SM and MM LC/SC Simplex Tight Jacketed Style Connector

1. INTRODUCTION

1.1. Purpose

Testing was performed on Tyco Electronics RWOC LC and SC, Tight Jacketed 2.0 mm singlemode fiber optic connectors to determine their conformance to the requirements specified in Figure 3.

1.2. Scope

This report covers the optical, environmental, and mechanical performance of RWOC LC and SC, Tight Jacketed 2.0 mm singlemode fiber optic connectors, manufactured by Tyco Electronics, Fiber Optics Business Unit. Testing was performed between 22Feb05 and 24Aug06. The test file numbers for this testing are B061295-003 and B061295-004. This documentation is on file at and available from the Fiber Optics Business Unit.

1.3. Product Description

| RWOC LC and SC, Tight Jacketed, 2.0 mm, fiber optic connectors are non-pull proof singlemode and multimode single-fiber connectors. These connectors are used in data communication and telecommunications networks and equipment.

1.4. Test Specimens

Test specimens were pre-production cable assemblies built using standard manufacturing processes. Specimens consisted of the LC or SC connector assemblies and the following supplies shown in Figure 1.

Component Description	Test Group								
	1	2	3	4	5	6	7	8	9
Fiber size (µm/µm)	9/125								
Cable Type	2.0 mm jacketed cable per MIL-PRF-85045/16								
Cable PN	1828110-4								
| SC Connector Kit PN	6828100-1								
| LC Connector Kit PN	6828095-1 (see Note)								
SC Coupling Bushing	1-502632-1								
| LC Coupling Bushing	1457567-1		1457567-4						
Test Cable Length	2 m								
SC Test Specimens Required	8 each								
LC Test Specimens Required	8 each								

NOTE *Test groups 2, 8 and 9 evaluated the LC connector with improved "plus sign" anti-rotation feature.*

Figure 1

* Trademark
| Indicates change

1.5. Design Verification Test Sequence/Test Description

Test or Examination	Test Group (a)								
	1	2	3	4	5	6	7	8	9
	Test Sequence (b)								
Visual and mechanical inspection	1	1	1	1	1	1	1	1	1
Attenuation (insertion loss)	2	2	2	2	2	2		2	2
Return Loss (return loss)	3	3	3	3	3	3		3	3
Temperature cycle	4								
Temperature life - Phase 1	5								
Temperature life - Phase 2	6								
Thermal shock		4							
Flex - Phase 1			4						
Flex - Phase 2			5						
Twist - Phase 1				4					
Twist - Phase 2				5					
Twist - Phase 3				6					
Mechanical shock					4				
Vibration					5				
90 degree cable pull - Phase 1						4			
90 degree cable pull - Phase 2						5			
90 degree cable pull - Phase 3						6			
Salt spray			6	7			2		
Strength of coupling mechanism								4	
0 degree cable pull								5	
Mating durability									4

NOTE *(a) See Figure 1*
(b) Numbers indicate sequence in which tests are performed.

Figure 2

1.6. Test Details

NOTE *Other than exceptions listed below, tests were performed to requirements and procedures specified Figure 3.*

- Temperature Life - per Figure 3 except:
  Phase 1: 90˚C for 120 hours
  Phase 2: 110˚C for 240 hours
- Flex - per Figure 3 except:
  Phase 1: 0.5 pound
  Phase 2: 1.1 pound
- Twist - per Figure 3 except:
  Phase 1: 0.5 pound
  Phase 2: 1.1 pound
  Phase 3: 3.4 pound

- 90 Degree Cable Pull - per Figure 3 except:
  Phase 1: 4.4 pounds for 5 seconds (FOTP 6)
  Phase 2: 7.5 pounds for 5 seconds
  Phase 3: 7.5 pounds for 10 seconds, and then repeat increasing time in 10 second intervals, 60 seconds maximum
- Salt Spray - per Figure 3 except:
  Samples were split into 3 groups post twist exposure, post flex exposure, and virgin
- 0 Degree Cable Pull - per Figure 3 except:
  Phase 1: 10 pounds
  Phase 2: 15 pounds

1.7. Test Requirements/Procedures

Test Description	Requirement	Procedure
Visual and mechanical inspection.	Meets requirements of product drawing.	TIA/EIA-455-13A. Visual, dimensional and functional per applicable quality inspection plan.
Attenuation insertion loss(initial and verification).	Maximum value for any single specimen shall be 0.75 dB. See Note.	TIA/EIA-455-171A, Method A1 or D1 for MM; TIA/EIA-455-171A, Method A3 or D3 for SM. Interconnection Device Insertion Loss Test. Wraps shall be on a smooth surface and be secured in such a manner to guarantee integrity for the duration of the testing. See Figure 4 for cable length.
Return loss.	Minimum value for any single specimen shall be 30 dB. See Note.	TIA/EIA-455-107A. Alternative procedure: an optical time domain reflectometer may be substituted for the coupler method.
Temperature cycling.	Maximum Change In Transmittance (CIT) for any single specimen shall be 0.5 dB during and after test. Minimum return loss for any single specimen shall be 30 dB during and after test.	TIA/EIA-455-3. Subject specimens to 5 cycles between -28 and 85˚C with a maximum ramp time of 40˚ per hour.
Temperature life.	Maximum CIT for any single specimen shall be 0.5 dB after test. Minimum return loss for any single specimen shall be 30 dB after test.	TIA/EIA-455-4. Subject specimens to 110˚C for 240 hours. If tested at lower temperature, increase the duration by 2.5 times for every 10˚C decrease.
Thermal shock.	Maximum CIT for any single specimen shall be 0.5 dB after test Minimum return loss for any single specimen shall be 30 dB after test. See Note.	TIA/EIA-455-71 Condition C-0. Subject specimens to cycles between -40 and 85˚C with a minimum of 5 minute transition between temperature extremes.

