

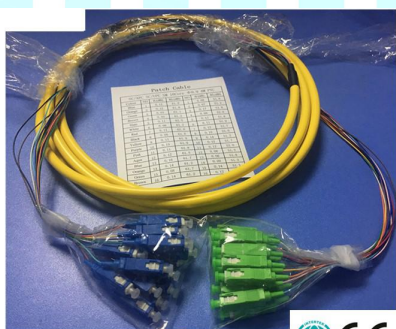
## 16 Core Bunch/Bundle PVC $\phi$ 13mm Fiber Optic Patch Cord

### SM G657.A2 ( $\phi$ 2.0mm), SC/UPC-SC/APC

**Product Ref.** : RT-PC-SC/UPC-SC/APC-SM-16C-G657A2-PVC-13mm $\phi$ -N meters

**Product Name** : Manguera con grosor de  $\phi$  13mm con 16 Latiguillos Simplex Modal 9/125, G657.A2 de 2mm  $\phi$  con Conectores SC/UPC-SC/APC (N) Metros, PVC

**H.S. CODE** : 8536700099



A Better Way

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## ● 1 Specifications & Outline drawing

Working temperature range √		-25°C~70°C √
Working humidity √		0%~95% √
Min. installation temperature √		-10°C √
Transport temperature range √		-5°C~50°C √
Application √		Indoor √
Service life √		≥15 years √
Reference √ standards √	Optical fiber √	ITU-T G.657 √
	Optical cable √	IEC 60794-2-50, YD/T 1258.2, UL1651, IEC 60332-1, IEC 60332-3-24, √ ITU-T G.657 √
	Connector √	YD/T 1272.3, IEC 61754-4, IEC61755-3-1, DKBA 6258 √
	Optical patch cord √	IEC61753-1, IEC61753-021-3, GR 326 √
Remark √		Other requirements not mentioned should fulfill the reference standards √ above. √

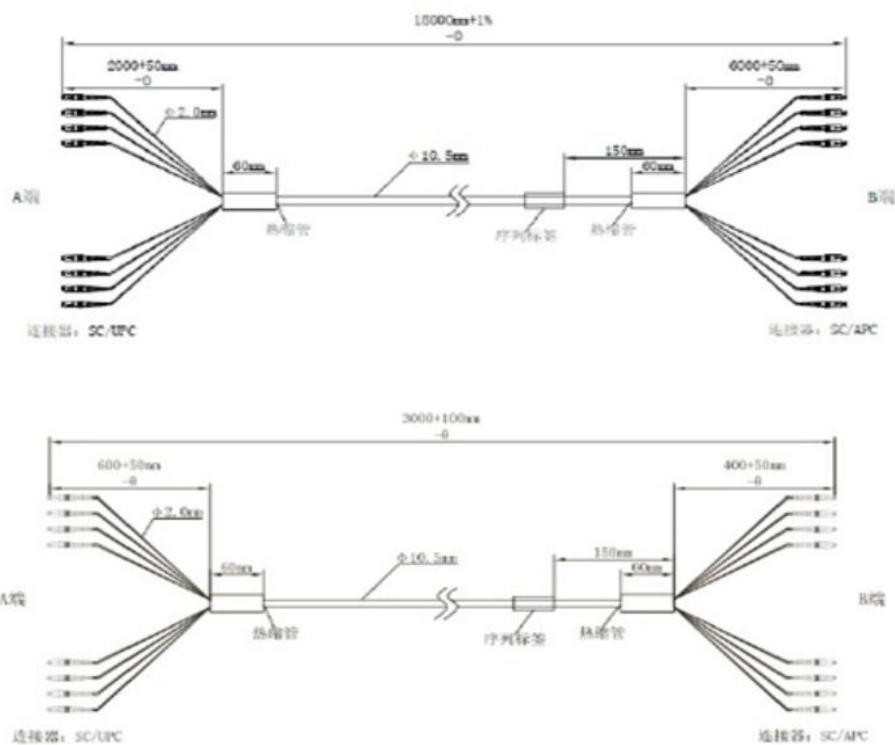
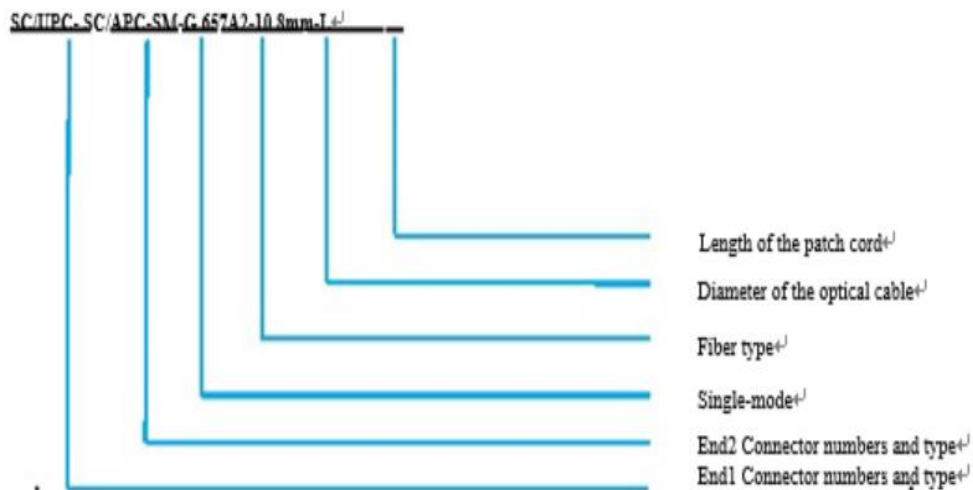


