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Optical Fiber Cable Specification

Micro duct Cable for Installation by Blowing

GCYFXTY-1/2/4/6/8/12/24 B6a2

1. General

This specification covers the design and performance of the single mode optical cables to be used in air blown micro duct application.

1.1 Cable Description

- 1/2/4/6/8/12/24 G657A2 SM-fibers.
- Central tube structure.
- Suitable for air blown cable in micro-duct installation.

1.2 Quality

YOFC ensures a continuing level of quality in our cable products through several programs including ISO 9001.

1.3 Reliability

YOFC ensures product reliability through rigorous qualification testing of each product family. Both initial and periodic qualification testing are performed to assure the cable's performance and durability in the field environment.

1.4 Reference

ITU-T G.657A2	Characteristics of a single-mode optical fiber
IEC 60794-1-1	Optical fiber cables- part1-1-Generic specification-General
IEC 60794-1-2	Optical fiber cables- part1-2-Generic specification-Basic optical cable test procedure
IEC 60794-3	Optical fiber cables- part3-Sectional specification- Outdoor cables
IEC 60794-5	Optical fiber cables- part5-Sectional specification- Microduct cabling for installation by blowing
GR 20-2013	6.9.5 Micro-Duct Cable

1.5 Working Condition

Transportation and storage temperature: $-40^{\circ}\text{C} \sim +70^{\circ}\text{C}$

Installation temperature: $-20^{\circ}\text{C} \sim +60^{\circ}\text{C}$

Operation temperature: $-40^{\circ}\text{C} \sim +70^{\circ}\text{C}$

1.6 Minimum Allowable Bending Radius

Static: 10D

Dynamic: 20D

D is the out diameter of the cable

1.7 Life Time

Optical fiber cables supplied in compliance with the specifications can be capable of withstanding the typical service condition for a period of twenty-five (25) years without detriment to the transmission or operation and maintenance characteristics of the cable.

2. Optical Fiber In Cable (ITU-G657A2)

Optical properties of the SM fiber are achieved through a germanium doped silica based core with a pure silica cladding which meets ITU-T G657A2, UV curable acrylate protective coating is applied over the glass cladding to provide the necessary maximum fiber lifetime.

Geometrical, optical, and mechanical characteristics of fiber in cable as the following table:

Category	Description	Specification	
		Before cable	After cable
Geometrical Characteristics	Cladding diameter	125.0 ± 0.7 μm	
	Cladding non-circularity	≤ 1.0 %	
	Core concentricity error	≤ 0.6 μm	
	Coating diameter	245 ± 10 μm (Before Colored) 250 ± 15 μm (Colored)	
	Coating/cladding concentricity error	≤ 12 μm	
Optical Characteristics	Mode field diameter at 1310 nm	8.8 ± 0.4 μm	
	Point discontinuity	≤ 0.05dB	
	Attenuation at 1310 nm	≤ 0.34 dB/km	≤ 0.35 dB/km
	Attenuation at 1383 nm	≤ 0.34 dB/km	≤ 0.35 dB/km
	Attenuation at 1550 nm	≤ 0.21 dB/km	≤ 0.22 dB/km
	Attenuation at 1625 nm	≤ 0.23 dB/km	≤ 0.24 dB/km
	Dispersion in 1288 – 1339 nm	≤ 3.5 ps/(nm·km)	
	Dispersion in 1271 – 1360 nm	≤ 5.3 ps/(nm·km)	
	Dispersion at 1550 nm	≤ 18 ps/(nm·km)	
	Zero dispersion wavelength	1300 – 1324 nm	
	Zero dispersion slope	≤ 0.092 ps/(nm ² ·km)	
	Cable cut-off wavelength	≤ 1260 nm	
	Polarization mode dispersion individual fiber	≤ 0.2 ps/√km	
	Polarization mode dispersion design link value (M=20, Q=0.01%)	≤ 0.1 ps/√km	
	Macro-bend loss (10 turns, 15mm radius, 1550)	≤ 0.03 dB	
Macro-bend loss (1 turn, 10mm radius, 1550)	≤ 0.10dB		
Macro-bend loss (1 turn, 7.5mm radius, 1550)	≤ 0.50 dB		
Mechanical Specification	Proof stress level	≥ 100kpsi (0.69 GPa)	
	Coating strip force(peak value)	1.3~8.9N	
	Fiber curl (Radius)	≥ 4 m	

3. Optic Cable

3.1 General Design

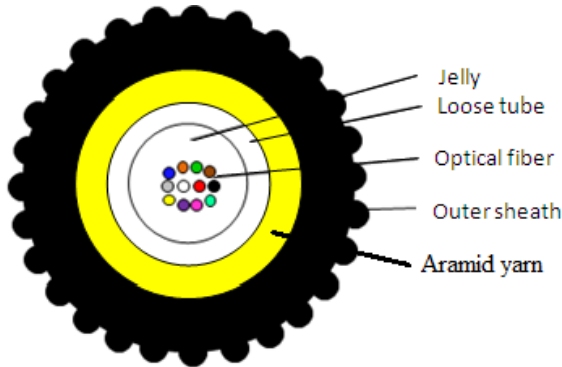
Optical fibers are housed in central loose tube that is made of high-modulus plastic and filled with waterproof compounds.

Aramid yarn as strength member.

Polyethylene sheath is applied over the cable core.

