LC connectors Technical Requirements

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Nippon Telegraph and Telephone Corporation

PREFACE

This document describes the technical conditions specified commonly for LC connectors used at Nippon Telegraph and Telephone Corporation (NTT). NTT hopes that this document will be useful for all designers and manufacturers of communication systems, equipment, and optic connector components.

The contents in this document may be altered without prior notice at the time of revision of related standards, at the time of introducing new technologies, or at the time when the conditions required of the system are modified.

The technical conditions in this document do not contain descriptions of the proprietary information or unique know-how owned by Nippon Telegraph and Telephone Corporation. At the time of providing specifications containing such proprietary information or unique know-how, it is necessary to take proper procedures such as contracts of technology disclosure, etc.

This edition relates to the standards established for LC connectors (plugs, adaptors, as well as receptacles).

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CONTENTS

1. Outline

This document describes the technical conditions specified commonly for LC connectors used at Nippon Telegraph and Telephone Corporation (NTT).

2. Related standards

The standards listed below shall be construed to be part of these technical requirements when they are quoted in these technical requirements. Further, the latest versions of the standards quoted in these technical requirements shall be applicable, unless otherwise specified herein.

- IEC 60793-2, Optical fibres - Part2: Product specification – General
- IEC 60794-1-1, Optical fibre cables – Part 1-1: Generic specification – General
- IEC 60874-1, Fibre optic interconnecting devices and passive components - Connectors for optical fibres and cables – Generic specification
- IEC 61300 series, Fibre optics interconnecting devices and passive components - Basic test and measurement procedures
- IEC 61754-20, Fibre optic devices and passive components - Fibre optic connector interfaces – Part 20: Type LC connector family
- IEC 61755-3-1, Fibre optic connector optical interfaces – Part 3-1: Optical interfaces、2,5mm and 1,25 mm diameter cylindrical full zirconia PC ferrule, single mode fibre
- IEC 62150-3 Fibre optic active components and devices - Test and measurement procedures - Part 3: Optical power variation induced by mechanical disturbance in optical receptacles and transceiver interfaces
- ITU-T G.652 Characteristics of a single-mode optical fibre cable

3. Terms and definitions

For the purposes of this document, the terms and definitions apply in Table 1. Other major technical terms are according to IEC 60793-2, IEC 60794-1-1, IEC 60874-1, IEC 61753-021-3, 61754-20, IEC 61755-1, IEC 61755-3-1, IEC 62150-3, and IEC 61300 series.

Table 1 - Terms and definitions

No.	Technical term	Definition
1	LC connector	An optical fiber connector that conforms to the dimension stipulated in “IEC 61754-20 Fibre optic connector interfaces – Part 20: Type LC connector family”.
2	plug	A connector attached to an optical fiber cord.
3	adaptor	A connector which connects one plug with another.
4	receptacle	A connector attached to a panel or chassis, which can mate plugs.
5	AdPC Polishing	Advanced Physical Contact polishing, a method to make the endface of a fiber connector ferrule convex spherical by polishing so that its return loss becomes 40dB or more.
6	SM optical fiber	A silica glass single-mode optical fiber.
7	optical transceiver interface	The part of an optical transceiver, which can mate plugs.

4. Types

Descriptions for the types of LC connectors are listed in Table 2.

Table 2 – The types of LC connectors

No.	Type of LC connectors	Description	Reference
1	LC simplex plug connector	A plug which can be attached to a SM optical fiber cord 2.0 mm or 1.7mm in diameter. Its ferrule endface is AdPC polished.	IEC 61754-20 : Interface 20-1
2	LC simplex adaptor	An adaptor which connects one LC simplex plug connector with another.	IEC 61754-20 : Interface 20-2
3	LC duplex adaptor	An adaptor which connects two LC simplex plug connectors with another two.	IEC 61754-20 : Interface 20-5
4	LC duplex active device receptacle	A receptacle used as an optical transceiver interface, which mates two LC simplex plug connectors.	IEC 61754-20 : Interface 20-6

5. Performance

5. 1 Performance criteria

The optical performance of LC simplex plug connector, LC simplex adaptor, and LC duplex adaptor shall meet the requirements as defined in Table 3.

Table 3 - Requirements

Test name	Test method	Initial	During/after test
Attenuation	IEC 61300-3-34	≤0.50 dB max.	
Return loss	IEC 61300-3-6	≥40 dB	
Monitoring change in attenuation and in return loss	IEC 61300-3-3		Maximum attenuation variation ≤0.2 dB during and after test Return loss ≥ 40 dB during and after test

5. 2 Performance details

Performance details are specified in Table 4.

