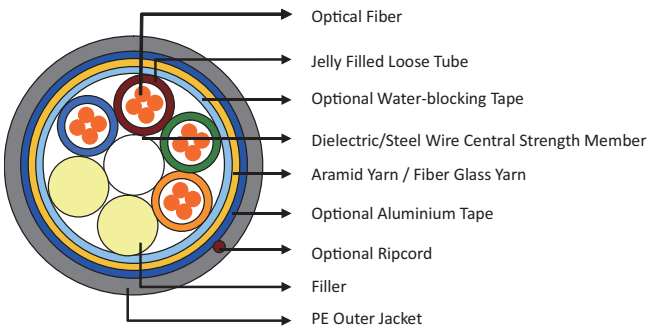
The multi loose tube non metallic cable is designed for outside plant, which is prone to electrical interference.

Description

The cable consists of 5 to 36 fibers containing tubes or fillers stranded in up to 3 layers around a central strength member and bound under a PE jacket. Each tube contains 4 -12 fibers. Solid or stranded steel wire coated with polyethylene is usually used as central strength member. Fiber glass reinforced plastics (FRP) will be used as central strength member if non metallic construction is required. Either aramid yarn or fiber glass is wound around the tube to provide physical protection and tensile strength. The cable can be jacketed with either PE, PVC or LSZH though PE is the preferred option for water protection purpose. For direct burial, steel wire armour or corrugated steel tape armour is applied with an optional inner jacket of either PVC or PE. An Aluminium moisture tape can be incorporated under the jacket for water blocking and shielding purpose. A ripcord is located under the jacket to facilitate jacket removal.

Construction





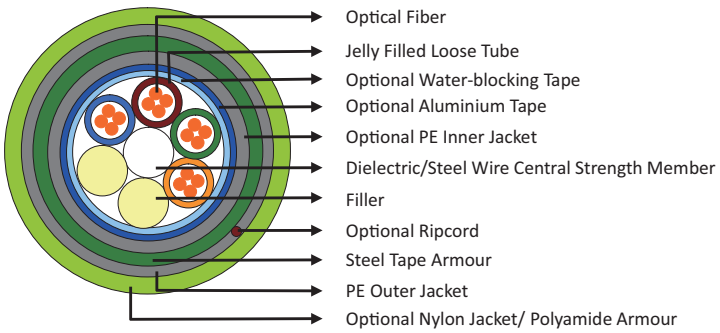
Unarmoured Type

Physical Properties

Fiber Count	Nominal Weight (kg/km)	Nominal Weight (lb/kft)	Nominal Outer Diameter (mm)	Nominal Outer Diameter (in)	Maximum Pulling/Tensile Load	
					Installation (N/lb)	In Service (N/lb)
2-36	110.0	73.83	12.0	0.472	2670/600	800/180
38-72	120.0	80.54	12.6	0.496	2670/600	800/180
74-84	135.0	90.60	13.5	0.531	2670/600	800/180
76-96	150.0	100.67	14.0	0.551	2670/600	800/180
98-108	170.0	114.09	15.0	0.590	2670/600	800/180
110-120	190.0	127.52	15.5	0.610	2670/600	800/180
122-132	210.0	140.94	16.5	0.649	2670/600	800/180
134-144	230.0	154.36	17.5	0.688	2670/600	800/180
146-216	250.0	167.79	18.0	0.708	2670/600	800/180
218-264	300.0	201.34	19.5	0.767	2670/600	800/180
266-312	350.0	234.90	21.0	0.826	2670/600	800/180
314-360	400.0	268.46	22.5	0.885	2670/600	800/180

MULTI LOOSE TUBE CABLE

Construction



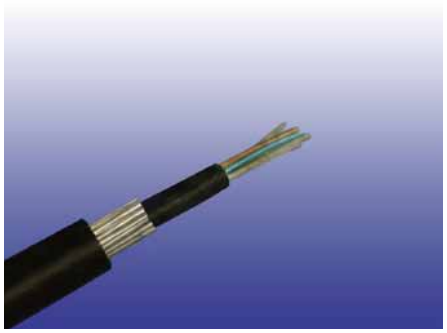
Corrugated Steel Tape Armoured Type

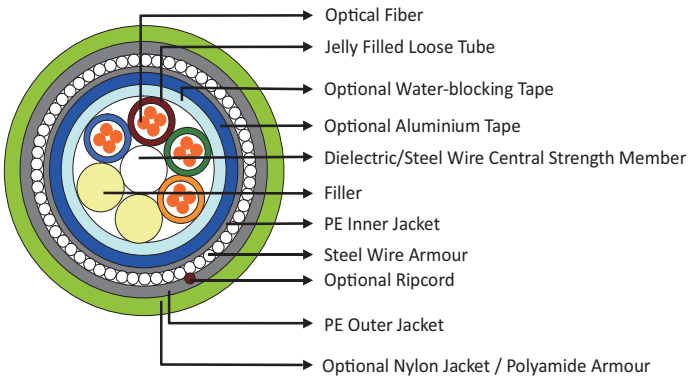
Physical Properties

Fiber Count	Nominal Weight (kg/km)	Nominal Weight (lb/kft)	Nominal Outer Diameter (mm)	Nominal Outer Diameter (in)	Maximum Pulling/Tensile Load	
					Installation (N/lb)	In Service (N/lb)
2-36	210.0	140.94	15.0	0.590	2670/600	800/180
38-72	230.0	154.36	15.5	0.610	2670/600	800/180
74-84	250.0	167.79	16.5	0.649	2670/600	800/180
76-96	270.0	181.21	17.0	0.669	2670/600	800/180
98-108	295.0	197.98	17.5	0.688	2670/600	800/180
110-120	320.0	214.77	18.5	0.728	2670/600	800/180
122-132	355.0	238.26	19.0	0.748	2670/600	800/180
134-144	370.0	248.32	20.0	0.787	2670/600	800/180
146-216	390.0	261.74	21.0	0.826	2670/600	800/180
218-264	455.0	305.37	22.5	0.885	2670/600	800/180
266-312	515.0	345.64	24.0	0.944	2670/600	800/180
314-360	580.0	389.26	26.0	1.023	2670/600	800/180

MULTI LOOSE TUBE CABLE

Construction





Steel Wire Armoured Type

Physical Properties

Fiber Count	Nominal Weight (kg/km)	Nominal Weight (lb/kft)	Nominal Outer Diameter (mm)	Nominal Outer Diameter (in)	Maximum Pulling/Tensile Load	
					Installation (N/lb)	In Service (N/lb)
2-36	700.0	469.80	21.0	0.826	8000/1800	2650/595
38-72	830.0	557.05	23.5	0.925	8000/1800	2650/595
74-84	870.0	583.89	24.0	0.944	8000/1800	2650/595
76-96	900.0	604.03	24.5	0.964	8000/1800	2650/595
98-108	950.0	637.58	26.0	1.023	8000/1800	2650/595
110-120	1000.0	671.14	27.0	1.062	8000/1800	2650/595
122-132	1050.0	704.70	28.0	1.102	8000/1800	2650/595
134-144	1100.0	738.26	29.0	1.141	8000/1800	2650/595
146-216	1300.0	872.48	31.0	1.220	8000/1800	2650/595
218-264	1400.0	939.60	33.0	1.299	8000/1800	2650/595
266-312	1500.0	1006.71	35.0	1.377	8000/1800	2650/595
314-360	1600.0	1073.83	37.0	1.456	8000/1800	2650/595

MULTI LOOSE TUBE CABLE

Mechanical Properties

Minimum Bending Radius:
Under installation: 20×OD
During operation: 10×OD for unarmoured cables; 20×OD for armoured cables.

Temperature Range:
Operating Temperature Range: -40℃(-40℉) to +70℃(+158℉)
Storage Temperature Range: -50℃(-58℉) to +70℃(+158℉)

Maximum Compressive Load: 4000N for unarmoured cables; 6000N for armoured cables
Repeated Impact: 4.4 N.m (J)
Twist (Torsion): 180×10 times, 125×OD
Cyclic Flexing: 25 cycles for armoured cables.; 100 cycles for unarmoured cables.
Crush Resistance: 220N/cm(125lb/in)

Fiber Compliance

Temperature Cycling	IEC60794-1-2-F2
Tensile Strength	IEC60794-1-2-E1A
Crush	IEC60794-1-2-E3
Impact	IEC60794-1-2-E4
Repeated Bending	IEC60794-1-2-E6
Torsion	IEC60794-1-2-E7
Kink	IEC60794-1-2-E10
Cable Bend	IEC60794-1-2-E11
Cool Bend	IEC60794-1-2-E11

Safety Compliance

General Purpose Grade	Flammability Test: OFN(UL1581)
Riser Grade	Flammability Test: OFNR/FT4 (UL1666)
Plenum Grade	Flammability Test: OFNP/FT6(UL 910)
FRPVC Grade	Flammability Test: IEC60332-1
LSZH Grade	Halogen Content Test: IEC 60754-1 Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2
LSFROH Grade	Halogen Content Test: IEC 60754-1 Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2 Flammability Test: IEC60332-1 & IEC 60332-3C/A
FR Grade	Fire Resistance Test: IEC 60331 / BS 6387 CWZ

Standard Compliance

Telcordia GR-20 RUS 7 CFR 1755.900 (REA PE-90) ICEA S 87-640

Features

- Loose Tube construction provides environmental protection
- Loose tube jelly filled for superior fiber protection
- Colored coded fibers and binders for quick and easy identification during installation.
- UV resistant for outdoor application
- Dry water blocking core design for ease of handling
- Anti-termite and rodent protection as options
- Optional Aluminium moisture barrier for EMI protection and water protection

CENTRAL LOOSE TUBE UNDER WATER CABLE

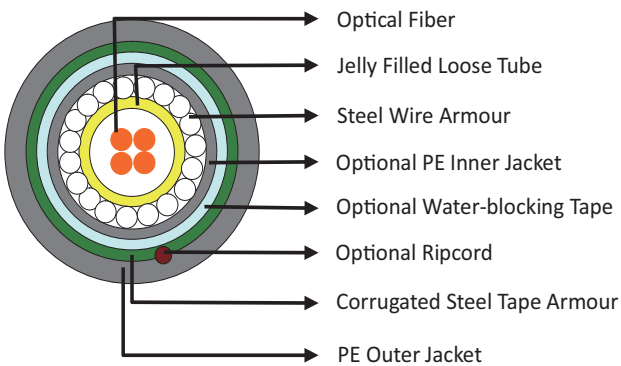
Application

This cable exhibits excellent tensile strength and side press retardancy, having excellent mechanical and environmental performance. Featured by its thin diameter and light weight, it is best suited for underwater condition, junction communication system and long haul communication system.

Description

Central loose tube cable contains one tube with 2 - 24 fibers, which is filled with water blocking gel. A water swelling tape is helically wrapped around the cable core. Either aramid yarn or fiber glass is wound around the tube to provide physical protection and tensile strength. The cable is jacketed with PE for water protection purpose. For direct burial, steel wire armour and corrugated steel tape armour are applied with an optional PE inner jacket. An optional Aluminium moisture tape can be incorporated under the jacket for water blocking and shielding purpose. An optional ripcord can be put under the jacket to facilitate jacket removal.

Construction



Physical Properties

Fiber Count	Nominal Weight (kg/km)	Nominal Weight (lb/kft)	Nominal Outer Diameter (mm)	Nominal Outer Diameter (in)	Maximum Pulling/Tensile Load	
					Installation (N/lb)	In Service (N/lb)
2-12	352.0	236.24	14.0	0.553	8000/1800	2650/595

CENTRAL LOOSE TUBE UNDER WATER CABLE

Mechanical Properties

Minimum Bending Radius:
Under installation: 20×OD
During operation: 10×OD for unarmoured cables;
20×OD for armoured cables.

