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## Plastic Optical Fiber Connector

### Part 1: Type LC

塑料光纤活动连接器

第 1 部分：LC 型

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## Foreword

“Plastic Optical Fiber Connector” is currently divided into the following parts:

- Part 1: Type LC;
- Part 2: Type SC;
- Part 3: Type FC.

This Part is Part 1 of “Plastic Optical Fiber Connector”.

This Part was drafted according to the rules given in GB/T 1.1-2009.

This Part was prepared by reference to IEC 61754-20-2012 “Fibre Optic Connector Interfaces – Part 20: Type LC Connector Family”.

Please note that some of the contents of this document may involve patents. The issuing organization of this document does not undertake the responsibility for identifying any or all of these patents.

This Part was proposed by and shall be under the jurisdiction of China Communications Standards Association.

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# Plastic Optical Fiber Connector

## Part 1: Type LC

### 1 Scope

This Part specifies the terms and definitions, technical requirements, measurement and test methods, quality assessment procedure, inspection rules and marking, packaging, transport and storage for the Type LC family of plastic optical fiber connectors.

This Part is applicable to the Type LC plastic optical fiber connectors (hereinafter referred to as "Type-LC connector").

### 2 Normative References

The following documents are indispensable for the application of this document. For the dated references, only the edition cited applies. For the undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 2828.1-2003	Sampling Procedures for Inspection by Attributes - Part 1: Sampling Schemes Indexed by Acceptance Quality Limit (AQL) for Lot-by-lot Inspection
YD/T 1272.1-2003	Optical Fiber Connector - Part 1: Type LC
YD/T 1272.3-2005	Optical Fiber Connector - Part 3: Type SC
YD/T 1447-20xx	Plastic Optical Fiber for Communication
SJ/T 11363-2006	Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products
SJ/T 11364-2006	Marking for Control of Pollution Caused by Electronic Information Products
SJ/T 11365-2006	Testing Methods for Hazardous Substances in Electronic Information Products

### 3 Terms and Definitions

For the purposes of this document, the terms and definitions defined in YD/T 1272.1-2003 AND the following one apply.

### 3.1

#### Type LC plastic optical fiber connector

Type LC connector that is made from plastic optical fiber for communication.

## 4 Technical Requirements

### 4.1 Classification

#### 4.1.1 Plug interface

It may be divided into four types of interfaces according to the optical fiber cores and plug-pin outer diameter:

- a)  $\phi$ 1.250 plug-pin single-core plastic optical fiber plug interface;
- b)  $\phi$ 1.250 plug-pin dual-core plastic optical fiber plug interface;
- c)  $\phi$ 1.950 plug-pin single-core plastic optical fiber plug interface;
- d)  $\phi$ 1.950 plug-pin dual-core plastic optical fiber plug interface.

#### 4.1.2 Adaptor interface

It may be divided into 8 types of interfaces according to the optical fiber cores and application:

- a)  $\phi$ 1.250 sheath single-core plastic optical fiber connector adapter;
- b)  $\phi$ 1.250 sheath single-core plastic optical fiber connector active-device receptacle interface;
- c)  $\phi$ 1.250 sheath dual-core plastic optical fiber connector adapter;
- d)  $\phi$ 1.250 sheath dual-core plastic optical fiber connector active-device receptacle interface;
- e)  $\phi$ 1.950 sheath single-core plastic optical fiber connector adapter;
- f)  $\phi$ 1.950 sheath single-core plastic optical fiber connector active-device receptacle interface;
- g)  $\phi$ 1.950 sheath dual-core plastic optical fiber connector adapter;
- h)  $\phi$ 1.950 sheath dual-core plastic optical fiber connector active-device receptacle interface.

