

**CORNING OPTICAL COMMUNICATIONS GENERIC SPECIFICATION
for 50µm MULTIMODE OPTICAL FIBER JUMPER ASSEMBLIES WITH LC OR SC
CONNECTORS**

**September 2017
PGS107
Revision 2**

Corning Optical Communications reserves the right to update this specification without prior notification.

27 16 19 Communication Patch cords, Station cords, and Cross Connect Wire

1.0 General Considerations

- 1.1 This document covers the specifications and performance requirements of SC and LC 50µm multimode optical fiber connectors installed on 2.0 mm diameter optical cable.

2.0 References

- 2.1 The following documents may be used as references:

TIA/EIA-568-C.3	Optical Fiber Cabling Components Standard
TIA/ EIA-604	Fiber Optic Connector Intermateability Standards (FOCIS).
GR-326 Section 4.4	Thermal Cycling Testing
ITU-G.651.1	Characteristics of a 50/125 um multimode graded index optical fibre cable for the optical access network
IEC 60793-2-10	Product specifications for category A1 multimode fibres
TIA-455-XXX	Fiber Optic Test Procedures

3.0 Connector Specifications

3.1 Design Features

3.1.1 Strain Relief

The connector shall provide a strain relief mechanism for coupling the aramid strength members to the connector.

3.1.2 Index Matching Material

The use of index matching material between connector endfaces to enhance performance shall not be permitted.

3.1.3 Intermateability

The connector shall be designed in such a manner to properly mate with connector assemblies and adapters of the same type, even though they may be supplied from different manufacturers. The connector supplied shall be compliant to the applicable current version of the intermateability standard, TIA/EIA-604.

Comment: These intermateability standards ensure that connectors and adapters offered from different vendors will mate together and function normally.

3.1.4 Connector Keying

The connectors shall be keyed to prevent rotation of the connector end faces relative to each other during installation or mating.

3.1.5 Product Marking

At a minimum, the connector shall have the connector manufacturer's unique identification mark on the connector itself. This shall be a permanent marking intended to last for the lifetime of the product.

3.2 Process Control

Connectors shall typically meet the following requirements when tested:

Comment: The values listed for radius, apex offset, and protrusion/undercut are extremely difficult to achieve consistently. Compliance with all three of these values is necessary to ensure adequate product performance.

3.2.1 Radius of Curvature

The connector ferrule endface shall have a radius of curvature of 7 to 25 mm.

Comment: This specification is necessary to ensure fiber cores maintain physical contact across the normal operating temperature. The size of the radius of curvature determines the size of the contact surface formed as the two fiber endfaces meet. The connector radius of curvature is represented in Figure 1.

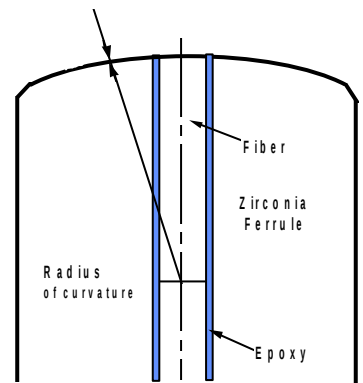


Figure 1

3.2.2 Apex/Dome Offset

The connector endface shall have the point of curvature apex at the geometric center of the fiber with a tolerance $\leq 50 \mu\text{m}$. This is typically measured using a non-contacting interferometer.

Comment: If the high point is not close enough to the center of the fiber core, an air-gap between the two fiber cores can occur. This will cause an increase in the insertion loss and reflectance at the joint.

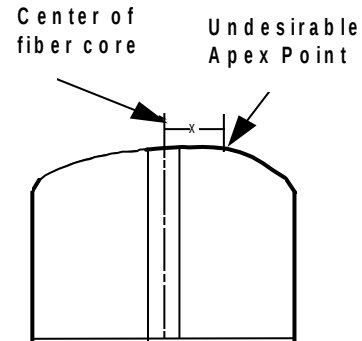


Figure 2

3.2.3 Fiber Undercut/Protrusion

The fiber to ferrule interface shall typically have a controlled fiber Undercut/Protrusion of ± 50 nm. See Figure 3.