Figure 3 (continued)

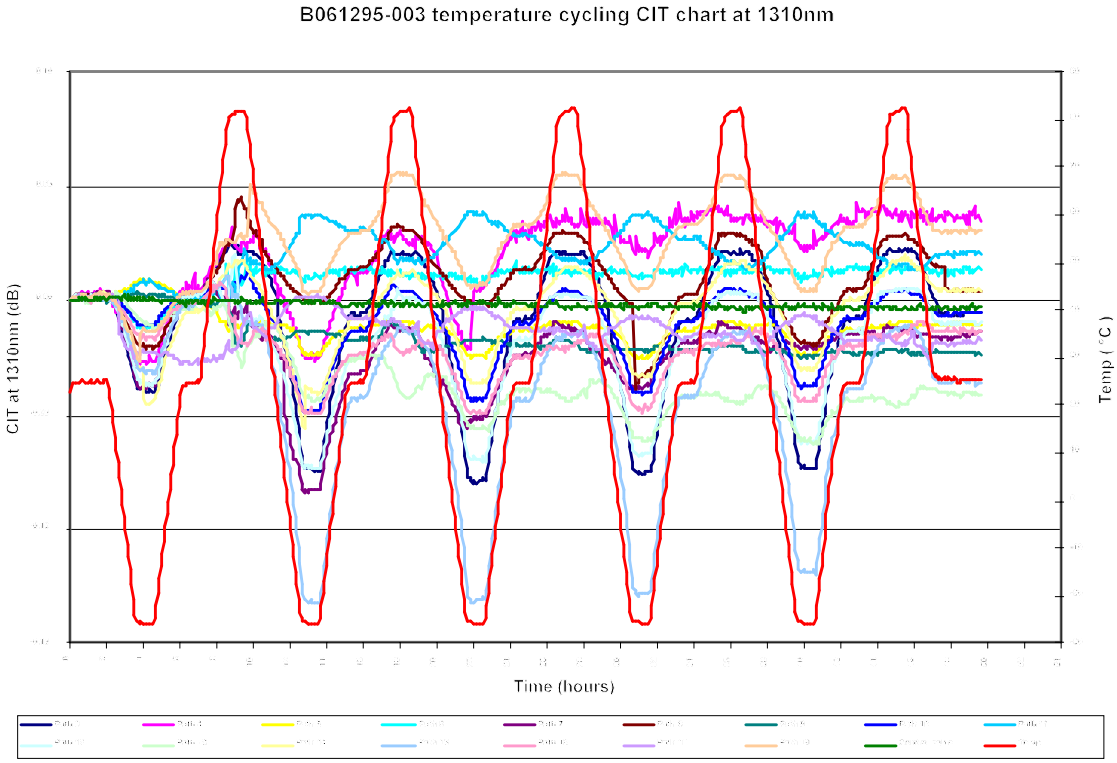
Test Description	Requirement	Procedure
Flex.	Maximum CIT for any single specimen shall be 0.5 dB after test. Minimum return loss for any single specimen shall be 30 dB after test. See Note.	TIA/EIA-455-1. Subject specimens to 200 flexing cycles, 100 initial cycles, and 100 cycles with the connector rotated 90 degrees with an applied load of 0.5 kg [1.1 lb] at a flexing rate of 12 to 14 cycles per minute.
Twist.	Maximum CIT for any single specimen shall be 0.5 dB after test. Minimum return loss for any single specimen shall be 30 dB after test. See Note.	TIA/EIA-455-36. Subject specimens to 500 twisting cycles with an applied load of 1.5 kg [3.3 lb] at a maximum twisting rate of 30 twists per minute.
Mechanical shock.	Maximum CIT for any single specimen shall be 0.5 dB after test. Minimum return loss for any single specimen shall be 30 dB after test. Optical discontinuities shall not exceed 0.5 dB for 50 microseconds.	TIA/EIA-455-14, Table I Test Conditions J, A, B. Subject specimens to sinusoidal shocks having a magnitude of 30 to 75 g on each axis. Three impacts per direction for a total of 9 impacts.
Vibration.	Maximum CIT for any single specimen shall be 0.5 dB after test. Minimum return loss for any single specimen shall be 30 dB after test. Optical discontinuities shall not exceed 0.5 dB for 50 microseconds.	TIA/EIA-455-11, Test Conditions II and VI. Subject specimens to 5 to 55 Hz, vibration excursion of 1.52 mm double amplitude, 10 g from 55 to 500 Hz, RMS level 10 g minimum. Thirty minutes in each axis.
90 degree cable pull.	Maximum CIT for any single specimen shall be 0.5 dB after test. Minimum return loss for any single specimen shall be 30 dB after test. See Note.	TIA/EIA-455-6. Subject specimens to a 33 N [7.5 lbf] static load applied at a 90 degree angle and held for 1 minute.
Salt spray.	No visual evidence of deterioration, loosening of finishes, corrosion of metal surfaces, or corrosion of base metal on plated parts. See Note.	EIA/TIA-455-16 Subject specimens to 5% NaCl solution for 48 hours.
Strength of coupling mechanism.	Connector shall not unlatch.	TIA/EIA-455-185. Subject specimens to a tensile load of 66 N [15 lbf].
0 degree cable pull.	Maximum CIT for any single specimen shall be 0.5 dB after test. Minimum return loss for any single specimen shall be 30 dB after test. See Note.	EIA/TIA-455-6. Subject specimens to a 67 N [15 lbf] static tensile load for 1 minute.
Mating durability.	Maximum CIT for any single specimen shall be 0.5 dB during (every 100 cycles) and after test. Minimum return loss for any single specimen shall be 30 dB during (every 100 cycles) and after test. See Note.	TIA/EIA-455-21. Mate and unmate specimens for 500 cycles at a maximum rate of 300 cycles per hour.

