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**FIBRE OPTIC
CABLES**

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Introduction

The principles of optical communications have been known for a long time but only in the last fifteen years have there been major applications in the field of telecommunication, data and image transmission.

This publication provides the main information required for good knowledge of optical core cables and their most recurrent applications.

Fibres

The fibres include a central zone of silica with a high index of refraction called core, a pure silica layer with a lower index of refraction called cladding and a coating layer.

The ray of light introduced in the fibre can be of different wave-lengths called “mode” and its number depends on the technology of the fibre production.

The transmission principle of the light in an optical fibre is based on the total reflection between core and cladding.

Continuous developments of the material quality which constitute the fibre have permitted better performances of the signal transmitted, reducing considerably the attenuation values and consequently the necessity of the amplification signal along the line.

Meanwhile a better geometry of the core, cladding and coating supports the performance of joints and terminations, excluding nearly all attenuation increase.

Design

When we design a fibre optic cable, it is necessary to take in consideration the minimum bending radius applicable, the frequency and the number of bendings, the thermal cycles and the pulling force to which the cable will be submitted during the installation.

It's important therefore that all the design parameters and the production technology ensure that the fibres are free of any mechanical loads.

The reliability of the fibre, as time passes, is largely due to the way that it has been placed inside the cable, which may be considered as a container of the fibre itself.

The fibres must be longer with regards to the actual length of the cable itself to avoid or, in any case, to moderate the mechanical stress and pertinent to the thermal expansion to which the fibre will be submitted during the production and usage phases, assuring therefore a long period of life.

Special features

- very large transmission capacity
- very low transmission loss
- very low dispersion
- very long line without signal amplification needs
- immune to electromagnetic interference
- non crosstalk
- suitable for data, telecommunication video, etc.
- no radiation along the cable
- flame retardant
- low smoke and toxic gas
- metal free design
- rodent proof
- light weight
- small diameter

Safety performances

In general all the cables we produce can be supplied in flame retardant version and with low emission of toxic fumes and corrosive gasses. They can pass several test levels in accordance with national and international standards. These particular performances can be achieved using special materials for inner and outer sheaths and for other materials.

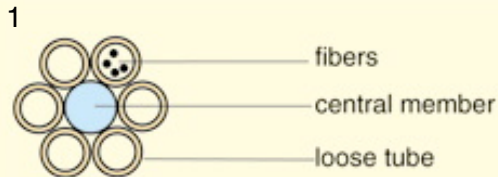
Technical references

Appropriate tests in accordance with the Quality Assurance procedures ensure a good performance.

For all the material supplied to the customer, a technical documentation will be provided confirming the compliance of the product with relevant technical specifications proving the fulfilment of the constructional and performance characteristics.

Here below there are the three main technologies with which the fibre optic cables are produced: Loose Tube, Slotted Core and Ribbon

LOOSE TUBE



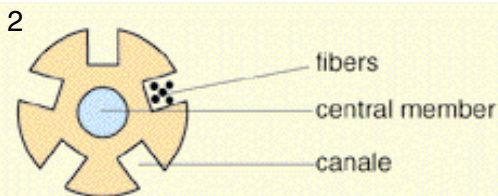
The fibres are situated inside small tubes together with jelly protection.

The fibres must be free to move.

The dimensions and the number of tubes can be different by way of the number of fibres they contain, the type of utilisation, etc.

Figure 1 shows a traditional stranded loose tube cable core.

SLOTTED CORE



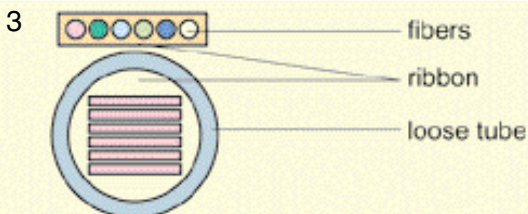
The fibres are situated inside helical ducts of a central element (slot) together with jelly protection.

The fibres must be free to move.

The dimensions and the number of ducts can be different by way of the number of fibres, the cable use, spare fibres for future utilisation.

Figure 2 shows a traditional slotted core cable.

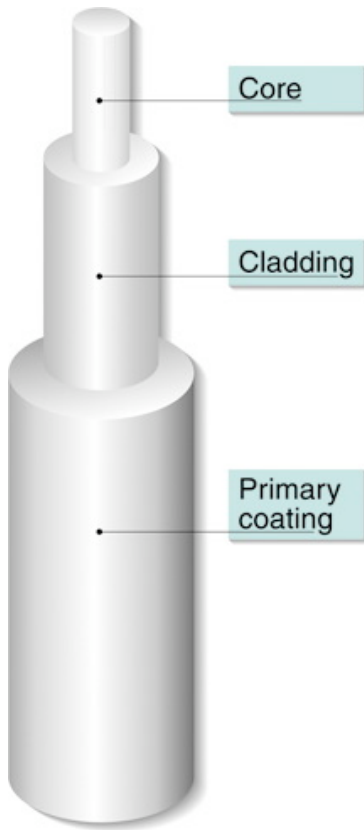
RIBBON



The fibres are situated in the same layer, one near to the other and resinated with special materials: with this method we obtain the "ribbon" which overlaid on each other are fitted inside tubes or slotted-core. The number of fibres for each ribbon can be different (normally from 4 up to 16 fibres) and same for the number of ribbon for each tube or duct.

Figure 3 shows a traditional ribbon core cable.

TECHNICAL SPECIFICATION FOR SINGLE MODE FIBRES SM-R CONFORM TO ITU-T G652



OPTICAL CHARACTERISTICS

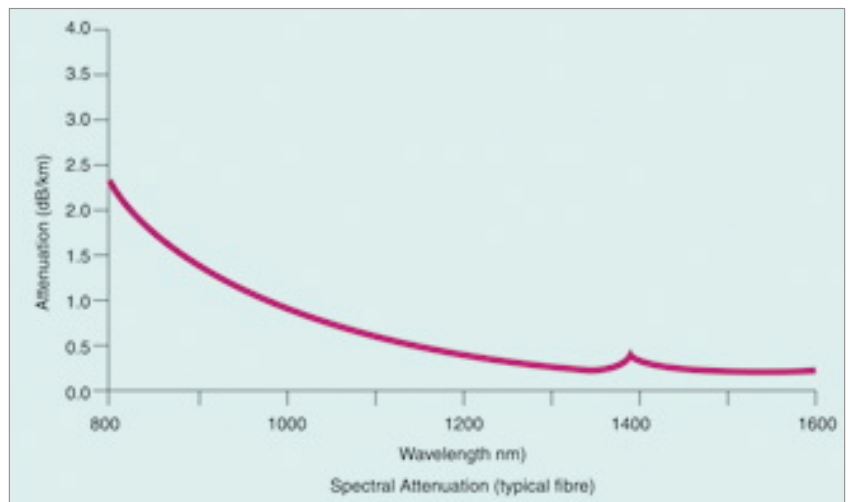
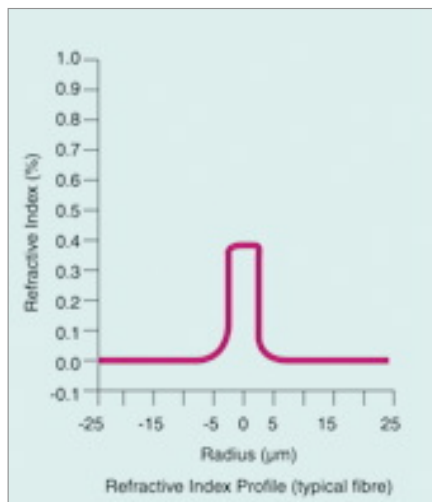
Max attenuation at 1310 nm	dB/Km	0.40
Max attenuation at 1550 nm	dB/Km	0.25
Max variation at 1530-1560 nm	dB/Km	0.03
Spectral attenuation between 1285-1330 nm respect at 1310 nm	dB/Km	0.1
Attenuation at 1393±3 nm	dB/Km	2
Chromatic dispersion coefficient:		
between 1285 nm and 1330 nm	ps/(nm.km)	3.5
at 1550	mn	20
Zero dispersion wavelength for fibre cabled	nm	1315 + 10
Dispersion slope	ps/(nm km)	<0.092
Mode field diameter at 1310 nm (Peterman II)	micron	9.4 ± 0.3
Cut-off wavelength	nm	1150÷1280
Cut-off walelenght for fibre cabled	nm	< 1280

PHYSICAL CHARACTERISTICS

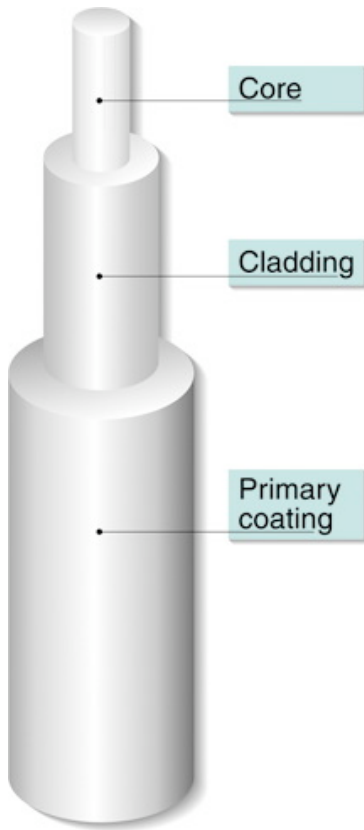
Cladding diameter	micron	125 ± 1
Mode field / cladding concentricity error	micron	0.8
Cladding non circularity	%	2
Coating diameter	micron	245 + 10

