

# **Specification**

**LA-LT-041**

**Loose Tube / Gel-Free /  
Single Jacket Single Armored Optical Fiber Cable**

[ LAC code : OPSP-LT-041 ]  
[ Optical Fiber based on SM ]

**LEXINGTON AMES LLC**

## 1. Scope

### 1.1 Application

This specification covers the general requirements for the optical fiber telecom. The cable intended for outdoor applications.

### 1.2 Cable Description

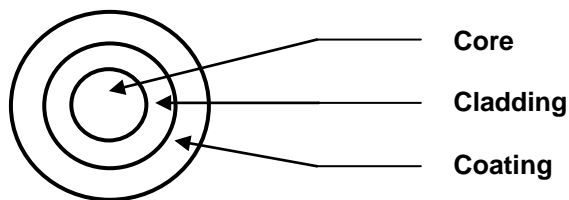
The cable core consists of color coded fibers, dry water swellable material, color coded loose tubes, PE filler (if necessary), SZ-stranded around the dielectric central strength member with water blocking yarn(s).

#### **Single Armored / Single Jacket**

The cable structure is completed by the application of a core wrapping tape, corrugated steel tape, which with the core, are covered by an outer PE jacket.

## 2. Optical Fiber

### 2.1 Construction of the fibers



2.2 The operating wavelength region of single-mode is around 1310 & 1550nm.

### 2.3 Material of the Fibers

The fiber shall be made from high grade silica glasses and the coating shall be made from UV curable acrylate material. A protective UV cured acrylate coating shall be applied over the fiber cladding and it shall be able to removed mechanically or chemically.

- Core : Silica (SiO<sub>2</sub>) Doped with Germanium Dioxide (GeO<sub>2</sub>)
- Cladding : Silica (SiO<sub>2</sub>)
- Coating : Dual Layers of UV curable acrylate (or equivalent)

### 2.4 Environmental conditions ; up to 100 % non-condensing humidity

- Operation : - 40 to 158 °F (- 40 to 70 °C)
- Installation : - 22 to 158 °F (- 30 to 70 °C)
- Storage : - 40 to 158 °F (- 40 to 70 °C)

2.5 The optical, geometrical and mechanical performance of the optical fiber shall be in accordance with Table 1 (below).

Table 1. Characteristics for Single mode ITU-T G.652D Type fiber  
(The optical, geometrical, and mechanical performance)

Items	Unit	Specification		
		G.652D	G.657A1	G.657A2
Type of Fiber		G.652D	G.657A1	G.657A2
Mode Field Diameter @1310nm	μm	9.2 ± 0.4	8.9 ± 0.4	8.6 ± 0.4
Mode Field Concentricity Error	μm	≤ 0.8		
Cladding Diameter	μm	125 ± 1.0		
Cladding Non-circularity	%	≤ 1.0		
Transmission Wavelength	nm	1310, 1550		
Attenuation (Max. 288C)	dB/km	≤ 0.35 @ 1310 nm ≤ 0.25 @ 1550 nm		
Attenuation (Max. 576C)	dB/km	≤ 0.40 @ 1310 nm ≤ 0.30 @ 1550 nm		
Zero Dispersion Wavelength	nm	1300 ~ 1324		
Chromatic Dispersion	ps/nm.km	≤ 3.2 @ 1290 ~ 1330 nm ≤ 18 @ 1550 nm		
Zero Dispersion Slope	ps/nm <sup>2</sup> /km	≤ 0.092		
PMD Coefficient (PMDQ) (M=20, Q=0.01)	ps/km <sup>1/2</sup>	≤ 0.2		
Proof Test (Nom.)	kpsi	100		

Table 1-2. Characteristics for Multi mode Type fiber  
(The optical, geometrical, and mechanical performance)

Items	Unit	Specification	
Type of Fiber		OM1 (62.5/125 MM)	OM2 (50/125 MM)
Attenuation co-efficient	dB/km	$\leq 3.5 @ 850 \text{ nm}$ $\leq 1.0 @ 1300 \text{ nm}$	$\leq 3.5 @ 850 \text{ nm}$ $\leq 1.0 @ 1300 \text{ nm}$
Bandwidth	MHz.km	$\geq 200 @ 850\text{nm}$ $\geq 500 @ 1300\text{nm}$	$\geq 400 @ 850\text{nm}$ $\geq 600 @ 1300\text{nm}$
Numerical Aperture	-	0.275 ± 0.015	0.200 ± 0.015
Core Diameter	µm	62.5 ± 3.0	50 ± 3.0
Core-cladding Concentricity Error	µm	≤ 3.0	≤ 3.0
Cladding Diameter	µm	125 ± 2.0	125 ± 2.0
Cladding Non-circularity	%	≤ 2.0	≤ 2.0
Coating Diameter	µm	245 ± 15	245 ± 15
Coating Non-circularity	%	≤ 6.0	≤ 6.0
Proof test (Nom)	kpsi	100	100