Figure 3 (end)

2 SUMMARY OF TESTING

NOTE *Data reported in paragraphs 2.1. through 2.3., and 2.5. through 2.9. is from DVT1 which evaluated the connector with the "non plus sign" (PN 1828091-1 Rev 2) ferrule base. Data reported in paragraphs 2.4., and 2.10. through 2.12. is from DVT2 which evaluated the connector with the "plus sign" ferrule base (PN 1828091-1 Rev 3). DVT2 also included test groups 3, 4, and 5 (less mechanical shock) from paragraph 1.6., which showed no significant change in performance from DVT1 therefore the data from those tests was omitted.*

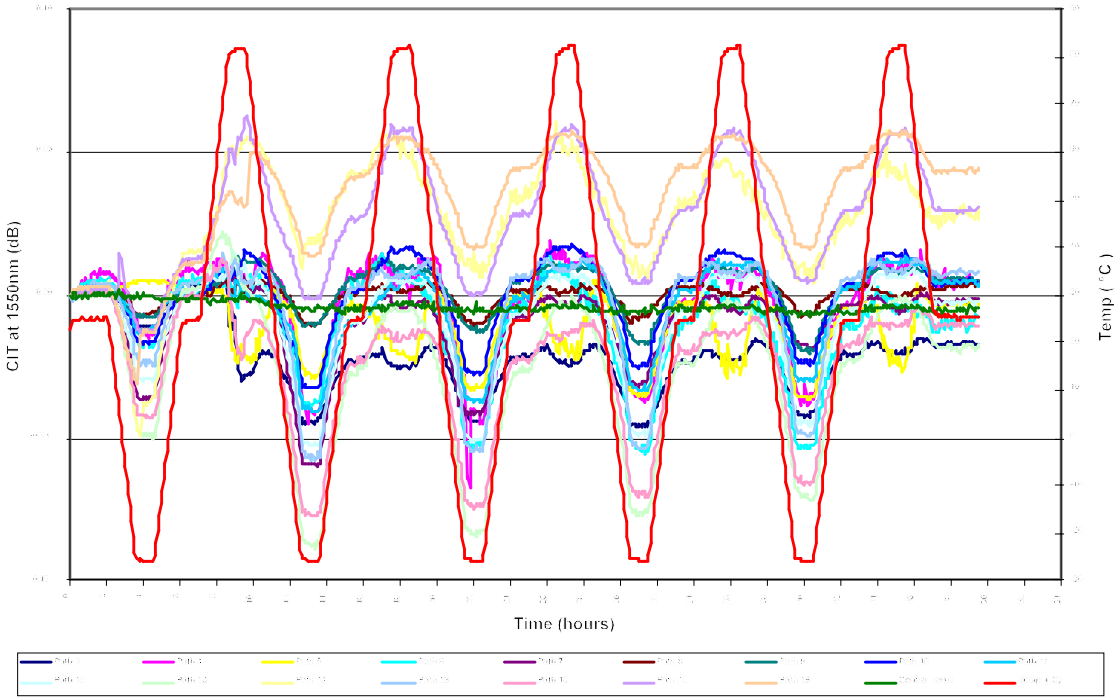
2.1. Temperature Cycle: Five cycles between -28 and 85˚C



Individual Statistics	SC Samples								LC Samples							
	Path 3	Path 4	Path 5	Path 6	Path 7	Path 8	Path 9	Path 10	Path 11	Path 12	Path 13	Path 14	Path 15	Path 16	Path 18	Path 19
Minimum	51.8	54.3	54.3	53.6	50.5	53.0	50.5	53.5	52.5	52.6	53.1	52.8	51.2	50.9	50.7	52.8
Maximum	53.7	56.1	55.8	54.7	51.1	54.3	51.5	54.2	53.6	53.7	54.2	53.6	52.2	52.0	51.7	53.8
Range	1.9	1.8	1.5	1.0	0.6	1.4	1.1	0.7	1.1	1.1	1.2	0.9	1.0	1.0	1.0	1.1
Average	53.0	55.1	54.9	54.1	50.7	53.7	50.9	53.8	53.0	53.1	53.6	53.2	51.9	51.4	51.3	53.2
Standard Deviation	0.43	0.3	0.3	0.2	0.1	0.3	0.2	0.1	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2

RL Data Summary at 1310 nm

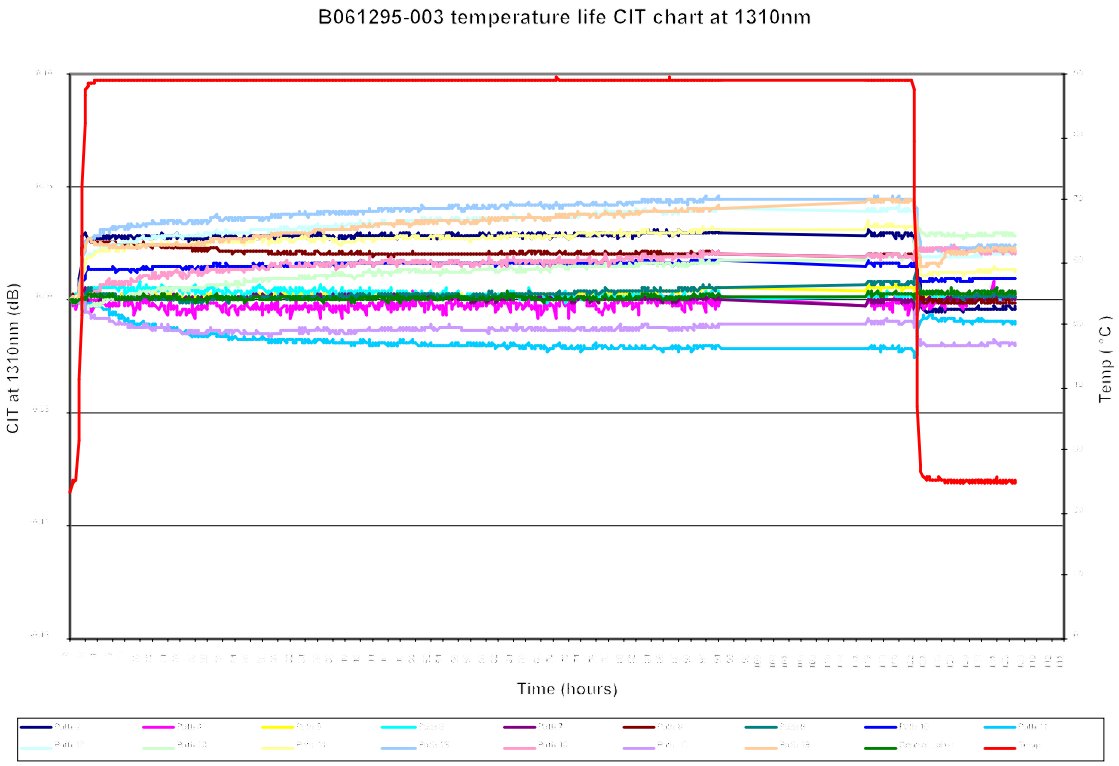
B061295-003 temperature cycling CIT chart at 1550nm