GENERAL CHARACTERISTICS

Proof test	%	1
Effective group index:		
at 1310 nm		1.467
at 1550 nm		1.468
Numerical aperture-indicative value		0.11
Young modulus	Gpa	71
Coating strippability	N	1÷5
Macrobending test additional loss at 1550 nm 100 turns on 75 mm mandrel	dB	< 0.3



TECHNICAL SPECIFICATION FOR DISPERSION SHIFTED SINGLE MODE FIBRES CONFORM TO ITU-T G653



OPTICAL CHARACTERISTICS

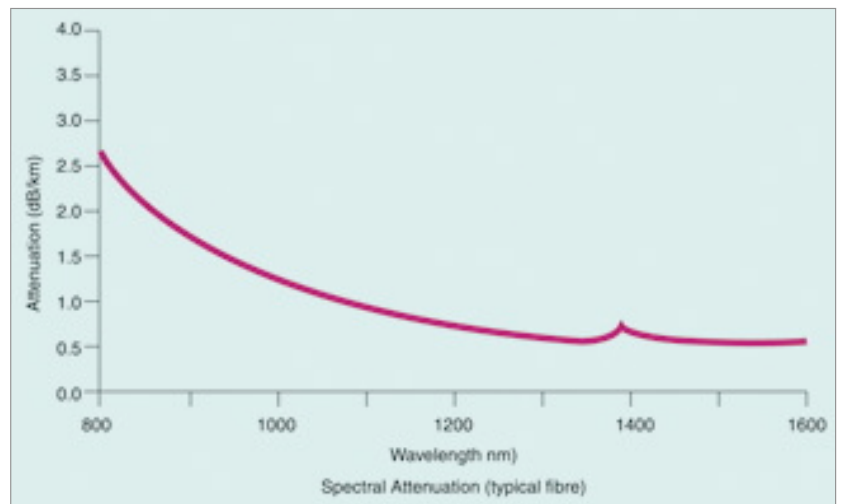
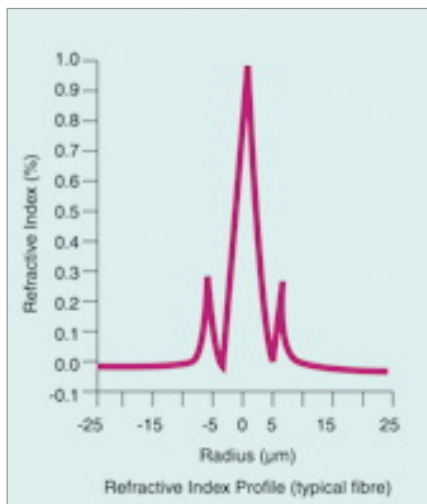
Max attenuation at 1550 nm	dB/Km	0.28
Average attenuation at 1550 nm	dB/Km	0.26
Max attenuation at 1330 nm	dB/Km	0.5
Max chromatic dispersion coefficient:		
between 1525 nm and 1575 nm	ps/(nm.km)	3
at 1330 nm		25
Mode field diameter	micron	$8.1 \pm 10\%$
Cut-off wavelength	nm	1120÷1320

PHYSICAL CHARACTERISTICS

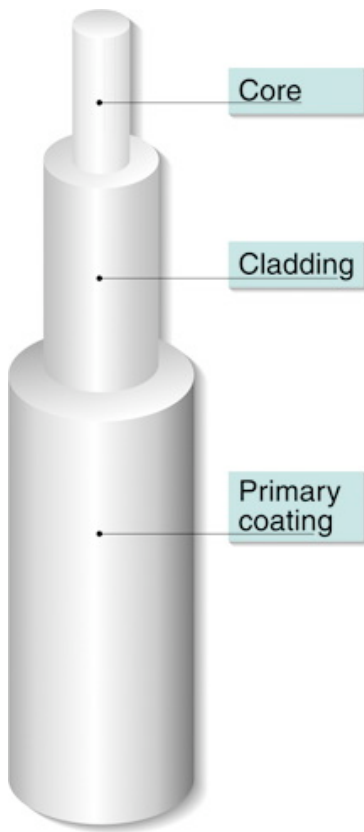
Cladding diameter	micron	125±2
Mode field / cladding concentricity error	micron	1
Cladding non circularity	%	2
Coating diameter	micron	245±10

GENERAL CHARACTERISTICS

Proof test	%	0.5
Effective group index:		
at 1310 nm		1.468
at 1550 nm		1.47
Coating strippability	N	15
Macrobending test additional loss at 1550 nm	dB	< 0.5
100 turns on 75 mm mandrel		



TECHNICAL SPECIFICATION FOR MULTIMODE FIBRES MM-62.5/125 CONFORM TO ITU-T G651



OPTICAL CHARACTERISTICS

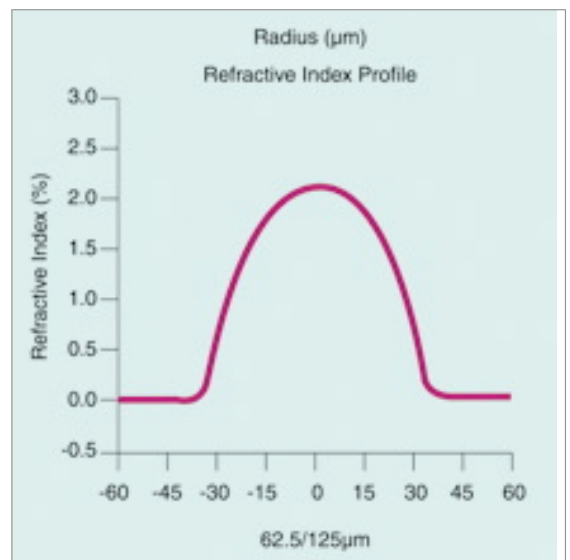
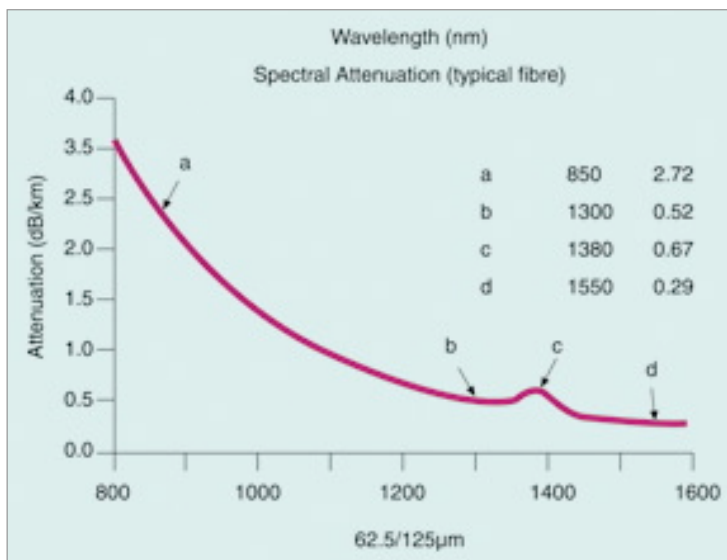
Attenuation range at 850 nm	dB/Km	3.0÷3.5
at 1300 nm		0.7÷1.5
Bandwidth range at 850 nm	MHz.km	160÷200
at 1300 nm		200÷600
Numerial aperture		0.275 ± 0.015

PHYSICAL CHARACTERISTICS

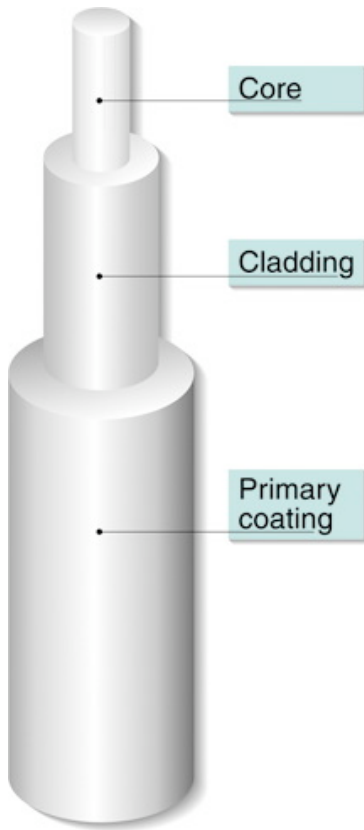
Core diameter	micron	62,5 ± 3
Cladding diameter	micron	125 ± 2
Core/cladding concentricity error	%	3
Core non circularity	%	6
Cladding non circularity	%	2
Coating diameter	micron	245 ± 10

GENERAL CHARACTERISTICS

Proof test	%	0.5
Effective group index:		
at 850 nm		1.4970
at 1300 nm		1.4919
Coating strippability	N	1÷5