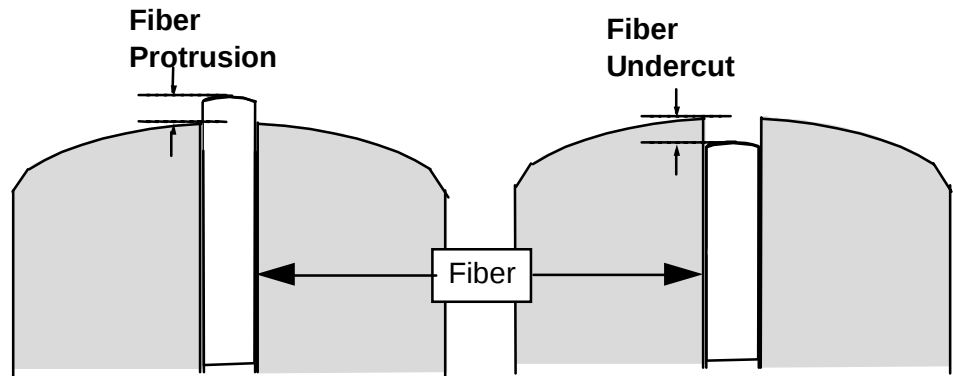


Figure 3.

Comment: During normal temperature variations, the fiber and the ferrule expand and contract microscopically. This causes movement of the fiber relative to the ferrule. Since the fiber is a softer material than the ferrule, the process of polishing the endface can cause fiber undercut relative to the ferrule endface. If the undercut is too severe, the fibers will not maintain contact.

4.0 Cable Identification

4.1 The outer cable jacket shall be marked with the manufacturer's name, date of manufacture, fiber type, flame rating, listing symbol, and sequential length markings

every two feet (e.g., "CORNING OPTICAL COMMUNICATIONS OPTICAL CABLE - MM/YY. XXXXX (feet or meters). The marking shall be in contrasting color to the cable jacket.

5.0 Cable Assembly Performance Specifications

5.1 Fiber Bending Performance

The optical fiber shall meet the macrobend loss performance shown in Table 1, according to IEC 60793-2-10 and ITU-G.651.1.

Macrobend Loss		
Mandrel Radius (mm)	Number of turns	Induced attenuation (dB) 850nm
37.5	100	≤ 0.05
15	2	≤ 0.1
7.5	2	≤ 0.2

Table 1

5.2 2.0 mm Jumper/cable bending performance

The jumper cable shall meet the macrobend loss performance shown in Table 2.

Macrobend Loss		
Mandrel Radius (mm)	Number of turns	Induced attenuation (dB) 850nm
4	1	≤ 1.0
5	1	≤ 0.75
6	1	≤ 0.5
7	1	≤ 0.35
7.5	1	≤ 0.25

Table 2

- 5.3 The supplied connectorized cable assemblies must typically meet the requirements outlined in sections 6.1 through 6.12. These requirements cover both environmental and mechanical tests.

Comment: The environmental requirements simulate the normal operating conditions seen by the connectors. The mechanical requirements simulate typical handling effects on the connector associated with installation and reconfiguration.

- 5.4 Insertion Loss Multimode LC and SC cable assemblies shall meet the insertion loss requirements shown in table 3. The measurements shall be performed in accordance with FOTP-171

Insertion Loss Performance			
LC/SC PC connector	General purpose	Data center grade	
	0.5dB ⁽¹⁾	Standard	Low-Loss
		0.25dB ⁽¹⁾	0.15dB ⁽¹⁾

Table 3

Note (1): Maximum IL performance as measured for mated pairs in jumper cable assembly products.

- 5.5 Reflectance

Each connector on the cable assembly shall have a reflectance of ≤ -20 dB. This testing shall be performed in accordance with FOTP-107.

- 5.6 Thermal Cycle

The cable assembly shall be subjected to and meet thermal cycling test per GR-326, Section 4. The assembly shall be cycled from 23 °C to 75 °C to -40 °C for 7 days and a total of 21 cycles. Measurements of loss and reflectance shall be made at the beginning, at each temperature plateau and at the end of the test. The maximum change in optical insertion loss at any measurement point during the test shall not exceed 0.3dB. The maximum increase in reflectance at any measurement point during the test shall not exceed 5.0 dB. The initial and final maximum insertion loss shall not exceed 0.5 dB.

- 5.7 Low Temperature

The cable assembly shall withstand a temperature of -10 °C (14 °F) for 4 days. The maximum change in optical insertion loss at any measurement point during the test shall not exceed 0.3dB. The initial and final maximum insertion loss shall not exceed 0.75 dB. The maximum reflectance shall be -20dB measured at the end of test. This testing shall be in accordance with FOTP-188.

5.8 Temperature Life:

The cable assembly shall withstand a temperature of 60 °C (140 °F) for 4 days. The initial and final maximum insertion loss shall not exceed 0.75 dB. The maximum reflectance shall be -20dB measured at the end of test. This testing shall be in accordance with FOTP-4.