**Table 4 Mating dimensions of Single-core and Dual-core Active-device Receptacle Interfaces**

Mark	Unit	Minimum	Maximum	Notes
A <sup>a,b</sup>	mm	-	-	Inner diameter of alignment-device, see Table 5
B	mm	9.9	10.0	
C	mm	4.5	-	
D	mm	3.4	3.5	
E	mm	2.6	2.7	
F	mm	0.2	0.3	Radius of curvature
G	mm	4.0	4.1	
H <sub>1</sub> <sup>c</sup>	mm	4.60	4.75	
H <sub>2</sub> <sup>c</sup>	mm	4.60	4.75	
I	mm	2.87	2.97	Diameter
J	mm	2.29		Basic dimension
K <sup>d</sup>	mm	6.25		Basic dimension
L <sup>c</sup>	°	-	0.2	
M	mm	1.0	1.1	
N	mm	0.5	0.6	
O	mm	-	1.3	
P	°	15		Typical value
AO	mm	11.0	12.8	
AP	mm	14.5	14.7	
AQ	mm	2.2	2.4	Diameter
AR	mm	1.1	1.2	
AS	mm	6.6	6.8	
AT	mm	0.6	0.7	
AV	mm	1.0	1.1	
AW	mm	0.5	0.6	Grade, see Table 5
AX	mm	1.9	-	

a The connector alignment-device is a rigid bore sheath or resilient alignment sheath. Dimension A defines the inner diameter of the alignment-device.

b The sheath may be fixed or floating. For a fixed sheath, the positional tolerance applies. For a floating sheath, a pin-gauge inserted in the sheath must be capable of moving freely into a position such that it is coincident with datum B.

c Taper (oblique), dimension L, is applied to the surfaces associated with dimensions/features H<sub>1</sub> and H<sub>2</sub>.

d Each of the units in the dual-core active-device receptacle shall comply with all dimensions of Figure 6, except the added dimension K, distance between dual-core active-device receptacles.

#### 4.2.6 Alignment sheath grade of adapter and active-device receptacle

See Table 5 for the classification of adapter and active-device receptacle interfaces (i.e. alignment sheath grade).

### **4.3 Materials**

Plastic optical fibers, as specified in YD/T 1447-20xx, including polymethylmethacrylate (PMMA) and fluorinated plastic, are recommended for Type-LC connectors.

The materials and plastic optical fiber cables used in Type-LC connector must be guaranteed aging-free and conforming to environmental protection requirements. They shall withstand the test conditions required for connectors. The adhesive applied to connector shall have no adverse effects on the connector structure and have its physical, chemical and optical properties compatible with plastic optical fibers, and shall not introduce any damage to the connector's optical performance.

### **4.4 Standard Connector**

#### **4.4.1 General**

A standard connector is one set of precisely-manufactured or well-selected connectors, including standard plug and standard adapter. It is used as a reference standard for connector measurement of optical performance. Therefore, it subjects to higher requirements for dimensional tolerances and optical performance.

#### **4.4.2 Optical performance of Type-LC standard connector**

Type-LC standard connector shall meet the following optical performance requirements:

The insertion loss of the connection of two standard plugs made with standard adapter shall be  $\leq 1.5$  dB (for PMMA plastic optical fiber) and 1.0 dB (for fluorinated plastic optical fiber).

### **4.5 Optical Performance of Type-LC Connector**

#### **4.5.1 Optical performance of Type-LC connector plug**

Type-LC connector plug shall meet the following optical performance requirements:

- a) The insertion loss of the connection between any plug and the standard plug made with standard adapter shall be  $\leq 2.0$  dB (for PMMA plastic optical fiber) and  $\leq 1.5$  dB (for fluorinated plastic optical fiber);
- b) The insertion loss of the connection between any two plugs made with random adapter shall be  $\leq 2.3$  dB (for PMMA plastic optical fiber) and  $\leq 1.8$  dB (for fluorinated plastic optical fiber).