TECHNICAL SPECIFICATION FOR MULTIMODE FIBRES MM-50/125 CONFORM TO ITU-T G651



OPTICAL CHARACTERISTICS

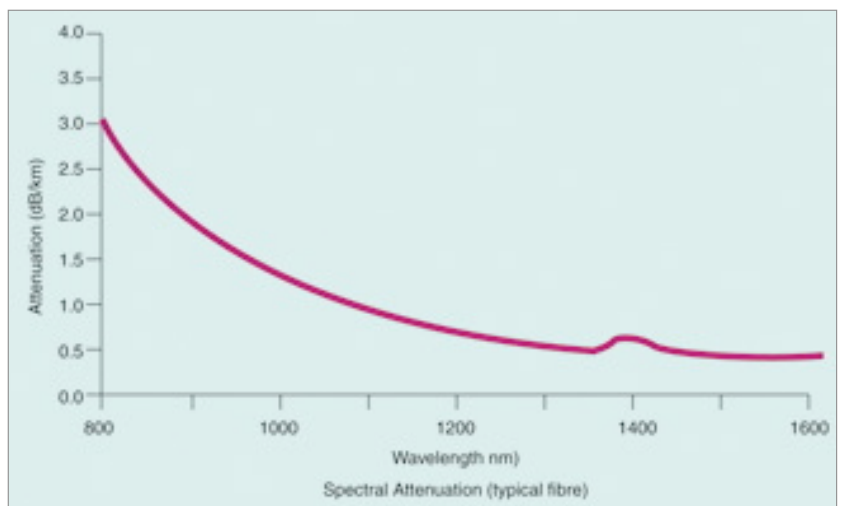
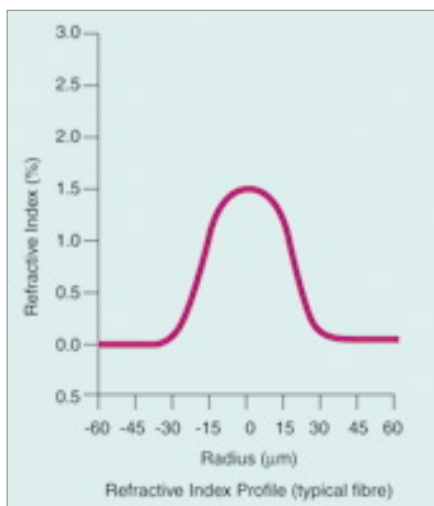
Attenuation range at 850 nm	dB/Km	2.4 ÷ 3.5
at 1300 nm		0.6 ÷ 1.5
Bandwith range at 850 nm	MHz.km	200÷1000
at 1300 nm		400÷1600
Numerial aperture		0.2 ± 0.02

PHYSICAL CHARACTERISTICS

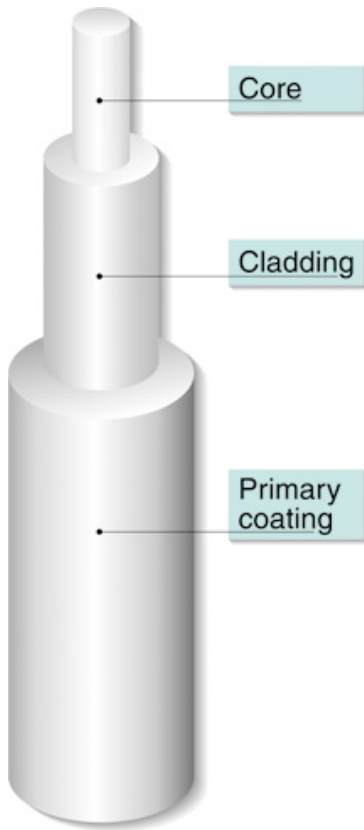
Core diameter	micron	50 ± 3
Cladding diameter	micron	125 ± 2
Core/cladding concentricity error	%	3
Core non circularity	%	6
Cladding non circularity	%	2
Coating diameter	micron	245 ± 10

GENERAL CHARACTERISTICS

Proof test	%	0.5
Effective group index:		
at 850 nm		1.488
Coating strippability	N	1 ÷ 5



TECHNICAL SPECIFICATION FOR NON ZERO DISPERSION FIBRES



OPTICAL CHARACTERISTICS

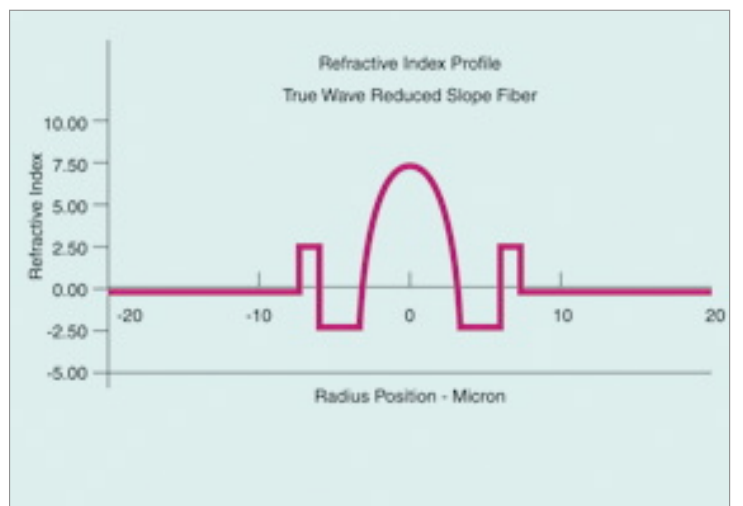
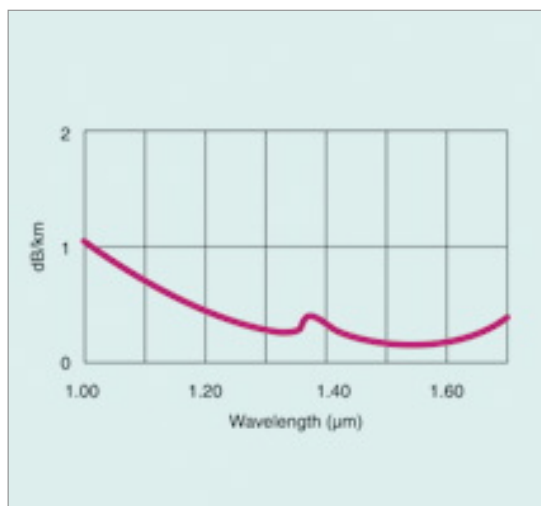
Max attenuation at 1550 nm	dB/Km	0.22±0.25
Max attenuation at 1310 nm	dB/Km	0.40
Max variation at 1525-1575 nm	dB/Km	0.05
Max attenuation at the OH absorbing peak (1383 ± 3 nm)	dB/Km	1
Max attenuation discontinuities	dB/Km	0.1
Chromatic dispersion coefficient: in nonzero region:		
minimum	ps/(nm.km)	0.8
maximum	ps/(nm.km)	4.0
Non-zero-dispersion region	nm	1540-1560
Dispersion coefficient at 1550 nm (typical)	ps/sqrt(km)	0.1
Mode field diameter at 1310 nm	micron	9.3 ± 0.5
Cut-offwavelength	nm	1260

PHYSICAL CHARACTERISTICS

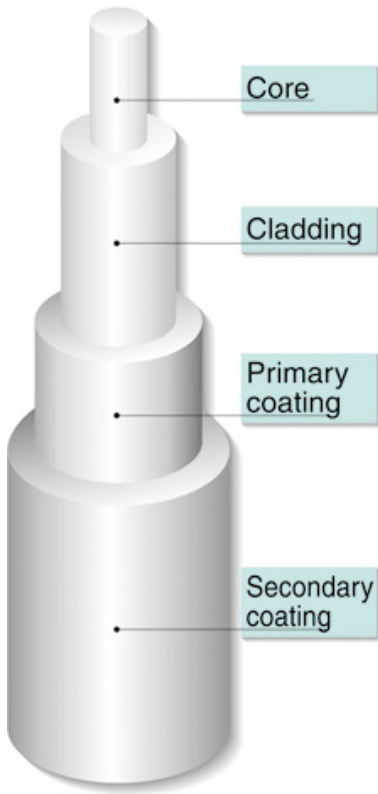
Cladding diameter	micron	125 ± 1
Core / cladding concentricity error	micron	0.8
Cladding non circularity	%	1
Coating diameter	micron	245 ± 10
Coating/cladding concentricity error	micron	< 12

GENERAL CHARACTERISTICS

Proof test	%	>= 1
Effective group index:		
at 1310 nm		1.4710
at 1550 nm		1.4700
Coating strippability	N	1 ÷ 5
Macrobending test additional loss at 1550 nm 100 turns on 75 mm mandrel	dB	< 0.05



TECHNICAL SPECIFICATION FOR TIGHT FIBRES



TIGHT FIBRES

For particular applications fibres with diameter 250 micron can be take to 850 ± 50 micron with a secondary tight coating.

The secondary coating is made of nylon or acrylate resin.

The tight fibre are generally used by:

- cable-equipment lines
- cable termination with terminal joint
- switching lines
- LAN network
- distribution network
- patch-cord.

FIBRES TYPE

Tight Fibre
 850 ± 0.5 micron

SMR - single mode fibre conform to
ITU-T G652

SM-DS- single mode dispersion shifted
conform to
ITU-T G653

62,5/125 multimode fibre conform to
ITU-T G651

50/125 multimode fibre conform to
ITU-T G651



DIELECTRIC LOOSE TUBE FIBRE OPTIC CABLE

Code: TOLx yy z (w fo) T/KE

x: elements in cable structure
yy: fibres number of fibres
z: number of loose tubes
w: number of fibres in each tube
fo: fibres type

Construction: dielectric central support (FRP), jelly filled loose tube, aramidic strength member and polyethylene outer sheath.

