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

Specification

For

Fiber Optic Cable
Flexible Loose Tube
Dry Blocked Core / PE Single Jacket
Steel Tape Armor

00	Sep. 11, 2023	Original Issue	Chang, Seungig	Lee, Mansu	Lee, Yuhyoung
Rev. No.	Date	Descriptions	Prepared By	Reviewed By	Approved By

1. SCOPE

This specification covers the general requirements of optical fiber cable for outdoor duct and direct burial applications.

2. OPTICAL FIBER

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

Table 1. Performance of the single mode fiber (ITU-T G.652D)

ITEMS		UNITS	SPECIFICATION
Attenuation at 1310/1383/1550 nm		dB/km	0.35 / 0.35 / 0.22
Chromatic Dispersion at 1285~1330/1550 nm		ps/nm.km	3.5 / 18
Zero Dispersion Wavelength		nm	1300 ~ 1324
Zero Dispersion Slope		ps/nm2.km	0.092
Cable PMD (PMDQ)		ps/km	0.2 (20 section link)
Cut-off wavelength (cc)		nm	1260
Bending loss	R30mm x 100[1]	dB	0.1 at 1625nm
MFD at 1310 / 1550nm		m	9.2 0.4 / 10.4 1.0
Core/Cladding Concentricity Error		m	0.6
Cladding Diameter		m	125 0.7
Cladding Non-circularity		%	1.0
Coating Diameter		m	245 10
Proof Test		GPa	0.69

Table 2. Performance of the single mode fiber (ITU-T G.657A)

ITEMS		UNITS	SPECIFICATION	
			G.657A1	G.657A2
Attenuation at 1310/1383/1550nm		dB/km	0.35 / 0.35 / 0.22	
Chromatic Dispersion at 1285~1330/1550nm		ps/nm.km	3.5 / 18	
Zero Dispersion Wavelength		nm	1300 ~ 1324	
Zero Dispersion Slope		ps/nm2.km	0.092	
Cable PMD (PMDQ)		ps/km	0.2 (20 section link)	
Cut-off wavelength (cc)		nm	1260	
Attenuation vs Bending at 1550/1625nm	R15mm x 10	dB	0.25 1.0	0.03 / 0.1
	R10mm x 1	dB	/ 1.5	0.1 / 0.2
	R7.5mm x 1	dB	0.75	0.5 / 1.0
MFD at 1310nm		m	8.9 0.4	8.6 0.4
Core/Cladding Concentricity Error		m	0.5	
Cladding Diameter		m	125 0.7	
Cladding Non-circularity		%	1.0	
Coating Diameter		m	245 10	
Proof Test		GPa	0.69	

[1] 100 turns with radius 30mm

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 ~ 72	96	144	192	288
Number of Fibers per Tube		12				
Loose Buffer Tube		PP tube with Low density white gel compound				
No. of Tubes		1 ~ 6	8	12	16	24
No. of Fillers		5 ~ 0	0	0	0	0
Central Strength Member		FRP (with PE coat if necessary)				
Water Blocking Material		Water Blocking Yarn Water				
Core Wrapping Tape		Blocking Tape Glass Yarns if				
Outer Strength Member		necessary Two Ripcords				
Ripcord		Corrugated Steel Tape Black PE				
Armor		Nom. 1.5 mm				
Outer Jacket	Material					
	Thickness					

4. FIBER AND LOOSE TUBE IDENTIFICATION

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

No.	Color	No.	Color	No.	Color
1 / 132	Blue	5 / 17	Gray	9 / 21	Yellow
2 / 14	Orange	6 / 18	White	10 / 22	Violet
3 / 15	Green	7 / 19	Red	11 / 23	Pink
4 / 16	Brown	8 / 20	Black	12 / 24	Aqua

5. PHYSICAL / MECHANICAL / ENVIRONMENTAL PERFORMANCE AND TESTS

5.1 Temperature Range

For the cables covered by this specification, the following temperature ranges apply:
- Operation : - 30□C to + 60□C
- Installation : - 30□C to + 60□C
- Storage/Shipping : - 40□C to + 70□C

5.2 Mechanical and Environmental Performance of the Cable

The mechanical and environmental performance of the cable shall be in accordance with Table 5 below. Unless otherwise specified, all attenuation measurements required in this section shall be performed at 1550nm.

[2] Tubes from 13 to 24 have an additional black or white(#20 only) continuous stripe along the tube.

Table 5. The Mechanical and Environmental Performance of the Cable

ITEMS	TEST METHOD AND ACCEPTANCE CRITERIA
Tensile Strength	▪ Test method : IEC 60794-1-21 Method E1 - Length under tension : Min. 50m - Mandrel diameter : Typically 1m or Min. 40D (D: cable diameter) - TM : 2,700N - TL : 810N - Load duration : 10 minutes ▪ Acceptance criteria - For TM : Fiber strain □ 0.60% - For TL : Fiber strain 0.20% and □ 0.05 dB in attenuation increment
Crush Resistance	▪ Test method: IEC 60794-1-21 Method E3 - Long term 1,100N/10cm for 10min - Short term 2,200N/10cm for 1min - Number of tests : 3 with interval 500mm ▪ Acceptance criteria - Attenuation increment For long term : □ 0.05 dB during the test For short term : □ 0.05 dB after the test - No damage to the sheath or cable elements under visual examination without magnification
Impact resistance	▪ Test method: IEC 60794-1-21 Method E4 - Impact energy : 20J (1kg × 1m) - Striking surface radius : 300mm - Number of impact : 3 in a different place (Min. 500mm apart) ▪ Acceptance criteria - Attenuation increment: □ 0.05 dB after the test - No damage to the sheath or cable elements under visual examination without magnification
Cable bend	▪ Test method : IEC 60794-1-21 Method E11A - Diameter of mandrel : 20D - Method : Single helix - No. of turns : 4 - No. of cycles : 3 ▪ Acceptance criteria - No change in attenuation after the test
Torsion	▪ Test method: IEC 60794-1-21 Method E7 - Cable length twisted: 2m - No. of twist cycles: 10 cycles - Twist angle: □180□ ▪ Acceptance criteria - Attenuation increment: □ 0.05 dB after the test and □ 0.10dB during the test - No damage to the sheath or cable elements under visual examination without magnification

