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TL 9000  
 ISO 9001  
 ISO 14001  
 OHSAS 18001

LS Cable & System

Tender No. :	Spec. No. : LSGS-17-OC0548-04
User / Customer : Fyco Telecomunicaciones	Page No. : 1 of 9
Tender Title :	
Bidder : LS Cable & System Ltd.	

Document Title :

# Specification

For

## Fiber Optic Cable Loose Tube / Dry Cored All-Dielectric / Self-Supporting Single Jacket (Span 120 & 200M)

04	Jan. 21, 2020	Added G.655D fiber. Updated G.652D spec to the latest ITU-T	Lee, Mansu	Jun, Youngho	Lee, YuHyoungh
03	Jun. 21, 2019	Added 192F S200M Cable	Lee, Mansu	Jun, Youngho	Lee, YuHyoungh
02	May. 2, 2019	Blue stripe option was removed	Lee, Mansu	Jun, Youngho	Lee, YuHyoungh
01	Nov. 8, 2018	288F cables added	Lee, Mansu	Jun, Youngho	Lee, YuHyoungh
00	Dec. 12, 2017	Original Issue	Lee, Mansu	Jun, Youngho	Lee, YuHyoungh
Rev. No.	Date	Descriptions	Prepared By	Reviewed By	Approved By

## 1. GENERAL

This specification covers the general requirements of all dielectric self-supporting aerial cable.

## 2. OPTICAL FIBER

The optical, geometrical, mechanical and environmental performance of the optical fiber shall be in accordance with Table 1 ~ 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	≤0.36 / ≤ 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/nm <sup>2</sup> .km	≤ 0.092
Cable PMD (PMD <sub>Q</sub> )		ps/√km	≤ 0.2 (20 section link)
Cut-off wavelength (λ <sub>cc</sub> )		nm	≤ 1260
Bending loss	R30mm x 100 <sup>1</sup>	dB	≤ 0.1 at 1625nm
MFD at 1310 / 1550nm		μm	9.2 ± 0.4 / 10.4 ± 1.0
Core/Cladding Concentricity Error		μm	≤ 0.6
Cladding Diameter		μm	125 ± 0.7
Cladding Non-circularity		%	≤ 1.0
Coating Diameter		μm	245 ± 10
Proof Test		GPa	≥ 0.69

Table 2. Performance of the single mode fiber (ITU-T G.655D)

ITEMS		UNITS	SPECIFICATION
Attenuation at 1550/1625nm		dB/km	≤ 0.24 / ≤ 0.26
Chromatic Dispersion		ps/nm.km	2.0 ~ 6.0 at 1530 ~ 1565nm 4.5 ~ 11.2 at 1565 ~ 1625nm
Dispersion Slope at 1550nm		ps/nm <sup>2</sup> .km	≤ 0.09
Cable PMD (PMD <sub>Q</sub> )		ps/√km	≤ 0.20 (20 section link)
Cut-off wavelength (λ <sub>cc</sub> )		nm	≤ 1450
Bending loss	R30mm x 100	dB	≤ 0.1 at 1625nm
Mode Field Diameter		μm	9.6 ± 0.5 at 1550nm
Core/Cladding Concentricity Error		μm	≤ 0.6
Cladding Diameter		μm	125 ± 1
Cladding Non-circularity		%	≤ 1
Coating Diameter		μm	245 ± 10
Proof Test Level		GPa	≥ 0.69

<sup>1</sup> 100 turns with radius 30mm

### 3. FIBER AND LOOSE BUFFER TUBE IDENTIFICATION

Color code of the loose buffer tubes and the individual fibers within each loose buffer tube shall be in accordance with Table 3 below.

Table 3. Color code of the individual fibers and tubes<sup>2</sup>

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

### 4. CABLE CONSTRUCTION

Table 4. Construction of the cable

ITEMS	DESCRIPTION												
Number of fibers	6	12	24	36	48	60	72	96	144	192	288		
No. of fibers per tube	6			12									
Loose buffer tube	Thixotropic gel filled PBT loose tubes												
No. of Tubes	1	2	4	3	4	5	6	8	12	6+10 <sup>3</sup>	9+15		
No. of Fillers	4	3	1	3	2	1	0	0	0	2	0		
Central strength member	FRP (with PE coat if necessary)												
Water blocking material	Water blocking yarn												
Core wrapping tape	Water blocking tape												
Peripheral strength member	Aramid yarns												
Ripcord	2 ripcords												
Outer jacket	Black PE												

### 5. QUALIFICATION TEST

The product shall be type tested for the qualifications according to Table 5 below. Unless otherwise specified, all attenuation measurements required in this section shall be performed at 1,550nm for SMF (single mode fiber).

