Adhesive for Single Fiber Field Terminations

1. INTRODUCTION

1.1. Purpose

Testing was performed on Tyco Electronics LC and SC, Multimode and Singlemode, Fiber Optic Connectors terminated with a field-use adhesive to determine their conformance to the requirements of Product Specification 108-2188, Revision A.

1.2. Scope

This report covers the optical and environmental performance of LC and SC, Multimode and Singlemode, Fiber Optic Connectors terminated to 900 µm, PVC buffered fiber using Loctite® Optiloc® Adhesive 3405 and Optiloc® Primer 3406. Testing was performed between 30Dec03 and 15Mar04. The test file number for this testing is B051701-002.

1.3. Conclusion

LC and SC, Multimode and Singlemode, Fiber Optic Connectors terminated onto 900 µm PVC buffered fiber, listed in paragraph 1.5., meet the optical and environmental performance requirements of Product Specification 108-2188, Revision A, when terminated with Loctite® Optiloc® Adhesive 3405 and Optiloc® Primer 3406.

1.4. Product Description

Tyco Electronics LC and SC fiber optic connectors are multimode or singlemode field installable connectors that are used in data communication and telecommunications networks and equipment.

1.5. Test Specimens

Test specimens were terminated by three different operators, using components taken from current production. Specimens consisted of a mated connector pair and the following supplies outlined below.

Test Group	1	2	3	4
Fiber size (µm/µm)	50/125	50/125	9/125	9/125
Fiber type	900-µm buffer	900-µm buffer	900-µm buffer	900-µm buffer
Fiber PN	599204-6	599204-6	599208-9	599208-9
Connector Type	LC	SC	LC	SC
Connector Kit PN	1588706-1	503948-5	1588710-1	504646-7
Coupling Receptacle PN	1457567-5	1-502632-2	1457567-4	1-502632-1
Test Cable Length	8-10m [26.2-32.8 ft]	8-10m [26.2-32.8 ft]	8-10m [26.2-32.8 ft]	8-10m [26.2-32.8 ft]
Test Specimens Required	(See Note)			
Control Cable Required	Yes	Yes	Yes	Yes

NOTE *Each group shall have 24 specimens initially, from which 8 specimens are randomly selected for environmental tests as shown in Figure 2.*

Figure 1

1.6. Product Qualification Test Sequence

Test or Examination	Test Groups 1, 2, 3 and 4 (See Note (a))	
	Test Sequence (See Note (b))	Specimen Quantity (See Note (c))
Visual and mechanical inspection	1	24
Attenuation	2	24
Return loss	3	24
Low temperature	4	8
Temperature life	5	8
Humidity, steady state	6	8

NOTE
(a) See paragraph 1.5.
(b) Numbers indicate sequence in which tests are performed.
(c) A specimen consists of a mated connector pair. See Figure 1.

Figure 2

2. SUMMARY OF TESTING

2.1. Visual and Mechanical Inspection - All Groups

All specimens submitted for testing were constructed using parts selected from normal, current production lots, and were inspected and accepted by the Product Assurance Department of the Fiber Optic Business Unit.

2.2. Initial Optical Performance - All Groups

All attenuation and return loss measurements met the specification requirements. Attenuation and return loss were measured at 850 and 1300 nm for 50/125 µm fiber size (Groups 1-2), and at 1310 and 1550 nm for 9/125 µm fiber size (Groups 3-4).

