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# Technical Specification

## Inner sheath Cable



**Designer: Yingxiang Lu**

**Approver: Qingwei Meng**

**Technical Support Engineer**

**Technical Manager**

**Hengtong Optic-electric Co., Ltd.**

No.88 Hentong Road, Qidu Town, Wujiang District, Suzhou City, Jiangsu Province, China

Tel: +86-0512-63800569

Fax: +86 0512 63956979

# 1. General

## 1.1 Scope

This specification covers the design requirements and performance standard for the supply of optical fiber cable in the industry. It also includes premium designed cable with optical, mechanical and geometrical characteristics.

Cable type	Application
TOL8D 48 6(8SM) T/M	Inner sheath cable
TOL8D 32 8(4SM) T/M	Inner sheath cable
TOL8D 16 4(4SM) T/M	Inner sheath cable

## 1.2 Cable Description

HTGD cable has excellent optical transmission and physical performance, to meet customer's requirements.

## 1.3 Quality

HTGD ensures a stable quality control system for our cable products through several programs including ISO 9001.

## 1.4 Reliability

Initial and periodic qualification tests for raw material and cable product are performed to assure the cable's performance and durability in the field environment.

## 1.5 Reference

ITU-T G.652	Characteristics of a single-mode optical fiber
IEC 60794-1-1	Optical fiber cables-part 1-1: Generic specification- General
IEC 60794-1-2	Optical fiber cables-part 1-2: Generic specification- Basic optical cable test procedure
IEC 60794-3	Optical fiber cables - Part 3: Outdoor cables-Sectional specification
IEC 60794-3-11	Optical fiber cables - Part 3-11: Outdoor cables - Product specification for duct, directly buried, and lashed aerial single-mode optical
EIA/TIA 598	Optical Fiber Cable Color coding

## 2. Optical Fiber

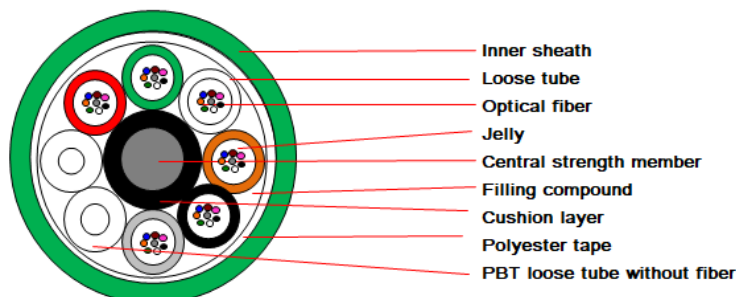
Optical properties of the optical fiber are achieved through a germanium doped silica based core with a pure silica cladding which meets ITU-T G.652D. UV curable acrylate protective coating is applied over the glass cladding to provide the necessary maximum fiber lifetime.

Optical, geometrical, and mechanical characteristics of optical fiber are showed in the following table:

Item	Contents	Value
<b>G652D Optical characteristics</b>		
Attenuation	@1310nm	$\leq 0.36\text{dB/km}$
	@1550nm	$\leq 0.22\text{dB/km}$
Dispersion	@1285nm~1330nm	$\leq 3.5\text{ps}/(\text{nm}\cdot\text{km})$
	@1550nm	$\leq 18\text{ps}/(\text{nm}\cdot\text{km})$
	@1625nm	$\leq 22\text{ps}/(\text{nm}\cdot\text{km})$
Zero-Dispersion wavelength		1302nm~1322nm
Zero-Dispersion slope		$\leq 0.092\text{ps}/(\text{nm}^2\cdot\text{km})$
Mode field diameter (MFD)	@1310nm	$9.2\pm 0.4\mu\text{m}$
	@1550nm	$10.4\pm 0.5\mu\text{m}$
Cable cutoff wavelength $\lambda_{cc}$ (nm)		$\leq 1260\text{nm}$
Micro bending Attenuation	@1550nm (1turns; $\Phi 32\text{mm}$ )	$\leq 0.05\text{dB}$
	@1550nm (100turns; $\Phi 60\text{mm}$ )	$\leq 0.05\text{dB}$
Individual polarization mode dispersion		$\leq 0.2\text{ps}/\text{km}^{1/2}$
Link polarization dispersion (PMD <sub>D</sub> )		$\leq 0.1\text{ps}/\text{km}^{1/2}$
<b>Geometrical characteristics</b>		
Cladding diameter		$125\pm 0.7\mu\text{m}$
Cladding non-circularity		$\leq 1\%$
Core/cladding concentricity error		$\leq 0.6\mu\text{m}$
Fiber diameter with coating (uncolored)		$242\pm 7\mu\text{m}$
Cladding/coating concentricity error		$\leq 12.0\mu\text{m}$
<b>Mechanical characteristics</b>		
Proof stress		$\geq 0.69\text{GPa}$
Fiber curl		$\geq 4\text{m}$
Coating strip force		1.0~8.9N
<b>Environmental characteristics</b>		
Temperature induced attenuation(-60~+85℃)		$\leq 0.05\text{dB/km}$
Dry heat induced attenuation (85℃ $\pm 2^\circ\text{C}$ , 30 days)		$\leq 0.05\text{dB/km}$
Water immersion induced attenuation (23℃ $\pm 2^\circ\text{C}$ , 30 days)		$\leq 0.05\text{dB/km}$
Damp heat induced attenuation (85℃ $\pm 2^\circ\text{C}$ , RH85%, 30 days)		$\leq 0.05\text{dB/km}$

## 3. Optical Cable

### 3.1 Cable structure



#### Technical Characteristics

- The unique second coating and stranding technology provide the fibers with enough space and bending, endurance, which ensure good optical property of the fibers in the cable
- Accurate process control ensures good mechanical and temperature performance
- High quality raw material supply the long service life of cable
- The filling compound structure is taken to ensure the cable watertight of cable core

### 3.2 Fiber & tube color code

Fiber color: according to EIA/TIA 598-A.

1	2	3	4	5	6
White	Blue	Pink	Orange	Green	Black
7	8				
Brown	Grey				

Tube color: according to EIA/TIA 598-A.

1	2	3	4	5	6
Red	Green	White	Orange	Black	Grey
7	8				
Brown	Violet				

### 3.3 Structure parameters

Item	Contents	Value		
Fiber count	/	16	32	48
Fiber type	/	G.652D		
Fiber No. per tube	/	4	4	8
Loose tube	Number	4	8	6



	Material	PBT		
	Nominal Diameter	1.8mm	1.8mm	2.1mm
Filler rod	Number	4	/	2
	Material	PBT tube with jelly		
	Nominal Diameter	1.8mm	/	2.1mm
Central strength member	Material	FRP		FRP /PE coated
	Nominal Diameter	3mm	3mm	3/3.6mm
Inner sheath	Material	LSZH		
	Color	Green RAL 6018		
	Nominal Thickness	1.3mm	1.3mm	0.9mm
Cable diameter $\pm 5\%$	mm	9.4	9.4	9.8
Cable weight $\pm 10\%$	kg/km	106	105	110

### 3.4 Mechanical & Environmental Performance

Tensile strength	Short term	2000N
Crush resistance	Short term	1500N/100mm
Min. bending radius	Installation	20 x OD
	Operation	10 x OD
Temperature range	Operation	-25℃ ~ +65℃
	Installation	-10℃ ~ +60℃
	Storage/transportation	-40℃ ~ +70℃

## 4. Test requirements

HTGD owns state-level Hi-trust transmission line laboratory (HTTL) which have passed China National Accreditation of laboratory accreditation (CNAS) and could conduct almost all kinds of testes related with optical fiber and cable.

### 4.1 Optical fiber test

During manufacturing period, all the optical fibers shall be tested in accordance with the following test method.