Table 5. Qualification test items

ITEMS	TEST METHOD AND ACCEPTANCE CRITERIA
Tensile	<ul style="list-style-type: none"> <li>▪ Test method: IEC 60794-1-21 E1               <ul style="list-style-type: none"> <li>- MAT<sup>4</sup> in Table 7 for 1 hour</li> </ul> </li> <li>▪ Acceptance criteria               <ul style="list-style-type: none"> <li>- Fiber strain: Max. 0.33% during the test</li> <li>- Attenuation increment : ≤ 0.15 dB</li> </ul> </li> </ul>

<sup>2</sup> For tube no. 13 ~ 24, color sequence is the same as 1 ~ 12, but an additional stripe of black (or white on black tube) is applied.

<sup>3</sup> 6+10 position stranding : 6 tubes on inner layer and 10 tubes on outer layer

<sup>4</sup> MAT (Max. Allowable Tension) : Maximum tensile load that may be applied to the cable without detriment to the performance requirements (optical performance, fiber durability) due to fiber strain

ITEMS	TEST METHOD AND ACCEPTANCE CRITERIA									
Impact	<ul style="list-style-type: none"> <li>▪ Test method: IEC 60794-1-21 E4               <ul style="list-style-type: none"> <li>- Impact energy : 5J (1kg × 1m)</li> <li>- Striking surface radius : 300mm</li> <li>- Number of impact : 3 in a different place (Min. 500mm apart)</li> </ul> </li> <li>▪ Acceptance criteria               <ul style="list-style-type: none"> <li>- Attenuation increment: ≤ 0.05 dB after the test</li> <li>- No jacket cracking and fiber breakage</li> <li>- No damage to the sheath or cable elements under visual examination without magnification</li> </ul> </li> </ul>									
Crush	<ul style="list-style-type: none"> <li>▪ Test method: IEC 60794-1-21 E3               <ul style="list-style-type: none"> <li>- Load : 1,000N/10cm for 10min</li> <li>- Number of tests : 3 with interval 500mm</li> </ul> </li> <li>▪ Acceptance criteria               <ul style="list-style-type: none"> <li>- Attenuation increment : ≤ 0.05 dB during the test</li> <li>- No damage to the sheath or cable elements under visual examination without magnification</li> </ul> </li> </ul>									
Bend	<ul style="list-style-type: none"> <li>▪ Test method : IEC 60794-1-21 Method E11A               <ul style="list-style-type: none"> <li>- Bending diameter : 40D</li> <li>- Method : Single helix</li> <li>- No. of turns : 4</li> <li>- No. of cycles : 3</li> </ul> </li> <li>▪ Acceptance criteria               <ul style="list-style-type: none"> <li>- No change in attenuation after test</li> </ul> </li> </ul>									
Torsion	<ul style="list-style-type: none"> <li>▪ Test method: IEC 60794-1-21 E7               <ul style="list-style-type: none"> <li>- Cable length twisted: 2m</li> <li>- No. of twist cycles: 10 cycles</li> <li>- Twist angle: ±180°</li> </ul> </li> <li>▪ Acceptance criteria               <ul style="list-style-type: none"> <li>- Attenuation increment: ≤ 0.05 dB after the test</li> <li>- No damage to the sheath or cable elements under visual examination without magnification</li> </ul> </li> </ul>									
Temperature cycling	<ul style="list-style-type: none"> <li>▪ Test method: IEC 60794-1-22 Method F1               <ul style="list-style-type: none"> <li>- Temperature condition                   <table border="1" data-bbox="630 1556 1249 1675" style="margin-left: 40px;"> <thead> <tr> <th></th> <th>Operation(1)</th> <th>Storage(2)</th> </tr> </thead> <tbody> <tr> <td>Low (A)</td> <td>T<sub>A1</sub> : -30°C</td> <td>T<sub>A2</sub> : -40°C</td> </tr> <tr> <td>High (B)</td> <td>T<sub>B1</sub> : 70°C</td> <td>T<sub>B2</sub> : 70°C</td> </tr> </tbody> </table> </li> <li>- Temperature cycle sequence (2 cycles)                   <ul style="list-style-type: none"> <li>- 1st cycle : T<sub>A2</sub> → T<sub>B2</sub></li> <li>- 2nd cycle : T<sub>A1</sub> → T<sub>A2</sub> → T<sub>B1</sub> → T<sub>B2</sub> → 23°C</li> </ul> </li> <li>- Soak time at each temperature : ≥16 hours</li> <li>- Attenuation shall be measured at 23°C (reference attenuation) before the sequence and at the end of the soak time at each step (T<sub>A1</sub>, T<sub>A2</sub>, T<sub>B1</sub>, T<sub>B2</sub>) in the 2<sup>nd</sup> cycle</li> </ul> </li> <li>▪ Acceptance criteria               <ul style="list-style-type: none"> <li>- Max. 0.05dB/km for T<sub>A1</sub> and T<sub>B1</sub></li> <li>- Max. 0.15dB/km for T<sub>A2</sub> and T<sub>B2</sub></li> </ul> </li> </ul>		Operation(1)	Storage(2)	Low (A)	T <sub>A1</sub> : -30°C	T <sub>A2</sub> : -40°C	High (B)	T <sub>B1</sub> : 70°C	T <sub>B2</sub> : 70°C
	Operation(1)	Storage(2)								
Low (A)	T <sub>A1</sub> : -30°C	T <sub>A2</sub> : -40°C								
High (B)	T <sub>B1</sub> : 70°C	T <sub>B2</sub> : 70°C								

