

**OPTICAL FIBER CABLE\_DUCT CABLE\_GYFTY68****1. GENERAL****1) SCOPE**

This specification covers the general requirements and performance of CABLE offered including optical characteristics, electrical characteristics, mechanical characteristics, geometrical characteristics.

**2) REFERENCES**

The CABLE offered shall be designed, manufactured and tested according to international standards as follows:

<b>ISO 9001</b>	Quality Management Systems
<b>ISO 14001</b>	Environmental Management Systems
<b>IEEE Std P.1222</b>	IEEE Standard construction of composite fiber for use on electric utility power lines
<b>IEC 60793-1</b>	Optical fiber Part 1: Generic specifications
<b>IEC 60793-2</b>	Optical fiber Part 2: Product specifications
<b>IEC 60794-1-2</b>	Optical fiber cables – Part 4: Sectional specification – Aerial optical cables along electrical power lines
<b>EIA/TIA 598</b>	Color code of fiber optic cables
<b>ITU-T G.650</b>	Definition and test methods for the relevant parameters of single-mode fibers
<b>ITU-T G.652</b>	Characteristics of a single-mode optical fiber cable
<b>ITU-T G.651</b>	Characteristics of a multimode optical fiber cable
<b>ITU-T G.657</b>	Characteristics of Bending loss insensitive single mode fiber for access network

**3) ANTI-RODENT AND FIRE RETARDANT PERFORMANCE**

1. Rat-proof optical fiber cable with double layers of glass yarn 600T with thickness of 0.33mm.
2. Fire retardant with outer sheath of LSZH and water moisture resistance with cable jelly, filling compound and water blocking tape.

## 2. OPTICAL FIBER

### G. 652D Type

The optical fiber shall be made of high pure silica and germanium doped silica. UV curable acrylate material is applied over fiber cladding as optical fiber primary protective coating. The detail data of optical fiber performance are shown in the following table:

Category	Description	Specifications
Optical Characteristics	Attenuation Coefficient: at 1310 nm Max: at 1550 nm Max:	≤ 0.35dB/km ≤ 0.21dB/km
	Chromatic Dispersion: between 1285 - 1330 nm: at 1550nm	≤ 3.5 ps/nm·km ≤ 18 ps/nm·km
	Chromatic dispersion coefficient	λomin:1300nm λoMax:1324nm Somax:0.092ps/(nm <sup>2</sup> *km)
	Point Discontinuity: at 1310&1550 nm	≤ 0.1 dB
	Polarization Mode Dispersion (PMD) PMD Q value	≤ 0.2 ps/√km ≤ 0.08 ps / √km.
	The optical fiber core and sheath shall be of the E9 / 125 type. The protective cover must be in direct contact with the surface of the optical fiber to protect it and avoid cracking of the optical fiber	E9 / 125 type
	Cable Cut off Wavelength ( $\lambda_{cc}$ )	≤ 1260 nm
Geometrical Characteristics	Mode Field Diameter: at 1310 nm at 1550 nm	9.2 ±0.4μm 10.4±0.5μm
	The uniformity attenuation at any projected wavelength	≤ 0.1 dB/km
	Cladding Diameter	125 ±1.0μm
	Mode field (Core/clad) concentricity error	≤ 0.5 μm
	Cladding Non-Circularity	≤1%
	Coating Diameter	245 ± 7μm
	Core / Cladding Concentricity error	≤ 0.6μm

	The increase in attenuation of 100 optical fiber cores wrapped on a 50 mm diameter chuck at 1310 nm: at 1550 nm:	≤0,05 dB; ≤ 0,05 dB
	Coating-Cladding Concentricity error	≤ 12um
	Effective Group Index of Refraction: at 1550 nm	1.4675
	Coating non-circularity The test must be carried out according to IEC/EN 60793-1-21.	≤6%
	Optical fiber shall be able to withstand a strain at minimum 8N for one second. This must correspond to a maximum optical fiber elongation of 1%	minimum 8 N for one second
	Temperature Cycling Induced Attenuation: at 1550nm and 1625 nm (-60°C to +85°C)	0.05dB/km
Environmental Characteristics	Variation of attenuation in the temperature range -40 °C to +65 °C must not exceed: at 1310 nm:	
	at 1550 nm:	0,05 dB/km;
	Macro bending Loss: at 1550nm and 1625 nm (100 turns; Φ 60 mm)	0,05 dB/km.
		≤ 0.1dB