Figure 1 Optical patch cord outline drawing<sup>+</sup>

Notes: The unit is meter for L and millimeter for others.<sup>+</sup>

## ● 2. Reference as 8 Core Type and spec



## ● 3. Performances of optical patch cord (according to IEC 61753-1 and IEC 61753-021-3)

### 3.1 Insertion loss

Test method: IEC61300-3-4 (insertion method B)

Test wavelength: 1310 nm and 1550 nm.

Insertion loss: see table 2.

Notes:

Insertion Loss=attenuation-(A\*L)

Attenuation is summed loss include one connector and the optical cable

A is optical cable attenuation per kilometer

L is length of optical cable in km

A\*L may be ignored for the patch cord length is not more than 100m

Table 2. Insertion loss and return loss<sup>1)</sup>

Item <sup>1)</sup>	Connector 1(SC/UPC) <sup>1)</sup>	Connector 2(SC/APC) <sup>1)</sup>
Insertion loss(Max) <sup>1)</sup>	0.3dB <sup>1)</sup>	0.3dB <sup>1)</sup>
Return loss(Min) <sup>1)</sup>	50dB <sup>1)</sup>	60dB <sup>1)</sup>

### 3.2 Return loss

Test method: IEC61300-3-6 (OTDR method)

Test wavelength: 1310 nm and 1550 nm  
Return loss: see table 2.

### 3.3 Insertion loss (random mate)

Test method: IEC61300-3-34.

Test wavelength: 1310 nm and 1550 nm.

Mean IL  $\leq 0.25\text{dB}$ , max 0.5 dB for  $\geq 97\%$  of samples.

Notes:

Insertion Loss = attenuation - (A \* L)

Attenuation is summed loss include one connector and the optical cable

A is optical cable attenuation per kilometer

L is length of optical cable in km

A \* L may be ignored for the patch cord length is not more than 100m

### 3.4 Vibration (sinusoidal)

Table 3. Optical performance of initial, during and after test<sup>4)</sup>

Item <sup>4)</sup>	Initial test <sup>4)</sup>	During test <sup>4)</sup>	After test <sup>4)</sup>
Max. insertion loss <sup>4)</sup>	0.3dB <sup>4)</sup>	/ <sup>4)</sup>	/ <sup>4)</sup>
Maximum insertion loss variation for pigtail <sup>4)</sup>	/ <sup>4)</sup>	0.2dB <sup>4)</sup>	0.2dB <sup>4)</sup>
Maximum insertion loss variation for patch cord <sup>4)</sup>	/ <sup>4)</sup>	0.5dB <sup>4)</sup>	0.4dB <sup>4)</sup>
Min. return loss <sup>4)</sup>	50/60 dB <sup>4)</sup>	50/60 dB <sup>4)</sup>	50/60 dB <sup>4)</sup>