3.2 Construction

3.2.1 Cross Section of Cable



3.2.2 Dimensions and Descriptions of Cable Constructions

Item	contents	Value	
Fiber	number	1/2/4/6/8/12	24
Loose tube	diameter(mm)	1.8 ± 0.2	2.1 ± 0.2
Outer sheath	Material	HDPE	
	Color	Black	
	Thickness(mm)	Nominal :0.2 /Min.0.1	
For micro –duct		5/3.5 OR 7/3.5	
Cable diameter(mm).		2.3 ± 0.2	2.6 ± 0.2
Cable weight(kg/km).		4.0 ± 1.0	5.0 ± 1.0

3.2.3 Mechanical Performance of Cable

Tensile performance(N)		Crush(N/100mm)	
Short term	Long term	Short term	Long term
0.5G	0.15G	200	100

G is the weight of cable per kilometer, the unit is Newton (N).

3.2.4 Color Code of the Fiber

Each fiber can be identifiable throughout the length of the cable in accordance with the following color sequence. Fiber color in each tube starts from No. 1 Blue.

Fiber Color Code

Fiber Colors

No.	1	2	3	4	5	6	7	8	9	10	11	12
Color	blue	orange	green	brown	grey	white	red	black	yellow	violet	pink	aqua

No.	1	2	3	4	5	6	7	8	9	10	11	12
Color	blue ¹	orange ¹	green ¹	brown ¹	grey ¹	white ¹	red ¹	Natural	yellow ¹	violet ¹	pink ¹	aqua ¹

<color>¹ with evenly spaced black ring marks
<color>² with evenly spaced double black ring marks

Ring marks width 2 ± 1.5 mm, Color ring intervals 60 ± 10 mm.

3.2.5 Color Code of the Loose Tube

The color of the tube will be blue.

3.3 Mechanical, Electrical and Environmental Test Characteristics

The finished cables can be subjected to the following mechanical, electrical and environmental conditions.

Item	Test Method	Requirements
Tensile performance	GR_20-6.9.5 IEC 60794-1-2-E1 Load: 0.5G Cable length under tension: Not less than 50m. Duration of load sustain: 1min. Velocity of transfer device: 10mm/min	The maximum increase in attenuation less than 0.1 dB . The maximum fiber strain less than 0.6% under maximum tensile short term load. No change in attenuation after test at 1550nm. Under visual examination without magnification, no damage to the sheath or to the cable elements after test.
Crush	GR_20-6.9.5 IEC 60794-1-2-E3 Load: 200N Duration of load: 1min	No change in attenuation after test at 1550nm. Under visual examination without magnification, no damage to the sheath or to the cable elements. The imprint of the striking surface on the sheath is not considered mechanical damage.
Bend	GR_20-6.9.5 IEC 60794-1-2-E11A Mandrel radius: 10 times cable diameter Turns:10 Cycles:5	No change in attenuation at 1550nm after test. Under visual examination without magnification, no damage to the sheath or to the cable elements.
Repeated bending	GR_20-6.9.5 IEC 60794-1-2-E6 Bending radius: 20 times cable diameter Cycles: 25 Load: 25N Duration of cycle: Approximately 2s.	No change in attenuation at 1550nm after test. Under visual examination without magnification, no damage to the sheath or to the cable elements.
Torsion	GR_20-6.9.5 IEC 60794-1-2-E7 Cycles:5 Length under test: 1m Turns: $\pm 180^\circ$ Load: 0.5G*W	The variation on attenuation for each fiber less than 0.1dB at 1550nm Under visual examination without magnification, no damage to the sheath or to the cable elements. No permanent change in attenuation after test
Temperature cycling	GR_20-6.9.5 IEC 60794-1-2-F1 Sample length: at least 1000m Temperature range: $-40^\circ\text{C} \sim +70^\circ\text{C}$ Cycles: 2 Temperature cycling test dwell time: 12 hours	No change in attenuation coefficient at 1550nm after test.
Water Penetration	GR_20-6.9.5 IEC 60794-1-2-F5B	No water leakage

	Time : 24 hours Sample length : 3m Water height : 1m	
Compound flow	GR_20-6.9.5 IEC 60794-1-2-E14 Sample count:5 Sample length:300 ±5 mm, Remove length: 130 ±2,5 mm, Time:24h	No filling compound dripped.
Abrasion	GR_20-6.9.5 IEC 60794-1-21-E2B Method 1- for embossing or hot foil marking method Steel needle diameter: 1mm Frequency:55 ± 5 cycles/m Load:4N Cycles:100	The marking shall be legible at the completion of the test after the test.
Jetting Performance	Conform to GR_20-6.9.5 & IEC 60794-5-10	
Other parameters	Conform to GR_20-6.9.5 & IEC 60794	

Remark: "No attenuation changes" is considered as the attenuation changes ≤ 0.05 dB.

4. Cable Sheath Marking

Unless otherwise specified, the cable sheath marking shall be as follows:

- Color: white
- Contents: YOFC, the year of manufacture, the type of cable, length marking
- Interval: 1m

5. Packaging and Shipping

5.1 Reel Length

Standard reel length: 2/3/4/ km/reel

5.2 Cable Drum

The cables are packed in wooden drums

The minimum barrel diameter of the drum shall be more than 30 times of the nominal diameter for armored cable, and 25 times of the nominal diameter for unarmored cable.

5.3 Labeling

The direction of rotation of the color scheme is shown by marking the clockwise and anti-clockwise ends with red and green adhesive tape respectively.

The markings are on both sides of the flanges as follows:

- Cable Type/Size
- Cable Length
- Gross Weight.
- Shipping mark.

5.4 Cable Packing

Both cable ends are provided with protections against water penetration and firmly secured to the drum, so the cable cannot move and the turns cannot slide when it is moved, handled or laid. the inner end has at least 3 meters of accessible length to perform reception tests in the cables

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