See No. 1 to No. 12 in Table 4 for LC simplex plug connector, LC simplex adaptor, and LC duplex adaptor.

The specimen shall consist of an Adaptor and two plug connectors.

See No. 13 in Table 4 for LC duplex active device receptacle.

Table 4 - Performance details

No.	Test	Test method	Applicable condition	Requirements
1	Vibration	IEC 61300-2-1	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: before, during and after each axis. The measurement interval during the test shall be < 2 ms.	See Table 3. (See Note 1.)
2	Impact	IEC 61300-2-12 Method A	Number of drops: 5 for each plug Drop height: 1.5 m Sampling rate: initially and after the last drop. Specimen shall be unmated during drop cycles.	See Table 3. (See Note 1.)

3	Mating durability	IEC 61300-2-2	Coupling mechanism to be cycled: plug-adaptor Cycling rate: not less than 3 s between each engagement and separation. Number of cycles: 500 minimum Recovery procedure: the mechanical and optical alignment parts of the specimen may be cleaned according to manufacturer's instructions up to 2 times after the final mating cycle.	See Table 3. (See Note 1.)
4	Ferrule withdrawal force	IEC 61300-3-33	Pin gauge grade: see Figure 1.	1.0 N to 2.5 N
5	Ferrule compression force	IEC 61300-3-22	Position of the ferrule endface: optical datum	5.0 N to 6.0 N
6	Tensile strength of coupling mechanism	IEC 61300-2-6	Magnitude and rate of application of the load: 40 N at 2 N/s Duration: 120 s Sampling rate: initially and after the load has reached its maximum level and been maintained for a minimum of 30 s.	See Table 3. (See Note 1.)
7	Salts mist	IEC 61300-2-26	Salt concentration: 5 % NaCl (pH 6.5 to 7.2) Temperature: +35 °C Relative humidity: > 85 % Duration of test: 96h Configuration: the configuration shall be a mated pair of connectors which once mated for the initial measurements shall not be disconnected until after the completion of the test.	See Table 3. (See Note 1.)
8	Change of temperature	IEC 61300-2-22	High temperature dwell: +70 °C ± 2 °C Low temperature dwell: –25 °C ± 2 °C Duration at each dwell temperature: 1 h Ramp time = 1 °C/minute Number of cycles: 12 Sampling rate: initially at room ambient, after 1/2 h during each dwell (measurements to be completed during dwell) and at the end of the test at room ambient.	See Table 3. (See Note 1.)
9	Composite temperature/humidity cyclic test	IEC 61300-2-21	Condition: refer to IEC61300-2-21. Number of cycles:10	See Table 3. (See Note 1.)
10	High temperature endurance	IEC 61300-2-18	Temperature: +85°C ± 2 °C Duration of exposure: 240 h Sampling rate: before and after test and at a maximum interval of 1 h during the test.	See Table 3. (See Note 1.)

11	Cold endurance	IEC 61300-2-17	Temperature: –25 °C ± 2 °C Duration of exposure: 96 h Sampling rate: before and after test and at a maximum interval of 1 h during the test.	See Table 3. (See Note 1.)
12	Nutation	See 5.3 Nutation Test.	See 5.3 Nutation Test.	See 5.3 Nutation Test. (See Note 1.)
13	Wiggle	IEC 62150-3 Method A or Method B	Test load: Method A 1.5N Method B 4.5N	Refer to IEC 62150-3.

Note 1: A connector assembly with a SM optical fiber cord complying with ITU-T G.652 shall be used. Test wavelengths shall be 1310 nm ± 30 nm.

5. 3 Nutation test

5.3.1 Test conditions

Device under test (DUT)：a connector assembly with optical fiber cord 2.0 mm or 1.7mm in diameter.

Tensile force：15N

Deflection angle：45°

Rotation angle：360°

Number of cycles：100

Rate of cycles：10 cycles/minute

Sampling rate： before and after test.

Examinations and measurements：maximum attenuation variation ≤0.2 dB and visual inspection.

5.3.2 Apparatus

Examples of the test apparatus are given in Figure 2(a) and Figure 2(b).

5.3.3 Procedure

(1)Initial examinations and measurements

Complete initial examinations and measurements specified in “5.3.1 Test conditions”.