Test method: IEC61300-2-1

Test wavelength: 1550 nm

Frequency range: 10 Hz to 55 Hz

Change in frequency: 1 oct /min

Number of axes: three orthogonal

Number of sweeps (10-55-10 Hz) per axis: 15

Vibration amplitude: 0.75 mm

Sampling rate (IL and RL): initially, during and after each axis. Measurement interval during the test shall be < 2 ms and transient monitoring shall be performed according to IEC 61300-3-28.

Requirements: see table 3.

### 3.5 Cold

Test method: IEC61300-2-17

Test wavelength: 1550 nm

Temperature: -25°C

Duration of exposure: 96h

Sampling rate (IL and RL): initially, after test and at a maximum interval of 1 h during the test.

Requirements: see table 3.

### 3.6 High temperature endurance

Test method: IEC61300-2-18

Test wavelength: 1550 nm

Temperature: 70°C

Duration of exposure: 96h

Sampling rate (IL and RL): initially, after test and at a maximum interval of 1 h during the test.

Requirements: see table 3.

### 3.7 Damp heat cyclic

Test method: IEC61300-2-46

Test wavelength: 1550 nm

Temperature: 25 °C~55 °C

Humidity: >95 %  
Duration of exposure: 96h  
Sampling rate (IL and RL): initially, after test and at a maximum interval of 1 h during the test.  
Requirements: see table 3.

3.8 Change of temperature  
Test method: IEC61300-2-22.  
Test wavelength: 1550 nm  
Temperature:  $-25^{\circ}\text{C} \sim 70^{\circ}\text{C}$   
Duration of extreme temperatures: 1h  
Temperature rate of change:  $1^{\circ}\text{C}/\text{min}$   
Number of cycles: 12  
Sampling rate (IL and RL): initially at room ambient, after 0.5 h during each dwell (measurements to be completed during dwell) and at the end of the test at room ambient.  
Requirements: see table 3.

3.9 Flexing of the strain relief of fiber optic devices  
Test method: IEC61300-2-44  
Test wavelength: 1310 nm and 1550 nm  
Tensile load: 5N  
Angle:  $\pm 90^{\circ}$   
Number of cycles: 100  
Sampling rate (IL and RL): initially, during and at the end of the test. Measurement interval during the test shall be < 2 ms and transient monitoring shall be performed according to IEC 61300-3-28.  
Requirements: see table 3.

3.10 Cable retention  
Test method: IEC61300-2-4  
Test wavelength: 1550 nm  
Load: 100N at 5N/s  
Duration: 120s  
Sampling rate (IL and RL): initially and after the load has reached its maximum level and been maintained for 120 s.  
Requirements: see table 3.

3.11 Impact  
Test method: IEC61300-2-12, method A  
Test wavelength: 1550 nm  
Drop height: 1.5m  
Number of drops: 5 for each plug  
Sampling rate (IL and RL): initially and after the last drop.  
Requirements: see table 3.

3.12 Tensile strength of coupling mechanism  
Test method: IEC61300-2-6  
Test wavelength: 1550 nm  
Load: 40 N at 2 N/s  
Duration: 120 s  
Sampling rate (IL and RL): initially and after the load has reached its maximum level and been maintained for 120 s.  
Requirements: see table 3.

