
LightCrimp* Plus Singlemode and Multimode LC Connector (Field Installable)

1. SCOPE

1.1. Content

This specification, which is based on ANSI/TIA-568-C.3, covers the performance, tests and quality requirements for the TE Connectivity (TE) LightCrimp* Plus Singlemode and Multimode LC Connectors (Field Installable) terminated to 900 micron tight buffered fiber and 2.0 mm jacketed cable.

1.2. Qualification

When tests are performed on the subject product line, procedures specified in Figure 2 shall be used. All inspections shall be performed using the applicable inspection plan(s) and product drawing(s).

1.3. Qualification Test Results

Successful qualification testing on the subject product line was completed on 03Feb09. The Qualification Test Report number for this testing is 501-586. This documentation is on file at and available from Engineering Practices and Standards (EPS).

2. APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the latest edition of the document applies. In the event of conflict between requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between requirements of this specification and referenced documents, this specification shall take precedence.

2.1. TE Documents

- 408-8925: Instruction Sheet (LightCrimp Plus LC Connector Kits)
- 408-10103: Instruction Sheet (LightCrimp Plus LC (for Jacketed Cable) Connectors)
- 501-586: Qualification Test Report (LightCrimp Plus Singlemode and Multimode LC Connector (Field Installable))

2.2. Commercial Documents

- TIA/EIA-455-B: Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices and Other Fiber Optic Components
- ANSI/TIA-568-C.3: Optical Fiber Cabling Components Standard
- TIA-604-10-B: FOCIS 10 Fiber Optic Connector Intermateability Standard - Type LC

2.3. Reference Documents

- 102-952: Quality Specification (Qualification of Fiber Optic Connectors and Cable Assemblies)
- 501-631: Qualification Test Report (LightCrimp Plus LC SECURE Fiber Optic Connector and LC SECURE Adapter)

3. REQUIREMENTS

3.1. Design and Construction

Product shall be of the design, construction and physical dimensions specified on the applicable product drawing(s).

3.2. Optical Power Source

The optical power source wavelengths shall be 850 ± 30 nm and 1300 ± 30 nm for multimode and 1310 ± 30 nm and 1550 ± 30 nm for singlemode, unless otherwise stated in the Qualification Test Report.

3.3. Ratings

Performance	Value For Buffered Fibers			Value For Jacketed Cable	Units
	Multimode	Singlemode		Singlemode	
	Standard PC	Standard PC	APC Digital	Standard PC	
Attenuation (insertion loss), typical, see Note (a)	0.2		0.3	0.2	dB
Return loss, typical, see Note (a)	37	55	56 at 1310 nm 64 at 1550 nm	55	dB
Storage temperature, see Note (b)	-40 to 70			-10 to 60	°C
Operating temperature	-10 to 60			-10 to 60	°C
Cable retention (0 degree)	5 [1.12]			50 [11.24]	N [lbf]
Cable retention (90 degree)	2 [0.45]			19.4 [4.4]	N [lbf]
Mating durability	500			500	Cycles
Flex	100			100	Cycles
Twist	10			10	Cycles

NOTE

- (a) Typical values represent the median of the sample data. See Figure 2 for maximum insertion loss and minimum return loss values. Refer to Qualification Test Report 501-586 for a list of part numbers used to acquire data.
- (b) Storage temperature range is not a requirement of ANSI/TIA-568-C.3.

Figure 1

3.4. Performance and Test Description

Product is designed to meet the mechanical, environmental and optical transmittance performance requirements specified in Figure 2. Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