ITEMS	TEST METHOD AND ACCEPTANCE CRITERIA
Water penetration	<ul style="list-style-type: none"> <li>▪ Test method: IEC 60794-1-22 F5B               <ul style="list-style-type: none"> <li>- Length of specimen: 3m</li> <li>- Height of pressure head: 1m</li> <li>- Test time: 24 hours</li> </ul> </li> <li>▪ Acceptance criteria               <ul style="list-style-type: none"> <li>- No water shall be detected at the unsealed end of the sample</li> </ul> </li> </ul>

## 6. SAG/TENSION PARAMETERS AND TABLES

Table 6. Operating Condition

Items	Value	
Operating temperature (°C)	-1	
Wind load (kgf/mm <sup>2</sup> )	48.3 (= 100 km/h)	
Ice thickness (mm)	No ice	
Minimum installation sag (%)	1.5 %	2.0 %
Maximum installation span (m)	120 m	200 m

Table 7. Sag/Tension Table

Type	No. of fiber	Max. Installation Tension			Max. Allowable Tension	
		Span (m)	Sag (%)	Tension (kgf)	Sag (m)	Tension (kgf)
S-120M	6 ~ 30F	50	1.5%	28	1.7	101
S-120M	6 ~ 30F	60	1.5%	33	2.2	115
S-120M	6 ~ 30F	70	1.5%	39	2.6	128
S-120M	6 ~ 30F	80	1.5%	44	3.1	141
S-120M	6 ~ 30F	90	1.5%	50	3.6	154
S-120M	6 ~ 30F	100	1.5%	55	4.1	166
S-120M	6 ~ 30F	110	1.5%	61	4.7	178
S-120M	6 ~ 30F	120	1.5%	66	5.2	<b>190</b>
S-120M	36~72F	50	1.5%	36	1.6	118
S-120M	36~72F	60	1.5%	43	2.0	135
S-120M	36~72F	70	1.5%	50	2.4	151
S-120M	36~72F	80	1.5%	57	2.9	166
S-120M	36~72F	90	1.5%	64	3.4	181
S-120M	36~72F	100	1.5%	72	3.8	196
S-120M	36~72F	110	1.5%	79	4.3	210
S-120M	36~72F	120	1.5%	86	4.8	<b>224</b>
S-120M	96F	50	1.5%	42	1.5	134
S-120M	96F	60	1.5%	50	1.9	153
S-120M	96F	70	1.5%	59	2.3	171
S-120M	96F	80	1.5%	67	2.7	189
S-120M	96F	90	1.5%	76	3.1	206
S-120M	96F	100	1.5%	84	3.6	223
S-120M	96F	110	1.5%	92	4.0	239
S-120M	96F	120	1.5%	101	4.5	<b>255</b>
S-120M	144F	50	1.5%	65	1.5	167
S-120M	144F	60	1.5%	78	1.9	191
S-120M	144F	70	1.5%	91	2.3	214