3.13 Static side load  
Test method: IEC61300-2-42  
Test wavelength: 1550 nm  
Load: 1 N

Duration: 1 h  
Sampling rate (IL and RL): initially and 3 min maximum intervals  
Requirements: see table 3

### 3.14 Mating durability

Test method: IEC61300-2-2  
Test wavelength: 1550 nm  
Coupling mechanism to be cycled: plug-adaptor  
Cycling rate: not less than 3 s between each engagement and separation  
Number of cycles: 500 minimum  
Sampling rate (IL and RL): measurements are recorded after every mating.  
Requirements: see table 3

### 3.15 Dust

Test method: IEC61300-2-27  
Test wavelength: 1550 nm  
Dust particle size:  $d < 150 \mu\text{m}$   
Dust type: talc  
Dust concentration:  $10.6 \text{ g/m}^3 \pm 7.1 \text{ g/m}^3$   
Temperature:  $+35^\circ\text{C}$   
Relative humidity: 60 %  
Duration of test: 10 min  
Sampling rate (IL and RL): initially and after the test at normal ambient conditions.  
Requirements: see table 3

### 3.16 Torsion

Test method: IEC61300-2-5  
Test wavelength: 1550 nm  
Tensile load: 15 N at a speed of 1 N/s  
Point of application of tensile load: 0.2 m from the endface of the connector  
Duration of the test: 25 cycles,  $\pm 180^\circ$   
Sampling rate (IL and RL): initially and at least once after the load has reached maximum level  
Requirements: see table 3

### 3.17 Bending moment

Test standard: IEC61300-2-7  
Test wavelength: 1550 nm  
Load: 10 N smoothly applied  
Sampling rate (IL and RL): initially and at least once after the load has reached its maximum level and been maintained for a minimum period of 30 s.  
Requirements: see table 3

### 3.18 Transmission with applied tensile load

Test wavelength: 1310 nm and 1550 nm  
Load: see table 4  
Test method: GR 326-4.4.3.5  
Requirements: see table 5

Table 4. Applied tensile load<sup>1)</sup>

Connector <sup>1)</sup>	Load (kg) <sup>1)</sup>		
	0° <sup>1)</sup>	90° <sup>1)</sup>	135° <sup>1)</sup>
SC <sup>1)</sup>	0.25 <sup>1)</sup>	0.25 <sup>1)</sup>	0.25 <sup>1)</sup>
	0.7 <sup>1)</sup>	0.7 <sup>1)</sup>	/ <sup>1)</sup>
	1.5 <sup>1)</sup>	1.5 <sup>1)</sup>	/ <sup>1)</sup>
	2 <sup>1)</sup>	/ <sup>1)</sup>	/ <sup>1)</sup>

Table 5. Optical performance with applied tensile load<sup>1)</sup>

Test <sup>1)</sup>	Insertion loss(dB) <sup>1)</sup>		Return loss(dB) <sup>1)</sup>
	Max. <sup>1)</sup>	Change value <sup>1)</sup>	Min. <sup>1)</sup>
Initial test <sup>1)</sup>	0.3 <sup>1)</sup>	/ <sup>1)</sup>	50/60 <sup>1)</sup>
During test, under load <sup>1)</sup>	/ <sup>1)</sup>	0.5 <sup>1)</sup>	50/60 <sup>1)</sup>
End of test <sup>1)</sup>	/ <sup>1)</sup>	/ <sup>1)</sup>	50/60 <sup>1)</sup>

### 3.19 Salt mist

Test method: IEC61300-2-26

Test wavelength: 1550 nm

Salt concentration 5 % NaCl (pH 6.5 to 7.2)

Temperature: +35 °C

Relative humidity: > 85 %

Duration of test: 96 h

Sampling rate (IL and RL): initially and after the test at normal ambient conditions.

Requirements:

1. See table 3
2. There is no visible evidence of the formation of corrosion under 5x magnification.

### 3.20 Dual 85 test

Test method: Huawei requirements

Temperature: 85 °C

Relative humidity: 85%

Requirements: there shall be no damage to the patch cord under visual inspection.

### 3.21. CE declaration

The patch cord should comply with 2011/65/EU.