(2)Conditioning

A static load is applied to the cable of the terminated assembly. The mated connector assembly is held by the adaptor installed in the clamping device. The load is applied at the deflection angle to the connector axis. The test procedure consists of the following tasks and shall be performed in the following order

a) Set up the apparatus to obtain the required deflection angle;

b) Fix the specimen to the clamping device;

c) Route the cable and apply the required tensile force to the cable end;

d) Run the required number of cycles of rotation (360°) at the required rate of cycles;

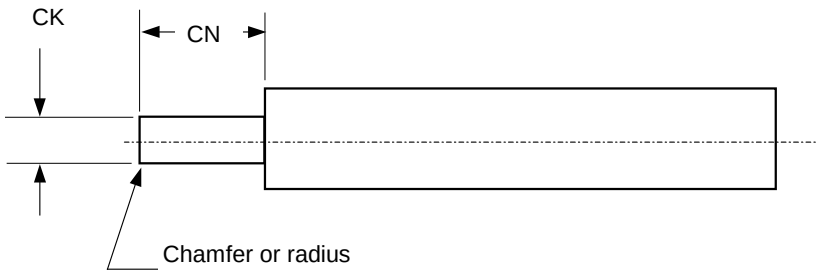
(3)Final examinations and measurements

On completion of the test, remove all fixtures. Clean the mechanical and optical alignment parts of the specimen according to the manufacturer's instructions. Take final examinations and measurements specified in "5.3.1 Test conditions" to ensure that there is no permanent damage.

6. Structure

The structure, shape, and dimensions shall conform to "IEC 61754-20 Fibre optic connector interfaces – Part 20: Type LC connector family".

7. Figures



CK 1.2490±0.002 mm

CN 4.2～15 mm

Surface roughness should be <0.2 μm

Cylindricity is less than 0.5 μm

Figure 1 Pin gauge grade (IEC 61754-20)

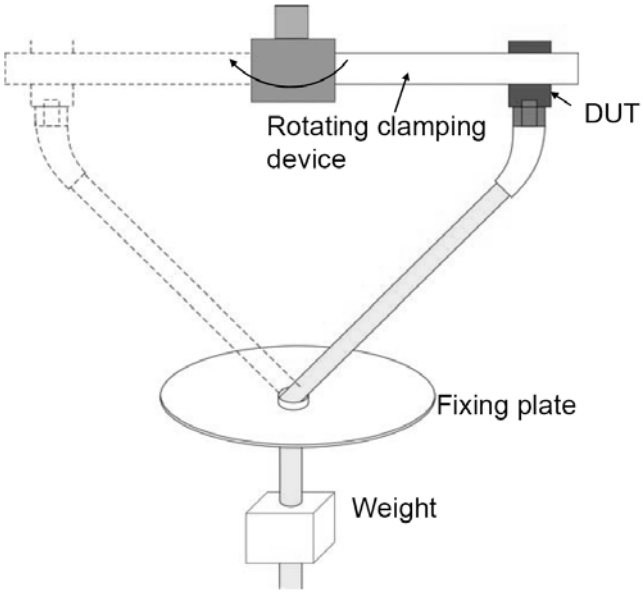


Figure 2(a) Test apparatus

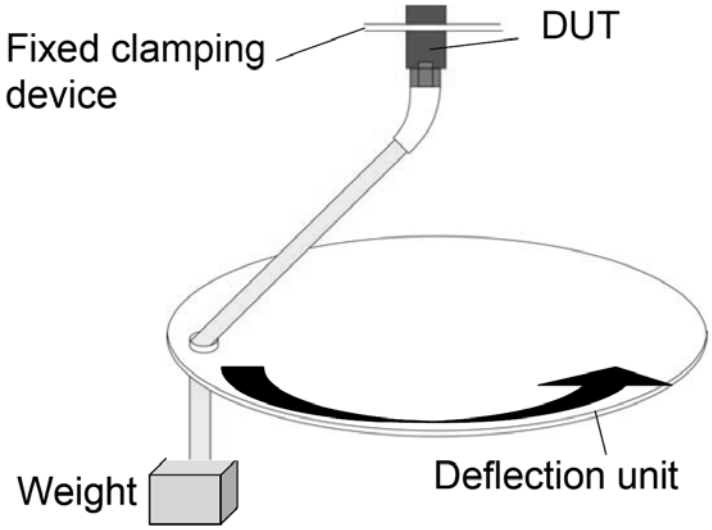


Figure 2(b) Test apparatus