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Tender Title	:		
Bidder	: LS Cable & System Ltd.		
Document Title	:		

Specification

For

Fiber Optic Cable
Loose Tube / Dry Cored
Non-Armored / Single Jacket

Rev. No.	Date	Descriptions	Prepared By	Reviewed By	Approved By
0	Aug. 26, 2019	Original Issue	Kim, Jungmok	Jun, Youngho	Lee, Yuhyoung

1. SCOPE

1.1 Application

This specification covers the general requirements for fiber optic telecommunication cables used for outdoor applications.

1.2 Cable Description

Color coded optical fibers, jelly filled color coded loose tubes, PE filler (if necessary), water blocking yarn around central strength member, SZ-stranded around the dielectric central strength member, outer strength member if necessary, ripcord and outer PE jacket

2. OPTICAL FIBER

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

Table 1. Characteristics of Single Mode Fiber (ITU-T G.657A1&A2)

ITEMS	UNITS	SPECIFICATION	
		G.657.A1	G.657.A2
Attenuation	dB/km	≤ 0.36 at 1310nm ≤ 0.35 at 1383nm ≤ 0.22at 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	
Cable PMD (PMD_Q)	ps/√km	≤ 0.2 (20 section link)	
Cut-off Wavelength (λcc, Cabled fiber)	nm	≤ 1260	
Attenuation vs. Bending (15mm radius x 10turns)	dB	≤ 0.25 at 1550nm ≤ 1.0 at 1625nm	≤ 0.03 at 1550nm ≤ 0.1 at 1625nm
Attenuation vs. Bending (10mm radius x 1turn)	dB	≤ 0.75 at 1550nm ≤ 1.5 at 1625nm	≤ 0.1 at 1550nm ≤ 0.2 at 1625nm
Attenuation vs. Bending (7.5mm radius x 1turn)	dB	-	≤ 0.5 at 1550nm ≤ 1.0 at 1625nm
Mode Field Diameter	μm	8.9 ± 0.4 at 1310nm	8.6 ± 0.4 at 1310nm
Core/Cladding Concentricity Error	μm	≤ 0.5	
Cladding Diameter	μm	125 ± 0.7	
Cladding Non-circularity	%	≤ 1.0	
Coating Diameter	μm	245 ± 10	
Proof Test	Gpa	≥ 0.69	

Table 2. Characteristics of Single Mode Fiber (ITU-T G.652D)

ITEMS	UNITS	SPECIFICATION
Attenuation	dB/km	≤ 0.36 at 1310nm ≤ 0.35 at 1383nm ≤ 0.22 at 1550nm
Chromatic Dispersion	ps/nm.km	≤ 3.5 at 1285nm ~ 1330nm ≤ 18 at 1550nm
Zero Dispersion Wavelength	nm	1300 ~ 1322
Zero Dispersion Slope	ps/nm^2.km	≤ 0.092
Cable PMD (PMD_Q)	ps/√km	≤ 0.2 (20 section link)
Cut-off Wavelength (λcc, Cabled fiber)	nm	≤ 1260
Attenuation vs. Bending (30mm radius x 100turns)	dB	≤ 0.1 at 1625nm
Mode Field Diameter	μm	9.2 ± 0.4 at 1310nm 10.4 ± 1.0 at 1550nm
Core/Cladding Concentricity Error	μm	≤ 0.6
Cladding Diameter	μm	125 ± 1
Cladding Non-circularity	%	≤ 1.0
Coating Diameter	μm	245 ± 10
Proof Test	Gpa	≥ 0.69

3. CABLE CONSTRUCTION

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

Table 3. Construction of the Cable

ITEMS		DESCRIPTION
Number of Fibers		12 ~ 144F
Max. No. of Fibers per Tube		12
Loose Buffer Tube		PBT (Polybutylene Terephthalate)
Filling Compound in Loose Buffer Tube		Thixotropic Jelly Compound
Filler		Polyethylene Rod(if necessary)
Central Strength Member		FRP or PE coated FRP(if necessary)
Water Blocking Material		Water Blocking Yarn or tape around CSM
Outer strength member		Glass yarns (if necessary)
Rip Cord		Two Ripcord
Outer Jacket	Material	Black HDPE
	Thickness	Nom. 1.3mm

4. FIBER AND LOOSE BUFFER TUBE IDENTIFICATION

The color code of the loose buffer tubes and the individual fibers within each loose buffer tube shall be in accordance with Table 4 and 5 below.

Table 4. Color code of the individual fibers

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

Table 5. Color code of the loose buffer tubes

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

5. PHYSICAL / MECHANICAL / ENVIRONMENTAL PERFORMANCE AND TESTS

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 for single mode fiber.

Table 6. The Mechanical and Environmental Performance of the Cable

ITEMS	TEST METHOD AND ACCEPTANCE CRITERIA
Tensile Strength	# Test method: IEC 60794-1-2 Method E1 -. Mandrel diameter: 30D (D = cable diameter) -. Length under tension: ≥ 50 m -. Load: 1500N for 10 minutes # Acceptance Criteria -. Attenuation increment: ≤ 0.5 dB After the test
Crush Resistance	# Test method: IEC 60794-1-2 Method E3 -. Applied load: 1,100 N/10 cm for 10 minutes -. No of points: 1 point # Acceptance Criteria -. Attenuation Increment: ≤ 0.05 dB after completion of the test -. No jacket cracking and no fiber breakage

