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Field-mountable optical fiber connectors - Part 1: Mechanical type

现场组装式光纤活动连接器 第 1 部分：机械型

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Field-mountable optical fiber connectors - Part 1: Mechanical type

1 Scope

This Part specifies the requirements, measurement and testing, quality assessment procedures, inspection rules, markings, packaging, transportation, storage of mechanical type field-mountable optical fiber connectors (also known as mechanical optical fiber quick connectors, hereinafter referred to as mechanical field-mountable connectors).

This Part applies to mechanical type field-mountable fiber optical connectors.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) is applicable to this standard.

GB/T 2421.1-2008 Environmental testing for electric and electronic products - General and guidance

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

GB/T 5169.16-2008 Fire hazard testing for electric and electronic products - Part 16: Test flames - 50W horizontal and vertical flame test methods

YD/T 1272.1-2003 Optical fiber connector - Part 1: type LC

YD/T 1272.3-2005 Optical fiber connector - Part 3: Type SC connector family

YD/T 1272.4-2007 Optical fiber connector - Part 4: Type FC

YD/T 2152-2010 The requirement of reliability and test methods for optical fiber connectors

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

a) Plug type;

- FC type plug;

- SC type plug;

- LC type plug.

b) Plug receptacle type:

- FC type plug receptacle;

- SC type plug receptacle;

- LC type plug receptacle.

4.1.1.2 Classification by the end face of ferrule

According to the shape of the end face of the ferrule, it can be divided into the following two types:

a) PC type or UPC type;

b) APC type.

Note: The physical structure of the UPC (Ultral PC [Translator note: should be Ultra]) type pin is the same as that of the PC type, however, the return loss is higher than that of the PC type.

4.1.1.3 Classification by applicable optical fiber or cable type

According to the matching optical fiber or optical cable, it can be divided into the following two types:

a) Optical fiber type: It is a field-mountable optical fiber connector, which is terminated on 250 μm pre-coated optical fiber or 900 μm tight-sleeved optical fiber;

b) Optical cable type: It is a field-mountable optical fiber connector, which is terminated on the cable sheath. Optical cable types include butterfly drop cables, round single-core optical cables or other optical cables.

4.1.1.4 Classification by the number of connection points

According to the number of connection points, it can be divided into the following two types:

a) Single jointed connector assembly;

of SJ/T 11363-2006. The refractive index of the materials, which match the refractive index used internally, needs to be close to that of the fiber core. The material shall be stable and reliable for a long time.

4.4 Appearance, structure, end face requirements of ferrule

4.4.1 Appearance and structure requirements

The assembled field-mountable optical fiber connector shall be smooth, clean, free of oil and burrs, free of scars and cracks, bright in color, sound in consistency. All parts and components shall be flatly assembled. The insertion and pull-out of the adapter shall be smooth and easy; the clamping is tight.

4.4.2 Requirements for the end face of ferrule

The end face of the ferrule of the field-mountable optical fiber connector plug shall not have obvious oil stains and dirt. There is no obvious impurity, crack, scratch, in the ceramic part. When observing the end face of the central optical fiber, under a 200x microscope, it is required that there be no obvious white spot (chip), black spot (dirt), shadow (internal crack). The scratches cannot pass through the light-transmitting part of the optical fiber. When observed with a light passer, the emitted light spot is normal.

The number of connectors is multi-point type. The geometrical size requirements of the ferrule's end face of the mechanical field-mountable connector, of the plug type connector structure, shall meet the requirements of clause 5.3.2.2 of YD/T 2152-2010.

4.5 Field assembly requirements for mechanical field-mountable connectors

4.5.1 Average assembly time

The average assembly time of mechanical field-mountable connectors refers to the total time -- which is required for several samples, FROM stripping the fiber or cable TO the completion of assembly, divided by the number of qualified samples -- thereby obtaining the average assembly time, which is required for assembly of a single device. For optical fiber mechanical field-mountable connectors, the average assembly time shall be within 4 min. For optical cable mechanical field-mountable connectors, the average assembly time shall be within 5 min.

4.5.2 Success rate of one-time assembly

Within the assembly time, which is required by clause 4.5.1, if the number of samples for the assembly success rate of mechanical field-mountable connectors (insertion loss and return loss shall meet the requirements of Table

5.1.2.2 Measurement and test light source for multi-mode mechanical field-mountable connector

The LED light source shall be used, when measuring the multi-mode mechanical field-mountable connector. The peak point wavelength is 850 nm/1300 nm. Because the mode distribution changes of the measurement system, which is caused by fiber disturbance, will affect the measurement results, it shall use the LED or other incoherent light sources. Meanwhile, it shall use a mode scrambler, in the pigtail, to remove undesirable instantaneous high-order modes. The multi-mode fiber scrambler consists of optical fiber, which tightly winds 5 rounds on a smooth mandrel. The diameter of the mandrel is based on the criterion that, the instantaneous high-order mode can be attenuated, to achieve a steady-state mode. Typical core diameter is as follows: The 50 μm core diameter fiber has a core diameter of 18 mm; the 62.5 μm core diameter fiber has a core diameter of 20 mm (if optical cable is used, the core diameter minus the cable diameter correspondingly).