### G.651. A1b Type-OM1

The optical fiber shall be made of high pure silica and germanium doped silica. UV curable acrylate material is applied over fiber cladding as optical fiber primary protective coating. The detail data of optical fiber performance are shown in the following table:

Category	Description	Specifications
Optical Characteristics	Attenuation Coefficient: at 850 nm at 1300 nm	2.8 ~ 3.5 dB/km 0.6 ~ 1.5 dB/km
	Mode Bandwidth: at 850 nm at 1300 nm	160 ~ 800 MHz.km 200 ~ 1000 MHz.km
	Numerical Aperture	0.275±0.015
	Zero dispersion wavelengthλ0	1295 ~ 1365 nm

	Zero dispersion slope S0 at 1295nm ~ 1300 nm at 1300nm ~ 1348 nm at 1348nm ~ 1365 nm	$\leq 0.105 + 0.001(\lambda_0 - 1295) \text{ ps}/(\text{nm}^2 \cdot \text{km})$ $\leq 0.11 \text{ ps}/(\text{nm}^2 \cdot \text{km})$ $\leq 0.001(1458 - \lambda_0) \text{ ps}/(\text{nm}^2 \cdot \text{km})$
<b>Geometrical Characteristics</b>	Core Diameter :	$62.5 \pm 2.5 \mu\text{m}$
	Cladding Diameter	$125 \pm 2 \mu\text{m}$
	Mode field (Core/clad) concentricity error	$\leq 1.5 \mu\text{m}$
	Cladding Non-Circularity	$\leq 2 \%$
	Core Non-Circularity	$\leq 6 \%$
	Coating-Cladding Concentricity error	$\leq 12.5 \mu\text{m}$
<b>Mechanical Characteristics</b>	Proof Test	$\geq 1.0\%, 1 \text{ sec.}$ $\geq 0.69 \text{ Gpa} (100 \text{ kpsi})$
<b>Environmental Characteristics</b>	Temperature Cycling Induced Attenuation: at 850nm and 1300 nm (-60°C to +85°C)	$\leq 0.2 \text{ dB/km}$
	Macro bending Loss : at 850nm and 1300 nm (100 turns; $\Phi 75 \text{ mm}$ )	$\leq 0.5 \text{ dB}$

### OM3 Type

The optical fiber shall be made of high pure silica and germanium doped silica. UV curable acrylate material is applied over fiber cladding as optical fiber primary protective coating. The detail data of optical fiber performance are shown in the following table:

Category	Description	Specifications
<b>Optical Characteristics</b>	Attenuation Coefficient: at 850 nm at 1300 nm	$\leq 2.3 \text{ dB/km}$ $\leq 0.6 \text{ dB/km}$
	Mode Bandwidth: at 850 nm at 1300 nm	$\geq 600 \text{ MHz} \cdot \text{km}$ $\geq 500 \text{ MHz} \cdot \text{km}$ $\geq 1200 \text{ MHz} \cdot \text{km}$ $\geq 500 \text{ MHz} \cdot \text{km}$
	Numerical Aperture	$0.200 \pm 0.015$
	Zero dispersion wavelength $\lambda_0$	1295 ~ 1320 nm
	Zero dispersion slope S0 at 1295nm ~ 1300 nm at 1300nm ~ 1320 nm	$\leq 0.001(\lambda_0 - 1190) \text{ ps}/(\text{nm}^2 \cdot \text{km})$ $\leq 0.11 \text{ ps}/(\text{nm}^2 \cdot \text{km})$
	Core Diameter :	$50 \pm 2.5 \mu\text{m}$
<b>Geometrical Characteristics</b>	Cladding Diameter	$125 \pm 1 \mu\text{m}$
	Mode field (Core/clad) concentricity error	$\leq 1.0 \mu\text{m}$
	Cladding Non-Circularity	$\leq 1 \%$
	coating Non-Circularity	$\leq 6\%$