Individual Statistics	SC Samples								LC Samples							
	Path 3	Path 4	Path 5	Path 6	Path 7	Path 8	Path 9	Path 10	Path 11	Path 12	Path 13	Path 14	Path 15	Path 16	Path 18	Path 19
Minimum	53.8	51.8	54.8	53.8	53.5	53.8	53.4	53.8	53.7	53.7	53.8	54.8	54.2	51.8	52.8	52.8
Maximum	53.8	51.8	54.8	53.8	53.8	53.8	53.8	53.8	53.8	54.8	53.8	54.8	54.8	51.8	52.8	52.8
Range	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.1	1.1	0.0	0.0	0.6	0.0	0.0	0.0
Average	53.8	51.8	54.8	53.8	53.8	53.8	53.8	53.8	53.8	54.8	53.8	54.8	54.8	51.8	52.8	52.8
Standard Deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RL Data Summary at 1550 nm

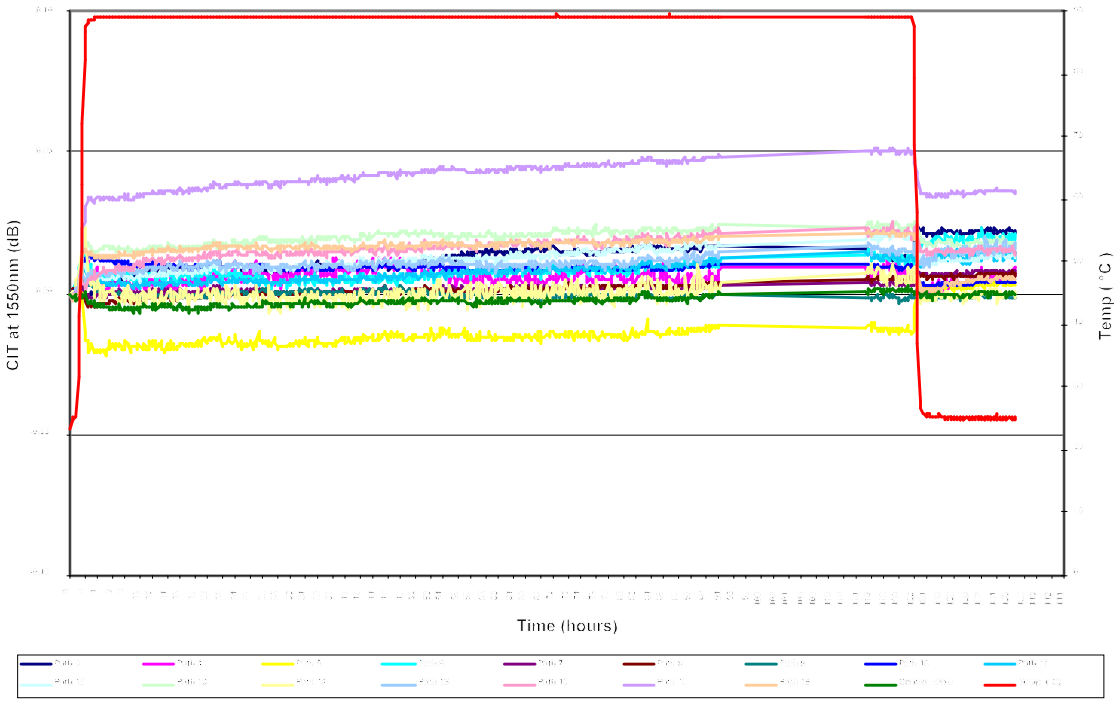
2.2. Temperature Life Phase 1: 90˚C for 120 hours



Individual Statistics	SC Samples								LC Samples							
	Path 3	Path 4	Path 5	Path 6	Path 7	Path 8	Path 9	Path 10	Path 11	Path 12	Path 13	Path 14	Path 15	Path 16	Path 18	Path 19
Minimum	53.1	54.9	54.7	54.0	50.7	53.8	50.7	53.6	52.8	52.8	53.4	53.1	51.8	51.2	51.2	52.9
Maximum	54.3	57.9	56.4	55.0	51.3	54.9	51.9	54.6	53.9	53.7	54.8	54.1	52.4	52.2	52.0	54.3
Range	1.2	3.0	1.7	1.0	0.6	1.1	1.2	0.9	1.2	0.9	1.4	1.0	0.6	0.9	0.8	1.4
Average	53.8	56.2	55.6	54.5	51.0	54.4	51.5	54.1	53.5	53.3	54.2	53.6	52.1	51.8	51.6	53.8
Standard Deviation	0.2	0.5	0.3	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.1	0.2	0.1	0.2

