20001787 TL
20004748 QM
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20001787 BSOH

TL 9000
ISO 9001
ISO 14001
OHSAS 18001

LS Cable & System

Tender No.	:	Spec. No.	: LSGS-09-OC0257-04
User / Customer	:	Page No.	: 1 of 11
Tender Title	:		
Bidder	: LS Cable & System Ltd.		
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Specification

For

Fibre Optic Cable
Loose Tube / Jelly Filled Core
Double Jacket / Single Armoured
A-DF(ZN)2Y(SR)2Y

Rev. No.	Date	Descriptions	Prepared By	Reviewed By	Approved By
04	Mar. 27, 2017	Added Normative reference	Kim, Jungmok	Jun, Youngho	Seo, Jaetae
03	AUG. 20, 2012	Length marking tolerances added	Lee, Mansu	Jun, Youngho	Lee, Yuhyoung
02	JAN. 22, 2010	Length marking tape added Cable marking description revised	Lee, Haenghwan	Lee, Yuhyoung	Son, Min
01	SEP. 3, 2009	Tube colour changed	Lee, Haenghwan	Lee, Yuhyoung	Son, Min
00	MAY. 21, 2009	Original Issue	Lee, Haenghwan	Seo, Jaetae	Son, Min

LS Cable & System

1. SCOPE

1.1 Application

This specification covers the general requirements for fibre optic telecommunication cables used for outdoor application.

1.2 Cable Description

Colour coded optical fibre, jelly filled colour coded loose tubes, PE filler (if required), SZ-stranded around the dielectric central strength member, jelly compound around tubes, plastic tape, length marking tape, glass yarns(if necessary), ripcord and inner MDPE jacket., water blocking tape, Corrugated Steel Tape with Plastic Coating, ripcord, outer MDPE jacket.

2. NORMATIVE REFERENCES

Unless otherwise specified, all cables shall be in accordance with all applicable section of the following Codes, Standards and Regulations, and their current amendments

Normative	Designation
IEC 60794-3	Optical fibre cables – Part 3: Duct, buried and aerial cables – Sectional specification

3. OPTICAL FIBRE

The optical, geometrical, mechanical and environmental performance of the optical fibre shall be in accordance with Table 1, 2 below.

Table 1. Performance of the Single Mode Fibre (ITU-T G. 652)

ITEMS	UNITS	SPECIFICATION
Attenuation	dB/km	≤ 0.36 at 1310nm ≤ 0.23 at 1550nm
Chromatic Dispersion	ps/nm.km	≤ 3.5 at 1285nm ~ 1330nm ≤ 18 at 1550nm
Zero Dispersion Wavelength	nm	1300 ~ 1324
Zero Dispersion Slope	$ps/nm^2.km$	≤ 0.092
Polarization Mode Dispersion	$ps/(km)^{1/2}$	≤ 0.3
Cut-off Wavelength (λcc, Cabled fibre)	nm	≤ 1270

ITEMS	UNITS	SPECIFICATION
Attenuation vs. Bending (30mm radius x 100turns)	dB	≤ 0.1 at 1625nm
Mode Field Diameter	㎛	8.6 ~ 9.5 ± 0.4 at 1310nm
Core-Clad Concentricity Error	㎛	≤ 0.6
Cladding Diameter	㎛	125 ± 1
Cladding Non-circularity	%	≤ 1
Coating Diameter	㎛	245 ± 10
Proof Test Level	Gpa	≥ 0.69

Table 2. The Optical, Geometrical and Mechanical Performance of the Multi Mode Fibre

ITEMS	UNITS	SPECIFICATION
		50 Multi Mode
Attenuation	dB/km	≤ 3.0 at 850nm ≤ 1.0 at 1300nm
Bandwidth	MHz.km	≥ 500 at 850nm ≥ 500 at 1300nm
Gigabit Ethernet Maximum Link Distance	M	≥ 550 at 850nm ≥ 550 at 1300nm
Numerical Aperture	-	0.20 ± 0.015
Core Diameter	μm	50 ± 3.0
Core Non-circularity	%	≤ 6.0
Cladding Diameter	μm	125 ± 3.0
Cladding Non-circularity	%	≤ 2.0
Core/Cladding Concentricity Error	μm	≤ 3.0
Coating Diameter	μm	245 ± 10
Proof Test Level	Gpa	≥ 0.69