#### **4.5.2 Optical performance of Type-LC connector adapter**

The additional insertion loss of the connection using Type-LC adapter shall be  $\leq 0.3$

The sample tested shall be free of mechanical damages, e.g. deformation, cracking and looseness. The change in insertion loss shall be  $\leq 0.3$  dB.

#### **5.5.5 Vibration (sinusoidal)**

The test shall be carried out according to 6.6.4 of YD/T 1272.3-2005.

The sample tested shall be free of mechanical damage, e.g. deformation, cracking and looseness. The change in insertion loss shall be  $\leq 0.3$  dB.

#### **5.5.6 Drop**

The test shall be carried out according to 6.6.5 of YD/T 1272.3-2005. The drop height used shall be as  $H = 1.5$  m.

The sample tested shall be free of mechanical damage, e.g. deformation, cracking and looseness. The change in insertion loss shall be  $\leq 0.3$  dB.

#### **5.5.7 Insertion and extraction forces**

The test shall be carried out according to 6.6.7 of YD/T 1272.3-2005.

The sample tested shall be free of mechanical damage, e.g. deformation, cracking and looseness. The change in insertion loss shall be  $\leq 0.3$  dB.

#### **5.5.8 Repeatability**

The test shall be carried out according to 6.6.8 of YD/T 1272.3-2005.

The sample tested shall be free of mechanical damage, e.g. deformation, cracking and looseness. The change in insertion loss shall be  $\leq 0.3$  dB.

#### **5.5.9 Mechanical durability**

The test shall be carried out according to 6.6.9 of YD/T 1272.3-2005.

The sample tested shall be free of mechanical damage, e.g. deformation, cracking and looseness. The change in insertion loss shall be  $\leq 0.3$  dB.

#### **5.5.10 Tensile strength of latch mechanism (for optical cables with outer sheath only)**

The test shall be carried out according to 6.6.10 of YD/T 1272.3-2005.

The sample tested shall be free of mechanical damage, e.g. deformation, cracking and looseness. The change in insertion loss shall be  $\leq 0.3$  dB.

#### **5.5.11 Tensile strength of optical cable (for optical cables with outer sheath only)**



The test shall be carried out according to 6.6.11 of YD/T 1272.3-2005.

The sample tested shall be free of mechanical damage, e.g. deformation, cracking and looseness. The change in insertion loss shall be  $\leq 0.3$  dB.

#### **5.5.12 Torsion of optical cable (for optical cables with outer sheath only)**

The test shall be carried out according to 6.6.12 of YD/T 1272.3-2005.

The sample tested shall be free of mechanical damage, e.g. deformation, cracking and looseness. The change in insertion loss shall be  $\leq 0.3$  dB.

## **6 Procedure of Quality Assessment**

### **6.1 General**

The procedure of quality assessment includes qualification approval procedure and quality conformity inspection.

### **6.2 Qualification Approval Procedure**

#### **6.2.1 Initial manufacturing stage**

It is defined as the manufacturing stage where single-element parts are assembled into Type-LC connector.

#### **6.2.2 Structure-similar component**

For qualification approval inspection and quality conformity inspection, structure-similar component is defined by:

- a) the same mating dimensions;
- b) manufactured with basically same materials;
- c) manufactured with basically same design;
- d) manufactured with basically same process and technique;
- e) using the same plastic optical fiber fixation technique;
- f) using the same plastic optical cable fixation technique;
- g) using the same alignment technique.