RL Data Summary at 1310 nm

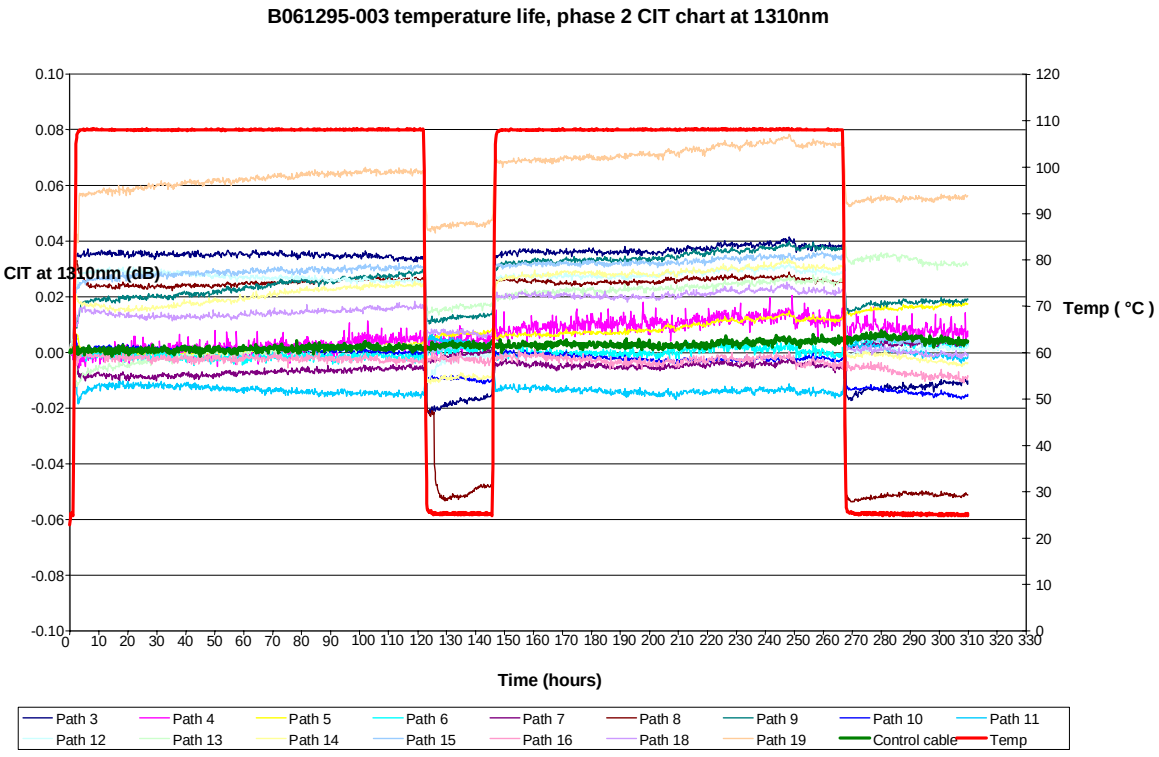
B061295-003 temperature life CIT chart at 1550nm



Individual Statistics	SC Samples								LC Samples							
	Path 3	Path 4	Path 5	Path 6	Path 7	Path 8	Path 9	Path 10	Path 11	Path 12	Path 13	Path 14	Path 15	Path 16	Path 18	Path 19
Minimum	53.8	51.8	54.6	53.8	53.8	52.7	53.5	53.8	53.8	54.8	53.8	54.8	54.8	51.8	52.8	52.8
Maximum	53.8	51.8	54.8	53.8	53.8	53.8	53.8	53.8	53.8	54.8	53.8	54.8	54.8	51.8	52.8	52.8
Range	0.0	0.0	0.2	0.0	0.0	1.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average	53.8	51.8	54.8	53.8	53.8	53.8	53.8	53.8	53.8	54.8	53.8	54.8	54.8	51.8	52.8	52.8
Standard Deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