Application: outside duct installation

Standard: ITU-T Rec. for optical fibre
ETSI Standards
IEC Rec. for cable tests
ISO 9000 Standards for raw material
CEI-UNEL

General data:

Operating temperature	-30°C+60°C
Installation temperature	-15°C+60°C
Transport and storage temperature	-40°C+70°C
Identification	cable code
Outer sheath colour	black
Cable sheath marking	TRATOS "cable code"

TECHNICAL TABLE

fibres cable	fibres for each tube	tube	tube diameter	central support diameter	layer elements	nominal sheath thickness	overall diameter approx	max. pulling load static dynamic N	min. bending radius static dynamic	nominal delivery length	cable weight approx
nr.	nr.	nr.	mm	mm	nr.	mm	mm		mm	m	kg/km
4	4	1	2.5	2	1	1.8	12.5	1800/2500	300/150	2100	130
8	4	2	2.5	2	1	1.8	12.5	1800/2500	300/150	2100	130
12	4	3	2.5	2	1	1.8	12.5	1800/2500	300/150	2100	130
16	4	4	2.5	2	1	1.8	12.5	1800/2500	300/150	2100	130
20	4	5	2.5	2	1	1.8	12.5	1800/2500	300/150	2100	130
24	6	5	2.5	2.5	1	1.8	13	2000/3000	300/150	2100	140
30	6	5	2.5	2.5	1	1.8	13	2000/3000	300/150	2100	140
32	8	4	2.5	2.5	1	1.8	13	2000/3000	300/150	2100	140
36	6	6	2.5	2.5	1	1.8	13	2000/3000	300/150	2100	140
40	8	5	3	2.5	1	1.8	13	2000/3000	300/150	2100	140
48	8	6	3	2.5	1	1.8	13	2000/3000	300/150	2100	140
50	10	5	3	6.5	1	1.8	18.5	2500/3000	400/200	2100	240
60	10	6	3	6.5	1	1.8	18.5	2500/3500	400/200	2100	240
70	10	7	3	6.5	1	1.8	18.5	2500/3500	400/200	2100	240
80	10	8	3	6.5	1	1.8	18.5	2500/3500	400/200	2100	240
90	10	9	3	6.5	1	1.8	18.5	2500/3500	400/200	2100	240
100	10	10	3	6.5	1	1.8	18.5	2500/3500	400/200	2100	240
110	10	11	3	6.5	1	1.8	18.5	2500/3500	400/200	2100	240
120	10	12	3	6.5	1	1.8	18.5	2500/3500	400/200	2100	240

LOOSE TUBE FIBRE OPTIC CABLE WITH MOISTURE BARRIER

Code: TOLx yy z (w fo) T/KH5E

x: elements in cable structure
yy: number of fibres
z: number of loose tubes
w: number of fibres in each tube
fo: fibres type

Construction: dielectric central support (FRP), jelly filled loose tube, aramidic strength member, longitudinal thermowelded aluminium tape as moisture barrier and polyethylene outer sheath.

Application: outside duct installation

Standard: ITU-T Rec. for optical fibre
ETSI Standards
IEC Rec. for cable tests
ISO 9000 Standards for raw material
CEI-UNEL

General data:

Operating temperature	-30°C+60°C
Installation temperature	-15°C+60°C
Transport and storage temperature	-40°C+70°C
Identification	cable code
Outer sheath colour	black
Cable sheath marking	TRATOS "cable code"



TECHNICAL TABLE

fibres cable	fibres for each tube	tube	tube diameter	central support diameter	layer elements	nominal sheath thickness	overall diameter approx	max. pulling load static dynamic N	min. bending radius static dynamic	nominal delivery length	cable weight approx
nr.	nr.	nr.	mm	mm	nr.	mm	mm		mm	m	kg/km
4	4	1	2.5	2	1	1.8	13	1800/2500	320/200	2100	140
8	4	2	2.5	2	1	1.8	13	1800/2500	320/200	2100	140
12	4	3	2.5	2	1	1.8	13	1800/2500	320/200	2100	140
16	4	4	2.5	2	1	1.8	13	1800/2500	320/200	2100	140
20	4	5	2.5	2	1	1.8	13	1800/2500	320/200	2100	140
24	6	4	2.5	2.5	1	1.8	13.5	2000/3000	320/200	2100	160
30	6	5	2.5	2.5	1	1.8	13.5	2000/3000	320/200	2100	160
32	8	4	2.5	2.5	1	1.8	13.5	2000/3000	320/200	2100	160
36	6	6	2.5	2.5	1	1.8	13.5	2000/3000	320/200	2100	160
40	8	5	3	2.5	1	1.8	13.5	2000/3000	320/200	2100	160
48	8	6	3	2.5	1	1.8	13.5	2000/3000	320/200	2100	160
50	10	5	3	6.5	1	1.8	19	3000/4000	420/250	2100	260
60	10	6	3	6.5	1	1.8	19	3000/4000	420/250	2100	260
70	10	7	3	6.5	1	1.8	19	3000/4000	420/250	2100	260
80	10	8	3	6.5	1	1.8	19	3000/4000	420/250	2100	260
90	10	9	3	6.5	1	1.8	19	3000/4000	420/250	2100	260
100	10	10	3	6.5	1	1.8	19	3000/4000	420/250	2100	260
110	10	11	3	6.5	1	1.8	19	3000/4000	420/250	2100	260
120	10	12	3	6.5	1	1.8	19	3000/4000	420/250	2100	260

LOOSE TUBE FIBRE OPTIC CABLE WITH METALLIC RODENT PROTECTION

Code: TOLx yy z (w fo) T/KH9E

x: elements in cable structure
yy: number of fibres
z: number of loose tubes
w: number of fibres in each tube
fo: fibres type

Construction: dielectric central support (FRP), jelly filled loose tube, aramidic strength member, longitudinal thermowelded corrugated steel tape as moisture barrier, rodent and mechanical protection, polyethylene outer sheath.

Application: outside duct installation

Standard: ITU-T Rec. for optical fibre
ETSI Standards
IEC Rec. for cable tests
ISO 9000 Standards for raw material
CEI-UNEL

General data:

Operating temperature	-30°C+60°C
Installation temperature	-15°C+60°C
Transport and storage temperature	-40°C+70°C
Identification	cable code
Outer sheath colour	black
Cable sheath marking	TRATOS "cable code"



TECHNICAL TABLE

fibres cable	fibres for each tube	tube	tube diameter	central support diameter	layer elements	nominal sheath thickness	overall diameter approx	max. pulling load static dynamic N	min. bending radius static dynamic	nominal delivery length	cable weight approx
nr.	nr.	nr.	mm	mm	nr.	mm	mm		mm	m	kg/km
4	4	1	2.5	2	1	1.8	14	1800/2500	320/200	2100	180
8	4	2	2.5	2	1	1.8	14	1800/2500	320/200	2100	180
12	4	3	2.5	2	1	1.8	14	1800/2500	320/200	2100	180
16	4	4	2.5	2	1	1.8	14	1800/2500	320/200	2100	180
20	4	5	2.5	2	1	1.8	14	1800/2500	320/200	2100	180
24	6	4	2.5	2.5	1	1.8	14.5	2000/3000	320/200	2100	200
30	6	5	2.5	2.5	1	1.8	14.5	2000/3000	320/200	2100	200
32	8	4	2.5	2.5	1	1.8	14.5	2000/3000	320/200	2100	200
36	6	6	2.5	2.5	1	1.8	14.5	2000/3000	320/200	2100	200
40	8	5	3	2.5	1	1.8	14.5	2000/3000	320/200	2100	200
48	8	6	3	2.5	1	1.8	14.5	2000/3000	320/200	2100	200
50	10	5	3	6.5	1	1.8	20	3000/4000	420/250	2100	300
60	10	6	3	6.5	1	1.8	20	3000/4000	420/250	2100	300
70	10	7	3	6.5	1	1.8	20	3000/4000	420/250	2100	300
80	10	8	3	6.5	1	1.8	20	3000/4000	420/250	2100	300
90	10	9	3	6.5	1	1.8	20	3000/4000	420/250	2100	300
100	10	10	3	6.5	1	1.8	20	3000/4000	420/250	2100	300
110	10	11	3	6.5	1	1.8	20	3000/4000	420/250	2100	300
120	10	12	3	6.5	1	1.8	20	3000/4000	420/250	2100	300

LOOSE TUBE FIBRE OPTIC CABLE WITH METALLIC PROTECTION

Code: TOLx yy z (w fo) T/KH6E

x: elements in cable structure
yy: number of fibres
z: number of loose tubes
w: number of fibres in each tube
fo: fibres type

Construction: dielectric central support (FRP), jelly filled loose tube, polyethylene inner sheath, aramidic strength member, longitudinal corrugated steel sheath, as moisture barrier, rodent and mechanical protection, polyethylene outer sheath.