Type	No. of fiber	Max. Installation Tension			Max. Allowable Tension	
		Span (m)	Sag (%)	Tension (kgf)	Sag (m)	Tension (kgf)
S-120M	144F	80	1.5%	104	2.7	237
S-120M	144F	90	1.5%	117	3.1	259
S-120M	144F	100	1.5%	130	3.5	280
S-120M	144F	110	1.5%	143	4.0	301
S-120M	144F	120	1.5%	156	4.4	<b>321</b>
S-120M	288F	50	1.5%	86	1.4	201
S-120M	288F	60	1.5%	103	1.8	231
S-120M	288F	70	1.5%	120	2.2	259
S-120M	288F	80	1.5%	137	2.5	287
S-120M	288F	90	1.5%	154	2.9	314
S-120M	288F	100	1.5%	171	3.4	340
S-120M	288F	110	1.5%	188	3.8	366
S-120M	288F	120	1.5%	205	4.2	<b>391</b>
S-200M	6 ~ 36F	130	2.0%	56	5.5	213
S-200M	6 ~ 36F	140	2.0%	60	6.1	226
S-200M	6 ~ 36F	150	2.0%	65	6.6	237
S-200M	6 ~ 36F	160	2.0%	69	7.2	249
S-200M	6 ~ 36F	170	2.0%	73	7.8	260
S-200M	6 ~ 36F	180	2.0%	78	8.4	272
S-200M	6 ~ 36F	190	2.0%	82	9.0	283
S-200M	6 ~ 36F	200	2.0%	86	9.6	<b>294</b>
S-200M	36 ~ 72F	130	2.0%	73	5.2	249
S-200M	36 ~ 72F	140	2.0%	78	5.7	263
S-200M	36 ~ 72F	150	2.0%	84	6.2	277
S-200M	36 ~ 72F	160	2.0%	89	6.8	290
S-200M	36 ~ 72F	170	2.0%	95	7.3	304
S-200M	36 ~ 72F	180	2.0%	100	7.9	317
S-200M	36 ~ 72F	190	2.0%	106	8.4	330
S-200M	36 ~ 72F	200	2.0%	112	9.0	<b>343</b>
S-200M	96F	130	2.0%	85	4.9	277
S-200M	96F	140	2.0%	91	5.4	293
S-200M	96F	150	2.0%	98	5.9	309
S-200M	96F	160	2.0%	104	6.4	324
S-200M	96F	170	2.0%	111	6.9	339
S-200M	96F	180	2.0%	118	7.4	354
S-200M	96F	190	2.0%	124	7.9	369
S-200M	96F	200	2.0%	131	8.5	<b>383</b>
S-200M	144F	130	2.0%	130	4.9	345
S-200M	144F	140	2.0%	140	5.4	365
S-200M	144F	150	2.0%	150	5.9	385
S-200M	144F	160	2.0%	160	6.4	404
S-200M	144F	170	2.0%	170	6.9	423
S-200M	144F	180	2.0%	180	7.4	442
S-200M	144F	190	2.0%	190	7.9	461
S-200M	144F	200	2.0%	200	8.4	<b>479</b>
S-200M	192F	130	2.0%	153	5.1	374

Type	No. of fiber	Max. Installation Tension			Max. Allowable Tension	
		Span (m)	Sag (%)	Tension (kgf)	Sag (m)	Tension (kgf)
S-200M	192F	140	2.0%	165	5.5	395
S-200M	192F	150	2.0%	177	6.0	417
S-200M	192F	160	2.0%	189	6.5	438
S-200M	192F	170	2.0%	200	7.1	459
S-200M	192F	180	2.0%	212	7.6	480
S-200M	192F	190	2.0%	224	8.1	500
S-200M	192F	200	2.0%	236	8.6	<b>520</b>
S-200M	288F	130	2.0%	171	4.7	413
S-200M	288F	140	2.0%	184	5.2	437
S-200M	288F	150	2.0%	197	5.6	461
S-200M	288F	160	2.0%	210	6.1	485
S-200M	288F	170	2.0%	224	6.6	508
S-200M	288F	180	2.0%	237	7.1	531
S-200M	288F	190	2.0%	250	7.6	554
S-200M	288F	200	2.0%	263	8.1	<b>576</b>

\* Actual values may deviate from the calculated values given in the tables above.

## 7. CABLE PACKING AND MARKING

### 7.1 Cable marking

The outer surface of the cable shall be marked with white characters at intervals of one meter with the following information. Other marking is also available upon request.