3.5. Test Requirements and Procedures Summary

Test Description	Requirement	Procedure
Visual and mechanical inspection.	Meets requirements of product drawing, including end face geometry. Complies with dimensional requirements of FOCIS TIA-604-10-B for all dimensions.	TIA/EIA-455-13A. Visual, dimensional and functional per applicable quality inspection plan. Measure dimensions B, D, G, H1, H2 and S as defined in the Fiber Optic Connector Intermateability Standard (FOCIS), TIA-604-10-B. See Note (a).
Attenuation (insertion loss).	Maximum attenuation for any single specimen is 0.75 dB. See Note (b).	TIA/EIA-455-171A, Method D1 (multimode); TIA/EIA-455-171A, Method D3 (singlemode), except launch and receive are both part of the pair under test and are not reference quality. Precondition by cleaning plug and adapter per manufacturer's instructions. Test at 850 ± 30 nm and 1300 ± 30 nm for multimode and at 1310 ± 30 nm and 1550 ± 30 nm for singlemode. For multimode measurements, source shall be a Category 1 light source. Apply mandrels as directed by FOTP-171 for the appropriate fiber size. For singlemode, only the fundamental mode shall propagate at the connector interface and at the detector. Use the following protocol for connector termination: Terminate the connector in accordance with the appropriate Tyco Electronics Instruction Sheet. If the initial IL reading is < 0.35 dB when mated against a reference quality test lead, the test specimen may be used for subsequent tests.
Return loss.	Minimum return loss for any single specimen is 20 dB for multimode or 26 dB for singlemode. See Note (b).	TIA/EIA-455-107A, or TIA/EIA-455-8. Test at 850 ± 30 nm and 1300 ± 30 nm for multimode and at 1310 ± 30 nm and 1550 ± 30 nm for singlemode.

Figure 2 (continued)

Test Description	Requirement	Procedure
Temperature life.	<p>Maximum attenuation for any single specimen is 0.75 dB before and after test.</p> <p>Minimum return loss for any single specimen is 20 dB for multimode or 26 dB for singlemode after test.</p> <p>See Note (b).</p>	<p>TIA/EIA-455-4C.</p> <p>Specimen shall be mated and optically functioning. Maintain specimens undisturbed in the chamber at room ambient ($23 \pm 5^\circ\text{C}$ and 20 to 70% RH) for 2 hours prior to recording initial attenuation and return loss. Subject specimens to $60 \pm 2^\circ\text{C}$ for 96 hours (4 days). At the completion of testing, measure final attenuation and return loss within 1 to 2 hours of the chamber's return to ambient conditions, with specimens undisturbed in the test chamber.</p> <p>See paragraph 5.2.</p>
Low temperature.	<p>Maximum attenuation for any single specimen is 0.75 dB before and after test.</p> <p>Maximum attenuation increase for any single specimen is 0.3 dB during test.</p> <p>Minimum return loss for any single specimen is 20 dB for multimode or 26 dB for singlemode after test.</p> <p>See Note (b).</p>	<p>EIA/TIA-455-188.</p> <p>With specimens in place in the chamber, precondition specimens at room ambient ($23 \pm 5^\circ\text{C}$ and 20 to 70% RH) for 24 hours prior to recording initial optical measurements. Subject specimens to $-10 \pm 3^\circ\text{C}$ for 96 hours (4 days). Attenuation and return loss shall be measured before test, at a maximum interval of 1 hour during test and after test. Maintain specimens undisturbed for at least 1 hour after the chamber's return to ambient conditions, before measuring final attenuation and return loss.</p> <p>See paragraph 5.2.</p>

Figure 2 (continued)