4. CABLE CONSTRUCTION

The construction of the cable shall be in accordance with Table 3 below

Table 3. Cable construction

ITEMS		DESCRIPTION
Number of Fibres		Max. 192
No. of Fibres per Tube		up to 12
Loose Buffer Tube	Material	PBT (Polybutylene Terephthalate)
	Diameter	2.8mm: 12 fibre /tube 2.0mm: 2, 4 fibre /tube
Filling Compound in Loose Buffer Tube		Thixotropic Jelly Compound
Filler		Polyethylene Rod (if necessary)
Central Strength Member		FRP(Fibreglass Reinforced Plastic)
Over-Coat of CSM		Black Polyethylene (if necessary)
Water Blocking Material I		Water Swellable Yarn around the CSM
Water Blocking Material		Jelly compound
Core Wrapping Tape		Plastic Tape
Length Marking Tape	Distance	every 10cm
	Type	… meter | cm … meter | cm …
Outer Strength Member		Glass Yarns
Rip Cord		Two ripcords
Inner Jacket	Material	Black MDPE
	Thickness	Nom. 2.0mm Min 1.6mm
Water Blocking Material		Water blocking Tape
Ripcord		Two ripcords
Armour	Material	Corrugated Steel Tape with Plastic Coating
	Thickness	Nom. 0.15mm (Steel Tape) Nom. 0.05mm (Plastic Coating on both sides)
Outer Sheath	Material	Black MDPE (UV protection)
	Thickness	Nom. 1.4mm Min 1.1mm

5. FIBRE AND LOOSE BUFFER TUBE IDENTIFICATION

The colour code of the individual fibres within each loose buffer tube shall be in accordance with Table 4, 5 below.

Table 4. The Colour Code of the Individual Fibres

No.	Colour	No.	Colour
1	Red	7	Brown
2	Green	8	Violet
3	Blue	9	Aqua
4	Yellow	10	Black
5	White	11	Orange
6	Grey	12	Pink

Table 5. The Colour Code of the Loose Buffer Tubes

Tube No.	Tube Colour
Start Tube	Red
The Others	Yellow
Filler if required	Natural or White

6. PHYSICAL/MECHANICAL/ENVIRONMENTAL PERFORMANCE AND TESTS

6.1 Temperature Range

For the cables covered by this specification, the following temperature ranges apply:

-. Storage/Shipping : -25°C to +70°C
-. Operation : -25°C to +70°C
-. Installation : -20°C to +50°C

6.2 Mechanical and Environmental Performance of the Cable

The mechanical and environmental performance of the cable shall be in accordance with Table 6 below. Unless otherwise specified, all attenuation measurements required in this section shall be performed at 1550nm(SMF) and at 1300nm(MMF) in Table 6.

Table 6. The Mechanical and Environmental Performance of the Cable

<table>
<tr><th>ITEMS</th><th>TEST METHOD AND
ACCEPTANCE CRITERIA</th></tr>
<tr><td>Tensile Performance</td><td># Test method: EN187000 Method 501
-. Mandrel diameter: 30D (D = cable diameter)
-. Length under test: ≥ 100 m
-. Load : for 60 min
<table>
<tr><th>No. of Fibres</th><th>Load</th></tr>
<tr><td>12~96</td><td>2500N</td></tr>
<tr><td>144</td><td>3500N</td></tr>
<tr><td>192</td><td>4500N</td></tr>
</table>
Acceptance Criteria
-. Fibre strain: ≤ 0.45% during Loading
-. Fibre strain: ≤ 0.2% after Loading
-. Attenuation increment: ≤ 0.05 dB/km (SMF)
≤ 0.05 dB/km (MMF)
after completion of the test
-. No jacket cracking and fibre breakage</td></tr>
<tr><td>Compressive Loading Resistance Test</td><td># Test method: EN187000 Method 504
-. Applied load: 3000 N/10cm
-. Duration of loading: 10 minutes
-. No. of points: 1 point
Acceptance Criteria
-. Attenuation increment: ≤ 0.10 dB/km (SMF)
≤ 0.20 dB/km (MMF)
after completion of the test
-. No jacket cracking and no fibre breakage</td></tr>
</table>