Application: outside duct installation, directly buried installation

Standard: ITU-T Rec. for optical fibre
ETSI Standards
IEC Rec. for cable tests
ISO 9000 Standards for raw material
CEI-UNEL

General data:

Operating temperature	-30°C+60°C
Installation temperature	-15°C+60°C
Transport and storage temperature	-40°C+70°C
Identification	cable code
Outer sheath colour	black
Cable sheath marking	TRATOS "cable code"



TECHNICAL TABLE

fibres cable	fibres for each tube	tube	tube diameter	central support diameter	layer elements	nominal sheath thickness	overall diameter approx	max. pulling load static dynamic N	min. bending radius static dynamic	nominal delivery length	cable weight approx
nr.	nr.	nr.	mm	mm	nr.	mm	mm		mm	m	kg/km
8	1	8	1.8	3	1	2.8	20.5	3000/4000	430/350	2000/3000	450
16	2	8	1.8	3	1	2.8	20.5	3000/4000	430/350	2000/3000	450
48	6	8	2.5	2.5	1	2.8	20.5	3000/4000	430/350	2000/3000	450
72	12	6	6	3	1	2.8	21.5	3000/4000	420/350	2000/3000	450



SLOTTED DIELECTRIC FIBRE OPTIC CABLE

Code: TOSx yy z (w fo) T/KE

x: slots number in cable structure
yy: number of fibres
z: number of slots
w: number of fibres in each slots
fo: fibres type

Construction: dielectric central support (FRP), jelly filled plastic slotted core, aramidic strength member and polyethylene outer sheath.

Application: outside duct installation

Standard: ITU-T Rec. for optical fibre
ETSI Standards
IEC Rec. for cable tests
ISO 9000 Standards for raw material
CEI-UNEL

General data:

Operating temperature	-30°C+60°C
Installation temperature	-15°C+60°C
Transport and storage temperature	-40°C+70°C
Identification	cable code
Outer sheath colour	black
Cable sheath marking	TRATOS "cable code"

TECHNICAL TABLE

fibres cable	fibres for each slot	slots	slot dimension approx	central support diameter	layer elements	nominal sheath thickness	overall diameter approx	max. pulling load static dynamic N	min. bending radius static dynamic	nominal delivery length	cable weight approx
nr.	nr.	nr.	mm	mm	nr.	mm	mm		mm	m	kg/km
4	4	4	2x2	2	1	1.6	11	1500/2000	220/160	2100	100
5	5	4	2x2	2	1	1.6	11	1500/2000	220/160	2100	100
8	4	4	2x2	2	1	1.6	11	1500/2000	220/160	2100	100
8	8	3	2x2	2	1	1.6	12.5	2000/3000	250/180	2100	140
10	5	4	2x2	2	1	1.6	11	1500/2000	220/160	2100	100
10	10	3	2x2	2	1	1.6	12.5	2000/3000	250/180	2100	140
12	4	4	2x2	2	1	1.6	11	1500/2000	220/160	2100	100
15	5	4	2x2	2	1	1.6	11	1500/2000	220/160	2100	100
16	4	4	2x2	2	1	1.6	11	1500/2000	220/160	2100	100
16	8	3	2x2	2	1	1.6	12.5	2000/3000	250/180	2100	140
20	4	4	2x2	2	1	1.6	11	1500/2000	220/160	2100	100
20	10	3	2x2	2	1	1.6	12.5	2000/3000	250/180	2100	140
24	8	3	2x2	2	1	1.6	12.5	2000/3000	250/180	2100	140
30	10	3	2x2	2	1	1.6	12.5	2000/3000	250/180	2100	140
40	10	4	2x2	2.4	1	1.6	12.5	2500/3500	250/180	2100	150
50	10	5	2x2	2.4	1	1.6	12.5	2500/3500	250/180	2100	150
60	10	6	2x2	2.4	1	1.6	13.5	2500/3500	270/200	2100	170
70	10	10	2x2	3	1	1.6	16.5	2500/3500	330/250	2100	210
80	10	10	2x2	3	1	1.6	16.5	2500/3500	330/250	2100	210
90	10	10	2x2	3	1	1.6	16.5	2500/3500	330/250	2100	210
100	10	10	2x2	3	1	1.6	16.5	2500/3500	330/250	2100	210

SLOTTED FIBRE OPTIC CABLE WITH MOISTURE BARRIER

Code: TOSx yy z (w fo) T/KH5E

x: slots number in cable structure
yy: number of fibres
z: number of slots
w: number of fibres in each slots
fo: fibres type

Construction: dielectric central support (FRP), jelly filled plastic slotted core, aramidic strength member, longitudinal thermowelded aluminum tape as moisture barrier and polyethylene outer sheath.

Application: outside duct installation

Standard: ITU-T Rec. for optical fibre
ETSI Standards
IEC Rec. for cable tests
ISO 9000 Standards for raw material
CEI-UNEL

General data:

Operating temperature	-30°C+60°C
Installation temperature	-15°C+60°C
Transport and storage temperature	-40°C+70°C
Identification	cable code
Outer sheath colour	black
Cable sheath marking	TRATOS "cable code"



TECHNICAL TABLE

fibres cable	fibres for each slot	slots	slot dimension approx	central support diameter	layer elements	nominal sheath thickness	overall diameter approx	max. pulling load static dynamic N	min. bending radius static dynamic mm	nominal delivery length m	cable weight approx kg/km
nr.	nr.	nr.	mm	mm	nr.	mm	mm				
4	4	4	2x2	2	1	1.6	11.5	1500/2000	230/170	2100	120
5	5	4	2x2	2	1	1.6	11.5	1500/2000	230/170	2100	120
8	4	4	2x2	2	1	1.6	11.5	1500/2000	230/170	2100	120
8	8	3	2x2	2	1	1.6	13	2000/3000	260/200	2100	160
10	5	4	2x2	2	1	1.6	11.5	1500/2000	230/170	2100	120
10	10	3	2x2	2	1	1.6	13	2000/3000	260/200	2100	160
12	4	4	2x2	2	1	1.6	11.5	1500/2000	230/170	2100	120
15	5	4	2x2	2	1	1.6	11.5	1500/2000	230/170	2100	120
16	4	4	2x2	2	1	1.6	11.5	1500/2000	230/170	2100	126
16	8	3	2x2	2	1	1.6	13	2000/3000	260/200	2100	160
20	4	4	2x2	2	1	1.6	11.5	1500/2000	230/170	2100	120
20	10	3	2x2	2	1	1.6	13	2000/3000	260/200	2100	160
24	8	3	2x2	2	1	1.6	13	2000/3000	260/200	2100	160
30	10	3	2x2	2	1	1.6	13	2000/3000	260/200	2100	160
40	10	4	2x2	2.4	1	1.6	13	2500/3500	260/200	2100	170
50	10	5	2x2	2.4	1	1.6	13	2500/3500	260/200	2100	170
60	10	6	2x2	2.4	1	1.6	14	2500/3500	280/210	2100	190
70	10	10	2x2	3	1	1.6	17	2500/3500	350/250	2100	230
80	10	10	2x2	3	1	1.6	17	2500/3500	350/250	2100	230
90	10	10	2x2	3	1	1.6	17	2500/3500	350/250	2100	230
100	10	10	2x2	3	1	1.6	17	2500/3500	350/250	2100	230

SLOTTED FIBRE OPTIC CABLE WITH METALLIC RODENT PROTECTION

Code: TOSx yy z (w fo) T/KH9E

x: slots number in cable structure
yy: number of fibres
z: number of slots
w: number of fibres in each slots
fo: fibres type

Construction: dielectric central support (FRP), jelly filled plastic slotted core, aramidic strength member, longitudinal thermowelded corrugated steel tape as moisture barrier, rodent and mechanical protection and polyethylene outer sheath.

Application: outside duct installation

Standard: ITU-T Rec. for optical fibre
ETSI Standards
IEC Rec. for cable tests
ISO 9000 Standards for raw material
CEI-UNEL

General data:

Operating temperature	-30°C+60°C
Installation temperature	-15°C+60°C
Transport and storage temperature	-40°C+70°C
Identification	cable code
Outer sheath colour	black
Cable sheath marking	TRATOS "cable code"



TECHNICAL TABLE

fibres cable	fibres for each slot	slots nr.	slot dimension approx.	central support diameter	layer elements	nominal sheath thickness	overall diameter approx	max. pulling load static dynamic N	min. bending radius static dynamic	nominal delivery length	cable weight approx
nr.			mm	mm	nr.	mm	mm		mm	m	kg/km
4	4	4	2x2	2	1	1.6	12.5	1500/2000	250/200	2100	140
5	5	4	2x2	2	1	1.6	12.5	1500/2000	250/200	2100	140
8	4	4	2x2	2	1	1.6	12.5	1500/2000	250/200	2100	140
8	8	3	2x2	2	1	1.6	14	2000/3000	280/210	2100	180
10	5	4	2x2	2	1	1.6	12.5	1500/2000	250/200	2100	140
10	10	3	2x2	2	1	1.6	14	2000/3000	280/210	2100	180
12	4	4	2x2	2	1	1.6	12.5	1500/2000	250/200	2100	140
15	5	4	2x2	2	1	1.6	12.5	1500/2000	250/200	2100	140
16	4	4	2x2	2	1	1.6	12.5	1500/2000	250/200	2100	140
16	8	3	2x2	2	1	1.6	14	2000/3000	280/210	2100	180
20	4	4	2x2	2	1	1.6	12.5	1500/2000	250/200	2100	140
20	10	3	2x2	2	1	1.6	14	2000/3000	280/210	2100	180
24	8	3	2x2	2	1	1.6	14	2000/3000	280/210	2100	180
30	10	3	2x2	2	1	1.6	14	2000/3000	280/210	2100	180
40	10	4	2x2	2.4	1	1.6	14	2500/3500	280/210	2100	180
50	10	5	2x2	2.4	1	1.6	14	2500/3500	280/210	2100	180
60	10	6	2x2	2.4	1	1.6	15	2500/3500	300/230	2100	190
70	10	10	2x2	3	1	1.6	18	2500/3500	360/270	2100	260
80	10	10	2x2	3	1	1.6	18	2500/3500	360/270	2100	260
90	10	10	2x2	3	1	1.6	18	2500/3500	360/270	2100	260
100	10	10	2x2	3	1	1.6	18	2500/3500	360/270	2100	260

SLOTTED DIELECTRIC FIBRE OPTIC RIBBON CABLE

Code: TOSx yy z (w fo) T/KE

x: slots number in cable structure
yy: number of fibres
z: number of slots
w: number of fibres in each slots
fo: fibres type

Construction: dielectric central support (FRP), jelly filled plastic slotted core, aramidic strength member and polyethylene outer sheath.