5.9 Humidity:

The cable assembly shall withstand 90 – 95% humidity at 40 ± 2 °C (104 ± 3.6 °F) for 4 days. The maximum change in optical insertion loss at any measurement point during the test shall not exceed 0.4 dB. The initial and final maximum insertion loss shall not exceed 0.75 dB. The maximum reflectance shall be -20dB measured at the end of test. This testing shall be in accordance with FOTP-5.

5.10 Impact

The cable assembly shall withstand 5 drops from 1.5 m (4.9 ft) height. The initial and final maximum insertion loss shall not exceed 0.75 dB. The maximum reflectance shall be -20dB measured at the end of test. This testing shall be in accordance with FOTP-2.

5.11 Strength of Coupling Mechanism:

The cable assembly shall withstand a 40N (9.0 lbf) load at 0-degrees pull angle. The load application rate shall be 2N (0.45 lbf) per second. The minimum test duration shall be 5 seconds. The initial and final maximum insertion loss shall not exceed 0.75 dB. The maximum reflectance shall be -20dB measured at the end of test. This testing shall be in accordance with FOTP-185.

5.12 Durability:

The cable assembly shall withstand a minimum of 500 mating cycles (1 cycle = mate and unmate). The initial and final maximum insertion loss shall not

exceed 0.75 dB. The maximum reflectance shall be -20dB measured at the end of test. This testing shall be in accordance with FOTP-21.

5.13 Cable Retention:

Test 1: 0-degrees

The cable assembly shall withstand a 50 N (11.24 lbf) load at 0-degrees pull angle. The minimum load application rate shall be 5N per second. The minimum test duration shall be 5 seconds. The initial and final maximum insertion loss shall not exceed 0.75 dB. The maximum attenuation increase shall not exceed 0.5 dB and the minimum return loss shall be 20 dB both measured at the end of the test.

Test 2: 90-degrees

The cable assembly shall withstand a 19.4 N (4.4 lbf) load at 90-degrees pull angle. The minimum load application rate shall be 5N per second. The minimum test duration shall be 5 seconds. The initial and final maximum insertion loss shall not exceed 0.75 dB. The maximum attenuation increase shall not exceed 0.5 dB and the minimum return loss shall be 20 dB both measured at the end of the test. This testing shall be in accordance with FOTP-6.

5.14 Flex:

The cable assembly shall withstand a number of 100 rotation cycles (0-degrees, + 90-degrees, 0-degrees, - 90 degrees, 0 degrees), with a 4.9N (1.1lb) applied load. The initial and final maximum insertion loss shall not exceed 0.75 dB. The maximum reflectance shall be -20dB measured at the end of test. This testing shall be in accordance with FOTP-1.

5.15 Twist:

The cable assembly shall withstand a number of 10 cycles (2.5 rev. in one direction, reverse for 5 revolutions, and reverse for 2.5 rev. to initial the position), with a 15 N (3.4 lbf) applied load at 0-degrees pull angle. The load shall be applied at 220 - 280 mm (8.6 -11 in) from the connector under test. The initial and final maximum insertion loss shall not exceed 0.75 dB. The maximum reflectance shall be -20dB measured at the end of test. This testing shall be in accordance with FOTP- 36.

5.16 Fiber Types, Optical Specifications, and Jacket Color

Property	50um Multimode		
	Pretium 150 50/125 (850/1300nm)	Pretium 300 50/125 (850/1300nm)	Pretium 550 50/125 (850/1300nm)
Attenuation, max (dB/km) Tight Buffered Fiber Cable	2.8/1.0	2.8/1.0	2.8/1.0
LED Bandwidth, min (MHz•km)	700/500	1500/500	3500/500
Effective Modal Bandwidth, min (MHz•km)	950/-- ⁽¹⁾	2000/-- ⁽²⁾	4700/-- ⁽²⁾
Jacket Color	Orange	Aqua	Aqua

Table 4

Note (1): As predicted by RML BW, per TIA/EIA 455-204 and IEC 60793-1-41, for *intermediate performance laser based systems* (up to 1 Gb/s).

Note (2): As predicted by minEMBc, per TIA/EIA 455-220 and IEC 60793-1-49 for *high performance laser-based systems* (up to 10 Gb/s).