Temperature Range:
Operating Temperature Range: -40℃(-40℉) to +70℃(+158℉)
Storage Temperature Range: -50℃(-58℉) to +70℃(+158℉)

Maximum Compressive Load:3000N
Repeated Impact: 4.4 N.m (J)
Twist (Torsion): 180×10 times, 125×OD
Cyclic Flexing: 25 cycles for armoured cables.;
100cycles for unarmoured cables.
Crush Resistance: 263N/cm(150lb/in)

Fiber Compliance

Temperature Cycling	IEC60794-1-2-F2
Tensile Strength	IEC60794-1-2-E1A
Crush	IEC60794-1-2-E3
Impact	IEC60794-1-2-E4
Repeated Bending	IEC60794-1-2-E6
Torsion	IEC60794-1-2-E7
Kink	IEC60794-1-2-E10
Cable Bend	IEC60794-1-2-E11
Cool Bend	IEC60794-1-2-E11

Safety Compliance

General Purpose Grade	Flammability Test: OFN(UL1581)
Riser Grade	Flammability Test: OFNR/FT4 (UL1666)
Plenum Grade	Flammability Test: OFNP/FT6(UL 910)
FRPVC Grade	Flammability Test: IEC60332-1
LSZH Grade	Halogen Content Test: IEC 60754-1 Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2
LSFROH Grade	Halogen Content Test: IEC 60754-1 Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2 Flammability Test: IEC60332-1 & IEC 60332-3C/A
FR Grade	Fire Resistance Test: IEC 60331 / BS 6387 CWZ

Standard Compliance

Telcordia GR-20 RUS 7 CFR 1755.900 (REA PE-90) ICEA S 87-640

Features

- Loose tube jelly filled for superior fiber protection
- Colored coded fibers and binders for quick and easy identification during installation.
- High tensile strength design
- Superior mechanical and environmental performance
- Rugged and lightweight design
- Durable construction to withstand high water pressure
- Sufficient waterproof to withstand water penetration

MULTI LOOSE TUBE UNDER WATER CABLE

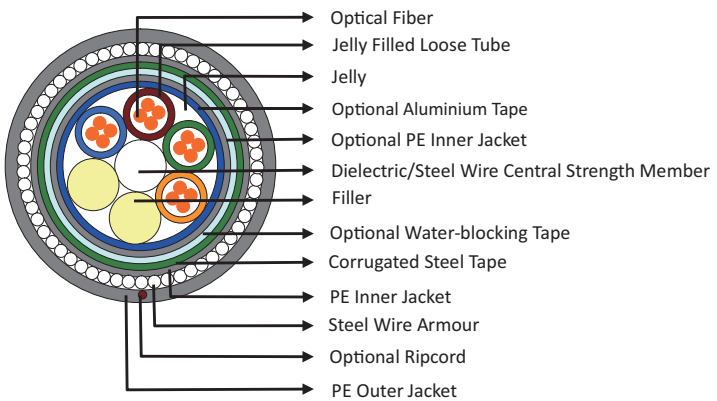
Application

This cable exhibits excellent tensile strength and side press retardancy, having excellent mechanical and environmental performance. Featured by its thin diameter and light weight, it is best suited for underwater condition, junction communication system and long haul communication system.

Description

The cable consists of 5 to 36 fibers containing tubes or fillers stranded in up to 3 layers around a central strength member and bound under a PE jacket. Each tube contains 4 -12 fibers. Solid or stranded steel wire coated with polyethylene is usually used as central strength member. Fiber glass reinforced plastics (FRP) will be used as central strength member if non metallic construction is required. Either aramid yarn or fiber glass is wound around the tube to provide physical protection and tensile strength. The cable incorporates the first layer of PE inner jacket, a layer of corrugated steel tape armour, the second layer of PE inner jacket, a layer of steel wire armour and PE outer jacket. An optional Aluminium moisture tape can be incorporated under the jacket for water blocking and shielding purpose. An optional ripcord is located under the jacket to facilitate jacket removal.

Construction



Physical Properties

Fiber Count	Nominal Weight (kg/km)	Nominal Weight (lb/kft)	Nominal Outer Diameter (mm)	Nominal Outer Diameter (in)	Maximum Pulling/Tensile Load	
					Installation (N/lb)	In Service (N/lb)
2-24	650.0	436.24	20.3	0.798	8000/1800	2650/595
26-36	716.0	480.54	21.6	0.849	8000/1800	2650/595
38-72	1008.0	676.51	25.2	0.991	8000/1800	2650/595

MULTI LOOSE TUBE UNDER WATER CABLE

Mechanical Properties

Minimum Bending Radius:

Under installation: 20×OD

During operation: 0×OD for unarmoured cables; 20×OD for armoured cables.

Temperature Range:

Operating Temperature Range: -40℃(-40℉) to +70℃(+158℉)

Storage Temperature Range: -50℃(-58℉) to +70℃(+158℉)

Maximum Compressive Load: 4000N for unarmoured cables; 6000N for armoured cables

Repeated Impact: 4.4 N.m (J)

Twist (Torsion): 180×10 times, 125×OD

Cyclic Flexing: 25 cycles for armoured cables.; 100 cycles for unarmoured cables.

Crush Resistance: 220N/cm(125lb/in)

Fiber Compliance

Temperature Cycling	IEC60794-1-2-F2	**Repeated Bending**	IEC60794-1-2-E6
Tensile Strength	IEC60794-1-2-E1A	**Torsion**	IEC60794-1-2-E7
Crush	IEC60794-1-2-E3	**Kink**	IEC60794-1-2-E10
Impact	IEC60794-1-2-E4	**Cable Bend**	IEC60794-1-2-E11
		Cool Bend	IEC60794-1-2-E11

Safety Compliance

General Purpose Grade	Flammability Test: OFN(UL1581)
Riser Grade	Flammability Test: OFNR/FT4 (UL1666)
Plenum Grade	Flammability Test: OFNP/FT6(UL 910)
FRPVC Grade	Flammability Test: IEC60332-1
LSZH Grade	Halogen Content Test: IEC 60754-1
	Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2
LSFROH Grade	Halogen Content Test: IEC 60754-1
	Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2
	Flammability Test: IEC60332-1 & IEC 60332-3C/A
FR Grade	Fire Resistance Test**:** IEC 60331 / BS 6387 CWZ

Standard Compliance

Telcordia GR-20 RUS 7 CFR 1755.900 (REA PE-90) ICEA S 87-640

Features

- Loose tube jelly filled for superior fiber protection
- Colored coded fibers and binders for quick and easy identification during installation.
- High tensile strength design
- Superior mechanical and environmental performance
- Rugged and lightweight design
- Durable construction to withstand high water pressure
- Sufficient waterproof to withstand water penetration

FIG8 SELF-SUPPORTING CABLE

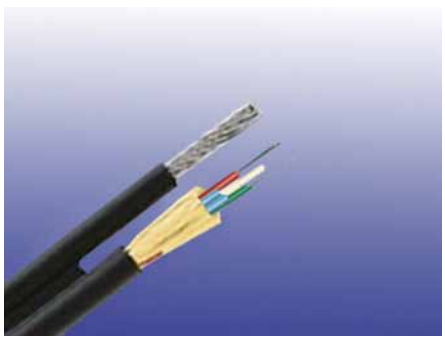
Application

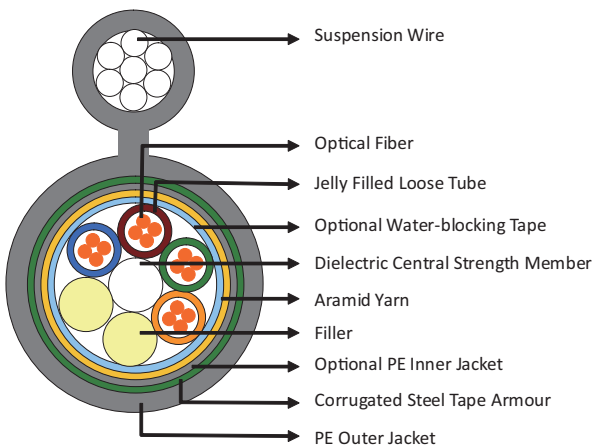
This cable is ideal for in long distance and interoffice communication in strong current zone, as well as power transmission system. The built in suspension stranded rope provides high tensile strength, enabling the cable suited for large span installation, resulting in time and installation cost savings. The suspension wire, being an integral part of the cable, is easily available for gripping, fastening and pulling. This cable is featured of its lightness, low dispersion and high tensile strength.

Description

The cable consists of 5 to 36 fibers containing tubes or fillers stranded in up to 3 layers around a central strength member and bound under a PE jacket. Each jelly filled tube contains 4 -12 fibers. Solid or stranded steel wire coated with polyethylene is usually used as central strength member. Fiber glass reinforced plastics (FRP) will be used as central strength member if non metallic construction is required. Either aramid yarn or fiber glass is wound around the tube to provide physical protection and tensile strength. Water blocking materials are filled in the interstice of the cable core, core wrapping layer/water blocking tape. The cable can be jacketed with either PE, PVC or LSZH though PE is the preferred option for water protection purpose. For direct burial, steel wire armour or corrugated steel tape armour is applied with an optional inner jacket of either PVC or PE. An optional Aluminium moisture tape can be incorporated under the jacket for water blocking and shielding purpose. Cable cores are connected with the suspension wires by PE sheath to form a figure “8” shape. An optional ripcord is located under the jacket to facilitate jacket removal.

Construction





Armoured Type

Physical Properties

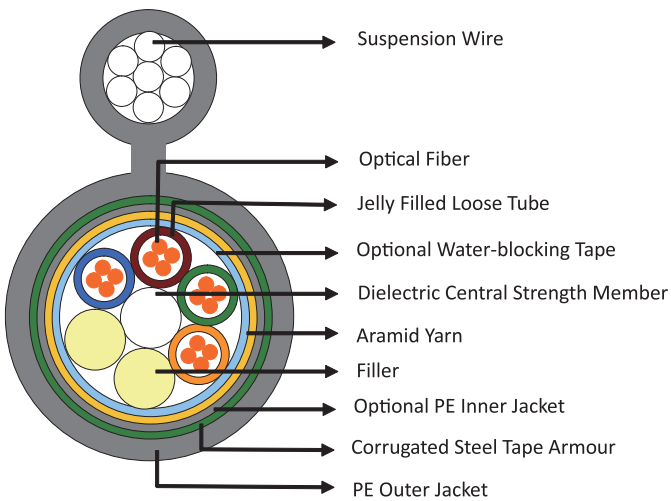
Fiber Count	Nominal Weight (kg/km)	Nominal Weight (lb/kft)	Nominal Outer Diameter (mm)	Nominal Outer Diameter (in)	Maximum Pulling/Tensile Load	
					Installation (N/lb)	Operating (N/lb)
2-24	389.0	261.07	12.6*25.1	0.50*0.99	2670/600	890/200
36-72	429.0	287.92	14.7*27.1	0.58*1.07	2670/600	890/200
96-144	571.0	383.22	20.2*32.6	0.80*1.29	2670/600	890/200

FIG8 SELF-SUPPORTING CABLE

Physical Properties

Fiber Count	Nominal Weight (kg/km)	Nominal Weight (lb/kft)	Nominal Outer Diameter (mm)	Nominal Outer Diameter (in)	Maximum Pulling/Tensile Load	
					Installation (N/lb)	Operating (N/lb)
2-24	303.0	203.36	9.1*21.5	0.36*0.85	2670/600	890/200
36-72	332.0	222.82	11.1*23.5	0.44*0.93	2670/600	890/200
96-144	417.0	279.87	15.9*28.3	0.63*1.12	2670/600	890/200

Construction



Armoured Type

Physical Properties

Fiber Count	Nominal Weight (kg/km)	Nominal Weight (lb/kft)	Nominal Outer Diameter (mm)	Nominal Outer Diameter (in)	Maximum Pulling/Tensile Load	
					Installation (N/lb)	Operating (N/lb)
2-24	389.0	261.07	12.6*25.1	0.50*0.99	2670/600	890/200
36-72	429.0	287.92	14.7*27.1	0.58*1.07	2670/600	890/200
96-144	571.0	383.22	20.2*32.6	0.80*1.29	2670/600	890/200

FIG8 SELF-SUPPORTING CABLE

Mechanical Properties

Minimum Bending Radius:

Under installation: 20×OD

During operation: 10×OD for unarmoured cables; 20×OD for armoured cables.