Application: outside duct installation

Standard: ITU-T Rec. for optical fibre
ETSI Standards
IEC Rec. for cable tests
ISO 9000 Standards for raw material
CEI-UNEL



General data:

Operating temperature	-30°C+60°C
Installation temperature	-15°C+60°C
Transport and storage temperature	-40°C+70°C
Identification	cable code
Outer sheath colour	black
Cable sheath marking	TRATOS "cable code"

TECHNICAL TABLE

fibres cable	fibres for each slot	slots	slot dimension approx	central support diameter	layer elements	nominal sheath thickness	overall diameter approx	max. pulling load static dynamic N	min. bending radius static dynamic mm	nominal delivery length m	cable weight approx kg/km
nr.	nr.	nr.	mm	mm	nr.	mm	mm				
4	4	2	2x2	2	1	1.6	10.5	400/600	210/160	2100	90
8	4	2	2x2	2	1	1.6	10.5	400/600	210/160	2100	90
20	4	5	2x2	3	1	1.6	12	2000/3000	240/180	2100	160
40	20	5	2x5	3	1	1.6	17	2500/3500	340/250	2100	230
60	20	5	2x5	3	1	1.6	17	2500/3500	340/250	2100	230
100	20	5	2x5	3	1	1.6	17	2500/3500	340/250	2100	230

SLOTTED FIBRE OPTIC RIBBON CABLE WITH MOISTURE BARRIER

Code: TOSx yy z (w fo) T/KH5E

x: slots number in cable structure
yy: number of fibres
z: number of slots
w: number of fibres in each slots
fo: fibres type

Construction: dielectric central support (FRP), jelly filled plastic slotted core, aramidic strength member, longitudinal thermowelded aluminum tape as moisture barrier and polyethylene outer sheath.

Application: outside duct installation

Standard: ITU-T Rec. for optical fibre
ETSI Standards
IEC Rec. for cable tests
ISO 9000 Standards for raw material
CEI-UNEL

General data:

Operating temperature	-30°C+60°C
Installation temperature	-15°C+60°C
Transport and storage temperature	-40°C+70°C
Identification	cable code
Outer sheath colour	black
Cable sheath marking	TRATOS "cable code"



TECHNICAL TABLE

fibres cable	fibres for each slot	slots	slot dimension approx	central support diameter	layer elements	nominal sheath thickness	overall diameter approx	max. pulling load static dynamic N	min. bending radius static dynamic	nominal delivery length	cable weight approx
nr.	nr.	nr.	mm	mm	nr.	mm	mm		mm	m	kg/km
4	4	2	2x2	2	1	1.6	11	400/600	220/170	2100	105
8	4	2	2x2	2	1	1.6	11	400/600	220/170	2100	105
20	4	5	2x2	3	1	1.6	12.5	2000/3000	250/190	2100	175
40	20	5	2x5	3	1	1.6	17.5	2500/3500	350/260	2100	245
60	20	5	2x5	3	1	1.6	17.5	2500/3500	350/260	2100	245
100	20	5	2x5	3	1	1.6	17.5	2500/3500	350/260	2100	245

SLOTTED FIBRE OPTIC RIBBON CABLE WITH METALLIC RODENT PROTECTION

Code: TOSx yy z (w fo) T/EKH9E

x: slots number in cable structure
yy: number of fibres
z: number of slots
w: number of fibres in each slots
fo: fibres type

Construction: dielectric central support (FRP), jelly filled plastic slotted core, polyethylene inner sheath, aramidic strength member, longitudinal thermowelded corrugated steel tape as moisture barrier, rodent and mechanical protection and polyethylene outer sheath.

Application: outside duct installation

Standard: ITU-T Rec. for optical fibre
ETSI Standards
IEC Rec. for cable tests
ISO 9000 Standards for raw material
CEI-UNEL

General data:

Operating temperature	-30°C+60°C
Installation temperature	-15°C+60°C
Transport and storage temperature	-40°C+70°C
Identification	cable code
Outer sheath colour	black
Cable sheath marking	TRATOS "cable code"



TECHNICAL TABLE

fibres cable	fibres for each slot	slots	slot dimension approx	central support diameter	layer elements	nominal sheath thickness	overall diameter approx	max. pulling load static dynamic N	min. bending radius static dynamic	nominal delivery length	cable weight approx
nr.	nr.	nr.	mm	mm	nr.	mm	mm		mm	m	kg/km
4	4	2	2x2	2	1	1.4	11.5	400/600	220/170	2100	120
8	4	2	2x2	2	1	1.4	11.5	400/600	220/170	2100	120
20	4	5	2x2	3	1	1.7	16	2000/3000	300/250	2100	215
40	20	5	2x5	3	1	1.7	19	2500/3500	350/290	2100	290
60	20	5	2x5	3	1	1.7	19	2500/3500	350/290	2100	290
100	20	5	2x5	3	1	1.7	19	2500/3500	350/290	2100	290

MONOTUBE DIELECTRIC FIBRE OPTIC CABLE

Code: TOL1 yy fo VE

yy: fibres number
fo: fibres type

Construction: jelly filled plastic monotube, glass fibre strength member and rats protection, polyethylene outer sheath

Application: outside duct installation

Standard: ITU-T Rec. for optical fibre
ETSI Standards
IEC Rec. for cable tests
ISO 9000 Standards for raw material
CEI-UNEL



General data:

Operating temperature	-20°C+60°C
Installation temperature	-15°C+60°C
Transport and storage temperature	-40°C+70°C
Identification	cable code
Outer sheath colour	black
Cable sheath marking	TRATOS "cable code"

TECHNICAL TABLE

fibres cable	fibres for each tube	tube	tube diameter	central support diameter	layer elements	nominal sheath thickness	overall diameter approx	max. pulling load static dynamic N	min. bending radius static dynamic	nominal delivery length	cable weight approx
nr.	nr.	nr.	mm	mm	nr.	mm	mm		mm	m	kg/km
4	4	1	4	glass yarns	1	1.2	8.2	1200/2000	105/140	2100	80
6	6	1	4	glass yarns	1	1.2	8.2	1200/2000	105/140	2100	80
8	8	1	4	glass yarns	1	1.2	8.2	1200/2000	105/140	2100	80
12	12	1	4	glass yarns	1	1.2	8.2	1200/2000	105/140	2100	80

MONOTUBE FIBRE OPTIC CABLE WITH MOISTURE BARRIER

Code: TOL1 yy fo VH5E

yy: fibres number
fo: fibres type

Construction: jelly filled plastic monotube, glass fibre strength member and rats protection, longitudinal thermowelded aluminium tape polyethylene outer sheath.

Application: outside duct installation

Standard: ITU-T Rec. for optical fibre
ETSI Standards
IEC Rec. for cable tests
ISO 9000 Standards for raw material
CEI-UNEL



General data:

Operating temperature	-20°C+60°C
Installation temperature	-15°C+60°C
Transport and storage temperature	-40°C+70°C
Identification	cable code
Outer sheath colour	black
Cable sheath marking	TRATOS "cable code"

TECHNICAL TABLE

fibres cable	fibres for each tube	tube	tube diameter	central support diameter	layer elements	nominal sheath thickness	overall diameter approx	max. pulling load static dynamic N	min. bending radius static dynamic	nominal delivery length	cable weight approx
nr.	nr.	nr.	mm	mm	nr.	mm	mm		mm	m	kg/km
4	4	1	4	glass yarns	1	1.2	9	1200/2000	120/150	2100	90
6	6	1	4	glass yarns	1	1.2	9	1200/2000	120/150	2100	90
8	8	1	4	glass yarns	1	1.2	9	1200/2000	120/150	2100	90
12	12	1	4	glass yarns	1	1.2	9	1200/2000	120/150	2100	90

MONOTUBE FIBRE OPTIC CABLE WITH METALLIC PROTECTION

Code: TOL1 yy fo VEH9E

yy: fibres number
fo: fibres type

Construction: jelly filled plastic monotube, glass fibre strength member and rats protection, longitudinal thermowelded corrugated steel tape, polyethylene outer sheath.