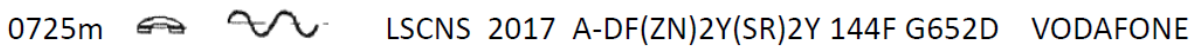
ITEMS	TEST METHOD AND ACCEPTANCE CRITERIA
Impact Resistance Test	# Test method: EN187000 Method 505 -. Height of impact: 1 m -. Drop hammer mass: 2 kg -. Diameter of drop hammer: 20 mm -. No. of impacts: 1 time at 3 points (500mm interval) # Acceptance Criteria -. Attenuation increment: ≤ 0.10 dB/km (SMF) ≤ 0.20 dB/km (MMF) after completion of the test -. No jacket cracking and no fibre breakage
Repeated Bending Test	# Test method: EN187000 Method 507 -. Sheave diameter: 20D (D = cable diameter) -. No. of flexing cycles: 10 cycles -. Flexing speed: 25 cycles/minute # Acceptance Criteria -. Attenuation increment: ≤ 0.10 dB/km (SMF) ≤ 0.20 dB/km (MMF) after completion of the test -. No jacket cracking and no fibre breakage
Cable Twist Test	# Test method: IEC 60794-1-2 Method E7 -. Cable length under test: 1m -. No. of twist cycles: 3 cycles -. Twist angle: ± 180° # Acceptance Criteria -. Attenuation increment: ≤ 0.10 dB/km (SMF) ≤ 0.20 dB/km (MMF) after completion of the test -. No jacket cracking and no fibre breakage
Temperature Cycling Test	# Test method: IEC 60794-1 Method F1 -. Temperature cycling schedule : 23℃→-25℃→70℃→-25℃→70℃ -. Soak time at each temperature: 24hours # Acceptance Criteria -. Attenuation increment: ≤ 0.15 dB/km (SM) ≤ 0.30 dB/km (MMF)
Water Penetration Test	# Test method: IEC 60794-1 Method F5 -. Length of specimen: 3m -. Height of pressure head: 1m -. Test time: 24 hours # Acceptance Criteria -. No leakage through the open cable end

7. PACKING AND MARKING

7.1 Cable Marking

The jacket shall be marked with white characters at intervals of one meter with following information. Other marking is also available if requested by customer.

Ex) A-DF(ZN)2Y(SR)2Y G.652D 144F cable



7.2 Length Marking Tolerances

Cable Type (tubes x fibres)	Fibre vs. Length Marking Tape		Marking Tape vs. Jacket Marking	
	Min.	Max.	Min.	Max.
12F (6x2)	0.3%	1.3%	0.0%	1.0%
24F (6x4)	0.3%	1.3%	0.0%	1.0%
48F (4x12)	0.5%	1.5%	0.0%	1.0%
60F (5x12)	0.5%	1.5%	0.0%	1.0%
72F (6x12)	0.8%	1.8%	0.0%	1.0%
84F (7x12)	1.0%	2.0%	0.0%	1.0%
96F (8x12)	1.2%	2.2%	0.0%	1.0%
144F (12x12)	2.5%	3.5%	0.0%	1.0%
192F (16x12)	4.3%	5.3%	0.0%	1.0%

7.3 Cable Re-marking

The re-marking shall be marked, preferably with yellow characters, on a different position of the outer cable jacket, and shall have a numbering scheme differing by a minimum of 5000 from the original number. Any cable that contains two sets of cable markings shall be marked to indicate the colour of the marking to be used.

7.4 Cable Packing

7.4.1 Standard length of cable shall be 2,000 meters. Other cable length is also available if required by customer.
7.4.2 Each length of the cable shall be wound on a separate wooden reel.
7.4.3 Both ends of the cable shall be sealed with a suitable plastic cap to prevent the entry of moisture during shipping, handling and storage.
7.4.4 The cable ends shall be securely fastened to the reel to prevent the cable form becoming loose in transit or during placing operations.
7.4.5 The inner end of the cable is housed into a slot on the side of the reel without extra cable length for testing.
7.4.6 Circumference battens or Fibre Board shall be secured with bands to protect the cable during normal handling and shipping.