5.1.3 Standard connector

When testing the optical performance of FC-type mechanical field-mountable connectors, the standard connectors used shall meet the requirements of clause 4.3 of YD/T 1272.4-2007. When testing the optical performance of SC-type mechanical field-mountable connectors, the standard connectors used shall meet the requirements clause 4.3 of YD/T 1272.3-2005. When testing the optical performance of LC-type mechanical field-mountable connectors, the standard connectors used shall meet the requirements of clause 4.3 of YD/T 1272.1-2003.

5.1.4 Preparation before measurement

Before the measurement, it shall use lint-free fiber paper or absorbent cotton, to wipe and clean the ferrule and the end surface as well as the inner surface of the adapter sleeve. If necessary, use absolute ethanol to scrub it.

5.1.5 Specimen

The samples for mechanical performance test and environmental performance test are all samples that have passed the field assembly test and passed the insertion loss and return loss tests.

5.2 Field assembly test

5.2.1 Conditions

The field assembly test is usually carried out, at the same time as the test procedures in clauses 5.4 and 5.5. The following items must be provided, before assembly and testing:

a) The mechanical field-mountable connector, which has a sample number "N" of 40;

b) Pigtail connector, which has ordinary plug, at the end; the length is about 3 m ~ 5 m; the optical fiber or optical cable shall be the same as the optical fiber or optical cable, which is required by the fusion splice field-mountable connector model;

c) Common or special construction tools;

d) Measuring instruments, which meet the test conditions in clauses 5.4 and 5.5.

5.2.2 Procedure

At the test site, assemble the mechanical field-mountable connector on the pigtail connector sample. Use the test procedures in clause 5.4 and clause 5.5, to measure the insertion loss and return loss. Record the total time, "T", which is required for assembly and testing of the sample. Record the number of qualified mechanical field-mountable connectors, "N1", that meets the requirements of clause 5.4 and clause 5.5. Samples that fail to be assembled can be disassembled and re-assembled; however, the time spent shall be included in the time, "T"; the number of successful reassembled connections is counted in "N1".

5.2.3 Average assembly time

The average assembly time is the total assembly time, "T", divided by the number of qualified assembled samples "N1".

5.2.4 Assembly success rate

Within the time specified in clause 4.5.1, it is the number of qualified assembled samples "N1" divided by the number of samples "N".

5.2.5 Test results

The average assembly time and assembly success rate shall meet the requirements in clause 4.5.

5.3 Appearance and size inspection

Check the assembled mechanical field-mountable connector, by visual inspection. The appearance shall meet the requirements in clause 4.4.1.

Use a caliper to measure the length of the assembled mechanical field-mountable connector. The length shall meet the requirements of clause 4.2.

temperature environment for 2 h. Test and record the insertion loss value and return loss value.

c) Situation after the test

After the test, the test results of the change in insertion loss, the change in return loss, the change in appearance of the specimen, shall meet the requirements of the serial number a, in Table 3.

5.7 Low temperature

Perform low temperature measurement of mechanical field-mountable connectors, as follows:

a) Conditions

Temperature: -40 °C;

Duration: 96 h.

b) Procedure

Pre-treat the specimen at room temperature. Measure the insertion loss and return loss of the specimen, as the original value before the test. Then place the specimen, in a thermostatic freezer, which has an accuracy of ±2 °C, at a temperature of -40 °C. Keep it at a constant temperature for 96 h. After the test is over, take the specimen out. Place it in a room temperature environment for 2 h. Test and record the insertion loss and return loss values.

c) Situation after the test

After the test, the test results of the change in insertion loss, the change in return loss, the change in appearance of the specimen, shall meet the requirements of the serial number b in Table 3.

5.8 Temperature cycle

Perform temperature cycle measurement of mechanical field-mountable connectors, as follows:

a) Conditions

Extreme low temperature: T_a = -40 °C;

Extreme high temperature: T_b = +80 °C;

Number of cycles: 12 cycles.

Duration: 96 h.

b) Procedure

Pre-treat the specimen, at room temperature. Measure the insertion loss and return loss of the specimen, as the original value before the test. Then place the specimen in a constant temperature and humidity box, which has a temperature accuracy of ±2 °C AND a humidity accuracy of ±2%. Connect the two ends of the specimen to the light source and the optical power meter, respectively. Set the temperature and humidity, as required. Maintain constant temperature and humidity for 96 h. Record the insertion loss value, every 6 hours (record data changes online). After the test is over, take the specimen out. Place it in an ambient temperature environment, for 2 h. Test and record the insertion loss value and the return loss value.

c) The situation after the test

During and after the test, the test results of the change in insertion loss, the change in return loss, the change in appearance of the specimen, shall meet the requirements of the serial number d in Table 3.