Application: outside duct installation

Standard: ITU-T Rec. for optical fibre
ETSI Standards
IEC Rec. for cable tests
ISO 9000 Standards for raw material
CEI-UNEL



General data:

Operating temperature	-20°C+60°C
Installation temperature	-15°C+60°C
Transport and storage temperature	-40°C+70°C
Identification	cable code
Outer sheath colour	black
Cable sheath marking	TRATOS "cable code"

TECHNICAL TABLE

fibres cable	fibres for each tube	tube	tube diameter	central support diameter	layer elements	nominal sheath thickness	overall diameter approx	max. pulling load static dynamic N	min. bending radius static dynamic	nominal delivery length	cable weight approx
nr.	nr.	nr.	mm	mm	nr.	mm	mm		mm	m	kg/km
4	4	1	4	glass yarns	1	1.5	13	1200/2000	200/250	2100	140
6	6	1	4	glass yarns	1	1.5	13	1200/2000	200/250	2100	140
8	8	1	4	glass yarns	1	1.5	13	1200/2000	200/250	2100	140
12	12	1	4	glass yarns	1	1.5	13	1200/2000	200/250	2100	140

FIBRE OPTIC STEEL WIRES ARMOURED CABLE

Code: TOLx yy z (w fo) T/H5EFE

x: optic elements in cable structure
yy: number of fibres
z: number of loose tubes
w: number of fibres in each tube
fo: fibres type

Construction: metallic central support, jelly filled loose tube, longitudinal thermowelded aluminium tape as moisture barrier, polyethylene inner sheath, steel wire armour as mechanical protection and polyethylene outer sheath.

Application: outside duct installation, directly buried installation

Standard: ITU-T Rec. for optical fibre
ETSI Standards
IEC Rec. for cable tests
ISO 9000 Standards for raw material
CEI-UNEL



General data:

Operating temperature	-30°C+60°C
Installation temperature	-15°C+60°C
Transport and storage temperature	-40°C+70°C
Identification	cable code
Outer sheath colour	black
Cable sheath marking	TRATOS "cable code"

TECHNICAL TABLE

fibre cable	fibre for each tube	tube	tube diameter	central support diameter	layer elements	nominal sheath thickness	overall diameter approx	max. pulling load static dynamic N	min. bend- ing radius static dynamic	nominal delivery length	cable weight approx
nr.	nr.	nr.	mm	mm	nr.	mm	mm		mm	m	kg/km
12	1	12	1.6	5	1	1.8	17.5	15.000/20.000	350/300	2100	400

FIBRE OPTIC & COPPER COMMUNICATION CABLE

Code: TOLx yy z (w fo) T/E nn 2Cu ss T/H5EKH6E

x: optic elements in cable structure
yy: number of fibres
z: number of loose tubes
w: number of fibres in each tube
fo: fibres type
nn: number of copper pairs
ss: copper conductors section

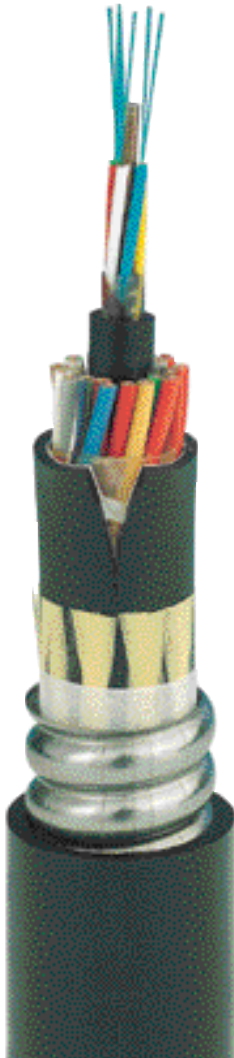
Construction: metallic central support, jelly filled loose tube, polyethylene inner sheath. Copper pairs jelly filled layer, longitudinal thermowelded aluminium tape, intermediate polyethylene sheath, aramidic strength member, longitudinal corrugated steel sheath as moisture barrier, rodent and mechanical protection, polyethylene outer sheath.

Application: outside duct installation, directly buried installaton

Standard: ITU-T Rec. for optical fibre
ETSI Standards
IEC Rec. for cable tests
ISO 9000 Standards for raw material
CEI-UNEL

General data:

Operating temperature	-30°C+60°C
Installation temperature	-15°C+60°C
Transport and storage temperature	-40°C+70°C
Identification	cable code
Outer sheath colour	black
Cable sheath marking	TRATOS "cable code"



TECHNICAL TABLE

fibres cable	fibres for each tube	tube	tube diameter	central support diameter	layer elements	nominal sheath thickness	overall diameter approx	max. pulling load static dynamic N	min. bending radius static dynamic	nominal delivery length	cable weight approx
nr.	nr.	nr.	mm	mm	nr.	mm	mm		mm	m	kg/km
12/10/0.9	2	6	1.8	2.2	2	3	35	3500/4000	700/600	1050	1250

OPGW

OPTICAL PROTECTION GROUND WIRE



The complete compatibility between the electrical power carrying and the optical transmission allows to optimise the use of low and medium tension network structures already existing or of new installation. The aperture of telecommunication market to new telephone operators, data transmission and video signals represent an additional possibility to employ OPGW cable everywhere. Its structure and its performances have been designed in relation with the characteristics of overhead lines where it will be installed. For example it has to be verified very carefully the short circuit current, which is very important for the calculation of the temperature which can develop in this case and the necessary cooling time.

Some notes for the design of OPGW conductors are listed in the following pages.

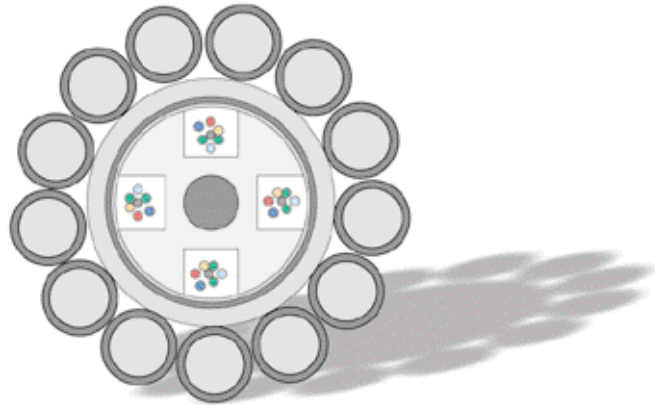
The OPGW conductor is usually composed of a central non metallic member containing the fibres, which is situated inside the steel or electro-welded tube. Over the tube are applied one or more layers of steel or aluminium, aluminium alloy and steel alloy wires. The type, the number and size of each wire is chosen on the basis of the working conditions .

In some cases it is possible to use a non metallic optical fibre cable helically wound on the protection conductor or on the phase conductor.

Some examples are shown in the following pages.

What to take in consideration for the project

- Operating voltage of the power line
- Maximum short circuit current
- Short circuit time
- Supporting structure type
- OPGW installation system
- Pole span and conductor hang
- Range of temperature for storage, installation and operation
- Ground profile
- General weather condition
- Light frequency
- Maximum wind speed
- Maximum ice load



FIBRE

Optical fibre cable		nr	24
Max Attenuation	1310 nm	dB/Km	0.43
	1550 nm		0.26
Chromatic Dispersion	1310 nm	ps (nm x Km)	3.5
	1550 nm		20

CABLE CORE

Strength member diameter	mm	1.7
Slot diameter	mm	5.3
Aluminium tube	mm thickness	0.8
	mm diameter	7.0

ARMOUR

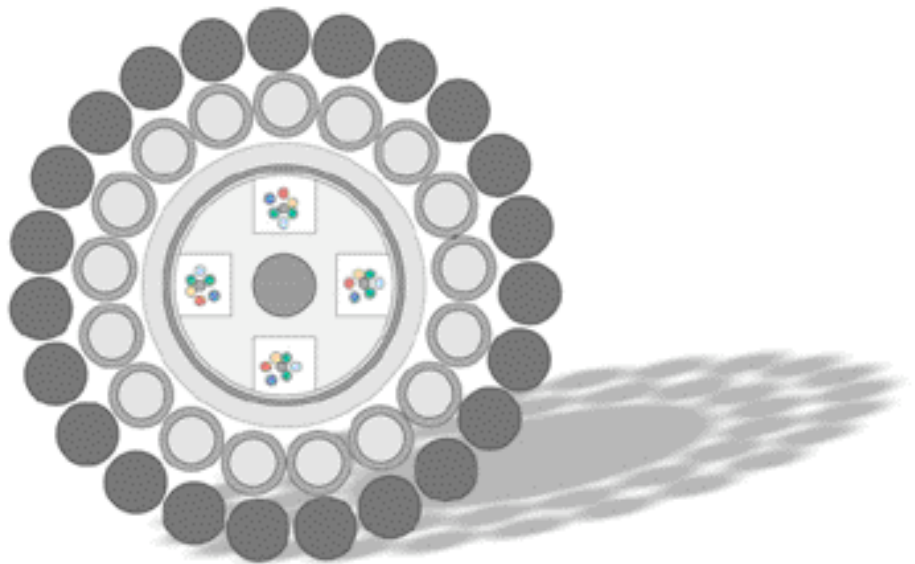
Single layer steel alumoweld wires	n x mm diam	13 x 2.4
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MECHANICAL VALUES

Breaking load	da N	> 7450
Modulus elasticity	da N mm ²	10000
Short circuit current	kA/1 sec	7
	kA/0.5 sec	10
Coeff. linear expansion	1/°C	16 x 10 exp-6