Temperature Range:

Operating Temperature Range: -40℃(-40℉) to +70℃(+158℉)

Storage Temperature Range: -50℃(-58℉) to +50℃(+158℉)

Maximum Compressive Load: 4000N for unarmoured cables; 6000N for armoured cables

Repeated Impact: 4.4 N.m (J)

Twist (Torsion): 180×10 times, 125×OD

Cyclic Flexing: 25 cycles for armoured cables.; 100 cycles for unarmoured cables.

Crush Resistance: 220N/cm (125lb/in)

Fiber Compliance

Temperature Cycling	IEC60794-1-2-F2	**Repeated Bending**	IEC60794-1-2-E6
Tensile Strength	IEC60794-1-2-E1A	**Torsion**	IEC60794-1-2-E7
Crush	IEC60794-1-2-E3	**Kink**	IEC60794-1-2-E10
Impact	IEC60794-1-2-E4	**Cable Bend**	IEC60794-1-2-E11
		Cool Bend	IEC60794-1-2-E11

Safety Compliance

General Purpose Grade	Flammability Test: OFN(UL1581)
Riser Grade	Flammability Test: OFNR/FT4 (UL1666)
Plenum Grade	Flammability Test: OFNP/FT6(UL 910)
FRPVC Grade	Flammability Test: IEC60332-1
LSZH Grade	Halogen Content Test: IEC 60754-1 Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2
LSFROH Grade	Halogen Content Test: IEC 60754-1 Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2 Flammability Test: IEC60332-1 & IEC 60332-3C/A
FR Grade	Fire Resistance Test: IEC 60331 / BS 6387 CWZ

Standard Compliances

Telcordia GR-20 RUS 7 CFR 1755.900 (REA PE-90) ICEA S 87-640

Features

- Suitable for self supporting aerial, duct and direct burial installation
- Tear away messenger simplifies grounding
- Ripcord allows easy cable entry and jacket removal
- Compatible with existing Fig 8 hardware
- Flexible buffer tube simplifies routing and splicing.
- Loose tube jelly filled for superior fiber protection
- UV or moisture resistant for outdoor application

CENTRAL LOOSE TUBE RIBBON FIBER CABLE

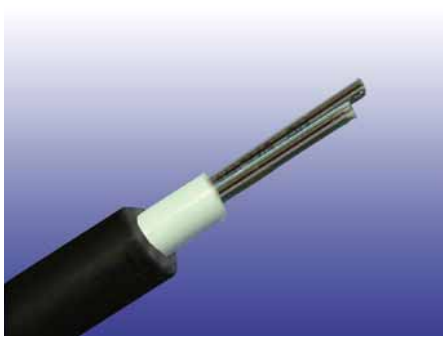
Application

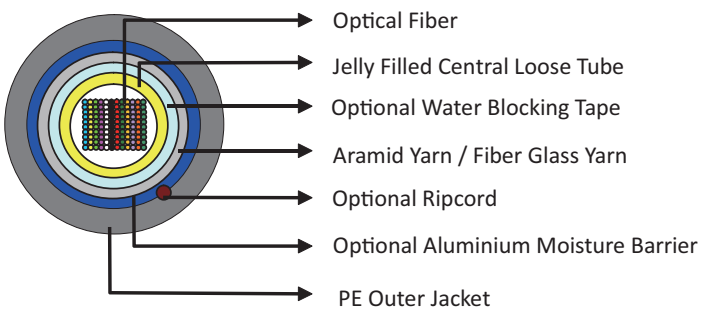
This cable can provide excellent transmission performance and protection of fibers in a variety of field environments. It is usually used in long haul communication system, subscriber network system, distribution, feeder network system and local area network system.

Description

Central loose tube cable contains one tube with 12 fiber ribbons, which is filled with water blocking gel. The fiber ribbon can be easily separated by hand tool. Either aramid yarn or fiber glass is wound around the tube to provide physical protection and tensile strength. The cable can be jacketed with either PE, PVC or LSZH though PE is the preferred option for water protection purpose. For direct burial, steel wire armour or corrugated steel tape armour is applied with an optional inner jacket of either PVC or PE. An optional Aluminium moisture tape can be incorporated under the jacket for water blocking and shielding purpose. An optional ripcord can be put under the jacket to facilitate jacket removal.

Construction





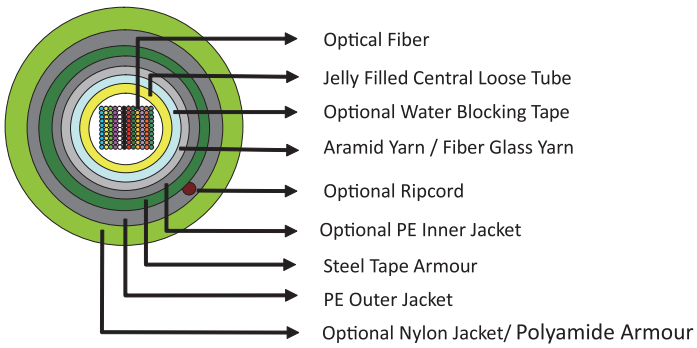
Unarmoured Type

Physical Properties

Fiber Count	Nominal Weight (kg/km)	Nominal Weight (lb/kft)	Nominal Outer Diameter (mm)	Nominal Outer Diameter (in)	Maximum Pulling/Tensile Load	
					Installation (N/lb)	Operating (N/lb)
12-96	166.0	111.41	16.2	0.637	2670/600	890/200
108-144	208.0	139.60	18.5	0.727	2670/600	890/200
156-216	244.0	163.76	20.5	0.806	2670/600	890/200

CENTRAL LOOSE TUBE RIBBON FIBER CABLE

Construction



Armoured Type

Physical Properties

Fiber Count	Nominal Weight (kg/km)	Nominal Weight (lb/kft)	Nominal Outer Diameter (mm)	Maximum Pulling/Tensile Load	
				Installation (N/lb)	Operating (N/lb)
12-96	233.0	156.38	14.8	2670/600	890/200
108-144	276.0	185.23	16.1	2670/600	890/200
156-216	316.0	212.08	17.1	2670/600	890/200

Mechanical Properties

Minimum Bending Radius:

Under installation: 20×OD

During operation: 10×OD for unarmoured cables
20×OD for armoured cables.

Temperature Range:

Operating Temperature Range: -40℃(-40℉) to +70℃(+158℉)

Storage Temperature Range: -50℃(-58℉) to +70℃(+158℉)

Maximum Compressive Load:3000N

Repeated Impact: 4.4 N.m (J)

Twist (Torsion): 180×10 times, 125×OD

Cyclic Flexing: 25 cycles for armoured cables.;
100 cycles for unarmoured cables.

Crush Resistance: 263N/cm(150lb/in)

CENTRAL LOOSE TUBE RIBBON FIBER CABLE

Fiber Compliance

Temperature Cycling	IEC60794-1-2-F2
Tensile Strength	IEC60794-1-2-E1A
Crush	IEC60794-1-2-E3
Impact	IEC60794-1-2-E4
Repeated Bending	IEC60794-1-2-E6
Torsion	IEC60794-1-2-E7
Kink	IEC60794-1-2-E10
Cable Bend	IEC60794-1-2-E11
Cool Bend	IEC60794-1-2-E11

Safety Compliance

General Purpose Grade	Flammability Test: OFN(UL1581)
Riser Grade	Flammability Test: OFNR/FT4 (UL1666)
Plenum Grade	Flammability Test: OFNP/FT6(UL 910)
FRPVC Grade	Flammability Test: IEC60332-1
LSZH Grade	Halogen Content Test: IEC 60754-1
	Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2
LSFROH Grade	Halogen Content Test: IEC 60754-1
	Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2
	Flammability Test: IEC60332-1 & IEC 60332-3C/A
FR Grade	Fire Resistance Test: IEC 60331 / BS 6387 CWZ

Compliance

Telcordia GR-20 RUS 7 CFR 1755.900 (REA PE-90) ICEA S 87-640

Features

- Large fiber counts with small cable diameter
- Highly adaptable to mass splicing
- Suitable for installation in pipeline
- High quality jelly filled loose tube provides the ribbon fiber satisfactory mechanical and environmental protection.
- Ripcord allows easy jacket removal
- UV or moisture resistant for outdoor application
- Dry water blocking core design for ease of handling

MULTI LOOSE TUBE RIBBON FIBER CABLE

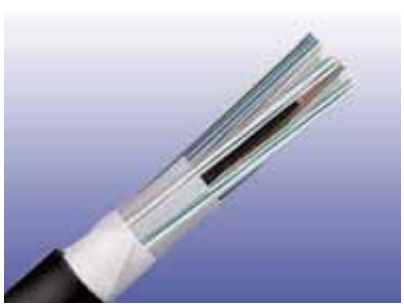
▶ Application

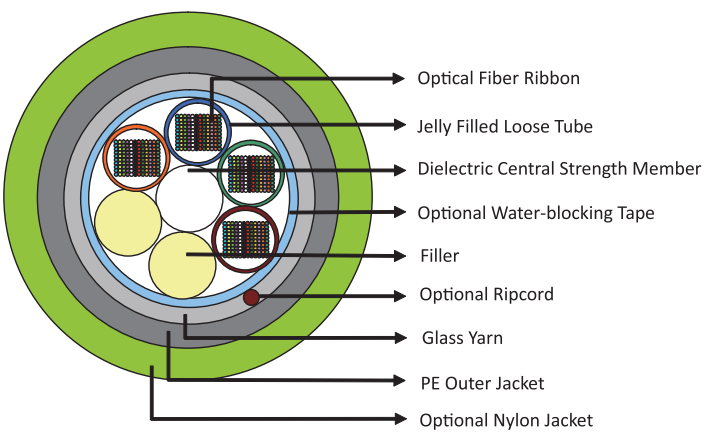
This cable can provide excellent transmission performance and protection of fibers in a variety of field environments. It is usually used in long haul communication system, subscriber network system, distribution, feeder network system and local area network system.

▶ Description

The cable consists of 12 to 648 fibers containing tubes or fillers stranded in up to 3 layers around a central strength member and bound under a PE jacket. Each tube contains 4 -12 ribbon fibers. Solid or stranded steel wire coated with polyethylene is usually used as central strength member. Fiber glass reinforced plastics (FRP) will be used as central strength member if non metallic construction is required. Either aramid yarn or fiber glass is wound around the tube to provide physical protection and tensile strength. The cable can be jacketed with either PE, PVC or LSZH though PE is the preferred option for water protection purpose. For direct burial, steel wire armour or corrugated steel tape armour is applied with an optional inner jacket of either PVC or PE. An optional Aluminium moisture tape can be incorporated under the jacket for water blocking and shielding purpose. An optional ripcord is located under the jacket to facilitate jacket removal.