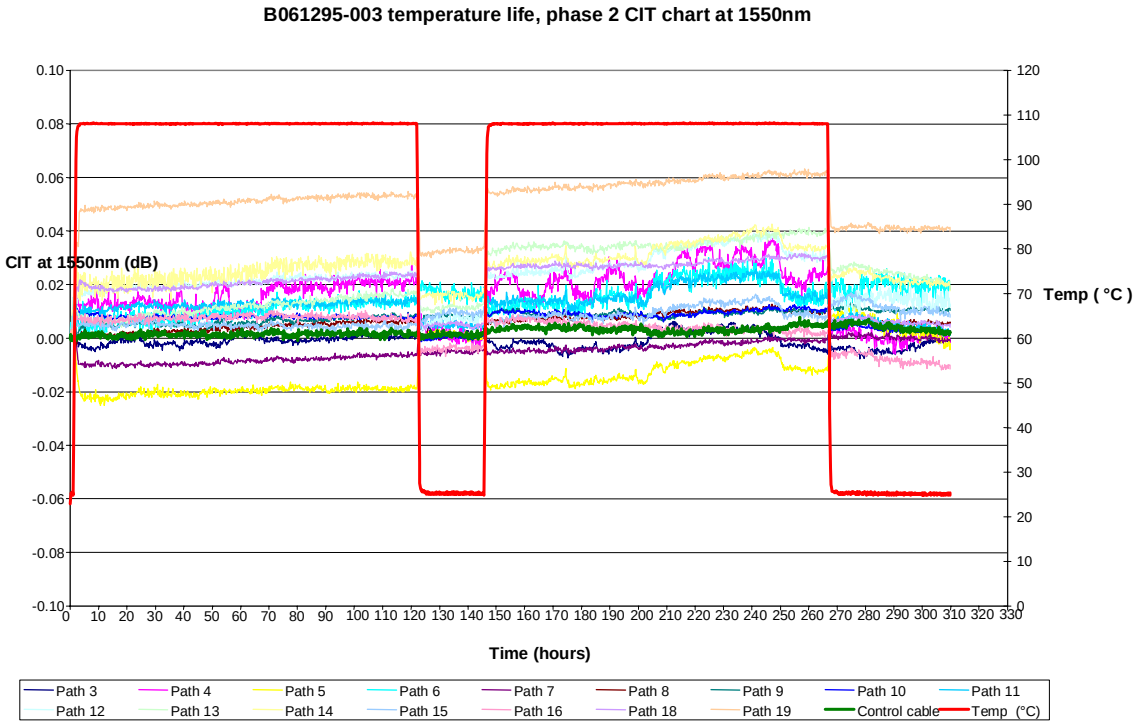
RL Data Summary at 1550 nm

2.3. Temperature Life, Phase 2: 110˚C for 240 hours



Individual Statistics	SC Samples								LC Samples							
	Path 3	Path 4	Path 5	Path 6	Path 7	Path 8	Path 9	Path 10	Path 11	Path 12	Path 13	Path 14	Path 15	Path 16	Path 18	Path 19
Minimum	53.5	55.5	55.2	54.2	50.7	53.9	51.0	53.5	53.3	52.8	53.7	53.1	51.9	51.3	51.4	52.7
Maximum	55.0	58.6	57.1	55.3	51.4	55.2	53.7	54.7	54.5	54.0	54.9	54.2	52.6	52.3	52.2	54.9
Range	1.6	3.0	2.0	1.0	0.6	1.3	2.7	1.2	1.2	1.2	1.2	1.1	0.7	1.0	0.8	2.3
Average	54.4	56.8	56.1	54.7	51.1	54.5	52.5	54.1	53.8	53.5	54.3	53.7	52.3	51.9	51.8	53.9
Standard Deviation	0.2	0.5	0.3	0.2	0.1	0.2	0.7	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.4

RL Data Summary at 1310 nm



Individual Statistics	SC Samples								LC Samples							
	Path 3	Path 4	Path 5	Path 6	Path 7	Path 8	Path 9	Path 10	Path 11	Path 12	Path 13	Path 14	Path 15	Path 16	Path 18	Path 19
Minimum	53.8	51.8	54.8	53.8	52.5	53.4	51.5	53.8	51.3	53.1	53.8	54.8	51.8	51.8	51.8	52.8
Maximum	53.8	51.8	54.8	53.8	53.8	53.8	53.8	53.8	53.8	54.8	53.8	54.8	54.8	51.8	52.8	52.8
Range	0.0	0.0	0.0	0.0	1.3	0.4	2.3	0.0	2.5	1.7	0.0	0.0	3.0	0.0	1.0	0.0
Average	53.8	51.8	54.8	53.8	53.8	53.8	53.8	53.8	53.8	54.8	53.8	54.8	54.8	51.8	52.8	52.8
Standard Deviation	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0

RL Data Summary at 1550 nm

2.4 Thermal Shock Data: -40 to 85˚C

1310 nm

CIT During	RWOC SC Samples	RWOC LC Samples
Most negative change (dB)	-0.18	-0.32
Most positive change (dB)	0.05	0.17
Range (dB)	0.24	0.49
Average (dB)	-0.01	-0.03
Standard Deviation	0.05	0.09

Group CIT After	RWOC SC Samples	RWOC LC Samples
Most negative change (dB)	-0.02	-0.04
Most positive change (dB)	0.03	0.05
Range (dB)	0.06	0.09
Average (dB)	0.00	0.00
Standard Deviation	0.01	0.02

Group RL During	RWOC SC Samples	RWOC LC Samples
Minimum (dB)	43.6	**5.8**
Maximum (dB)	45.7	45.0
Range (dB)	2.1	39.3
Average (dB)	44.9	40.2
Standard Deviation	0.5	9.6

Group RL After	RWOC SC Samples	RWOC LC Samples
Minimum (dB)	43.7	**9.6**
Maximum (dB)	45.5	44.9
Range (dB)	1.8	35.4
Average (dB)	44.9	39.2
Standard Deviation	0.5	11.0

Group IL During	RWOC SC Samples	RWOC LC Samples
Minimum (dB)	0.13	0.00
Maximum (dB)	0.43	**0.91**
Range (dB)	0.31	0.90
Average (dB)	0.22	0.21
Standard Deviation	0.09	0.20

Group IL After	RWOC SC Samples	RWOC LC Samples
Minimum (dB)	0.13	0.00
Maximum (dB)	0.32	**0.61**
Range (dB)	0.19	0.61
Average (dB)	0.21	0.18
Standard Deviation	0.06	0.15

1550 nm

CIT During	RWOC SC Samples	RWOC LC Samples
Most negative change (dB)	-0.17	-0.15
Most positive change (dB)	0.03	0.32
Range (dB)	0.20	0.46
Average (dB)	-0.05	-0.01
Standard Deviation	0.04	0.09

Group CIT After	RWOC SC Samples	RWOC LC Samples
Most negative change (dB)	-0.06	-0.07
Most positive change (dB)	0.05	0.11
Range (dB)	0.11	0.18
Average (dB)	-0.01	0.00
Standard Deviation	0.04	0.04

Group RL During	RWOC SC Samples	RWOC LC Samples
Minimum (dB)	45.5	5.5
Maximum (dB)	47.9	46.9
Range (dB)	2.5	41.4
Average (dB)	46.8	40.1
Standard Deviation	0.5	13.0

Group RL After	RWOC SC Samples	RWOC LC Samples
Minimum (dB)	45.5	5.4
Maximum (dB)	47.8	46.8
Range (dB)	2.3	41.4
Average (dB)	46.8	40.1
Standard Deviation	0.5	13.3

Group IL During	RWOC SC Samples	RWOC LC Samples
Minimum (dB)	0.09	0.06
Maximum (dB)	0.38	**1.22**
Range (dB)	0.29	1.16
Average (dB)	0.21	0.25
Standard Deviation	0.07	0.29

Group IL After	RWOC SC Samples	RWOC LC Samples
Minimum (dB)	0.10	0.05
Maximum (dB)	0.34	**1.12**
Range (dB)	0.24	1.07
Average (dB)	0.18	0.24
Standard Deviation	0.07	0.33

Comments:

- All SC samples met the requirements.
- There was one LC sample that was damaged at the start of the test. The endface was damaged and thus caused out of spec IL and RL readings at both wavelengths. The data summary reflects these out of spec measurements. All other samples met the IL and RL requirements at both wavelengths.