	Coating-Cladding Concentricity error	$\leq 12\mu m$
<b>Mechanical Characteristics</b>	Proof Test	$\geq 1.0\%$ , 1 sec. $\geq 0.69 Gpa$ (100kpsi)
<b>Environmental Characteristics</b>	Temperature Cycling Induced Attenuation: at 850nm and 1300 nm (-60°C to +85°C)	$\leq 0.1 dB/km$
	Macro bending Loss : at 850nm and 1300 nm (100 turns; $\Phi 60 mm$ )	$\leq 0.5 dB$

### OM4 Type

The optical fiber shall be made of high pure silica and germanium doped silica. UV curable acrylate material is applied over fiber cladding as optical fiber primary protective coating. The detail data of optical fiber performance are shown in the following table:

Category	Description	Specifications
<b>Optical Characteristics</b>	Attenuation Coefficient: at 850 nm at 1300 nm	$\leq 2.3 dB/km$ $\leq 0.7 dB/km$
	Mode Bandwidth: at 850 nm at 1300 nm	$\geq 3500 MHz.km$ $\geq 500 MHz.km$
	Numerical Aperture	$0.200 \pm 0.015$
	Zero dispersion wavelength $\lambda_0$	1295 ~ 1340 nm
	Zero dispersion slope S0 at 1295nm ~ 1310 nm at 1310nm ~ 1340 nm	$\leq 0.105 ps/(nm^2.km)$ $\leq 0.000375 (1590-\lambda_0) ps/(nm^2.km)$
	Core Diameter :	$50 \pm 2.5 \mu m$
<b>Geometrical Characteristics</b>	Cladding Diameter	$125 \pm 1 \mu m$
	Mode field (Core/clad) concentricity error	$\leq 1.0 \mu m$
	Cladding Non-Circularity	$\leq 1 \%$
	coating Non-Circularity	$\leq 5 \%$
	Coating-Cladding Concentricity error	$\leq 10 \mu m$
<b>Environmental Characteristics</b>	Temperature Cycling Induced Attenuation: at 850nm and 1300 nm (-60°C to +85°C)	$\leq 0.1 dB/km$

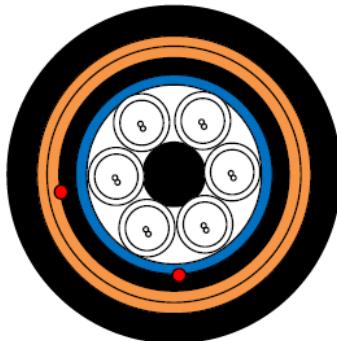
### 3. DRAWING AND DATASHEET OF CABLE

#### Optical Fiber Cable Specifications

Type:

**GYFTY68-12OM1**

Structure:



Details			
FRP	Diameter	1.8	mm
Losse tube	Outer/Inner Dia.	1.6/1.0	mm
Optical fiber	No.	12	
Jelly			
Filling compound			
Water blocking tape	Thickness	0.25	mm
MDPE inner sheath	Thickness	0.8	mm
Layer1:Glass yarn(600T)	Thickness	0.3	mm
Layer2:Glass yarn(600T)	Thickness	0.3	mm
LSZH outer sheath	Thickness	1.5	mm
Ripcord	No.	2	

Fiber: 12 x G.651OM1

Tube/Fibers	6/2
Color of Optical fiber	Green,Yellow
Color of buffer tube	Green,Yellow,Natural,Natural,Natural,Natural,

Overall diameter	11.3±0.1	mm
Weight	132	kg/km

<b>Tech. Data</b>	Standard: IEC 60794		
	Features: Water blocking, Moistureproof, Crashing resistant, Tesile resistant		
	Allowalbe tensile strength	2500	N
	Allowable crush strength	short term	2200 N/10cm
		long term	1000 N/10cm
	Minimum Bending Radius (Dynamic)	20	D
	Minimum Bending Radius (Static)	10	D
	Life Expectancy	≥30	Years
	operating temperature range	-20°C ~ +70°C	
	Note: All dimension and datas are nominal value.		