DIMENSIONS

Outer diameter	mm	12.5
Nominal weight	Kg/m	0.60



FIBRE

Optical fibre cable		nr	24
Max Attenuation	1310 nm	dB/Km	0.43
	1550 nm		0.26
Cromatic Dispersion	1310 nm	ps (nm x Km)	3.5
	1550 nm		20

CABLE CORE

Strength member diameter	mm	1.7
Slot diameter	mm	5.3
Aluminium tube	mm thickness	0.8
	mm diameter	7.0

ARMOUR

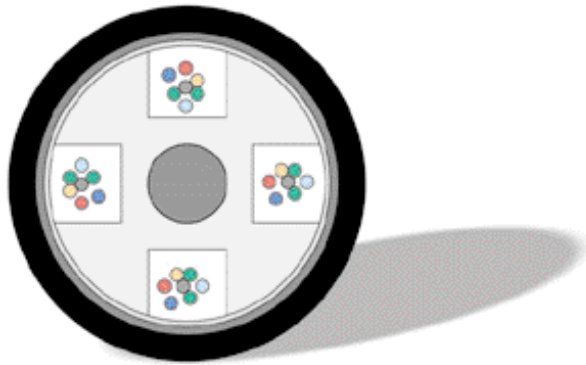
1° layer steel alumoweld wires	n x mm diam	18 x 2.02
2° layer aluminium wires	n x mm diam	23 x 2.02

MECHANICAL VALUES

Breaking load	da N	>10600
Modulus elasticity	da N mm ²	8800
Short circuit current	kA/1 sec	14
	kA/0.5 sec	20
Coeff. linear expansion	1/°C	17 x 10 exp-6

DIMENSIONS

Outer diameter	mm	17.9
Nominal weight	Kg/m	0.82



FIBRE

Optical fibre cable		nr	24
Max Attenuation	1310 nm	dB/Km	0.43
	1550 nm		0.26
Cromatic Dispersion	1310 nm	ps (nm x Km)	3.5
	1550 nm		20

CABLE CORE

Strength member diameter	mm	1.7
Slot diameter	mm	5.3

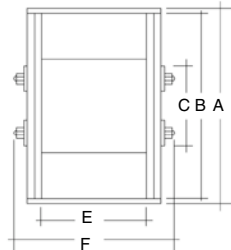
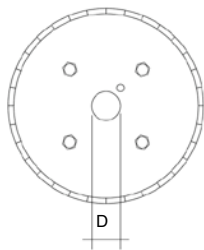
MECHANICAL VALUES

Max applicable load	N	600
Max applicable load during installation	N	100
Minimun bending radius	mm	50

DIMENSIONS

Sheaths	inner	mm thickness	0.45
		diameter	6.6
Outer diameter	outer	mm thickness	0.45
		mm	7.5
Nominal weight		Kg/m	0.55

PACKAGING WOODEN DRUMS

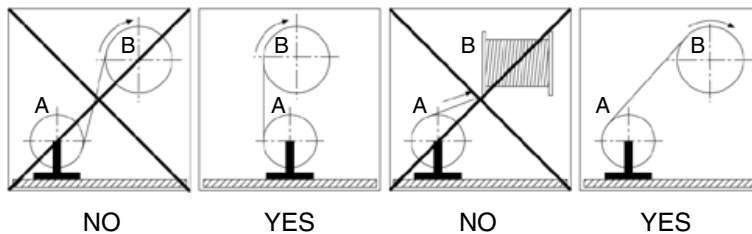


- A - Flange diameter including circumference batten
- B - Flange diameter without circumference batten
- C - Inner barrel diameter
- D - Axis hole
- E - Inner width
- F - External width

DIMENSIONS

Drum type	A mm	B mm	C mm	D mm	E mm	F mm	Weight Kg	Volume m ³
BL 60	690	630	315	80	315	435	30	0.19
BL 70	770	710	355	80	400	515	35	0.28
BL 80	960	800	400	80	450	575	40	0.39
BL 90	960	900	450	80	450	575	50	0.45
BL 100	1.060	1.000	500	80	560	685	60	0.77
BL 120	1.310	1.250	630	80	630	760	100	1.27
BL 140	1.460	1.400	710	80	750	920	140	1.76
BL 160	1.660	1.600	900	80	900	1.070	250	2.80
BL 180	1.860	1.800	1.120	80	1.120	1.320	300	4.20
BL 200	2.060	2.000	1.250	125	1.120	1.320	400	5.20
BL 220	2.300	2.240	1.400	125	1.120	1.320	450	6.30
BL 250	2.510	2.450	1.500	125	1.120	1.320	500	8.20

HANDLING



DRUM CAPACITY

CABLE DIAMETER	DRUM TYPE								
	60	80	100	120	160	180	200	220	250
mm.	METRES								
6	1400	3590							
7	1000	2600							
8	800	2000							
9	600	1590							
10	500	1290							
11	400	1000	2000						
12	350	850	1800						
13	300	750	1500						
14	250	650	1350						
15	237	550	1150	1900					
16	208	500	1000	1800					
17	184	450	900	1400					
18	164	400	800	1350					
19	147	350	700	1200					
20	133	320	650	1100					
21	120	293	600	1000	2100				
22	110	267	550	900	2000				
23	100	244	500	850	1750				
24	97	224	450	750	1600				
25		206	410	700	1500				
26		191	379	650	1400				
27		177	352	600	1350				
28		165	327	550	1200				
29		153	305	510	1100				
30		143	285	475	1000		1850		
32		126	250	450	900	1420	1650		
34		121	222	400	800	1250	1450		
36		99	198	350	700	1200	1290		
38		89	177	300	650	990	1160	1575	
40			160	260	575	890	1050	1420	
42			145	240	500	800	950	1290	
44			132	220	475	725	865	1175	1535
46			121	200	435	660	790	1075	1405
48			111	185	400	605	725	985	1290
50			102	170	370	555	670	910	1190
52			94	157	340	510	620	840	1100
54				146	320	470	575	780	1020
56				136	295	440	535	725	950
58				126	275	410	500	675	885
60				118	255	380	465	630	825
62				111	240	355	435	590	775
64				104	225	330	410	555	725
66				97	212	310	385	520	685
68				95	200	295	360	490	640
70					188	275	340	465	605
72					178	260	320	440	575
74					168	245	305	415	540
76					160	230	290	390	515
78					152	220	275	370	490
80					144	210	260	355	465
82					137	200	250	340	440
84					131	190	235	320	420
86					125	181	225	305	400
88					119	173	215	290	385
90					114	165	205	280	365
92					109	158	195	265	350
94					104	151	189	255	335
96					100	144	181	245	320
98					96	138	175	235	310
100						133	167	225	295

PRODUCTION RANGE

TELECOMMUNICATION CABLES

- Optical fibre cables slot type up to 100 fibres
- Optical fibre cables loose buffer tubes up to 96 fibres
- Optical fibre cables slot ribbon types up to 400 fibres
- Jelly filled telephone cables up to 1200 pairs
- Underground telephone cables without jelly filling up to 2400 pairs
- Flame retardant cables and low emission of fumes, toxic and corrosive gasses.
- Public telephone cable - home telephone cables.
- OPGW cables (Optical Protection Ground Wire)
- Signalling cables with or without screen
- Instrument cables in pairs and/or triples
- Thermocouples
- Coaxial cables
- Special cables to customer's specifications
- Flame retardant cables and low emission of fumes, toxic and corrosive gasses.
- Fire resistant cables

LOW AND MEDIUM TENSION POWER CABLES UP TO U₀/U 26/45 KV

- Distribution, industrial and domestic cables
- Cables with copper or aluminium conductor
- Insulated in XLPE - RUBBER - PVC
- Screened and/or armoured cables
- Cables with concentric conductor
- Flame retardant cables and low emission of fumes, toxic and corrosive gasses.
- Fire resistant cables

QUALITY SYSTEM

Our Quality System management includes two certificates: BSI and Aenor (E), in accordance to ISO 9001/2000 covering the production, purchasing of raw materials design and final test including various documents typologies. Tratos Quality System management is under constant control by inspectors working for the certifying bodies.



THE INTERNATIONAL CERTIFICATION NETWORK[®]

CERTIFICATE

IQNet and AENOR
hereby certify that the organization

TRATOS CAVI, s.p.a.
VIA STADRO, 2
52018 - FIVELANNO VERLANO
(AREZZO - ITALIA)

for the following field of activities

THE DESIGN, PRODUCTION AND SALES OF:
FIBRE-OPTIC, HARDWARE DATA AND COMMUNICATION CABLES, THERMOPLASTIC AND THERMOSETTING INSULATED POWER CABLES (RATED UP TO 30KV, ARMORED AND UNARMORED).

has implemented and maintains a

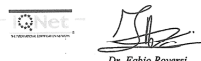
Quality Management System

which fulfills the requirements of the following standard

ISO 9001:2000

Issued on: **1999-08-01** Renewed on: **2003-12-30** Validity date: **2006-12-30**

Registration Number: **ES-1034/1998**


Dr. Fabio Roversi
 President of IQNet


Edoardo Nazzari
 General Manager of AENOR


AENOR

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Tratos Cavi S.p.A. reserves the right to modify at any time technical dimensional and weight characteristics shown in this catalogue to improve the features of its products. However these will still be in accordance to the mentioned standards.

There is no responsibility of the manufacturer for damages to persons and property in case of improper use and/or neglecting the recommendations for using cables and norms contained in this catalogue.

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**FIBRE OPTIC
CABLES**