ITEMS	TEST METHOD AND ACCEPTANCE CRITERIA
Impact resistance	# Test method: IEC 60794-1 Method E4 -. Impact Energy: 5J -. Radius of impact mass: 25mm -. No. of impact per point: 1 time at 3 points each # Acceptance Criteria -. Attenuation Increment : ≤ 0.05 dB after completion of the test -. No jacket cracking and no fiber breakage
Cable bend	# Test method: IEC 60794-1-2 Method E11A -. Mandrel diameter: 20D (D = cable diameter) -. No. of turns: 4 turns(wrapped and unwrapped) -. No. of flexing cycles: 10 cycles # Acceptance Criteria -. Attenuation Increment: ≤ 0.05 dB after the completion of the test -. No jacket cracking and no fiber breakage
Torsion	# Test method: IEC 60794-1-2 Method E7 -. Cable length twisted: 2m -. No. of twist cycles: 10 cycles -. Twist angle: ± 180° # Acceptance Criteria -. Attenuation Increment: ≤ 0.05 dB after the completion of the test -. No sheath cracking and no fiber breakage
Water Penetration	# Test method: IEC 60794-1-2 Method F5 -. Length of specimen: 3m -. Height of pressure head: 1m -. Test time: 24 hours # Acceptance Criteria -. No leakage through the open cable end
Temperature Cycling	# Test method: IEC 60794-1-2 Method F1 -. Cable length: at least 1000m -. At least 6 fibers shall be spliced and tested. -. Temperature cycling schedule : 23°C → -30°C → 70°C -. Soak time at each temperature: 24 hours -. No of cycles: 2 # Acceptance Criteria -. Attenuation increment: ≤ 0.1 dB/km

6. PACKING AND MARKING

6.1 Cable Marking

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

1) Cable type and fiber counts
2) Manufacturer's name
3) Year of manufacture
4) Length marking

Ex.1) For single mode 72-fiber cable

0000m	SJNA	SM72C	LS Cable & System	2019	0001m …

6.2 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 1000 from the original number. Any cable that contains two sets of cable markings shall be marked to indicate the color of the marking to be used.

6.3 Cable Packing

6.3.1 Standard length of cable shall be 4,000 meters. Other cable length is also available if required by customer.

6.3.2 Each length of the cable shall be wound on a separate wooden reel.

6.3.3 Both ends of the cable shall be sealed with a suitable plastic cap to prevent the entry of moisture during shipping, handling and storage.

6.3.4 The cable ends shall be securely fastened to the reel to prevent the cable form becoming loose in transit or during placing operations.

6.3.5 Circumference battens or Wood-fiber board shall be secured with steel bands to protect the cable during normal handling and shipping.

6.4 Cable Reel

6.4.1 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) Cable type and fiber counts
3) Length of cable in meter
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

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

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

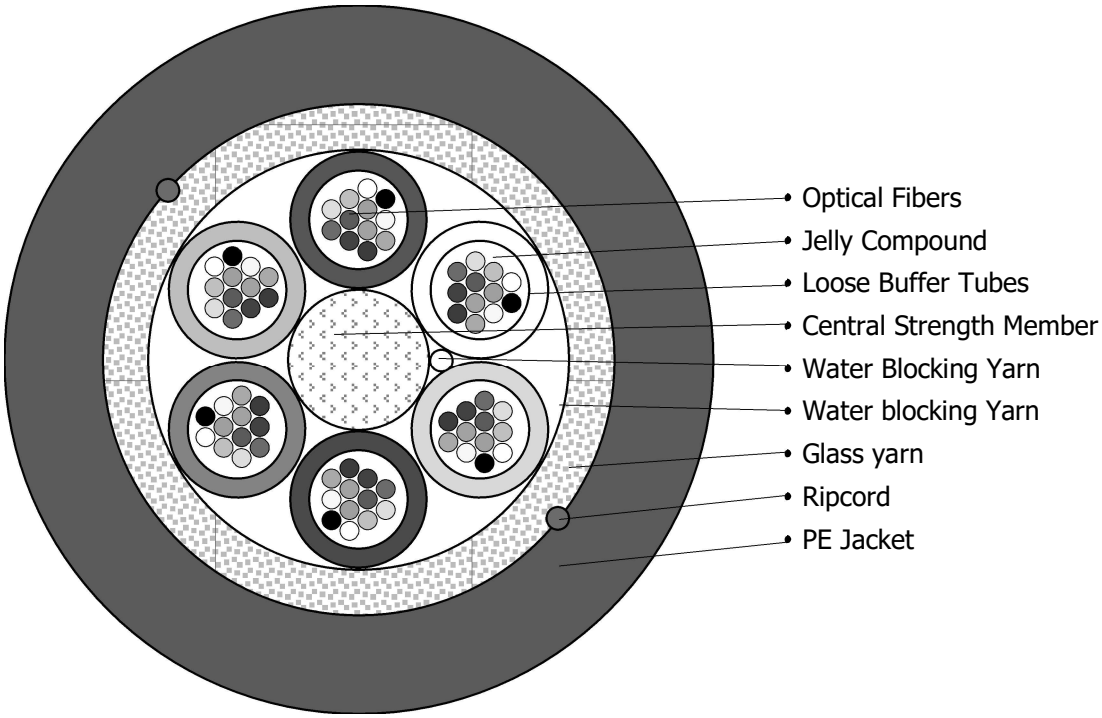
7. SAFETY

7.1.1 ROHS DIRECTIVE
All cables and any associated packing and labelling materials shall meet RoHS (Restriction of the Use of certain Hazardous Substances) regulations as appropriate.

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

< Cross-sectional Drawing of Cable >

1. 72-Fiber Cable



"The drawing appearing on this page may be subject to change or modification without any prior notice"

2. Diameter, Weight and Minimum Bending Radius

No. of Fibers	No. of fibers per tube	Nominal Cable Diameter(mm)	Approx. Cable Weight(kg/km)	Min. Bending Radius(mm)	
				No Load	Under Load
~72	12	8.3	60	90	180
96	12	9.2	75	90	180
144	12	11.6	110	90	180

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

= End of Specification =