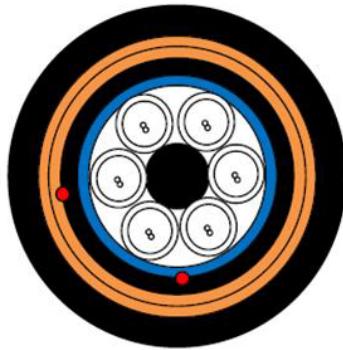
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## Optical Fiber Cable Specifications

Type:

**GYFTY68-12OM4**

Structure:



Details			
FRP	Diameter	1.8	mm
Losse tube	Outer/Inner Dia.	1.6/1.0	mm
Optical fiber	No.	12	
Jelly			
Filling compound			
Water blocking tape	Thickness	0.25	mm
MDPE inner sheath	Thickness	0.8	mm
Layer1:Glass yarn(600T)	Thickness	0.3	mm
Layer2:Glass yarn(600T)	Thickness	0.3	mm
LSZH outer sheath	Thickness	1.5	mm
Ripcord	No.	2	

Fiber: 12 x G.651OM4

Tube/Fibers	6/2
Color of Optical fiber	Green,Yellow
Color of buffer tube	Green,Yellow,Natural,Natural,Natural,Natural,

Overall diameter	11.3±0.1	mm
Weight	132	kg/km

Tech. Data	Standard: IEC 60794		
	Features: Water blocking, Moistureproof, Crashing resistant, Tesile resistant		
	Allowalbe tensile strength	2500	N
	Allowable crush strength	short term	2200 N/10cm
		long term	1000 N/10cm
	Minimum Bending Radius (Dynamic)	20	D
	Minimum Bending Radius (Static)	10	D
	Life Expectancy	≥30	Years
Temperature	operating temperature range	-20°C ~ +70°C	

Note: All dimension and datas are nominal value.

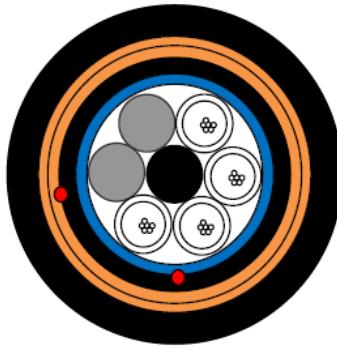
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## Optical Fiber Cable Specifications

Type:

**GYFTY68-24OM3**

Structure:



Details			
FRP	Diameter	1.8	mm
Losse tube	Outer/Inner Dia.	1.6/1.0	mm
Optical fiber	No.	24	
Filler	No.	2	
Jelly			
Filling compound			
Water blocking tape	Thickness	0.25	mm
MDPE inner sheath	Thickness	0.8	mm
Layer1:Glass yarn(600T)	Thickness	0.3	mm
Layer2:Glass yarn(600T)	Thickness	0.3	mm
LSZH outer sheath	Thickness	1.5	mm
Ripcord	No.	2	

Fiber: 24 x G.651OM3

Tube/Fibers	4/6
Color of Optical fiber	Green,Yellow,White,Blue,Red,Violet
Color of buffer tube	Green, Yellow, Natural, Natural

Overall diameter	11.3±0.1	mm
Weight	133	kg/km

<b>Tech. Data</b>	Standard: IEC 60794		
	Features: Water blocking, Moistureproof, Crashing resistant, Tesile resistant		
	Allowalbe tensile strength	2500	N
	Allowable crush strength	short term	2200 N/10cm
		long term	1000 N/10cm
	Minimum Bending Radius (Dynamic)	20	D
	Minimum Bending Radius (Static)	10	D
	Life Expectancy	≥30 Years	
	Temperature operating temperature range	-20°C ~ +70°C	

**Note:** All dimension and datas are nominal value.

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## Optical Fiber Cable Specifications

Type:

**GYFTY68-48B1.3**

Structure:



Details			
FRP	Diameter	2.2	mm
Loss tube	Outer/Inner Dia.	2.0/1.4	mm
Optical fiber	No.	48	
Filler	No.	2	
Jelly			
Filling compound			
Water blocking tape	Thickness	0.25	mm
MDPE inner sheath	Thickness	0.8	mm
Layer1:Glass yarn(600T)	Thickness	0.3	mm
Layer2:Glass yarn(600T)	Thickness	0.3	mm
LSZH outer sheath	Thickness	1.5	mm
Ripcord	No.	2	