2.5. Flex: 0.5 and 1.1 Pound Loading, 1310 and 1550 nm

1310 nm Initial Measurements

Initial Group IL Statistics		SC RWOC Samples	LC RWOC Samples
	Minimum	0.02	0.07
	Maximum	0.22	0.74
	Range	0.20	0.67
	Average	0.08	0.21
	Standard Deviation	0.06	0.20
Initial Group RL Statistics		SC RWOC Samples	LC RWOC Samples
	Minimum	48.5	50.5
	Maximum	54.4	55.5
	Range	5.9	5.0
	Average	51.5	52.8
	Standard Deviation	1.4	1.6

1310 nm 0.5 Pound Measurements

Group IL Statistics - During/After 0.5 Pound Flex Test		SC RWOC Samples	LC RWOC Samples
	Minimum	0.02	0.08
	Maximum	0.22	0.83
	Range	0.20	0.75
	Average	0.07	0.21
	Standard Deviation	0.04	0.22
Group IL Change Statistics - During/After 0.5 Pound Flex Test		SC RWOC Samples	LC RWOC Samples
	Minimum	-0.05	-0.09
	Maximum	0.15	0.05
	Range	0.20	0.14
	Average	0.01	0.00
	Standard Deviation	0.04	0.03
Group RL Statistics - During/After 0.5 Pound Flex Test		SC RWOC Samples	LC RWOC Samples
	Minimum	49.4	48.6
	Maximum	53.0	56.5
	Range	3.6	7.9
	Average	51.5	52.5
	Standard Deviation	0.9	1.8

1310 nm 1.1 Pound Measurements

Group IL Statistics - During/After 1.1 Pound Flex Test		SC RWOC Samples	LC RWOC Samples
	Minimum	0.01	0.07
	Maximum	0.24	0.96
	Range	0.23	0.89
	Average	0.07	0.24
	Standard Deviation	0.06	0.23
Group IL Change Statistics - During/After 1.1 Pound Flex Test		SC RWOC Samples	LC RWOC Samples
	Minimum	-0.06	-0.24
	Maximum	0.08	0.04
	Range	0.14	0.28
	Average	0.01	0.02
	Standard Deviation	0.03	0.07
Group RL Statistics - During/After 1.1 Pound Flex Test		SC RWOC Samples	LC RWOC Samples
	Minimum	45.6	22.2
	Maximum	53.0	55.5
	Range	7.4	33.3
	Average	51.1	48.5
	Standard Deviation	1.6	9.6

1550 nm Initial Measurements

Initial Group IL Statistics		SC RWOC Samples	LC RWOC Samples
	Minimum	0.01	0.11
	Maximum	0.20	0.61
	Range	0.19	0.50
	Average	0.08	0.22
	Standard Deviation	0.06	0.15
Initial Group RL Statistics		SC RWOC Samples	LC RWOC Samples
	Minimum	47.7	49.5
	Maximum	52.5	55.6
	Range	4.8	6.1
	Average	50.7	52.3
	Standard Deviation	1.3	1.8

1550 nm 0.5 Pound Measurements

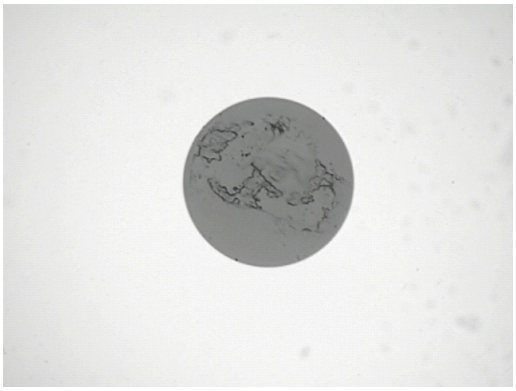
Group IL Statistics - During/After 0.5 Pound Flex Test		SC RWOC Samples	LC RWOC Samples
	Minimum	0.01	0.11
	Maximum	0.21	0.71
	Range	0.20	0.60
	Average	0.05	0.22
	Standard Deviation	0.04	0.17
Group IL Change Statistics - During/After 0.5 Pound Flex Test		SC RWOC Samples	LC RWOC Samples
	Minimum	-0.03	-0.10
	Maximum	0.14	0.05
	Range	0.17	0.15
	Average	0.03	0.00
	Standard Deviation	0.05	0.04
Group RL Statistics - During/After 0.5 Pound Flex Test		SC RWOC Samples	LC RWOC Samples
	Minimum	48.6	49.5
	Maximum	52.5	57.0
	Range	3.9	7.5
	Average	50.6	52.2
	Standard Deviation	0.8	1.9

1550 nm 1.1 Pound Measurements

Group IL Statistics - During/After 1.1 Pound Flex Test		SC RWOC Samples	LC RWOC Samples
	Minimum	0.01	0.10
	Maximum	0.21	0.79
	Range	0.20	0.69
	Average	0.06	0.23
	Standard Deviation	0.06	0.18
Group IL Change Statistics - During/After 1.1 Pound Flex Test		SC RWOC Samples	LC RWOC Samples
	Minimum	-0.14	-0.18
	Maximum	0.14	0.07
	Range	0.28	0.25
	Average	0.02	-0.01
	Standard Deviation	0.05	0.06
Group RL Statistics - During/After 1.1 Pound Flex Test		SC RWOC Samples	LC RWOC Samples
	Minimum	45.5	23.8
	Maximum	52.4	55.8
	Range	6.9	32.0
	Average	50.1	48.5
	Standard Deviation	1.5	9.0

Comments:

- LC sample #7 had high initial loss reading (0.74 dB) prior to applying 0.5 pound load. Monitoring of this sample continued, and the results are included in the above statistical summaries. The sample with high loss was replaced, and the new sample met the requirements.
- LC Endface damage was recorded after the 0.5 and 1.1 pound flex cycles (see photos). No SC endface damage occurred.
- The optical performance was acceptable at 0.5 and 1.1 pound loads.