▶ Construction





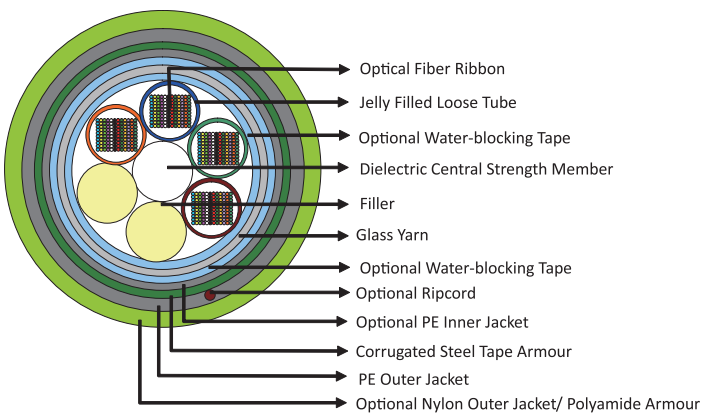
Unarmoured Type

MULTI LOOSE TUBE RIBBON FIBER CABLE

Physical Properties

Fiber Count	Nominal Weight (kg/km)	Nominal Weight (lb/kft)	Nominal Outer Diameter (mm)	Nominal Outer Diameter (in)	Maximum Pulling/Tensile Load	
					Installation (N/lb)	Operating (N/lb)
12-96	195.0	130.87	18.5	0.727	2670/600	890/200
108-288	320.0	214.77	22.0	0.865	2670/600	890/200
288-648	400.0	268.46	24.5	0.963	2670/600	890/200

Construction



Armoured Type

Physical Properties

Fiber Count	Nominal Weight (kg/km)	Nominal Weight (lb/kft)	Nominal Outer Diameter (mm)	Nominal Outer Diameter (in)	Maximum Pulling/Tensile Load	
					Installation (N/lb)	Operating (N/lb)
12-96	280.0	187.92	22.5	0.885	2670/600	890/200
108-288	400.0	268.46	25.0	0.983	2670/600	890/200
288-648	500.0	335.57	29.0	1.141	2670/600	890/200

MULTI LOOSE TUBE RIBBON FIBER CABLE

Mechanical Properties

Minimum Bending Radius:

Under installation:	20×OD
During operation:	10×OD for unarmoured cables;
	20×OD for armoured cables

Temperature Range:

Operating Temperature Range:	-40℃(-40℉) to +70℃(+158℉)
Storage Temperature Range:	-50℃(-58℉) to +70℃(+158℉)

Maximum Compressive Load: 4000N for unarmoured cables;
6000N for armoured cables

Repeated Impact: 4.4 N.m (J)

Twist (Torsion): 180×10 times, 125×OD

Cyclic Flexing: 25 cycles for armoured cables.;
100 cycles for unarmoured cables.

Crush Resistance: 220N/cm(125lb/in)

Fiber Compliance

Temperature Cycling	IEC60794-1-2-F2
Tensile Strength	IEC60794-1-2-E1A
Crush	IEC60794-1-2-E3
Impact	IEC60794-1-2-E4
Repeated Bending	IEC60794-1-2-E6
Torsion	IEC60794-1-2-E7
Kink	IEC60794-1-2-E10
Cable Bend	IEC60794-1-2-E11
Cool Bend	IEC60794-1-2-E11

Safety Compliance

General Purpose Grade	Flammability Test: OFN(UL1581)
Riser Grade	Flammability Test: OFNR/FT4 (UL1666)
Plenum Grade	Flammability Test: OFNP/FT6(UL 910)
FRPVC Grade	Flammability Test: IEC60332-1
LSZH Grade	Halogen Content Test: IEC 60754-1 Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2
LSFROH Grade	Halogen Content Test: IEC 60754-1 Acidity Test: IEC 60754; Smoke Emission Test: IEC61034-1/2 Flammability Test: IEC60332-1 & IEC 60332-3C/A
FR Grade	Fire Resistance Test: IEC 60331 / BS 6387 CWZ

Standard Compliance

Telcordia GR-20 RUS 7 CFR 1755.900 (REA PE-90) CEA S 87-640

Features

- Large fiber counts with small cable diameter
- Highly adaptable to mass splicing
- Suitable for installation in pipeline
- High quality jelly filled loose tube provides the ribbon fiber satisfactory mechanical and environmental protection.
- Ripcord allows easy jacket removal
- UV or moisture resistant for outdoor application
- Dry water blocking core design for ease of handling

ALL DIELECTRIC SELF-SUPPORTING (ADSS) CABLE

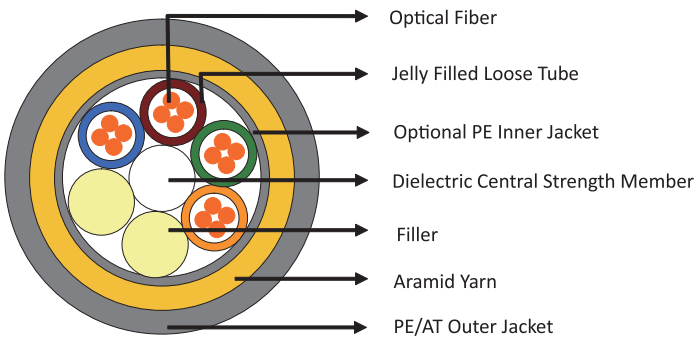
Application

The "All Dielectric Self-supporting (ADSS)" cable is designed for aerial self supporting application at short, medium and long span distances. ADSS cable offers a rapid and economical means for deployment by cable television operators, telephone companies and power utilities. It is adopted for high voltage, middle, small span conditions in Power Transmission System or mazy terrain such as river spanning, mountains.

Description

The cable consists of 5 to 36 fibers containing tubes or fillers stranded in up to 3 layers around a central strength member and bound under a PE jacket. Each tube contains 6 -12 fibers. All the fibers in the cores are filled with water blocking gel. Fillers may be used to preserve the cable geometry. A water swelling tape is helically wrapped around the cable core. Aramid yarns are helically laid to supply peripheral strengthening of the cable. The outer jacket is tightly bounded over the aramid yarn layer. The cable jacket incorporates an optional inner polyethylene jacket and an outer polyethylene or AT (anti-tracking) jacket. When the induction on cable surface is above 12KV, anti-tracking sheath material (AT) will be applied. With AT outer jacket, the maximum electric field strength at operating point can reach 35KV. For long span application, a double jacket design can be considered. An optional ripcord can be put under the jacket layer to faciliate its removal.

Construction



Physical Properties

Span (m)	Ice + Wind: 0mm + 35m/sec				Ice + Wind: 12mm + 30m/sec			
	Cable O.D. (mm/in)	Cable Weight (kg/km)/(lb/kft)	Max. Working Tension (N/lb)	Max. Sag (%)	Cable O.D. (mm/in)	Cable Weight (kg/km)/(lb/kft)	Max. Working Tension (N/lb)	Max. Sag (%)
100	13.9/5.472	152/102.01	7578/1704	2	13.8/0.543	150.0/100.67	6621/1489	2
200	14.3/0.562	161/108.05	10430/2346	3	14.1/0.555	157.0/105.37	9000/2024	3
400	15.9/0.625	199/133.56	23221/5223	3	15.4/0.606	187.0/125.50	19255/4331	3
500	16.7/0.657	220/147.65	30590/6881	3	16.1/0.633	204.0/136.91	24885/5598	3
600	16.3/0.641	209/140.27	26952/6063	4	15.7/0.618	196.0/131.54	22154/4983	4
800	16.5/0.649	216/144.97	29452/6625	5	15.9/0.625	201.0/134.90	24042/5408	6
1000	16.7/0.657	221/148.32	31271/7034	6	16.1/0.633	204.0/136.91	24407/5490	6

* Above table do not cover all of available types. Other ADSS cables can be manufactured upon customer's request according to different span and sag environment.

ALL DIELECTRIC SELF-SUPPORTING (ADSS) CABLE

Mechanical Properties

Minimum Bend Radius:

Under installation:	20×OD
During operation:	10×OD for unarmoured cables;
	20×OD for armoured cables

Temperature Range:

Operating Temperature Range:	-40℃(-40℉) to +70℃(+158℉)
Storage Temperature Range:	-50℃(-58℉) to +70℃(+158℉)

Maximum Compressive Load:4000N

Repeated Impact:	4.4 N.m (J)
Twist (Torsion):	180×10 times, 125×OD
Cyclic Flexing:	100 cycles .
Crush Resistance:	220N/cm(125lb/in)

Fiber Compliance

Temperature Cycling	IEC60794-1-2-F2
Tensile Strength	IEC60794-1-2-E1A
Crush	IEC60794-1-2-E3
Impact	IEC60794-1-2-E4
Repeated Bending	IEC60794-1-2-E6
Torsion	IEC60794-1-2-E7
Kink	IEC60794-1-2-E10
Cable Bend	IEC60794-1-2-E11
Cool Bend	IEC60794-1-2-E11

Standard Compliance

Telcordia GR-20 RUS 7 CFR 1755.900 (REA PE-90) ICEA S 87-640 IEEE 1222

Features

- High capacity cable offer great flexibility for placement on overhead transmission towers, eliminating the need for a support messenger.
- Dry core design and high tension strength capability suitable for toughest environmental and electrical conditions.
- Fit for extra high voltage power lines without interruption of power service to the customers.
- Typical spans with 1%-1.5% installation sag

Overhead Power Ground Wire (OPGW) FIBER CABLE

Application

OPGW is a dual functioning cable performing the duties of a ground wire and also providing a patch for the transmission of voice, video or data signals . The fibers are protected from environmental conditions (lightning, short circuit, loading) to ensure reliability and longevity. The cable is designed to be installed on transmission and distribution lines to carry voice, data and video communications, especially in lighting waveform monitoring system, an observation system for overhead test line, maintenance data information system, power line protection system, power line operation system, and unmanned substation monitoring.

Description

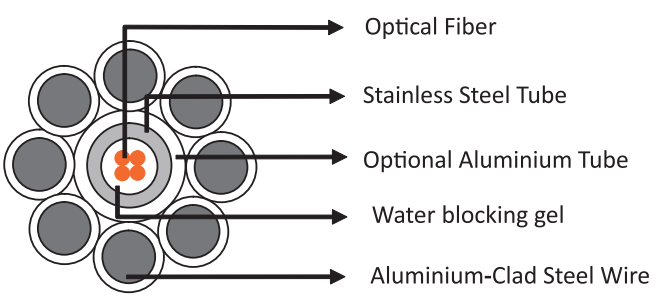
OPGW cable has two constructions:

Central loose tube type---The fibers is placed loosely in a sealed and water resistant stainless steel tube filled with water blocking gel. This tube provides protection to the fibers during installation and operation under severe environmental conditions. Aluminium layer over the tube is optional. The stainless optical tube is located at the center of the cable protected by single or multiple layers of aluminium clad steel and aluminium alloy wires. The Aluminium-clad steel wires are shaped trapezoidally around the optical unit to provide compact construction. The metallic wires provide mechanical strength to withstand severe installation and operating conditions, while achieving conductivity to control temperature rise during short circuit conditions.

This type can accommodate up to 48 fibers in a cable. Despite such a high fiber count in a single tube, each optical fiber is clearly distinguishable utilizing a fiber identification system consisting of coloring and the number of ring marks on it. This compact design features high mechanical strength and fault current rating within a smaller diameter. The smaller diameter also results in excellent sag tension performance.

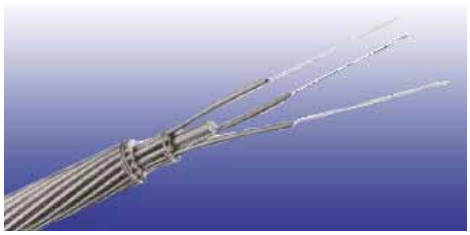
Multi loose tube type--- The fibers is placed loosely in a sealed and water resistant stainless steel tube filled with water blocking gel. Two or three stainless steel optical tubes are helically stranded in the inner layer of a multiple-layer cable.
The multi loose tube type is designed mostly for very high fiber count requirement over 48 with the maximum fiber count reaching 144. The multi loose tube type can meet the requirement of huge cross and large current capacity.