#### **6.2.3 Approval procedure**

##### **6.2.3.1 General**

**Table 7 Fixed Sample Quality Inspection Procedure**

Inspection sequence	Applicable method	Quantity of Plug(s)
Group 0 inspection		
- appearance inspection	5.1	20
- appearance dimensions	5.2	
Group 1 inspection		
- insertion loss of plug	5.4.1	20
- additional insertion loss of adapter	5.4.2	
Group 2 inspection		
- low temperature	5.5.1	6
- high temperature	5.5.2	
- damp-heat (steady-state)	5.5.3	
Group 3 inspection		
- temperature cycling	5.5.4	6
- vibration	5.5.5	
- drop	5.5.6	
Group 4 inspection		
- insertion and extraction forces	5.5.7	4
- repeatability	5.5.8	
- mechanical durability	5.5.9	
Group 5 inspection		
- tensile strength of latch mechanism	5.5.10	4
- tensile for optical cable	5.5.11	
- torsion for optical cable	5.5.12	
In order to satisfy the requirements of qualification approval, no test items in each group shall fail. In case of failure, the cause shall be examined and analyzed; double quantity of samples shall be re-drawn for the inspection on the failed items. It is regarded as acceptable provided such re-inspection is passed. The frequency of re-inspection shall not exceed two and shall be indicated in detailed in report.		

### 6.3 Quality Conformity Inspection

#### 6.3.1 General

It refers to the product quality inspection at normal production, including lot-by-lot inspection and periodic inspection.

#### 6.3.2 Lot-by-lot inspection

Lot-by-lot inspection includes the Groups A and B inspections as specified in Table 8. The samples to be inspected shall be randomly taken from recent lot production according to the quantity as specified in GB/T 2828.1-2003. The test samples shall meet the required optical performance as specified in 4.5.

Once the inspection is successfully completed, all specifications of the products submitted as structure-similar component will be regarded as passing.

**Table 8 Lot-by-lot Quality Inspection Procedure**

Inspection sequence	Applicable method	Given level	
		IL	AQL
Group A - appearance inspection - appearance dimensions	5.1 5.2	II	4%
Group B - insertion loss of plug - additional insertion loss of adapter	5.4.1 5.4.2	II	4%
Note: IL denotes the inspection level; AQL is acceptable quality level.			

### 6.3.3 Periodic inspection

Periodic inspection includes Group C or Group D inspections as specified in Table 9. An inspection period shall be so maintained mutually as to replace the Group C inspection with Group D inspection within the Group D period. Once the inspection is successfully completed, all specifications of the products submitted as structure-similar component will be regarded as passing the periodic inspection.

#### a) Sample

The sample to be tested shall be a complete connector manufactured from the plastic optical fiber/optical cable of the minimum core diameter as specified for the optical fiber used in connector and shall be randomly drawn from the product lot. After the sample inspections of "C0" or "D0" group are completed, the samples for other groups shall be randomly drawn from the "C0" or "D0" samples.

#### b) Test

The tests shall be carried out according to the method and sequence as specified in Table 9. After the tests, the samples shall meet the optical performance as specified in 4.5 and applicable test requirements as specified in 5.5.

## **8 Marking, Packaging, Transport and Storage**

### **8.1 Marking**

#### **8.1.1 General marking**

The product model, production lot, date of manufacture, name of manufacturer, and reference of applicable standard shall be marked on the product packaging.

#### **8.1.2 Pollution control marking**

The pollution control marking for electronic information product shall be printed on the packing case (bag) as specified in Chapter 6 of SJ/T 11364-2006.

### **8.2 Packaging**

Products shall be well packed; both the plug and adapter/receptacle of each connector shall be well covered with protective cap. Optical fibers and cables with plug shall be well maintained in coils which shall not be less than 100 mm in diameter.

### **8.3 Transport**

When the products are subjected to long-distance transportation, wooden case or hard carton shall be used for external packaging on which written indication that no hard casting, impact or compression shall be expressly provided. A marking for rain protection shall be provided in order to avoid damage to the product.

### **8.4 Storage**

The product shall not be stored in open air or badly corrosive environment for long term but shall be stored at a temperature range of  $-10^{\circ}\text{C}\sim+60^{\circ}\text{C}$ . Products expected with more than 12 months of storage duration shall, before release, have insertion loss test as specified in 5.4 and can be released provided passing the test.

\_\_\_\_\_ **END** \_\_\_\_\_