## ● 4 Connector requirements

### ● 4.1 Ferrule dimension

Table 6. Ferrule dimension<sup>1)</sup>

Item <sup>1)</sup>	Connector 1(SC/UPC) <sup>1)</sup>	Connector 2(SC/APC) <sup>1)</sup>
Fiber height (A, note1) <sup>1)</sup>	-100nm~A <sub>max</sub> (note 2) <sup>1)</sup>	-100nm~A <sub>max</sub> (note 2) <sup>1)</sup>
Radius of curvature(B) <sup>1)</sup>	5mm~30mm <sup>1)</sup>	5mm~12mm <sup>1)</sup>
Apex offset(C) <sup>1)</sup>	0~70 $\mu\text{m}$ <sup>1)</sup>	0~70 $\mu\text{m}$ <sup>1)</sup>
Ferrule diameter	2.4985mm~2.4995mm <sup>1)</sup>	2.4985mm~2.4995mm <sup>1)</sup>

Note 1 A negative value indicates fiber protrusion.<sup>1)</sup>

Note 2 A<sub>max</sub>=1988 $\times (-0.795)-B\times 6+(B\times 6-C\times 0.5\times 3-80B101010)^{1)}$

#### 4.2 Color

Table 7. Connector color

Item	Connector 1(SC/UPC)	Connector 2(SC/APC)
Housing color	RAL5015, $\Delta E < 2$	RAL5015, $\Delta E < 2$
Boot color	RAL5015, $\Delta E < 2$	RAL5015, $\Delta E < 2$

#### 4.3 Ferrule compression force

Table 8. Ferrule compression force

Item	Connector 1(SC/UPC)	Connector 2(SC/APC)
Ferrule compression force	7.8N-11.8N(note 3)	7.8N-11.8N(note 3)

Note 3 Ferrule compression force shall be 7.8 N to 11.8 N, when the dimension H (see IEC 61754-4 figure 1) is 7mm $\pm$ 0.1mm.

## ● 5 Cable requirements

### ● 5.1 Fiber requirements

Item	Unit	Specification
Attenuation	dB/km	1310nm $\leq 0.4$ 1550nm $\leq 0.3$
Dispersion	Ps/nm.km	1285~1330nm $\leq 3.5$ 1550nm $\leq 18.0$
Zero dispersion wavelength	Nm	1300~1324
Zero dispersion slope	Ps/nm.km	$\leq 0.095$
Fiber cutoff wavelength	Nm	$\leq 1260$
Mode field diameter	Um	$9.2 \pm 0.5$
Mode field concentricity	Um	$\leq 0.8$
Cladding diameter	um	$125 \pm 1.0$
Cladding non-circularity	%	$\leq 1.0$
Coating/cladding concentricity error	Um	$\leq 12.5$
Coating diameter	um	$245 \pm 10$
bending,dependence attenuation	induced 1550nm, 1turns,32mm diameter 100turns,60mm diameter	$\leq 0.5$ db
Proof test	kpsi	$\geq 100$