Performance Requirements	Multimode Groups (1-2)	Singlemode Groups (3-4)
	850 & 1300 nm	1310 & 1550 nm
Maximum allowed attenuation for any individual specimen	0.75	0.75
Minimum allowed return loss for any individual specimen	20	26

Attenuation and Return Loss - Requirements for New Product (dB)
Figure 3

Test Group	1 (MM LC)		2 (MM SC)		3 (SM LC)		4 (SM SC)	
Wavelength	850 nm	1300 nm	850 nm	1300 nm	1310 nm	1550 nm	1310 nm	1550 nm
Maximum Attenuation	0.25	0.24	0.47	0.45	0.65	0.66	0.36	0.38
Minimum Return Loss	21.6	26.0	22.4	28.2	28.3	29.4	29.1	30.4

Attenuation and Return Loss - Actual for New Product (dB)
Figure 4

2.3. Attenuation, Change in Attenuation and Return Loss - All Groups

All attenuation, change in attenuation and return loss measurements met the specification requirements. All measurements were recorded at 850 and 1300 nm for 50/125 µm fiber size (Groups 1-2) and at 1310 and 1550 nm for 9/125 µm fiber size (Groups 3-4).

Test Group	Condition	Requirements (850 & 1300 nm for MM) (1310 & 1550 nm for SM)			Actual (850 nm for MM) (1310 nm for SM)			Actual (1300 nm for MM) (1550 nm for SM)		
		Before	During	After	Before	During	After	Before	During	After
		IL	ΔIL	IL,RL	IL	ΔIL	IL,RL	IL	ΔIL	IL,RL
1 (MM LC)	Low temperature	0.75 (IL) 20 (RL)	0.2	0.75 (IL) 20 (RL)	0.13 (IL) 21.9 (RL)	0.08	0.18 (IL) 22.0 (RL)	0.11 (IL) 24.8 (RL)	0.06	0.17 (IL) 24.9 (RL)
	Temperature life				0.18 (IL) 21.8 (RL)	0.16	0.28 (IL) 23.1 (RL)	0.17 (IL) 25.0 (RL)	0.12	0.21 (IL) 25.1 (RL)
	Humidity, steady state				0.28 (IL) 23.1 (RL)	0.06	0.13 (IL) 22.8 (RL)	0.21 (IL) 24.8 (RL)	0.05	0.15 (IL) 25.1 (RL)
2 (MM SC)	Low temperature	0.75 (IL) 20 (RL)	0.2	0.75 (IL) 20 (RL)	0.28 (IL) 22.4 (RL)	0.06	0.20 (IL) 22.4 (RL)	0.24 (IL) 24.5 (RL)	0.05	0.20 (IL) 24.6 (RL)
	Temperature life				0.20 (IL) 22.5 (RL)	0.09	0.26 (IL) 23.5 (RL)	0.20 (IL) 24.7 (RL)	0.08	0.25 (IL) 24.6 (RL)
	Humidity, steady state				0.26 (IL) 23.2 (RL)	0.03	0.21 (IL) 23.3 (RL)	0.25 (IL) 24.6 (RL)	0.03	0.19 (IL) 24.7 (RL)
3 (SM LC)	Low temperature	0.75 (IL) 26 (RL)	0.2	0.75 (IL) 26 (RL)	0.65 (IL) 30.4 (RL)	0.06	0.66 (IL) 30.5 (RL)	0.66 (IL) 31.8 (RL)	0.03	0.62 (IL) 31.7 (RL)
	Temperature life				0.66 (IL) 30.5 (RL)	0.16	0.65 (IL) 30.7 (RL)	0.62 (IL) 31.8 (RL)	0.11	0.59 (IL) 31.8 (RL)
	Humidity, steady state				0.65 (IL) 30.6 (RL)	0.05	0.70 (IL) 30.6 (RL)	0.59 (IL) 31.9 (RL)	0.03	0.61 (IL) 31.9 (RL)
4 (SM SC)	Low temperature	0.75 (IL) 26 (RL)	0.2	0.75 (IL) 26 (RL)	0.36 (IL) 37.1 (RL)	0.06	0.35 (IL) 37.2 (RL)	0.38 (IL) 38.7 (RL)	0.05	0.43 (IL) 38.6 (RL)
	Temperature life				0.35 (IL) 37.1 (RL)	0.13	0.31 (IL) 37.7 (RL)	0.43 (IL) 38.7 (RL)	0.08	0.47 (IL) 39.0 (RL)
	Humidity, steady state				0.31 (IL) 37.6 (RL)	0.14	0.40 (IL) 37.6 (RL)	0.47 (IL) 39.1 (RL)	0.07	0.41 (IL) 39.0 (RL)