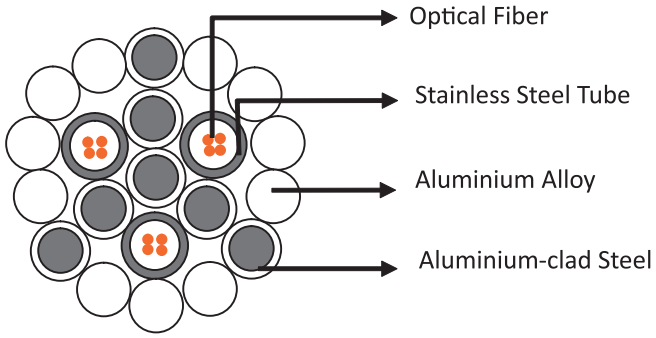
Construction



Central Loose Tube Type

Overhead Power Ground Wire (OPGW) FIBER CABLE





Multi Loose Tube Type

Physical Properties

Cable section (mm2)	Nominal Outer Diameter (mm/in)	Nominal Weight (kg/km)/(lb/kft)	Max working tension (kN)	Modulus of elasticity (kN/mm2)	Heat expansion coefficient (10-6/℃)	DC Resistance (Ω/km)	Short-circuit current capacity (kA2s)
35	8.1/0.318	250/167.79	45.2	162.0	13.0	2.433	8.9
50	9.6/0.378	343/230.20	63.0	162.0	13.0	1.743	16.5
70	11.4/0.448	487/326.85	89.3	162.0	13.0	1.237	3.04
90	12.5/0.492	368/246.98	58.2	94.1	17.3	0.473	72.7
105	13.5/0.531	428/287.25	67.9	94.1	17.3	0.403	98.8
130	15.0/0.590	527/353.69	83.8	94.1	17.3	0.329	149.9

* The effective sectional area of the single-layer design ranges from 50mm2 to 83mm2, suitable for rated voltages of 66kV, 115kV, 150kV, 250kV and 275kV.
* The effective sectional area of the double-layer design ranges from 90mm2 to 200mm2, suitable for rated voltages of 150kV, 250kV, 275kV, 380kV and 500kV.
* The effective sectional area of the three-layer design ranges from 200mm2 to 400mm2, suitable for rated voltages of 380kV, 420kV and 500kV in European markets.

Overhead Power Ground Wire (OPGW) FIBER CABLE

Mechanical Properties

Minimum Bend Radius:

Under installation:	20×OD
During operation:	10×OD for unarmoured cables
	20×OD for armoured cables.

Temperature Range:

Operating Temperature Range:	-40℃(-40℉) to +70℃(+158℉)
Storage Temperature Range:	-50℃(-58℉) to +70℃(+158℉)

Maximum Compressive Load: 4000N for unarmoured cables;
6000N for armoured cables

Repeated Impact: 4.4 N.m (J)

Twist (Torsion): 180×10 times, 125×OD

Cyclic Flexing: 25 cycles for armoured cables.;
100 cycles for unarmoured cables.

Crush Resistance: 220N/cm (125lb/in)

Fiber Compliance

Temperature Cycling	IEC60794-1-2-F2	**Repeated Bending**	IEC60794-1-2-E6
Tensile Strength	IEC60794-1-2-E1A	**Torsion**	IEC60794-1-2-E7
Crush	IEC60794-1-2-E3	**Kink**	IEC60794-1-2-E10
Impact	IEC60794-1-2-E4	**Cable Bend**	IEC60794-1-2-E11
		Cool Bend	IEC60794-1-2-E11

Standard Compliance

IEEE 1138-1994

Features

- Colored coded fibers and binders for quick and easy identification during installation.
- Compact design results in excellent sag tension performance of the cable
- Aluminium-clad steel wires and Aluminium alloy wires provides mechanical strength to withstand the installation and operating conditions, while achieving conductivity required to control temperature rise, during the short circuit fault condition
- Optical unit placed inside the Aluminium tube provides exceptional mechanical and thermal protection for the fiber against severe environments and external laternal force.
- Thick walled Aluminium tubes provide hermetic seal for optical units, providing excellent crush resistance and low resistivity.
- Unique design has maximum allowable tension to control fiber strain
- Stranded wires used for optimizing the mechanical and electrical properties of the cables
- High load, long span capability.

Ordering Information

Central Member Options

Blank	No central strength member	
S	Solid steel	Solid steel is used as an anti bucking element in the cable for providing very high tensile strength in outdoor cables where the cable has to be pulled or blown into ducts. The steel is hot rolled with anticorrosion treatment, Steel is chosen when extreme cold temperature performance is required since it exhibits good temperature stability.
SR	Stranded steel	Stranded steel is used as an anti bucking element for providing both flexibility and high strength.
F	Fiber reinforced plastic (FRP)	FRP Rods combine the high performance properties of glass reinforcements with unique resin formulation to produce a strong and cost effective non-metallic cable strength member. The dielectric nature of glass fibers renders them immune to electromagnetic interference and lightning. In addition to being dielectric, FRP has high young modulus and exhibits high tensile strength and low weight. FRP is used when all dielectric construction is required.
A	Aramid yarn	High strength aramid yarn strength member ensures tension resistance and long term stability. Aramid yarn is a dielectric with high modulus and low specific weight. It is mostly employed as a central strength member for indoor tight buffered cables.

Inner Jacket Options

Blank	No inner jacket	
2Y	Polyethylene (PE)	PE is used mostly for outdoor applications. PE sheath acts as a moisture barrier as well as a protection to the core. PE will not crack or become brittle at low temperatures and will retain its mechanical properties and stability at high temperatures. PE is very resistant to water, chemical and solvents and thus used as sheath for outdoor installation. PE can be UV resistant if carbon black additive is added. It will exhibit extremely good aging properties and high UV and weather resistance.
Y	Polyvinyl Chloride (PVC)	PVC is mostly used mostly for indoor applications. It is most widely used because of its good mechanical and electrical properties combined with cheap cost. The PVC material may include special carbon black additives for being UV and weather resistant.
Yu	Fire retardant PVC (FRPVC)	Fire retardant PVC will not allow fire to propagate along the cable when ignited. Fire retardant PVC jacketed cables will usually meet the flammability requirements of UL 1581(VW-1) and IEC 60332-1. With special design, the cables can meet IEC 60332-3A/C or UL 1666 (OFNR riser grade or UL 910 (OFNP plenum grade).
H	Low smoke and Halogen-free, (LSZH)	LSZH material is used mostly for indoor applications. When exposed to fire it will retard fire propagation while emitting non toxic corrosive halogen gases (halogen free as per IEC 60754-1 and IEC 60754-2) and low amounts of smoke emission as per IEC 61034-2. LSZH cables can usually meet the flammability requirement of UL 1581(VW-1) and IEC 60332-1. With special design, the cables can meet IEC 60332-3A/C.

Ordering Information

Strength Member Options

G	Fiber Glass yarn	Fiber glass is a dielectric with high compressive strength high modulus and light weight. It is characterized by its great abrasion resistance. Fiber glass yarn is usually used in a form of thin fiber bundles or roving. Compared to aramid yarn, fiber glass yarn is much easier to cut. Fiber glass yarn has similar impact resistance as steel.
A	Aramid yarn	Aramid yarn is a dielectric with high strength, high modulus and light weight. Aramid yarn is usually produced in its natural yellow color. Because of its toughness, aramid yarn is difficult to cut and requires a high quality scissor dedicated for cutting aramid. Aramid yarn is 5 times stronger than steel.
AG	Fiber Glass yarn + Aramid yarn	The weakest aspect of aramid yarn is its compressive strength and that is one of the strong points of fiberglass yarn. Putting the two together combines the tensile strength, toughness, and light weight of aramid yarn with the compressive strength and rigidity of fiberglass yarn.
FG	Fire Resisting Fiber Glass yarn	Fiber glass is characterized by its hazard proof and soft nature. Special fiber glass yarn can be used as both a strength member and fire barrier for meeting IEC 60331

Armour Options

Blank	No armouring	
T	Corrugated steel tape armour	Steel tape is corrugated to enhance the flexibility of the cable. Steel tape armour is used to provide mechanical protection and rodent resistance. The steel tape armour is usually offered with either PE, PVC or LSZH inner jacket. It is not recommended to use PVC for outer jacket. Compared with steel wire armour, it has the advantage of lower cost, increased torsional stiffness and reduced cable diameter
J	Fiberglass armour	Flexible dielectric armour is made of a thick layer of fiber glass roving, It is a dielectric with high modulus and low weight glass. Fiberglass armour is used when there is a need for dielectric and high flexibility. Fiberglass armour is a fraction of weight of the steel wire armour for identical performance level.
W	Steel wire armour	Helical wrap of galvanized steel wire armour provides the best protection against rodent attack and mechanical damage, also offering high tensile strength and crush resistance.
TW	Corrugated steel tape armour + Steel wire armour	The double armour is designed for underwater application. The double armour wires provide the necessary tensile stiffness needed during installation to prevent excessive strain of the optical fibers, mechanical protection from outside disturbances, as well as the structural strength needed for underwater cables as relatively long lengths of cable must be lifted to bring the cable to the water's surface for servicing. Without the strength provided by the double armour, the weight of the cable could break the optical fibers at the point of lifting the cable.
B	Bronze armour	The braided bronze armour is used for increased mechanical protection for offshore and shipboard cables. With this design, the cable can pass IEC60332-3A. The bronze armour layer may also be used to assist in locating buried cables. This is accomplished by imparting a signal to the bronze armour and detecting the signal by suitable above-ground apparatus.

Ordering Information

Outer Jacket Options

Blank	No inner jacket	
2Y	Polyethylene (PE)	PE is used mostly for outdoor applications. PE sheath acts as a moisture barrier as well as a protection to the core. PE will not crack or become brittle at low temperatures and will retain its mechanical properties and stability at high temperatures. PE is very resistant to water, chemical and solvents and thus used as sheath for outdoor installation. PE can be UV resistant if carbon black additive is added. It will exhibit extremely good aging properties and high UV and weather resistance.
Y	Polyvinyl Chloride (PVC)	PVC is mostly used mostly for indoor applications. It is most widely used because of its good mechanical and electrical properties combined with cheap cost. The PVC material may include special carbon black additives for being UV and weather resistant
Yu	Fire retardant PVC (FRPVC)	Fire retardant PVC will not allow fire to propagate along the cable when ignited. Fire retardant PVC jacketed cables will usually meet the flammability requirements of UL 1581(VW-1) and IEC 60332-1. With special design, the cables can meet IEC 60332-3A/C or UL 1666 (OFNR riser grade or UL 910 (OFNP plenum grade).
H	Halogen-free, Fire-retardant (LSFH)	LSZH material is used mostly for indoor applications. When exposed to fire it will retard fire propagation while emitting non toxic corrosive halogen gases (halogen free as per IEC 60754-1 and IEC 60754-2) and low amounts of smoke emission as per IEC 61034-2. LSZH cables can usually meet the flammability requirement of UL 1581(VW-1) and IEC 60332-1. With special design, the cables can meet IEC 60332-3A/C.
4Y	Polyamide/Nylon (PA)	The nylon sheath provides necessary protection against rodents and termites and the smooth surface of nylon makes laying of cables in duct much easier. This material does not degrade the cable mechanical properties or causes environmental damage.
11Y	Polyurethane (PU)	PU is used for harsh environments requiring very high flexibility. This cable material is characterized by its good resistance to humidity, moisture and weather, high flexibility, stable electrical characteristics, and excellent resistance to abrasion or chemicals PU provides good tear strength, providing cut-resistance in many rugged environment. With special design, the cables may include a flame retarding additive.