7.5 Cable Reel

7.5.1 Details given below shall be distinctly marked with a weather proof material on the both outer sides of the reel flange. Other shipping mark is also available if requested by customer.

1) Purchaser's name
2) Length of cable in meter
3) Number of fibres and size
4) Gross weight in kilogram
5) Reel number
6) Name of the manufacturer
7) Year of manufacture
8) Arrow showing the direction the drum shall be rolled

7.5.2 The cable shall be shipped on reels designed to prevent damage to the cable during shipment and installation.

7.5.3 The arbour holes provided in the reels shall be at least 65 mm and at most 120 mm in diameter.

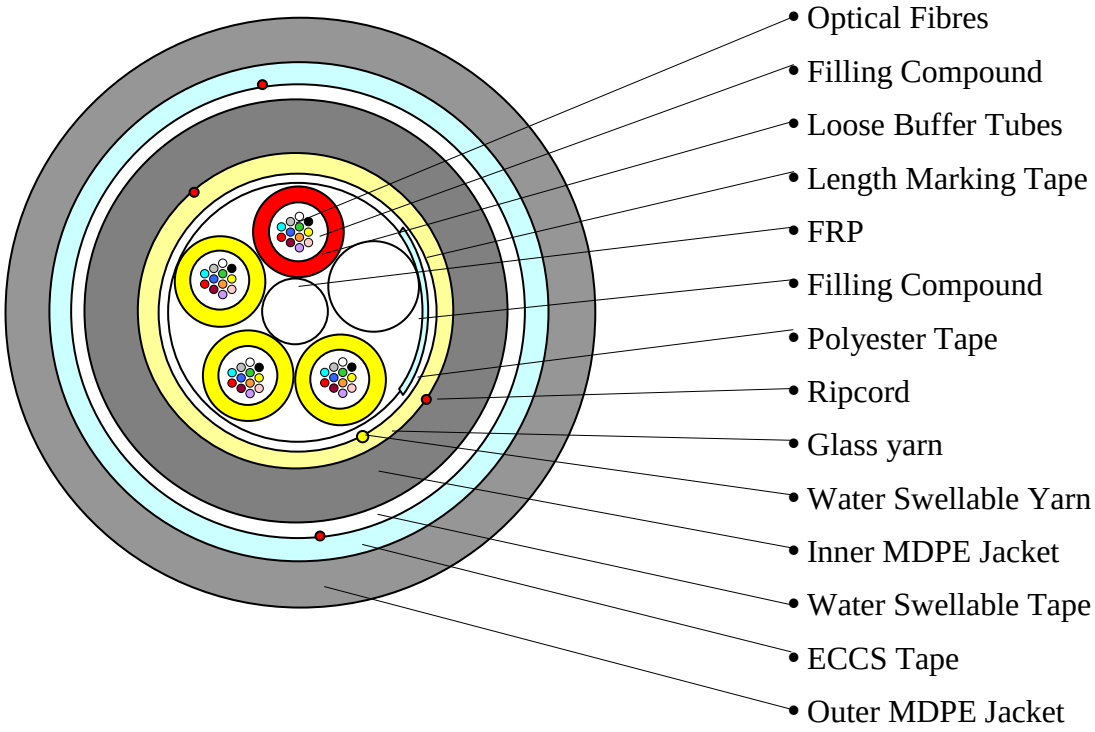
7.6 Safety

7.6.1 RoHS DIRECTIVE
All cables and any associated packing and labelling materials shall meet RoHS(Restriction of the use of certain Hazardous Substances) regulation as appropriate.