5.10 Immersion (optional)

Perform the water immersion measurement of the mechanical field-mountable connector, as follows:

a) Conditions

Water tank environment: (25 ± 2) °C, deionized water/distilled water;

Duration: 144 h.

b) Procedure

Pre-treat the specimen, at room temperature. Measure the insertion loss and return loss of the specimen, as the original value before the test. Then put the specimen in a water tank, which has an accuracy of ±2 °C, at a temperature of 25 °C. Keep it for 144 h. Then take the specimen out. Place it in an ambient temperature environment for 24 h. Test and record the insertion loss and return loss values.

c) The situation after the test

After the test, the test results of the change in insertion loss, the change in return loss, the change in appearance of the specimen, shall meet the requirements of the serial number e in Table 3.

5.11 Vibration (sinusoidal)

Perform vibration measurement of mechanical field-mountable connectors, as follows:

a) Conditions

Frequency range: 10 Hz ~ 55 Hz;

Frequency sweep requirements: The frequency of scanning shall be 1 octave per minute;

Amplitude: 0.75 mm single amplitude;

Duration: 30 min each, in two vertical directions.

b) Procedure

Pre-treat the specimen, at room temperature. Measure the insertion loss and return loss of the specimen, as the original value before the test. Fix the specimen on a special vibration bench. At an amplitude of 0.75 mm AND a continuous frequency sweep range of 10 Hz ~ 55 Hz, vibrate in each direction for 30 min. After the vibration is over, measure and record the insertion loss and return loss.

c) The situation after the test

After the test, the test results of the change in insertion loss, the change in return loss, the change in appearance of the specimen, shall meet the requirements of the serial number f in Table 3.

5.12 Drop

Perform the drop measurement of the mechanical field-mountable connector, as follows:

a) Conditions

Drop height: 1.5 m away from the specimen head;

Number of drops: 8 times;

b) Procedure

Pre-treat the specimen, at room temperature. Measure the insertion loss and return loss of the specimen, as the original value before the test. Then put a protective dust cap on the head of the mechanical field-mountable connector specimen. Fix the tail of the optical cable or optical fiber, at a

a) Conditions

Assembly times: 3.

b) Procedure

Pre-treat the specimen, at room temperature. Measure the insertion loss and return loss of the specimen, as the original value before the test. Then disassemble the assembled mechanical field-mountable connector specimen. Remake the fiber end face, according to the assembly procedure. Reassemble the connector. Assemble 3 times, in a row. After each assembly is completed, it needs to measure and record the insertion loss and return loss.

c) Situation after the test

After the test, the test results of the change in insertion loss, the change in return loss, the change in appearance of the specimen, shall meet the requirements of No.1 in Table 3.

6 Quality assessment procedures

6.1 Classification of quality assessment procedures

The quality assessment procedure includes appraisal approval procedure AND quality consistency inspection.

6.2 Appraisal approval procedures

6.2.1 Initial manufacturing stage

The initial manufacturing stage of mechanical field-mountable connectors is the manufacturing stage, of assembling parts into saleable units AND packaging them.

6.2.2 Components with similar structure

For structurally similar components, it stipulates the types and specifications of components, which can be grouped together, for appraisal approval and quality consistency inspection purposes.

Mechanical field-mountable connectors can be considered as structurally similar components, as long as they belong to the following conditions:

- Have a common design, size, purpose, performance level (multi-mode mechanical field-mountable connectors cannot be used for quality assessment of single-mode mechanical field-mountable connectors, of the

same structure);

- The results, which are obtained from a given test, as performed on one of these devices, can be considered valid for other devices with similar structures;

- Produced by the same manufacturer with basically the same materials, processes, methods, and at the same time.

6.2.3 Appraisal approval requirements

The appraisal approval requirements are as follows:

a) The manufacturer shall comply with the requirements for completing the initial manufacturing stage, as specified in clause 6.2.1;

b) The manufacturer shall comply with the structural similar limits of the device varieties and specifications, which are included into a group, during the identification specified in clause 6.2.2;

c) The manufacturer shall provide a test certificate, showing that the qualification requirements of this part have been successfully completed.

In order to obtain appraisal approval, one of the following procedures shall be used:

- Appraisal of fixed sample procedures;

- Identification of batch-by-batch and periodic inspection procedures.

6.2.4 Approval procedures

6.2.4.1 Appraisal using a fixed sample procedure

The fixed sample appraisal procedure consists of samples, which meet the requirements of this clause a), AND the test procedures of this clause b).

Once the tests in b) of this clause have been successfully completed, all specification products, which are submitted as structurally similar components, will pass the appraisal approval.

The requirements for samples and test procedures are as follows:

a) Sample

- Fixed sample inspection plan may require more than one device type. The sample of the tested type shall be a product, which is produced by the equipment and procedures currently used in production; meanwhile

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