Ordering Information

Fiber Options

9	9.3/125um standard single mode fiber per ITU-T G.652D (SMF)	This most employed fiber has a simple step index structure. It is optimized for operation at the 1300 nm band and can also operate in the 1550 nm, but it is not optimized for this region. The typical chromatic dispersion at 1550nm is high at 17ps/nm-km. Dispersion compensation must be employed for high-bit-rate applications. The attenuation is typically 0.2dB/km at 1550nm and the PMD is less than 0.1ps/km. This fiber is designed for use in long distance, high bandwidth systems such as telecommunication and CATV.
2	9.3/125um low water peak non dispersion shifted single mode fiber per ITU-T G.652C	The ITU-T G.652 standard SMFs are not optimized for WDM applications due to the high attenuation around the water peak region. ITU G.652.C-compliant fibers offer extremely low attenuation around the OH peaks. The G.652.C fiber is optimized for networks where transmission occurs across a broad range of wavelengths from 1285 nm to 1625 nm. Although G.652.C-compliant fibers offer excellent capabilities for shorter, unamplified metro and access networks, they do not fully address the needs for 1550-nm transmission. The attenuation parameter for G.652 fiber is typically 0.2 dB/km at 1550 nm, and the PMD parameter is less than 0.1 ps/km.
3	Dispersion Shifted single mode fiber per G.653 (DSF)	Conventional SMF has a zero-dispersion wavelength that falls near the 1310-nm window band. SMF shows high dispersion values over the range between 1500 nm and 1600 nm (third window band). The trend of shifting the operating transmission wavelength from 1310 nm to 1550 nm initiated the development of a fiber type called dispersion-shifted fiber (DSF). DSF exhibits a zero-dispersion value around the 1550-nm wavelength where the attenuation is minimum. The DSFs are optimized for operating in the region between 1500 to 1600 nm. With the introduction of WDM systems, however, channels allocated near 1550 nm in DSF are seriously affected by noise induced as a result of nonlinear effects caused by FWM. This initiated the development of NZDSF. G.653 fiber is rarely deployed any more and has been superseded by G.655.
8	Non-Zero Dispersion Shifted single mode fiber per G.655 (NZDSF)	Using nonzero dispersion-shifted fiber (NZDSF) can mitigate nonlinear characteristics. NZDSF fiber overcomes these effects by moving the zero-dispersion wavelength outside the 1550-nm operating window. The practical effect of this is to have a small but finite amount of chromatic dispersion at 1550 nm, which minimizes nonlinear effects, such as FWM, SPM, and XPM, which are seen in the dense wavelength-division multiplexed (DWDM) systems without the need for costly dispersion compensation. There are two fiber families called nonzero dispersion (NZD+ and NZD–), in which the zero-dispersion value falls before and after the 1550-nm wavelength, respectively. The typical chromatic dispersion for G.655 fiber at 1550 nm is 4.5 ps/nm-km. The attenuation for G.655 fiber is typically 0.2 dB/km at 1550 nm, and the PMD is less than 0.1 ps/ km.

Ordering Information

7	Non-Zero Dispersion Shifted single mode fiber per G.656 (NZDSF)	In order to overcome the defects of G652 and G655 optical fibers, G656 fiber is developed. G656 fibers are designed for use in long haul transmission system and metro network. CWDM and DWDM can also be applied on S+C+L bands with these types fiber. These fibers are manufactured by PCVD process. The minimum dispersion value from 1460nm to 1625nm is greater than 2ps/nm km; the maximum value is less than 14ps/nm km. The effective area at 1550nm is around 52 to 66μm. The excellent polarization mode dispersion properties help the fiber to meet the requirement of high bit rate transmission. The PMD co efficiency of these fibers is less 0.05 ps/km. By use of improved PCVD process, excellent attenuation of these fibers was obtained, the water peak around 1385nm is almost removed; attenuation from 1310nm to 1650nm is less than 0.4 dB/km, attenuation at 1550nm is less than 0.22dB/km. Excellent attenuation performance will help the fiber to utilize the bandwidth more effectively.
4	Laser optimized 50/125um multi mode fiber. OM3 grade per ISO/IEC 11801	OM3 MMF has a 50-um nominal core diameter and a 125-um nominal cladding diameter with a graded refractive index. The attenuation parameter for OM3 fiber is typically 0.9 dB/km at 1300 nm. The main application for OM3 fiber is for 10G Ethernet network where very long transmission distance is required. This fiber is optimized for use in the 850-nm band.
5	50/125um multi mode fiber per G.651. OM2 grade per ISO/IEC 11801(MMF)	MMF has a 50-um nominal core diameter and a 125-um nominal cladding diameter with a graded refractive index. The attenuation parameter for G.651 fiber is typically 0.9 dB/km at 1300 nm. The main application for ITU-T G.651 fiber is for local area network. This fiber is optimized for use in the 1300-nm band. It can also operate in the 850-nm band.
6	62.5/125um multi mode fiber per ITU-T G651, OM1 grade per ISO/IEC 11801.	MMF has a 62.5-um nominal core diameter and a 125-um nominal cladding diameter with a graded refractive index. The attenuation parameter for G.651 fiber is typically 0.9 dB/km at 1300 nm. The main application for ITU-T G.651 fiber is for local area networks.. This fiber is optimized for use in the 1300-nm band. It can also operate in the 850-nm band
1	9/125um or 50/125um or 62.5/125um fiber.	Composite Cables containing two or more fiber types within the same cables.
0	9/125um or 50/125um or 62.5/125um fiber plus copper cable.	Hybrid Cables containing two or more fibers and copper conductors within the same cables.

Ordering Information

General Options

J	Water-blocking gel in tubes only	For moderate protection of the fibers against water penetration.
JJ	Water-blocking gel in tubes and in cable core interstices	For better protection of the fibers against water penetration.
JD	Water-blocking gel in tubes and dry water blocking elements in cable core interstices	For better protection of the fibers against water penetration.
VT	Tight buffer	The fibers are tightly buffered by a plastic material. Buffer diameter is 0.9mm.
CG	Semi-tight buffer	A semi-tight buffer, 0.9 outer diameter, gel filled.
AT	Anti-termite coating	This is a special coating applied over the cable jacket to reduce the damage of the cable by repelling insects and the termites. The anti termite coating does not degrade the cable mechanical properties or causes environmental damage.
AL	Aluminium moisture barrier tape	The aluminium moisture barrier tape offers extra protection against water ingress. The tape is applied around the cable cores to form a moisture barrier along the entire cable length.
OPGW	Overhead Power Ground Wire	Used in lighting waveform monitoring system, an observation system for overhead test line, maintenance data information system, power line protection system, power line operation system, and unmanned substation monitoring.
ADSS	All Dielectric Self Supporting	For aerial self supporting aerial installation at short, medium and long span distances. Adapted for high voltage, middle, small span conditions in Power Transmission System or mazy terrain such as river spanning, mountains.
SS	Figure-8-self-supporting cable	For self-supporting aerial installation, with steel messenger wire. The Fig 8 cable is recommended for spans up to 150m. The messenger wire is made of 7 stranded galvanized steel elements having a diameter and tensile strength to match the cable weight.
R	Ribbon Fiber	For use in long haul communication system, subscriber network system, distribution, feeder network system and local area network system.

ORDERING OPTIONS

Cable Type Family

S	Simplex Cord
D	Duplex Cord
MT	Tight Buffer Distribution
BT	Tight Buffer Breakout
CL	Central Loose Tube
ML	Multi Loose Tube
ADSS	All Dielectric Self Supporting
OPGW	Overhead Power Ground Wire

Simplex/Duplex Cord

Simplex: SA-B-C-D

Duplex: FC-DA-B-C-D-E

A: Cord Diameter

20=2.0mm; 25=2.5mm; 28=2.8mm; 30=3.0mm

B: Fiber Type

0=Fiber and copper conductors in cable
4=50/125 multi-mode fiber (OM3) per ITU-T G.651
5=50/125 multi-mode fiber (OM2) per ITU-T G.651
6=62.5/125 multi-mode fiber (OM1) per ITU-T G.651
7=NZDS SM fiber per ITU-T G.656.
8=NZDS SM fiber per ITU-T G.655.
9=Standard SM fiber per ITU-T G.652.D

C: Tight Buffer Type:

VT=Standard tight buffer (Default), YT=Tactical grade,
CG=Semi-tight buffer, jelly filled, CD-D=Semi-tight buffer, dry

D: Jacket Type

2Y=PVC, H=LSZH, ONR-OFNR PVC; ONP-OFNP FEP; Yu-FRPVC

E: Cable Shape

FT= Flat Cord; RD= Round Cord; ZIP= Zip Cord

ORDERING OPTIONS

Tight Buffered Cable

Distribution: MTA-B-C-D-E-FGH-IJKL

Breakout: BTA-B-C-DEFGH-IJKL

A: Distribution: Sub Unit Diameter
A=0.9mm (up to 12 fibers)
B=3.6mm (12-36 fibers)
C=4.2mm (24-72 fibers)

Breakout Mini Cable Jacket Diameter
A- 1.8mm; B-2.0mm ; C-2.5mm; D-2.8mm; E-3.0mm

B: Fiber Type
0=Fiber and copper conductors in cable
4=50/125 multi-mode fiber(OM3)
5=50/125 multi-mode fiber(OM2)
6=50/125 multi-mode fiber(OM1)
7=NZDS SM fiber per G.656.
8=NZDS SM fiber per G.655.
9=Standard SM fiber per G.652.D

C: No. of fibers:
4 to 72

D: Sub-unit Jacket Options
0=No sub-unit (for up to 12 fibers), Y=PVC, H=LSZH

E: Central member Options
Blank=No central member; A=Aramid yarn, F=Fiber Reinforced Plastic (FRP)

F: Inner Jacket Options
2Y=PE, Y=PVC, H=LSZH; ONR-OFNR PVC; ONP-OFNP FEP; Yu-FRPVC

G: Armour options
Blank=No armour, T=Corrugated steel tape armour, W=Steel wire armour
B=Bronze armour, D=Fiber glass armour; TW= Steel tape + Steel wire armour

H: Outer Jacket Options
Y=PVC, H=LSZH; ONR-OFNR PVC; ONP-OFNP FEP; Yu-FRPVC

I: Water-Blocking Options for cable core
X=No water-blocking; J= Water blocking gel in tubes;
JD=Water-blocking gel in tubes + dry water blocking in cable core interstices;
JJ= Water-blocking gel in tubes and cable core interstices.

J: Water-Blocking Options for cables with more than one jacket
X=No water-blocking, J= Water blocking gel between jackets;
D=Dry water-blocking between cable jackets;

K: Tight Buffer Type
VT=Standard tight buffer, YT=Tactical grade, CG=Semi-tight buffer, gel-jelly,
CD=Semi-tight buffer, dry

L: Strength Member Options
A=Aramid yarn, AG=Aramid yarn and fiberglass yarn, G=Fiberglass yarn

ORDERING OPTIONS

Central Loose Tube Cable

CLA-B-C-DEF-GHIJ

A: Loose tube diameter

A=2.1mm, B=2.5mm

B: Fiber type

0=Fiber and copper conductors in cable

4=50/125 multi-mode fiber (OM3) per ITU-T G.651

5=50/125 multi-mode fiber (OM2) per ITU-T G.651

6=62.5/125 multi-mode fiber (OM1) per ITU-T G.651

7=NZDS SM fiber per ITU-T G.656.

8=NZDS SM fiber per ITU-T G.655.