Table 1-3. Characteristics for Multi mode Type fiber for 10G grade  
(The optical, geometrical, and mechanical performance)

Items	Unit	Specification	
		OM3 (50/125 MM)	OM4 (50/125 MM)
Type of Fiber		OM3 (50/125 MM)	OM4 (50/125 MM)
Attenuation co-efficient	dB/km	≤ 3.0 @ 850 nm ≤ 1.0 @ 1300 nm	≤ 3.0 @ 850 nm ≤ 1.0 @ 1300 nm
OFL Bandwidth	MHz.km	≥ 1500 @ 850nm ≥ 500 @ 1300nm	≥ 3500 @ 850nm ≥ 500 @ 1300nm
Effective Modal Bandwidth	MHz.km	≥ 2000 @ 850nm	≥ 4700 @ 850nm
Transmission link length for 10Gbps Ethernet SX	m	300 @ 850nm	550 @ 850nm
Numerical Aperture	-	0.200 ± 0.015	0.200 ± 0.015
Core Diameter	μm	50 ± 3.0	50 ± 3.0
Core-cladding Concentricity Error	μm	≤ 3.0	≤ 3.0
Cladding Diameter	μm	125 ± 2.0	125 ± 2.0
Cladding Non-circularity	%	≤ 2.0	≤ 2.0
Coating Diameter	μm	245 ± 15	245 ± 15
Coating Non-circularity	%	≤ 6.0	≤ 6.0
Proof test (Nom)	kpsi	100	100

**3. Cable Construction**

3.1 The construction of the cable shall be in accordance with Table 2 (below).

Table 2.1 Construction of the cable

Items	Description
Fiber Type	See Table 1
No. of Fibers	Max. 576C
Loose buffer tube	Made of PBTP (Polybutylene Terephthalate) or PP
No. of fiber per tube	12 (Max. 288C); 24 (Max. 576C)
Filler	Natural color PE rod(s). If necessary, the PE filler(s) shall be used for circular-section core(s) (for better core configuration).
Central Strength Member	FRP (If necessary, PE coating)
Water blocking material	Water blocking yarn(s) or tape (to prevent the ingress of water)
S-Z Stranding (Cable Core)	The required numbers of loose tube and filler rod are S-Z stranded tightly around the CSM.
Core wrapping tape	Water blocking tape
Rip cord	Two ripcords (for easy cable entry)
Armor Tape	A corrugated steel tape of ECCS (Electrolytic Chrome Coated Steel) coated with polymer on both sides. This tape shall be bonded with outer jacket. -. Nom. 0.15mm (Steel tape thickness) -. Nom. 0.05mm (Plastic coating on one-side thickness)
Outer Jacket	Black colored MDPE

**4. Fiber & Loose tube Identification**

4.1 The color code of the loose tubes and the individual fibers within each loose tube shall be accordance with Table 3 (below).

Table 3-1 Color code of the fibers & the loose buffer tubes

No	Color	No	Color
1	Blue	13	Blue + Single dot marking
2	Orange	14	Orange + Single dot marking
3	Green	15	Green + Single dot marking
4	Brown	16	Brown + Single dot marking
5	Gray	17	Gray + Single dot marking
6	White	18	White + Single dot marking
7	Red	19	Red + Single dot marking
8	Black	20	Natural + Single dot marking
9	Yellow	21	Yellow + Single dot marking
10	Violet	22	Violet + Single dot marking
11	Pink	23	Pink + Single dot marking
12	Aqua	24	Aqua + Single dot marking

Table 3-2 Color code of the loose buffer tubes

No	Color	No	Color
1	Blue	13	Blue + Black longitudinal stripe
2	Orange	14	Orange + Black longitudinal stripe
3	Green	15	Green + Black longitudinal stripe
4	Brown	16	Brown + Black longitudinal stripe
5	Gray	17	Gray + Black longitudinal stripe
6	White	18	White + Black longitudinal stripe
7	Red	19	Red + Black longitudinal stripe
8	Black	20	Black + White* longitudinal stripe
9	Yellow	21	Yellow + Black longitudinal stripe
10	Violet	22	Violet + Black longitudinal stripe
11	Pink	23	Pink + Black longitudinal stripe
12	Aqua	24	Aqua + Black longitudinal stripe

**5. Mechanical / Environmental Performance & Tests**

5.1 The mechanical & environmental performance of the cable shall be in accordance with Table 4 (below). Unless otherwise specified, all attenuation measurements required in this section shall be performed at 1550 nm for single mode.