## 5.2 As reference 8 core Cable section view

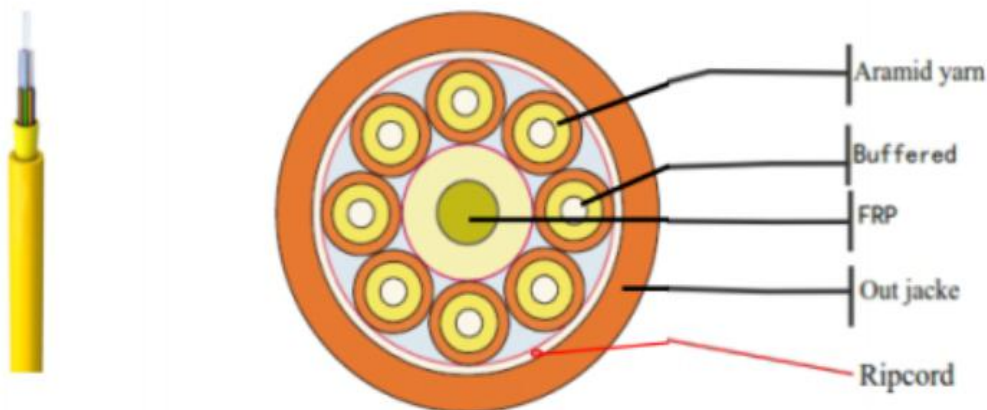


Figure 2 Optical cable section view

## 5.3 General requirements of optical cable

*Table 10. General requirements of optical cable*

1	–Fiber count-----2/4/6/8/12/16/24/48
2	–Fiber characteristic -----OD: $245 \pm 10 \mu\text{m}$
3	–2.0 simplex optical fiber cable : yellow or orange color with number print at jacket to distinguish with each <ul style="list-style-type: none"> <li>- White 0.9 mm PVC</li> <li>- OD: <math>0.87 \pm 0.05 \text{ mm}</math></li> <li>Thickness: <math>0.30 \pm 0.03 \text{ mm}</math></li> </ul>
4	–FRP as central strength member <ul style="list-style-type: none"> <li>- FRP+ Jacket</li> </ul>
5	–Out jacket: LSZH / PVC <ul style="list-style-type: none"> <li>- . Characteristic of out jacket</li> </ul>
	Color: according to the contract

#### 5.4 Mechanical requirements of optical cable (according to IEC60794-2-50)

##### 5.4.1 Tensile performance

Method: IEC 60794-1-2-E1A

Diameter of chuck drums and transfer devices: approximately 250mm

Rate of transfer device: 100 mm/min or 100N/min

Sample length: not less than 50m

Load: 100N for 5 min

Requirements:

1. Fiber attenuation at 1550nm wavelength  $\leq 0.1\text{dB} / 10\text{m}$  during the test.
2. Maximum increase in attenuation at 1550nm wavelength  $\leq 0.03\text{dB}$  after the test.
3. There shall be no damage to the cable elements under visual inspection.

##### 5.4.2 Crush

Method: IEC 60794-1-2-E3

Force: 500 N/10cm

Duration: 1 min

Length between test locations: 500 mm

Requirements:

1. Maximum increase in attenuation at 1550nm wavelength  $\leq 0.03\text{dB}$  after the test.
2. There shall be no damage to the cable elements under visual inspection

##### 5.4.3 Impact

Method: IEC 60794-1-2-E4

Radius of striking surface: 12.5 mm

Impact energy: 1.0 J

Number of impacts: at least 3, each separated at least 500 mm

Requirement: no fiber breakage, there shall be no damage to the cable elements under visual inspection.

##### 5.4.4 Repeat bending

Method: IEC 60794-1-2-E6

Bending radius: 30mm

Number of cycles: 200

Mass of weights: 2kg

Requirements:

1.  $\leq 0.1\text{dB}$  change in attenuation at 1550nm during the test.
2. There shall be no damage to the cable elements under visual inspection.

#### 5.4.5 Flexing

Method: IEC 60794-1-2-E8

Number of cycles: 300

Pulley diameter: 100mm

Mass of weights: 2kg

Requirements: no fiber breakage, there shall be no damage to the cable elements under visual inspection.

#### 5.4.6 Bending

Method: IEC 60794-1-2-E11A

Mandrel diameter: 60mm

Tensile: 10N

Number of turns per helix: 6

Number of cycles: 3

Requirements:

1.  $\leq 0.1\text{dB}$  change in attenuation at 1550nm during the test.

2. There shall be no damage to the cable elements under visual inspection.

#### 5.4.7 Torsion

Method: IEC 60794-1-2-E7

Number of cycles: 10

Distance between fixed and rotation clamp: 250mm

Tension load: 20 N

Torsion angle:  $\pm 180^\circ$

Requirements:

1.  $\leq 0.1\text{dB}$  change in attenuation at 1550nm during the test.