<table>
<tr><th>ITEMS</th><th>TEST METHOD AND ACCEPTANCE CRITERIA</th></tr>
<tr><td>Water Penetration</td><td>▪ Test method: IEC 60794-1-22 Method F5B
- Length of specimen: 3m
- Height of pressure head: 1m
- Test time: 24 hours
▪ Acceptance criteria
- No water shall be detected at the unsealed end of the sample</td></tr>
<tr><td>Temperature Cycling</td><td>▪ Test method: IEC 60794-1-22 Method F1
- Temperature condition
<table>
<tr><th></th><th>Operation(1)</th><th>Storage(2)</th></tr>
<tr><td>Low (A)</td><td>TA1 : -30°C</td><td>TA2 : -40°C</td></tr>
<tr><td>High (B)</td><td>TB1 : 60°C</td><td>TB2 : 70°C</td></tr>
</table>
- Temperature cycle sequence (2 cycles)
1st cycle : TA2 → TB2
2nd cycle : TA1 → TA2 → TB1 → TB2 → 23°C
- Soak time at each temperature : ≥16 hours - Attenuation shall be measured at 23°C (reference attenuation) before the sequence and at the end of the soak time at each step (TA1, TA2, TB1, TB2) in the 2nd cycle
▪ Acceptance criteria
- Max. 0.05dB/km for TA1 and TB1
- Max. 0.15dB/km for TA2, TB2</td></tr>
</table>

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) For a SJSA[3] G657A1 48 fiber cable

0000M SJSA G657A1 SM48C LS Cable & System 2023 0001M ...

6.2 Cable Packing

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

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

[3] SJSA (Single Jacket Single Armor)

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

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

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

6.3 Cable Reel

6.3.1 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

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

6.3.3 The arbor holes provided in the reels shall be 75 mm or 110 mm in nominal diameter.

7. HEALTH, SAFETY AND ENVIRONMENT

7.1 ROHS Directive

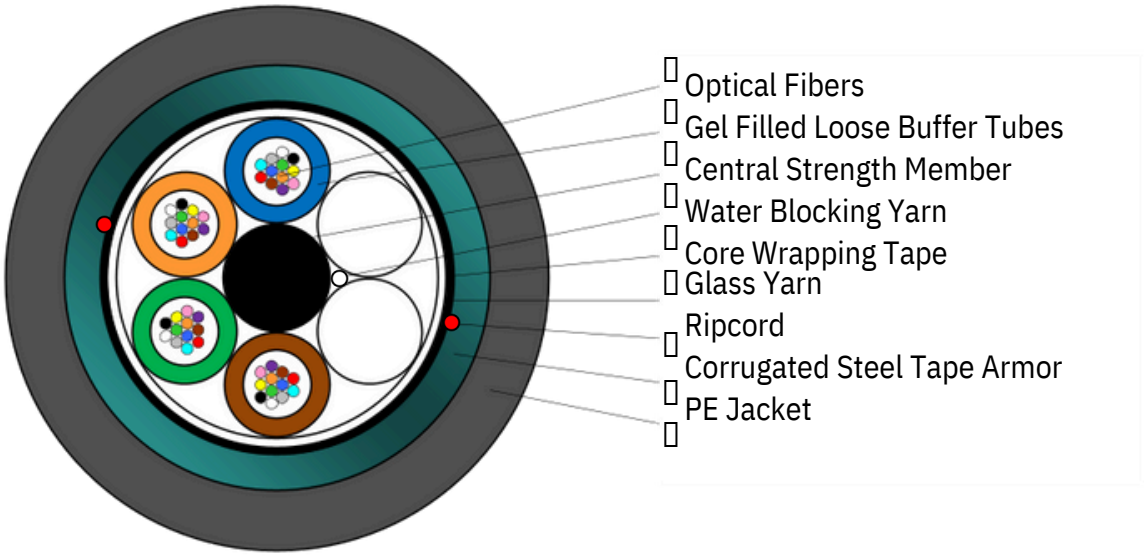
All cables and any associated packing and labeling materials shall meet RoHS (Restriction of the Use of certain Hazardous Substances) regulations as appropriate.

7.2 ISPM 15

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

8. CROSS-SECTIONAL DRAWING OF CABLE

Ex) SJSA 48F Cable



- Not to scale -

No. of Fibers	No. of fibers per tube	Cable Diameter (mm)	Approx. Cable Weight(kg/km)	Min. Bending Radius (mm)	
				No Load	Under Load
12 ~ 72	12	12.5 ± 0.5	148	250	125
96	12	14.0 ± 0.5	175	280	140
144	12	17.1 ± 0.5	247	340	170
192	12	17.7 ± 0.5	250	360	180
288	12	20.0 ± 0.5	310	400	200

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

= End of Specification =