Table 4 Mechanical & Environmental Performance of the cable

Items	Description
<b>Tensile Strength</b>	<ul style="list-style-type: none"> <li>● Test method: IEC 60794-1-2 Method E1</li> <li>- Mandrel diameter: 40D (D: cable diameter)</li> <li>- Applied tensile load: 2,700 N</li> <li>- Duration of loading: 60 min.</li> <li>● Acceptance criteria</li> <li>- Attenuation increment: ≤ 0.15 dB for SM; ≤ 0.40 dB for MM</li> </ul>
<b>Crush Resistance (Compressive loading)</b>	<ul style="list-style-type: none"> <li>● Test method: IEC 60794-1-2 Method E3</li> <li>- Applied load: 2,200N</li> <li>- No of points: 1 point</li> <li>- Plate size: 100 mm x 100 mm</li> <li>- Duration of loading: 10 min.</li> <li>● Acceptance criteria</li> <li>- Attenuation increment: ≤ 0.15 dB for SM; ≤ 0.40 dB for MM</li> </ul>
<b>Impact resistance</b>	<ul style="list-style-type: none"> <li>● Test method: IEC 60794-1-2 Method E4</li> <li>- Drop hammer mass: 9.8 N.M</li> <li>- No. of impact per point: 1 time @ 3 point</li> <li>● Acceptance criteria</li> <li>- Attenuation increment: ≤ 0.15 dB for SM; ≤ 0.40 dB for MM</li> </ul>
<b>Cable bend</b>	<ul style="list-style-type: none"> <li>● Test method: IEC 60794-1-2 Method E11A</li> <li>- Mandrel diameter: 20D (D: cable dia.)</li> <li>- No. of bend cycles: 4 cycles</li> <li>- Bend angle: ±90 degree</li> <li>● Acceptance criteria</li> <li>- Attenuation increment: ≤ 0.15 dB for SM; ≤ 0.40 dB for MM</li> </ul>
<b>Torsion</b>	<ul style="list-style-type: none"> <li>● Test method: IEC 60794-1-2 Method E7</li> <li>- Cable twisted length: 2 m</li> <li>- Applied load: 55 N (5.5 kg weight)</li> <li>- No. of twist cycles: 10 cycles</li> <li>- Twist angle: ±180 degree</li> <li>● Acceptance criteria</li> <li>- Attenuation increment: ≤ 0.15 dB for SM; ≤ 0.40 dB for MM</li> </ul>
<b>Water penetration</b>	<ul style="list-style-type: none"> <li>● Test method: IEC 60794-1-2 Method F5</li> <li>- Length of specimen: 3 m</li> <li>- Height of pressure head: 1 m</li> <li>- Test time: 24 h</li> <li>● Acceptance criteria</li> <li>- No leakage through the open cable end</li> </ul>
<b>Temperature Cycling</b>	<ul style="list-style-type: none"> <li>● Test method: IEC 60794-1-2 Method F1</li> <li>- Cable length: ≥ 1,000 m</li> <li>- Test condition: ≥ 2 fibers shall be spliced</li> <li>- Temperature cycling schedule               <ul style="list-style-type: none"> <li>: +23°C → -40°C → +70°C → +23°C</li> </ul> </li> <li>- Soak time at each temperature: 16 h</li> <li>- No. of cycles: 2</li> <li>● Acceptance criteria</li> <li>- Attenuation increment: ≤0.15 dB/km for SM; ≤ 0.40 dB for MM</li> </ul>



## 6. Packing and marking

### 6.1 Cable marking

The jacket shall be marked every two feet with following information.

- 1) Cable type & counts
- 2) Name of the manufacturer
- 3) Year of manufacture (YYYY)
- 4) Serial number (NNNNN)
- 5) Length marking (FT)