2. There shall be no damage to the cable elements under visual inspection.

#### 5.4.8 Kink

Method: IEC 60794-1-2-E10

Minimum loop diameter: 10mm

Requirement: no kink shall occur

#### 5.4.9 Sheath pull-off force

Method: IEC60794-2-50 Annex B.

Rate of separation:  $\leq 200\text{mm/min}$ .

Strip length: 50 mm.

Requirement: the force to strip the sheath shall not be greater than 15N.

#### 5.5 Environment performance of optical cable requirements (according to IEC60794-2-50 and YD/T1258.2)

##### 5.5.1 Temperature cycling

Method: IEC 60794-1-2-F1

Temperature:  $-25^\circ\text{C} \sim 70^\circ\text{C}$

Sample length: 1000m

Number of cycles: 2

The cooling and heating rate:  $1^\circ\text{C/min}$ . hold time at every temperature plateau should be 8h.

Requirements:

1. Maximum increase in attenuation at 1550nm wavelength  $\leq 0.5\text{dB/km}$  during test.

2. There shall be no damage to the cable elements under visual inspection.

##### 5.5.2 Cable bending at high temperature

Method: Huawei requirements

Temperature:  $130^\circ\text{C}$  for 1 hour

Bending diameter: 9mm

Number of turns per helix: 4

Requirement: no crack of cable sheath under visual inspection

### 5.5.3 Cable bending at high temperature

Method: Huawei requirements

Temperature :70°C for 5 hours

Bending diameter: 9mm

Number of turns per helix: 4

Requirement: no crack of cable sheath under visual inspection

### 5.5.4 Cable bending at low temperature

Method: IEC 60794-1-2-E11A (see IEC 60811-1-4, Clause 8)

Bending diameter: 60mm

Test temperature: -25°C for 8 hours

Number of turns per helix: 10

Number of cycles: 2

Requirements: no fiber shall break during the test, there shall be no damage to the cable elements

under

visual inspection.

### 5.5.5 Sheath shrinkage

Method: IEC 60794-2-50 Annex C.

Sample length: 1050mm

Exposure temperature: 70°C

Exposure duration: 24h per cycle

Number of cycles: 4

Requirement: the average of the sheath shrinkage values shall not exceed 20 mm.

### 5.5.6 Flammability

OFNR, IEC 60332-1 and IEC 60332-3-24

### 5.5.7 Dual 85 test

Test method: Huawei requirements

Temperature: 85 °C

Relative humidity: 85%

Duration of test: 1000 h

Requirements: there shall be no damage to the optical cable under visual inspection.

### 5.5.8 CE declaration

The finished cable shall comply with 2011/65/EU

## 5.6 Outer sheath mechanical performance

Outer sheath mechanical performance of indoor optical cable should meet the requirements of table 11.

*Table 11. Outer sheath mechanism performance*

Item	Requirements
Outer-sheath material	PVC
Un-aged mechanical performance	
Tensile strength, MPa	$\geq 12.5$
Elongation, %	$\geq 150$
Aging (100°C, 240H) mechanical performance	
After tensile strength variation absolute value, %	$\leq 20$
Elongation, %	$\geq 125$
Aging elongation variation absolute value, %	$\leq 20$

## 5.7 Cable marking

5.7.1 Marking should include following contents:

- a. UL certification code
- b. Manufacture name
- c. GJFJV G.652D or G657A1 or G657A2
- d. OFNR IEC 60332-1 and IEC 60332-3-24
- e. Month/Day/Year (e.g. 05/22/2008)
- f. Length: (xxxx m)

5.7.2 Continuity of marks

The distance between the beginning of the mark and the beginning of the next identical mark shall be 1000

mm (tolerance: 0mm~10mm). Each specified mark shall be regarded as continuous.

5.7.3 Durability

Test method: IEC 60794-1-2 E2B

Requirement: the surface marking words should be clear enough to identify after rubbing 5 times with a piece of cotton wool or cloth soaked in water.

5.7.4 Legibility

All markings shall be clear and natty, have no overprint and lack of printing. The colors of the identification threads shall be easy to recognize or easily made recognizable.