Fiber: 48 x G.652D

Tube/Fibers	4/12
Color of Optical fiber	Green,Yellow,White,Blue,Red,Violet,Brown,Pink,Black,Grey,Orange,Aqua
Color of buffer tube	Green, Yellow, Natural, Natural

Overall diameter	12.5	mm
Weight	161	kg/km

Tech. Data	Standard: IEC 60794		
	Features: Water blocking, Moistureproof, Crashing resistant, Tesile resistant		
	Allowalbe tensile strength	2500	N
	Allowable crush strength	short term	2200 N/10cm
		long term	1000 N/10cm
	Minimum Bending Radius (Dynamic)	20	D
	Minimum Bending Radius (Static)	10	D
	Life Expectancy	≥30 Years	
	Temperature operating temperature range	-20°C ~ +70°C	

Note: All dimension and datas are nominal value.

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#### **4. COLOR IDENTIFICATION OF FIBER IN CABLE**

##### **4.1 Fiber color code**

Each fiber will 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	1	2	3	4	5	6
Color	Blue	Orange	Green	Brown	Grey	White
Code	7	8	9	10	11	12
	Red	Black	Yellow	Purple	Pink	Aqua

##### **4.2 Color Codes for Loose Tube**

The loose tubes will be identifiable in accordance with the following color sequence. If there are fillers, the color is Black.

Fiber	1	2	3	4	5	6
Color	Green	Yellow	Natural	Natural	Natural	Natural
Code	7	8	9	10	11	12
	Natural	Natural	Natural	Natural	Natural	Natural

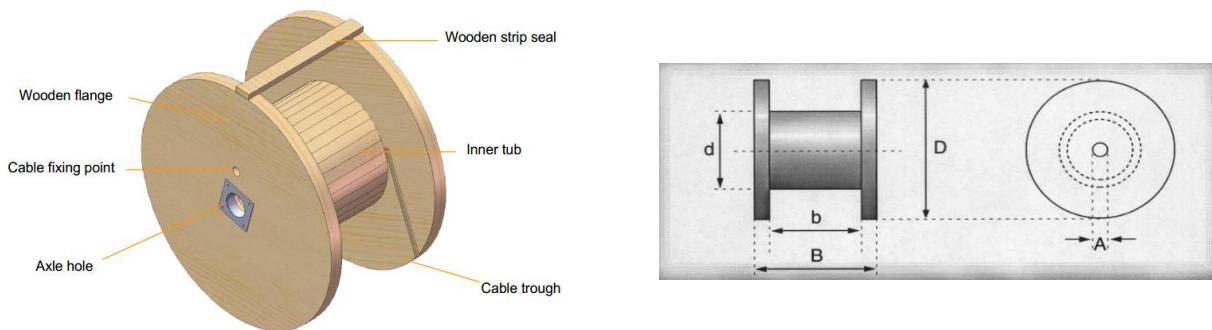
#### **5. CHARACTERISTIC OF OPTICAL CABLE**

Optical fiber cable shall be accordance with applicable standard of optical fiber cable and requirement of customer. The following test items shall be carried out according to corresponding reference.

Tests of Completed Optical Fiber Cable		
1	Impact test	IEC-60794
2	Crush test	IEC-60794
3	Water penetration(0.1bar/24h)	≤1m
4	Attenuation test	ITU

## 6. PACKING AND DRUM FOR CABLE

CABLE shall be wound on a non-returnable wooden drum or metal drum. Both ends of CABLE shall be securely fastened to drum and sealed with a shrinkable cap. The required marking shall be printed with a weather-proof material on the outsides of drum according to customer's requirement.



Cable Diameter (mm)	Drum Length (km)	Drum Dimensions & Weights					
		D	b	B	d	A	weight
		m	m	m	m	m	t
11.3	4	1.35	0.61	0.7	0.6	0.08	0.122
12.5	4	1.5	0.61	0.7	0.6	0.08	0.158