5.17 Summary of Performance Requirements

Test Name	MM Jumpers	Test Conditions
3.2.1 Radius of Curvature		
	7mm – 25mm	Non-contacting Interferometer.
3.2.2 Apex Offset		
	≤ 50 μm	Non-contacting Interferometer.
3.2.3 Protrusion/Undercut		
	± 50 nm	Non-contacting Interferometer.
4.0 Fiber bending performance		
Mandrel radius size (mm) 37.5mm	≤ 0.05 dB	100 turns
15.0mm	≤ 0.10 dB	2 turns
7.5mm	≤ 0.2 0dB	2 turns
5.0 2mm jumper/cable bending performance		
Mandrel radius size (mm) 4.0mm	≤ 1.0 dB	1 turn
5.0mm	≤ 0.75 dB	1 turn
6.0mm	≤ 0.5dB	1 turn
7.0mm	≤ 0.35 dB	1 turn
7.5mm	≤ 0.25 dB	1 turn
6.3 Thermal Cycle		
Max. Insertion Loss	0.5 dB	23 °C to 75 °C to -40 °C for 7 days and a total of 21 cycles.
Max. Insertion Loss Change	0.3 dB	
6.4 Low Temperature		

Max. Insertion Loss	0.75 dB	FOTP-188, 4 days @+0 °C. (pre-conditioned 24 hrs)
Max. Insertion Loss Change	0.30 dB	
Max. Reflectance Post Test	-20 dB	
6.5 Temperature Life		
Max. Insertion Loss	0.75 dB	FOTP-4, 4 days @+60 °C.
Max. Insertion Loss Post Test	0.75 dB	
Max. Reflectance	-20 dB	
6.6 Humidity		
Max. Insertion Loss	0.75 dB	FOTP-5, 4 days @ 40 ± 2 °C, 90-95% RH.
Max. Insertion Loss Change	0.40 dB	
Max. Reflectance Post test	-20 dB	
6.7 Impact		
Max. Insertion Loss	0.75 dB	FOTP-2, 8 drops from 1.8 m
Max. Insertion Loss Post Test	0.75 dB	
Max. Reflectance Post test	-20 dB	
6.8 Strength of coupling mechanism		
Max. Insertion Loss	0.75 dB	FOTP-185, 33N (7.4lbf) @ 0-degrees pull angle. Load application rate 25.4mm (1 in) per minute.
Max. Insertion Loss Post Test	0.75 dB	
Max. Reflectance Post test	-20 dB	
6.9 Durability		
Max. Insertion Loss	0.75 dB	FOTP-21, 500 cycles. (1 cycle= mate and unmate).
Max. Insertion Loss Post Test	0.75 dB	
Max. Reflectance Post Test	-20 dB	
6.10 Cable retention		
Max. Insertion Loss	0.75 dB	FOTP-6, 1 st Test: 50N (11.24lbf) @ 0-degrees pull angle. 2 nd Test: 19.4N (4.4lbf) @ 90-degrees pull angle.
Max. Insertion Loss Change	0.50 dB	
Max. Reflectance Post Test	-20 dB	
6.11 Flex		
Max. Insertion Loss	0.75 dB	FOTP-1, 100 cycles with 0.5kg (1.1lb) applied weight. (1 cycle = 0°, 90°, 0°, 90°, 0°).
Max. Insertion Loss Post Test	0.75 dB	
Max. Reflectance Post Test	-20 dB	
6.12 Twist		
Max. Insertion Loss	0.75 dB	FOTP-36, 9 cycles with 15N (3.4lbf) @ 0-degrees pull angle. (1 cycle = 2.5 rev in one direction, reverse for 5 rev, and reverse for 2.5 rev).
Max. Insertion Loss Post Test	0.75 dB	
Max. Reflectance Post Test	-20 dB	

6.0 Quality Assurance Provisions

6.1 Product Qualification Testing

The supplier shall demonstrate compliance to the specifications and requirements stated in this document. This should be demonstrated internally during the supplier's initial product qualification and then repeated as deemed appropriate by the purchaser and/or as spelled out in the purchasing agreement.

7.0 Packing and Shipping

7.1 Unit Packaging

The individual cable assemblies shall be packaged in a plastic bag unless long lengths require the use of reels.

7.2 Protection

The product shall be packaged in a manner to adequately protect the cable assembly during shipment and storage.

7.3 Ferrule Protection

Each connector shall be equipped with a protective ferrule endcap.

7.4 Marking

The packaging shall indicate, type of connector, date of manufacture, and cable length.

7.2 The cable assembly manufacturer shall be TL 9000 registered.

8.0 Miscellaneous

8.1 At the request of the customer, the cable manufacturer shall provide installation procedures and technical support concerning the items contained in this specification.

Gen Spec PGS107 Revision History

Revision #	Date	Reason for Change
0	11/04/09	Initial creation
1	12/17/09	Changed all references to "Return Loss" to "Reflectance" and value to ≤ -20 dB (section 6). Added "TIA-455-xxx" in section 2.0 References.
2	Sept 2017	Reformatted, added Master Format number and added Identification section.