9=Standard SM fiber per ITU-T G.652.D

Ended with R=Ribbon type fiber (Ex: 9R= SM fiber per G.652.D ribbon type)

C: No. of fibers:

1 to 24

D: Inner jacket options

2Y=PE, Y=PVC, H=LSZH

E: Armour options

Blank=No armour, T=Corrugated steel tape armour, W=Steel wire armour

B=Bronze armour, D=Fiber glass armour; TW= Steel tape + Steel wire armour

F: Jacket material options

2Y=PE, Y=PVC, H=LSZH, 11Y=PU, A=Aluminium moisture barrier,

T=Anti-termite protection

G: Water-blocking options for cable core

X=No water-blocking; J= Water blocking gel in tubes;

JD=Water-blocking gel in tubes + dry water blocking in cable core interstices;

JJ= Water-blocking gel in tubes and cable core interstices.

H: Water-blocking options for cables with more than one jacket

X=No water-blocking, J= Water blocking gel between jackets;

D=Dry water-blocking between cable jackets;

I: Strength member options

A=Aramid yarn, AG=Aramid yarn and fiberglass yarn, G=Fiberglass yarn

J: General options

SS=Fig-8 self-supporting

UW=Under Water

ORDERING OPTIONS

Multi Loose Tube Cable

MLA-B-C×D-EFGH-IJKL

A: Loose tube diameter

B=2.1mm, C=2.5mm, D=2.8mm, E=3.0mm, F=3.2mm

B: Fiber type

0=Fiber and copper conductors in cable

4=50/125 multi-mode fiber (OM3) per ITU-T G.651

5=50/125 multi-mode fiber (OM2) per ITU-T G.651

6=62.5/125 multi-mode fiber (OM1) per ITU-T G.651

7=NZDS SM fiber per ITU-T G.656.

8=NZDS SM fiber per ITU-T G.655.

9=Standard SM fiber per ITU-T G.652.D

Ended with R=Ribbon type fiber (Ex: 9R= SM fiber per G.652.D ribbon type)

C: No. of tubes:

1 to 36

D: No. of fibers per tubes:

2 to 12

E: Central member

S=Solid steel, SR=Stranded steel, F=Fiber Reinforced Plastic (FRP)

F: Inner jacket options

2Y=PE, Y=PVC, H=LSZH

G: Armour options

Blank=No armour, T=Corrugated steel tape armour, W=Steel wire armour

B=Bronze armour, D=Fiber glass armour; TW= Steel tape + Steel wire armour

H: Jacket material options

2Y=PE, Y=PVC, H=LSZH,

11Y=PU, A=Aluminium moisture barrier, T=Anti-termite protection

I: Water-blocking options for cable core

X=No water-blocking; J= Water blocking gel in tubes;

JD=Water-blocking gel in tubes + dry water blocking in cable core interstices;

JJ= Water-blocking gel in tubes and cable core interstices.

J: Water-blocking options for cables with more than one jacket

X=No water-blocking, J= Water blocking gel between jackets;

D=Dry water-blocking between cable jackets;

K: Strength member options

A=Aramid yarn, AG=Aramid yarn and fiberglass yarn, G=Fiberlass yarn

L: General options

SS=Fig-8 self-supporting

UW=Under Water

ORDERING OPTIONS

ADSS Multi Loose Tube Cable

MLA-B-C×D-EFGH-IJKLM- ADSS

A: Loose tube diameter

B=2.1mm, C=2.5mm, D=2.8mm,

E=3.0mm, F=3.2mm

B: Fiber type

0=Fiber and copper conductors in cable

4=50/125 multi-mode fiber(OM3)

5=50/125 multi-mode fiber(OM2)

6=50/125 multi-mode fiber(OM1)

7=NZDS SM fiber per G.656.

8=NZDS SM fiber per G.655.

9=Standard SM fiber per G.652.D

Ended with R=Ribbon type fiber (Ex: 9R= SM fiber per G.652.D ribbon type)

C: No. of tubes:

01 to 36

D: No. of fibers per tubes:

02 to 12

E: Central member

S=Solid steel, SR=Stranded steel, F=Dielectric(FRP)

F: Inner jacket options

2Y=PE, Y=PVC, H=LSZH

G: Armour options

T=Corrugated steel tape armour, B=Bronze, W=Steel wire Armour, WB= Steel Wire Braid

H: Jacket material options

2Y=PE, AT= Anti-tracking

I: Water-blocking options for cable core

X=No water-blocking; J= Water blocking gel in tubes;

JD=Water-blocking gel in tubes + dry water blocking in cable core interstices;

JJ= Water-blocking gel in tubes and cable core interstices.

J: Water-blocking options for cables with more than one jacket

X=No water-blocking, J= Water blocking gel between jackets;

K: Strength member options

A=Aramid yarn, AG=Aramid yarn and glass yarn, G=Glass yarn

L: Span Length

M: Voltage Rating

ORDERING OPTIONS

OPGW Type Cable

A-B-C-D-E-OPGW

A: Fiber type

0=Fiber and copper conductors in cable
4=50/125 multi-mode fiber(OM3)
5=50/125 multi-mode fiber(OM2)
6=50/125 multi-mode fiber(OM1)
7=NZDS SM fiber per G.656.
8=NZDS SM fiber per G.655.
9=Standard SM fiber per G.652.D

B: No. of steel tubes:

01 to 3

C: No. of fibers per tubes:

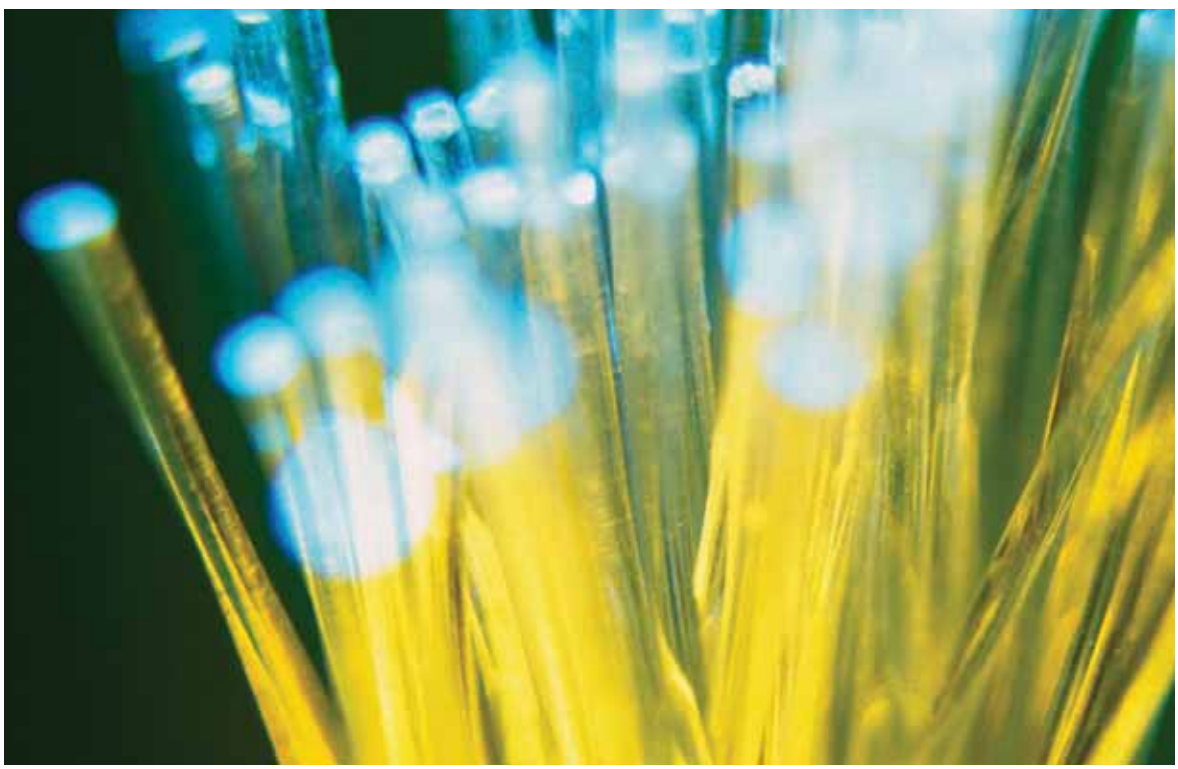
02 to 12

D: Cross Sectional Area

35=35mm2; 50=50mm2; 70=70mm2; 90=90 mm2; 130=130mm2

E: Rated Voltage

66=66KV; 115=115kV; 150=150kV;
250=250kV; 275=275kV; 380=380kV; 500=500kV



Optical & Geometrical Properties for Single Mode Fibers

Optical & Geometrical Properties for Single Mode Fibers

Parameter		Standard Single Mode Fiber per ITU-T G.652D	Non-zero Dispersion Shifted fiber per ITU-T G.655	Non-zero Dispersion Shifted fiber per ITU-T G.656	Units
		9	8	7	
Attenuation, Loose Tube Cables		Standard	Metro Area	Long Haul	
	@1310nm	≤0.35	-	-	dB/km
	@1550nm	≤0.22	≤0.22	≤0.22	dB/km
	@1625nm	≤0.25	≤0.26	≤0.26	dB/km
Attenuation, Tight Buffer or Semi-Tight Cables					
	@1310nm	≤0.38	-		dB/km
	@1550nm	≤0.28	-		dB/km
Chromatic Dispersion	between 1260 and 1360nm (O Band)	≤3.5	NA-	-	ps/(nm*km)
	between 1460 and 1530nm (S Band)	-	-	2.0-7.0	ps/(nm*km)
	between 1530 and 1565nm (C Band)	≤18	1.0-10.0	7.0-10.0	ps/(nm*km)
	between 1565 and 1625nm (L Band)	≤22	7.0-12.0	10.0-14.0	ps/(nm*km)
Zero Dispersion Wavelength		1310±11	≤1520	≤1420	nm
Zero Dispersion Slope		0.093	0.093	0.093	ps/(nm2.km)
Point Discontinuity at 1300nm& 1550nm		0.1	0.1	0.1	dB
Mode Field Diameter	@1300nm	9.3±0.5	-		um
	@1550nm	10.4±0.8	8.5±0.6	9.0±0.5	um
Cable Cut-off Wavelength		≤1260	≤1450	≤1310	nm
PMD (Individual fiber)		≤0.2	≤0.2	≤0.2	ps/km 1/2
Cladding Diameter		125±1	125±1	125±1	um
Core/Cladding Concentricity Error		≤0.5	≤0.5	≤0.6	um
Cladding Non-Circularity		≤1.0	≤1.0	≤1.0	%
Coating Non-Circularity		≤6.0	≤6.0	≤6.0	%
Primary Coating Diameter		245±10	245±10	245±10	um
Proof-Test Level		100 (0.7)	100 (0.7)	100 (0.7)	Kpsi/GN/m^2
Fatigue Coefficient		≥20	≥20	≥20	
Temperature Dependence between 0℃ ~ +70℃ @ 1310 & 1550nm		0.1	0.1	0.1	Db/km

Optical & Geometrical Properties for Multimode Fibers

Optical & Geometrical Properties for Multimode Fibers

Parameter		50/125		62.5/125	Units
Fiber Code		5	4	6	-
ISO/IEC 11801 Classification(2)					-
Attenuation, Loose Tube Cables					
@850nm		≤3.0		≤3.0	dB/km
@1300nm		≤0.8		≤0.8	dB/km
Attenuation, Tight Buffer and Semi-tight Cables					
@850nm		≤3.0		≤3.5	dB/km
@1300nm		≤1.0		≤1.0	dB/km
Bandwidth *	@850nm	≥500	≥2000	≥200	MHz*km
	@1300nm	≥800/500	≥500	≥500/600	MHz*km
Numerical Aperture		0.20±0.015		0.275±0.015	-
Core Diameter		50±3		62.5±3	um
Cladding Diameter		125±2		125±2	um
Core/Cladding Concentricity		≤1.5		≤1.5	um
Core Non-Circularity		≤6		≤6	%
Cladding Non-Circularity		≤2 1		≤2 1	%
Core/Cladding Offset		≤3		≤3	um
Coating Diameter		245±10		245±10	um
Proof-Test Level		100 (0.7)		100 (0.7)	Kpsi (GN/m^2)
Fatigue Coefficient		≥20		≥20	
Temperature Dependence between 0℃ - 70℃		0.1		0.1	dB