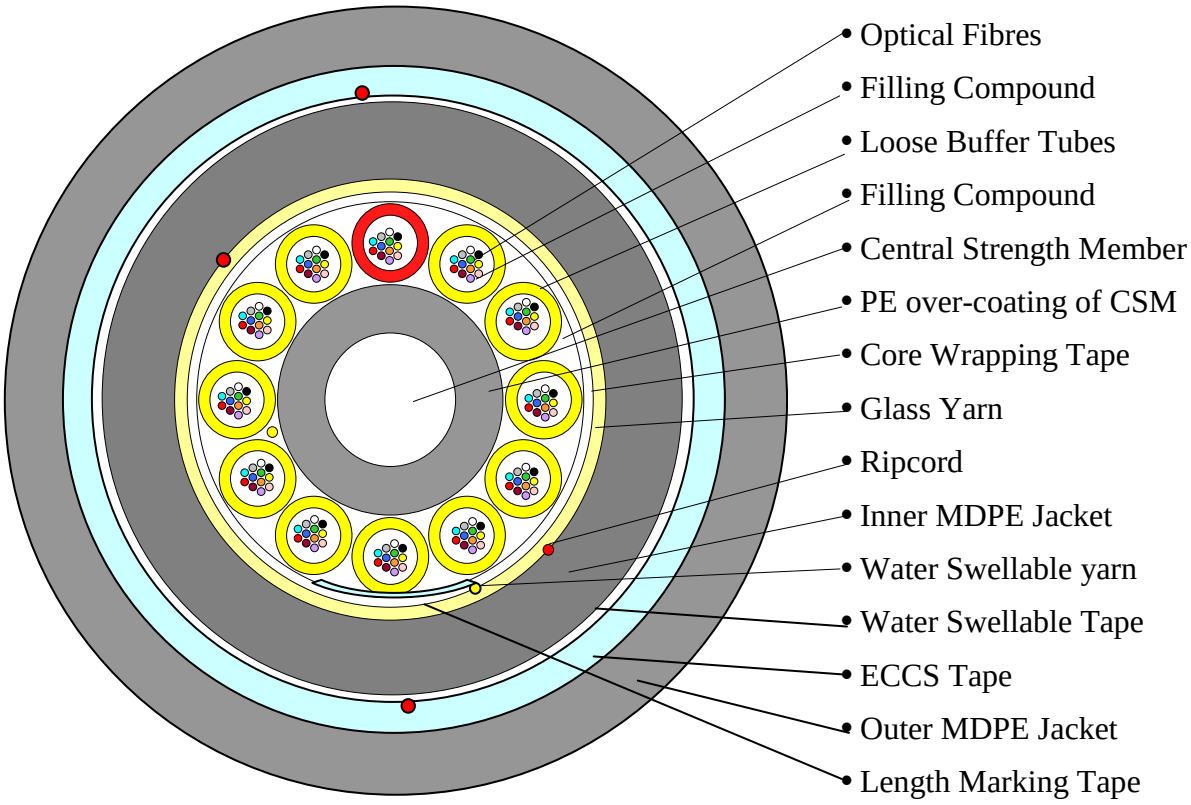
7.6.2 ISPM 15 DIRECTIVE
All wooden packing materials shall meet ISPM (International Standards for Phytosanitary Measures) regulations as appropriate.

< Cross-sectional Drawing of Cable >

1. G.652 48-Fibre Cable (12 Fibres/Tube)



2. G. 652 144-Fibre Cable (12Fibres/tube)



* The drawing appearing on this page is not a warranty, and may be subject to change or modification without any prior notice

3. Diameter, Weight and Minimum Bending Radius

No. of Fibres	Fibres per Tube	No. of Tubes	No. of Fillers	Nominal Cable Diameter (mm)	Approx. Cable Weight (kg/km)	Minimum Bending Radius	
						Under Load (mm)	No Load (mm)
12	2	6	0	15.9	235	318	159
24	4	6	0	15.9	233	318	159
48	12	4	1	17.3	269	346	173
60	12	5	0	17.3	268	346	173
72	12	6	0	18.1	293	362	181
84	12	7	0	18.9	320	398	189
96	12	8	0	19.7	343	394	197
144	12	12	0	23.3	475	466	233
192	12	16	0	27.0	620	540	270

*) Actual values for cable weight and diameter may deviate from the calculated values given in the table above.

== End of Specification ==