NOTE *IL is Insertion Loss (Attenuation), ΔIL is Change in Insertion Loss (Change in Attenuation) and RL is Return Loss.*

Attenuation, Change in Attenuation and Return Loss Results (dB)
Figure 5

2.4. Low Temperature - All Groups

There was no evidence of physical damage to the connector or terminated fiber and no change in optical performance beyond the specified limit during low temperature exposure. All attenuation and return loss measurements met requirements before and after test.

2.5. Temperature Life - All Groups

There was no evidence of physical damage to the connector or terminated fiber and no change in optical performance beyond the specified limits during temperature life. All attenuation and return loss measurements met requirements before and after test.

2.6. Humidity, Steady State - All Groups

There was no evidence of physical damage to the connector or terminated fiber and no change in optical performance beyond the specified limits during steady state humidity. All attenuation and return loss measurements met requirements before and after test.

3. TEST METHODS

The multimode and singlemode environmental measurement facilities were both automated, FOTP-20 compliant test systems. Initial specimen installation was performed according to FOTP-171 procedures. Following the installation of the specimens, the sequential testing was performed.

3.1. Visual and Mechanical Inspection

Product drawings and inspection plans were used to examine the specimens. They were examined visually and functionally.

3.2. Attenuation

All multimode and singlemode attenuation was measured in accordance with FOTP-171, Method D1/D3, processes, except that the launch was part of the specimen under test and was not reference quality. The initial optical power through each of the selected launch connector fibers was measured. The connector assembly was then mated and final optical power measured from the receive side cable assembly. The attenuation was calculated by taking the difference between the initial measurement and the final measurement. Optical power readings were compensated by changes in a source monitor cable. In cases where a control cable was also used and exceeded limits stated in the specification, the change in the control cable was also factored into the loss.

3.3. Return Loss

Multimode return loss was measured in accordance with FOTP-8. Singlemode return loss was measured in accordance with FOTP-107. A single measurement was recorded for return loss. Optical return loss was measured initially and after each test evaluation.

3.4. Change in Attenuation

The initial optical power (dBm) through each specimen was recorded before the test using an optical source and detector. Relative optical power (dB) through the fiber was measured during and after each test. Change in attenuation was calculated by taking the difference between the initial measurement and the during/after measurements and recording the maximum range of all values for a specimen. Optical power readings were compensated by changes in the source monitor cable. In cases where a control cable was also used and exceeded limits stated in the specification, the change in the control cable was also factored into the loss.

3.5. Low Temperature

Mated specimens were preconditioned for 24 hours at room ambient, then subjected to 0 ± 3˚C with an uncontrolled standard ambient humidity for a period of 96 hours (4 days). Optical performance for each specimen was recorded before and after exposure with the specimens in place in the test chamber and at 4 hour intervals throughout the exposure. Final optical performance was recorded after specimens stabilized at ambient conditions for at least 1 hour.

3.6. Temperature Life

Mated specimens were subjected to 60 ± 2˚C with an uncontrolled standard ambient humidity for a period of 96 hours (4 days). Optical performance for each specimen was recorded before and after exposure with the specimens in place in the test chamber and at 4 hour intervals throughout the exposure. Final optical performance was recorded after specimens stabilized at ambient conditions for at least 1 hour.

3.7. Humidity, Steady State

Mated specimens were subjected to 40 ± 2˚C at 90 to 95% RH for a period of 96 hours (4 days). Optical performance for each specimen was recorded before and after exposure with the specimens in place in the test chamber and at 4 hour intervals throughout the exposure. Final optical performance was recorded after specimens stabilized at ambient conditions for at least 1 hour.