Item	Test method
<b>Optical characteristics</b>	
Mode field diameter	IEC 60793-1-45
Attenuation	IEC 60793-1-40
Cut-off wavelength	IEC 60793-1-44
Bending loss	IEC 60793-1-47
Chromatic dispersion	IEC 60793-1-42
PMD	IEC 60793-1-48
<b>Geometrical characteristics</b>	
Core diameter	IEC 60793-1-20



Drawing common		Loading cable and system supplier	
Cladding diameter			
Coating diameter			
Cladding non-circularity			
Core/cladding concentricity error			
Cladding/coating concentricity error			
Mechanical characteristics			
Proof test		IEC 60793-1-30	
Fiber curl		IEC 60793-1-34	
Coating strip force		IEC 60793-1-32	
Environmental characteristics			
Temperature induced attenuation		IEC 60793-1-52	
Dry heat induced attenuation		IEC 60793-1-51	
Water immersion induced attenuation		IEC 60793-1-53	
Damp heat induced attenuation		IEC 60793-1-50	

## 4.2 Optical cable test

The finished cables shall be conducted to test mechanical and environmental characteristics in accordance with the following requirements.

Item	Test Method	Acceptance Condition
Tensile Strength IEC 60794-1-2-E1	- Load: Short term tension - Length of cable: about 50m - Load time: 1min	- Fiber strain $\leq 0.33\%$ - No fiber break and no sheath damage.
Crush IEC 60794-1-2-E3	- Load: Short term crush - Load time: 1min	-After test, additional attenuation $\leq 0.1\text{dB}@1550\text{nm}$ - No fiber break and no sheath damage.
Impact IEC 60794-1-2-E4	- Points of impact: 3 - Times of per point: 1 - Impact energy:5J - Impact hammer radius:300mm	-After test, additional attenuation $\leq 0.1\text{dB}@1550\text{nm}$ - No fiber break and no sheath damage.
Repeated Bending IEC 60794-1-2-E6	- Bending radius: 20 x OD - No. of cycle: 25	-After test, additional attenuation $\leq 0.1\text{dB}@1550\text{nm}$ - No fiber break and no sheath damage.
Kink IEC 60794-1-2-E10	-Diameter of the loop 20 x D	-No Kink
Water Penetration IEC 60794-1-2-F5B	- Height of water: 1m - Sample length: 3m - Time: 24h	- No water leak from the cable core of the opposite end
Temperature Cycling IEC 60794-1-2-F1	- Temperature: -30°C~+60°C - Time of each step: 12h	- Loss change $\leq 0.1\text{dB/km}@1550\text{nm}$ - No fiber break and no sheath



	- Number of cycle: 2	damage.
Other parameters	According to IEC 60794.	

## 5. Packing and Marking

### 5.1 Packing

- 5.1.1 Each single length of cable shall be reeled on **Fumigated Wooden Drum** suitable for long-distance shipment.
- 5.1.2 Covered by plastic buffer sheet.
- 5.1.3 Sealed by strong wooden battens.
- 5.1.4 At least 1 m of inside end of cable will be reserved for testing.
- 5.1.5 Drum length: Standard drum length is **4.3km±3%**.

### 5.2. Marking

#### 5.2.1 Cable marking

**HTGD \*\*\*\*\* (Cable type) 201\* (Year) \*\*\* (Customer Info.) F\*\*\*\* (Cable No.) \*\*\*\*m (Length)**

#### 5.2.2 Marking plate

- Manufacturer name;
- Manufacturing year and month;
- Roll-direction arrow;
- Cable outer end position indicating arrow;
- Cable type and size;
- Drum number;
- Drum length;
- Gross / net weight;
- Caution plate indicating the correct method for loading, unloading and convey the cable;
- Other customer information such as contract no., project no., and delivery destination. (if needed)

#### 5.2.2 Cable identification documents

- Product qualified certificate
- Test report