- Ex) For SM 72 fiber cable

**00002FT OPSP-LT-041 SM 72C LAC YYYY NNNNN 00004FT**

### 6.2 Cable packing

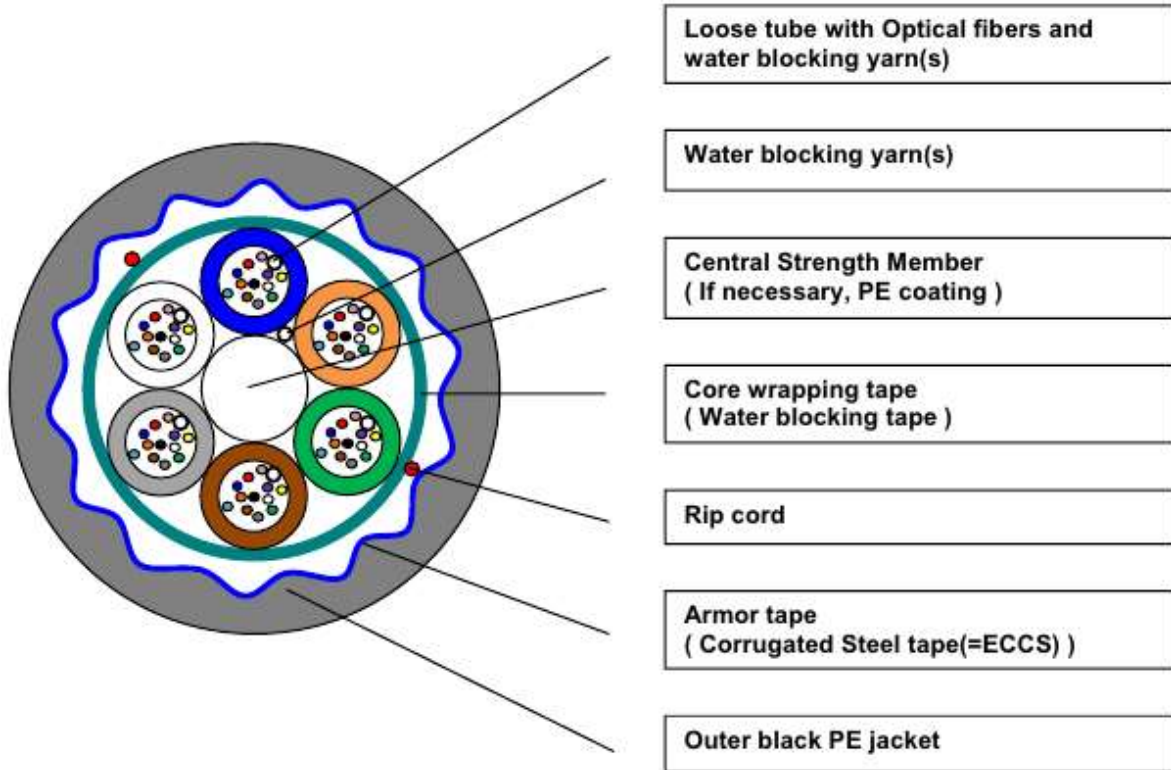
- 6.2.1 Standard length of cable shall be accordance with Appendix 2. Other cable length is also available if required by customer.
- 6.2.2 Each length of the cable shall be shall be wound on a separate wooden reel.
- 6.2.3 Both ends of the cable shall be sealed with a suitable plastic cap to prevent 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 from becoming loose in transit or during placing operations.
- 6.2.5 The inner end of the cable is housed into a slot on the side of the reel without extra cable length for testing.
- 6.2.6 The reels must have a number of rotations that there is a min. free space of 50mm between the upper layer and the edge of the flanges.
- 6.2.7 Circumference battens or Wood-fiber board shall be secured with steel band to protect the cable during normal handling and storage.

### 6.3 Cable reel

- 6.3.1 Details given below shall be distinctly marked on a weather proof material on both outer sides of the reel flange;
  - 1) Customer's name
  - 2) Contract Number
  - 3) Type & fiber counts of cable
  - 4) Length of cable in meter/feet
  - 5) Drum number & Gross & Net weight in kilograms/pounds
  - 6) Year of manufacture and the manufacturer
  - 7) Arrow showing the direction the drum shall be rolled\* Other shipping mark is also available if required by customer.
- 6.3.2 The cable shall be wound on the reel designed to prevent damages during shipment and installation.
- 6.3.3 The minimum barrel diameter of the cable drums shall be at least 30 times the overall cable diameter.
- 6.3.4 The arbor holes provided in the reels shall be 75 ~ 125 mm in diameter. The arbor hole on each flange shall be reinforced with a bearing plate.

## Appendix 1

( Cable Cross-Sectional, drawing not to scale, 72 Fiber )



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

## Appendix 2

Diameter, Weight & Min. Bending radius

No. of Fiber	Nom. Cable Diameter (inch)	Approx. Cable weight (lbs/ft)	Standard cable packing length (ft)	Min. Bending Radius (mm)	
				No Load	Under Load
~ 72	0.488 (12.4mm)	0.091 (135kg/km)	13,124 (4,000m)	10 D	20 D
96	0.551 (14.0mm)	0.117 (175kg/km)	13,124 (4,000m)	10 D	20 D
120	0.614 (15.5mm)	0.141 (210kg/km)	13,124 (4,000m)	10 D	20 D
144	0.681 (17.3mm)	0.168 (250kg/km)	13,124 (4,000m)	10 D	20 D
216	0.701 (17.8mm)	0.168 (250kg/km)	6,560 (2,000m)	10 D	20 D
288	0.795 (20.2mm)	0.212 (315kg/km)	6,560 (2,000m)	10 D	20 D
432	0.846 (21.5mm)	0.228 (340kg/km)	6,560 (2,000m)	10 D	20 D
576	0.965 (24.5mm)	0.292 (435kg/km)	6,560 (2,000m)	10 D	20 D