Test Description	Requirement	Procedure
Humidity, steady state.	<p>Maximum attenuation for any single specimen is 0.75 dB before and after test.</p> <p>Maximum attenuation increase for any single specimen is 0.4 dB during test.</p> <p>Minimum return loss for any single specimen is 20 dB for multimode or 26 dB for singlemode after test. See Note (b).</p>	<p>TIA/EIA-455-5C, Method A, Test Condition A.</p> <p>Maintain specimens undisturbed in the chamber at $50 \pm 5^\circ\text{C}$ and $<33\%$ RH for 24 hours, then stabilize at ambient for at least 1 hour before recording initial optical measurements. Subject mated specimens to $40 \pm 2^\circ\text{C}$ with 90 to 95% RH for 96 hours (4 days). Attenuation shall be measured before test and at a maximum interval of 1 hour during test. At the completion of testing, measure final attenuation and return loss within 1 to 2 hours of the chamber's return to ambient conditions, with specimens undisturbed in the test chamber. See paragraph 5.2.</p>
Cable retention, 0 degree.	<p>Maximum attenuation for any single specimen is 0.75 dB before and after test.</p> <p>Maximum attenuation increase for any single specimen is 0.5 dB after test.</p> <p>Minimum return loss for any single specimen is 20 dB for multimode or 26 dB for singlemode after test. See Note (b).</p>	<p>EIA/TIA-455-6B, Method 1. Specimen shall be mated. Adapter shall be rigidly attached to the mounting fixture. Using a 7.6 cm [3 in] mandrel located 23 cm [9 in] from the strain relief, apply a tensile load of 5 N [1.12 lbf] to buffered fiber and 50 N [11.24 lbf] for jacketed cable (with strength members terminated to the connector) to the connector-to-fiber joint. Apply load at a 0 degree pull angle to the mated specimen using a rate of 5 N [1.12 lbf] per second for reinforced cables and 0.5 N [0.11 lbf] per second for buffered fiber. Hold load for a minimum of 5 seconds. Measure attenuation and return loss before and after test with the load removed.</p>
Cable retention, 90 degree.	<p>Maximum attenuation for any single specimen is 0.75 dB before and after test.</p> <p>Maximum attenuation increase for any single specimen is 0.5 dB after test.</p> <p>Minimum return loss for any single specimen is 20 dB for multimode or 26 dB for singlemode after test. See Note (b).</p>	<p>EIA/TIA-455-6B, Method 1. Repeat cable retention test with the tensile load applied at a 90 degree pull angle. Use 2 N [0.45 lbf] load for buffered fiber and a 19.4 N [4.4 lbf] load for jacketed cable (with strength members terminated to the connector).</p>

Figure 2 (continued)

Test Description	Requirement	Procedure
Flex.	<p>Maximum attenuation for any single specimen is 0.75 dB before and after test.</p> <p>Minimum return loss for any single specimen is 20 dB for multimode or 26 dB for singlemode after test.</p> <p>See Note (b).</p>	<p>TIA/EIA-455-1B.</p> <p>Using a 7.6 cm [3 in] mandrel located at a point 23 cm [9 in] from the strain relief, apply a tensile load of 2 N [0.45 lbf] for buffered fiber and 4.9 kg [1.1 lbf] for jacketed cable (with strength members terminated to the connector) to mated specimens. Flex loaded side ± 90 degrees per cycle for 100 cycles, at a maximum rate of 15 cycles per minute. Attenuation and return loss shall be measured before and after test with the load removed.</p>
Twist.	<p>Maximum attenuation for any single specimen is 0.75 dB before and after test.</p> <p>Minimum return loss for any single specimen is 20 dB for multimode or 26 dB for singlemode after test.</p> <p>See Note (b).</p>	<p>EIA-455-36A.</p> <p>Apply tensile load of 2 N [0.45 lbf] for buffered fiber and 15 N [3.4 lbf] for jacketed cable (with strength members terminated to the connector) at 0 degree pull angle at a point 23 cm [9 in] from the ferrule end face of the mated specimen. Rotate the loaded side ± 2.5 revolutions per cycle for 10 cycles. Attenuation and return loss shall be measured before and after test with the load removed.</p>
Strength of coupling mechanism.	<p>Maximum attenuation for any single specimen is 0.75 dB before and after test.</p> <p>Minimum return loss for any single specimen is 20 dB for multimode or 26 dB for singlemode after test.</p> <p>See Note (b).</p>	<p>EIA/TIA-455-185.</p> <p>Adapter shall be rigidly attached to the mounting fixture. Apply a tensile load of 40 N [9.0 lbf] to the connector (not the fiber) at a rate of 2 N [0.45 lbf] per second. Hold load for a minimum of 5 seconds. Attenuation and return loss shall be measured before and after test with the load removed.</p>
Impact.	<p>Maximum attenuation for any single specimen is 0.75 dB before and after test.</p> <p>Minimum return loss for any single specimen is 20 dB for multimode or 26 dB for singlemode after test.</p> <p>See Note (b).</p>	<p>TIA/EIA-455-2C, Method B, with the following exceptions: 1.5 m [4.9 ft] drop height, 5 drops. Drop surface is steel plate with minimum thickness of 12.5 mm [0.5 in]. A ferrule cap may be placed over the ferrule only to protect the fiber end face. Measure attenuation and return loss before and after test. At the completion of testing, clean specimen before recording final optical measurements.</p> <p>See paragraph 5.1.</p>