Testing Method for Optical & Geometrical Properties of Fiber

Testing Method for Optical & Geometrical Properties of Fiber

Testing Parameters	Parameter & Test Method Description	EIA/ TIA-455 FOTP	IEC-607931	ITU-T
Fiber Geometry	Fiber geometry is important where two fibers cores are to be joined together. Fiber geometry is measured to identify fiber mismatches which occur when manufacturer fails to maintain the optical and structural tolerances during the fiber fabrication process. Fiber mismatches will lead to fiber attenuation and intrinsic coupling loss. EIA/TIA 455-176 introduces method to measure all key parameters of fiber cross sectional geometry except core diameter. IEC-60793-1-20 describes four methods for measuring fiber geometry (namely refractive near field, transverse interference, near-field light distribution and mechanical diameter). The following parameters are measured: cladding diameter, cladding non circularity, core diameter, core non circularity and core cladding concentricity error and theoretical numerical aperture. IEC 60793-1-21 describes four methods for coating geometry of the fiber. The following parameters are measured: coating diameter, coating non-circularity and coating cladding concentricity error.	176	20,21	SM: G.650 Method 5.2.1 MM: G.651,Sec.1, Method B.3
Spectral Attenuation	The reduction in signal strength is measured as attenuation. Attenuation is function of wavelength. TIA 455-78 describes a method for measuring the spectral attenuation of single mode fiber. TIA 455-46 describes a method for measuring the spectral attenuation of long length grade index multimode fiber. IEC 60793-1-40 describes four methods for measuring attenuation: (a) cut-back, (b) insertion loss, (c) backscattering (d) modelling spectral attenuation.	SM Fibers:78 MM Fibers:46	40	SM: G.650 Method 5.4.1 MM: G.651,Sec.2,1, Method B.2
Attenuation Uniformity (Point discontinuity)	The backscattering method adopted in IEC 60793-1-40 covers the location, loss and characterization of point discontinuity. This test is to monitor the change in optical transmittance of the fiber and cables arising from optical discontinuity.	78	40	SM: G.650 Method 5.4.2 MM: G.651,Sec.2, Method B.4
Numerical Aperture (MMF)	The numerical aperture (NA) is a measurement of the ability of an optical fiber to capture light. TIA 455-177 is to determine the NA of near parabolic profile, graded index, glass core and glass clad optic fibers. NA is determined either from the fiber far field radiation pattern (Method A) or the fiber refractive index profile (Method B). IEC 60793-1-43 establishes requirement for measuring A1 graded index multimode fiber and its light gathering ability. The test is used to predict launching efficiency, joint loss at splices, and micro/macrobending performance	177	43	G.651,Sec.1, Method B.4

Testing Method for Optical & Geometrical Properties of Fiber

Testing Parameters	Parameter & Test Method Description	EIA/ TIA-455 FOTP	IEC-607931	ITU-T
Cutoff Wavelength (SMF)	The wavelength at which a mode stops to propagate is called cutoff wavelength for that mode; However, an optical fiber is always able to propagate at least one mode, the fundamental mode. The fundamental mode can never be cut off. The cufoff wavelength of a single mode fiber is the wavelength above which the fiber propagates only the fundamental mode Measuring the cutoff length involves comparing the transmitted Power from the test fiber with that of a reference fiber at different wavelength. TIA 455-80 & IEC 60793-1-44 provides methods for measuring the cut-off wavelength of single-mode optical fibers. The test method applies to sample fiber in either an uncabled condition or in a cable or as a jumper cable.	80	44	G.650, Methods5.3.1, 5.3.3
Mode Field Diameter (SMF)	Not all light travels through the core of the fiber, but is distributed through both the core and the cladding. The "mode field" is the distribution of light through the core and cladding of a particular fiber. Mode-Field Diameter (MFD) defines the size of the power distribution. TIA/EIA 455-191establishes unifrom requirement for measuring MFD of fiber. Four methods are described in IEC 60793-1-45:a) direct far field scan b) variable aperture in the far field c) near field scan d) bidirectional backscattering using an ODTR. Mode field diameter is a key parameter because the radial extent of the mode can be used to predict losses at joints and microbends. In addition, if its spectral variation is known, it can be used to measure cut off wavelength. Other parameters which can be predicted using MFD data include waveguide dispersion and refractive index profile.	191	45	G.650, Methods5.1.2
Bandwidth (MMF)	Bandwidth is generally the amount of data that can be carried from one point to another in a given time period. Bandwidth is measured by launching light into fiber from LED. With this type of light, all modes are filled and which is called overfilled launch. TIA/EIA 455-204 describes two methods for determining the transmission capacity for multimode fiber. IE 60793-1-41 describes two methods for measuring the modal bandwidth of multimode fiber. a) optical time domain measurement (pulse distortion) b) frequency domain measurement. Each method can be performed using one of the two launches: an overfilled launch (OFL) condition or a restricted mode launch (RML) condition.	204	41	G.651, Sec.3 Methods B2 G650 Method 5.5.1

Chromatic Dispersion (SMF)	Chromatic dispersion occurs because different colors of light travels through the fiber at different speed. Some colors arrive at the fiber end before the others. This differential delay difference is called group delay which leads to pulse broadening. Chromatic dispersion is obtained by measuring this fiber group delay in the time domain. TIA455-175 use the differential phase shift method to determine the dispersion coefficient at a particular wavelength from the differential group delay between two closely spaced wavelength. IEC 60793-1 describes four methods for measuring chromatic dispersion: (a) phase shift, (b) spectral group delay in the time domain, (c) differential phase shift, and (d) interferometry.	175	42	G.650, Method 5.5.1
Polarization Mode (PMD)	Polarization mode dispersion (PMD) is the average differential group delay (DGD) which is the time delay between two principle polarization modes of the transmission link at the receiver. PMD occurs when different planes of light inside a fiber travel at slightly different speeds, making it impossible to transmit data reliably at high speeds. PMD is the biggest challenge for high speed optic system. IEC 60793-1 describes three methods of measuring PMD of single mode fiber. TIA455-124 describes methods for measuring average PMD of SMF and cable assemblies over the measurement wavelength range of the selected source from 1210 nm and/or 1550 nm region.	124	48	G.650 Method 5.7.3

Mechanical & Environmental Properties for Single Mode Fiber
Mechanical & Environmental Properties for Multi Mode Fiber

▶ Mechanical & Environmental Properties for Single Mode Fiber

Testing Parameters	EIA/TIA-455 FOTP Number	IEC-794-1 Test Method	EN 187000 Test Method	Maximum Increased loss
Tensile Load & Bending	33	E1	501	<0.05dB (90%); <0.15dB (100%)
Low & High Temperature Bend	37	E11		<0.05dB (90%); <0.15dB (100%)
Compression loading (Crush)	41	E3	504	<0.05dB (90%); <0.15dB (100%) 440N/km(250lb/in) load
Impact Resistance	25	E4	505	<0.05dB (90%); <0.15dB (100%)
Twist (Torson)	85	E7	508	<0.05dB (90%); <0.15dB (100%)
Cyclic Flexing (Repeated Bending)	104	E6	509	<0.05dB (90%); <0.15dB (100%)
External freezing	98	F6		<0.05dB (90%); <0.15dB (100%)
Temperature Cycling	3	F1	601	<0.05dB (90%); <0.15dB (100%)
Fiber Stripability	178	B6		<8.9N(2lbf) on unaged and aged fiber; >1.3N(0.3lbf) on unaged and aged fiber
Cable Aging	82	F5		<0.1dB (90%); <0.25dB (100%)
Water Penetration	82	F5		No flow after 24 hours from 1 meter length of cable
Compound Flow (Drip)	81	E14		80 C 24 hrs duration, no drip

▶ Mechanical & Environmental Properties for Multi Mode Fiber

Testing Parameters	EIA/TIA-455 FOTP Number	IEC-794-1 Test Method	EN 187000 Test Method	Maximum Increased loss
Tensile Load & Bending	33	E1	501	<0.2dB
Low & High Temperature Bend	37	E11		<0.4dB
Compression loading (Crush)	41	E3	504	<0.2dB 440N/km(250lb/in) load
Cyclic Impact	25	E4	505	<0.4dB
Twist (Torsion)	85	E7	508	<0.2dB
Cyclic Flexing (Repeated Bending)	104	E6	509	<0.2dB
External freezing	98	F6		<0.2dB
Temperature Cycling	3	F1	601	<0.05dB (90%); <0.15dB (100%)
Fiber Stripability	178	B6		<13.4N(3lbf) on unaged fiber
Cable Aging	82	F5		<0.1dB (90%); <0.25dB (100%)
Water Penetration	82	F5		No flow after 24 hours from 1 meter length of cable
Compound Flow (Drip)	81	E14		80 C 24 hrs duration, no drip

Testing Method for Optical & Geometrical Properties of Fiber

▶ Testing Method for Mechanical & Environmental Properties of Fiber

Testing Parameters	Test Method Description	EIA/ TIA-455 FOTP Number	IEC-794-1
Tensile Load & Bending	Cable installed outside will be exposed to tensile load during installation and service. The cable should be able to withstand this force without fiber strain and attenuation change over its limit.	33	E1
Low & High Temperature Bend	This test measures the ability of the cable to retain its mechanical and optical properties in spite of wide and rapid changes in temperature.	37	E11
Compression loading (Crush)	The purpose of this test is to test the ability of the fiber to withstand transverse pressure.	41	E3
Cyclic Impact	The fall of a heavy device is simulated in this test. The weight is allowed to fall vertically onto an intermediate steel piece that transmits the force to the cable sample. No damage to the cable sheath may occur.	25	E4
Twist (Torsion)	During feeding, the fiber must withstand torsion forces in addition to tension, transverse pressure and bending load. Thus a cable sample is turned around its own axis and attenuation is measured during the test. Nether fiber or sheath material may be damaged during the test.	85	E7
Cyclic Flexing (Repeated Bending)	The resistance of a fiber optic cable to repeated bending is determined by a cable sample bent forwards and backward 180 degree over a specific radius.	104	E6
External freezing	This freezing test evaluates the ability of the fiber cable to withstand the freezing of the water that may immediately surround the cable. The test evaluates the physical appearance and mechanical properties of the jacket after test, monitoring the attenuation change during/after freezing.	98	F6
Temperature Cycling	This test measures the effect of wide swing in temperature and humidity on the optical and mechanical performance of the cables.. Since the thermal coefficient of expansion of the plastic coating and buffer are different from the fibers themselves, microbending may occur with the temperature changes, and which may bring changes in attenuation.	3	F1
Fiber Stripability	This test measures the forces required to remove the fiber coating.	178	B6
Cable Aging	This test measures the effect of prolonged heat aging on the fiber. The accelerated oxygen test simulates the result of long term aging on the cable jacket. After test, the cable is examined for color changes, embrittlement, softening and surface damages etc.	82	F5
Water Penetration	This test is to determine whether the interstices within the cable is continuously filled with jelly compound or water blocking to prevent water to enter the cable	82	F5
Compound Flow (Drip)	This test is to determine whether the flooding compound will remain stable for ambient temperature up to 70deg and will not drip, flow or leak with age or at the change of temperature. No drip of the jelly compound may be observed during and after the test.	81	E14

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