- 1) Cable type (ex, "ADSS S-120M" )
- 2) Fiber type and counts (ex, " SM24C")
- 3) Name of the manufacturer (" LS Cable & System")
- 4) Year of manufacture
- 5) Length marking

Ex.1) For single mode 24 fibers cable

**0000M ADSS S-120M SM24C LS Cable & System 2020 0001M...**

### 7.2 Cable packing

- 7.2.1 Standard length of the cable shall be 3,000m and 4,000m. Other cable length is also available if requested by customer.
- 7.2.2 Each length of the cable shall be wound on a separate wooden reel.
- 7.2.3 Both ends of the cable shall be sealed with suitable plastic caps to prevent the entry of moisture during shipping, handling and storage.
- 7.2.4 The cable ends shall be securely fastened to the reel to prevent the cable from becoming loose in transit or during placing operations.
- 7.2.5 Circumference battens or wood-fiber board shall be secured with bands to protect the cable during normal handling and shipping.

### 7.3 Cable reel

7.3.1 Details given below shall be distinctly marked with a weather proof materials on both outer sides of the reel flange:

- 1) Purchaser's name
  - 2) Cable type and fiber counts
  - 3) Length of cable in meters
  - 4) Gross weight in kilograms
  - 5) Reel number
  - 6) Name of manufacturer
  - 7) Year of manufacture
  - 8) Arrow showing the direction drum shall be rolled
- \* Other shipping mark is also available upon request.

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

7.3.3 The arbor holes provided in the reels shall be at least 75 mm and at most 110 mm in diameter.

## **8. SAFETY**

### **8.1 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.

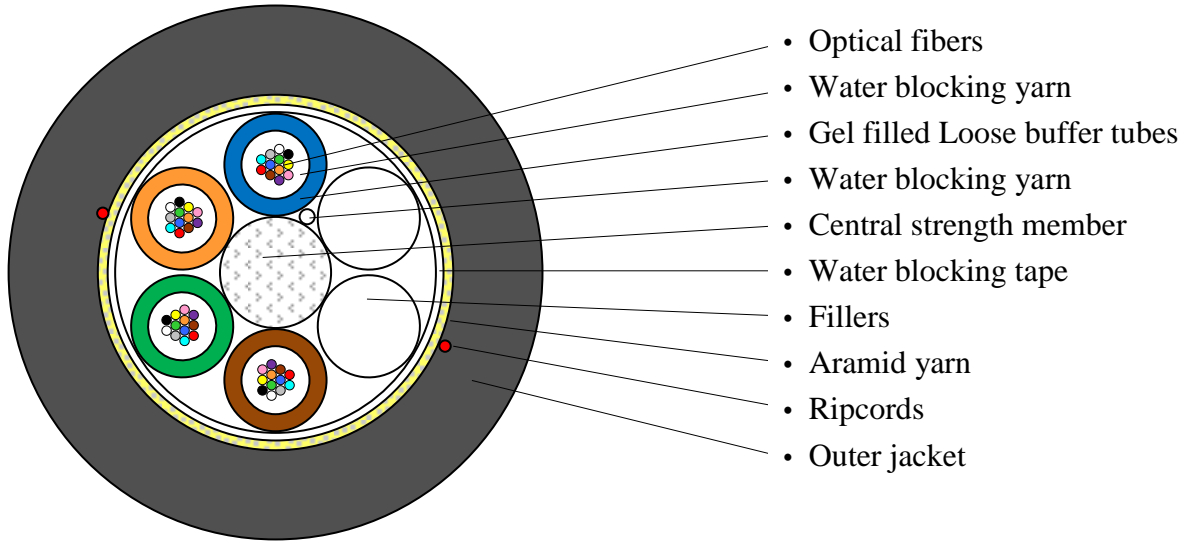
### **8.2 ISPM 15 directive**

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



**9. CROSS-SECTIONAL DRAWING OF CABLE**

Example) 48 fiber ADSS Cable



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

Type	Fiber counts	Cable dia. (mm)	Approx. cable weight (kg/km)	Minimum bending radius (mm)	
				Under load	No load
S-120M	6 ~ 30F	9.6 ± 0.5	66	190	95
	36 ~ 72F	10.6 ± 0.5	86	210	105
	96F	11.3 ± 0.5	101	230	115
	144F	14.3 ± 0.5	155	290	145
	288F	16.7 ± 0.5	205	330	165
S-200M	6 ~ 30F	9.8 ± 0.5	69	200	100
	36 ~ 72F	10.8 ± 0.5	89	220	110
	96F	11.5 ± 0.5	104	230	115
	144F	14.5 ± 0.5	159	290	145
	192F	16.3 ± 0.5	188	330	165
	288F	16.8 ± 0.5	210	340	170

\* Actual values may deviate from the calculated values given in the table above.

= End of Specification =