Figure 2 (continued)

Test Description	Requirement	Procedure
Mating durability.	Maximum attenuation for any single specimen is 0.75 dB before and after test. Minimum return loss for any single specimen is 20 dB for multimode or 26 dB for singlemode after test. See Note (b).	EIA-455-21A. Engage and separate plug and adapter 500 times, at a maximum rate of 300 cycles per hour. Measure attenuation and return loss before and after test. Clean plug and adapter per manufacturer's instructions as necessary during test. At the completion of testing, record final optical measurements after the specimens have been inspected and cleaned. See paragraph 5.1.

NOTE

- (a) Dimensions not measured on actual test specimens are covered by First Article approval, which includes verification of product drawings per dimensions specified in TIA-604-10-B.
- (b) Shall meet visual requirements, show no physical damage, and shall meet the requirements of additional tests as specified in the Product Qualification Test Sequence in Figure 3.

Figure 2 (end)

3.6. Product Qualification Test Sequence

Test or Examination	Test Sequence See Note (a)	Specimen Minimum Quantity See Note (c)
Visual and mechanical inspection	1	24
Attenuation (insertion loss)	2	24
Return loss	3	24
Temperature life	See Note (b)	8
Low temperature		8
Humidity, steady state		8
Cable retention, 0 degree		8
Cable retention, 90 degree		8
Flex		8
Twist		8
Strength of coupling mechanism		8
Impact		8
Mating durability		8

NOTE

- (a) Numbers indicate sequence in which tests are performed.
- (b) Tests 4 through 13 may be performed on the same specimens or different specimens, in any sequence, as long as specimens are sourced as shown.
- (c) A specimen consists of a mated connector pair, see paragraph 4.1.A.

Figure 3

4. QUALITY ASSURANCE PROVISIONS

4.1. Qualification Testing

A. Specimen Selection

Specimens shall be prepared in accordance with applicable Instruction Sheets (408-8925 and 408-10103) and shall be selected at random from current production. Specimen shall be defined as a mated LC connector pair consisting of the following: a launch cable terminated with a LightCrimp Plus singlemode or multimode LC connector and a receive cable terminated with an epoxy-style LC connector. Connector plugs form a mated pair.

B. Specimen Quantity

Specimen quantity shall be 24 mated connector pairs for Tests 1, 2 and 3. All remaining tests shall have a minimum quantity of 8 mated connector pairs. See Figure 3.

C. Test Sequence

Qualification inspection shall be verified by testing specimens as specified in Figure 3.

4.2. Requalification Testing

If changes significantly affecting form, fit or function are made to the product or manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by development/product, quality and reliability engineering.

4.3. Acceptance

Acceptance is based on verification that the product meets requirements of Figure 2. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify the product. When product failure occurs, corrective action shall be taken and specimens resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

4.4. Quality Conformance Inspection

The applicable quality inspection plan will specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification.

5. SPECIAL INSTRUCTIONS

5.1. Cleaning

If at any time, a connector specimen is uncoupled during qualification testing, the optical interfaces shall be cleaned according to the applicable Instruction Sheet prior to any subsequent optical measurements. Additional cleaning techniques deemed necessary by Product Engineering shall be described in the Test Report. If, after cleaning the connector as prescribed, loss performance exceeds the specified limit, or, if the operator suspects the presence of debris at the optical interface, perform the cleaning procedure a second time. If the resultant optical reading still exceeds the specification, clean the interface a third time and accept that reading.

5.2. Control Cables

Control cables shall be subjected to climatic environmental tests. Transmittance shall be recorded each time a specimen transmittance is made. Changes in control cable power of less than 0.05 dB may be neglected in the test specimen power and loss calculations. If control cable power changes by more than 0.05 dB during the duration of the test or sequence of tests, change in control cable power should be included in power and loss calculations per TIA/EIA-455-20A.