2.6. Twist: 0.5, 1.1 and 3.4 Pound Loading, 1310 and 1550 nm

1310 nm Initial Measurements

Initial Group IL Statistics		SC RWOC Samples	LC RWOC Samples
	Minimum	0.01	0.09
	Maximum	0.17	0.28
	Range	0.16	0.19
	Average	0.06	0.18
	Standard Deviation	0.04	0.06
Initial Group RL Statistics		SC RWOC Samples	LC RWOC Samples
	Minimum	51.0	51.0
	Maximum	53.9	54.3
	Range	2.9	3.3
	Average	52.5	52.5
	Standard Deviation	0.8	0.9

1310 nm 0.5 Pound Measurements

Group IL Statistics - After 0.5 Pound Twist Test		SC RWOC Samples	LC RWOC Samples
	Minimum	0.02	0.10
	Maximum	0.15	0.29
	Range	0.13	0.19
	Average	0.07	0.17
	Standard Deviation	0.05	0.06
Group IL Change Statistics - After 0.5 Pound Twist Test		SC RWOC Samples	LC RWOC Samples
	Minimum	-0.11	-0.11
	Maximum	0.02	0.05
	Range	0.13	0.16
	Average	-0.01	-0.01
	Standard Deviation	0.03	0.04

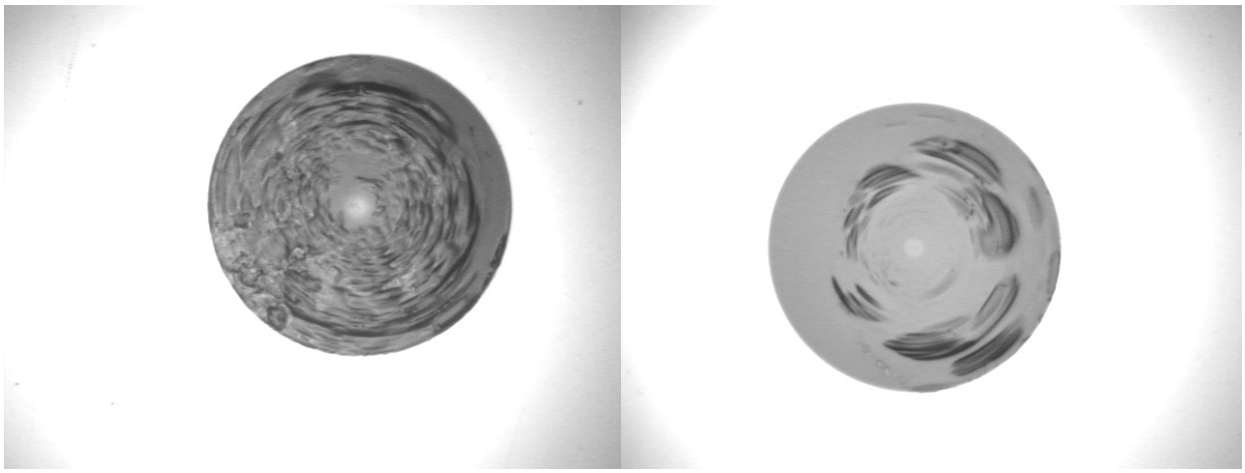
Group RL Statistics - After 0.5 Pound Twist Test		SC RWOC Samples	LC RWOC Samples
	Minimum	51.2	29.9
	Maximum	53.5	53.5
	Range	2.3	23.6
	Average	52.1	49.0
	Standard Deviation	0.6	7.4
1310 nm 1.1 Pound Measurements			
Group IL Statistics - After 1.1 Pound Twist Test		SC RWOC Samples	LC RWOC Samples
	Minimum	0.01	0.11
	Maximum	0.15	0.25
	Range	0.14	0.14
	Average	0.06	0.18
	Standard Deviation	0.05	0.05
Group IL Change Statistics - After 1.1 Pound Twist Test		SC RWOC Samples	LC RWOC Samples
	Minimum	-0.04	-0.05
	Maximum	0.03	0.09
	Range	0.07	0.14
	Average	0.00	0.01
	Standard Deviation	0.02	0.04
Group RL Statistics - After 1.1 Pound Twist Test		SC RWOC Samples	LC RWOC Samples
	Minimum	51.0	50.1
	Maximum	53.5	53.2
	Range	2.5	3.1
	Average	51.9	52.2
	Standard Deviation	0.6	1.0
1310 nm 3.4 Pound Measurements			
Group IL Statistics - After 3.4 Pound Twist Test		SC RWOC Samples	LC RWOC Samples
	Minimum	0.01	0.10
	Maximum	0.14	0.29
	Range	0.13	0.19
	Average	0.06	0.16
	Standard Deviation	0.05	0.07
Group IL Change Statistics - After 3.4 Pound Twist Test		SC RWOC Samples	LC RWOC Samples
	Minimum	-0.03	-0.04
	Maximum	0.02	0.04
	Range	0.05	0.08
	Average	0.00	0.00
	Standard Deviation	0.02	0.02
Group RL Statistics - After 3.4 Pound Twist Test		SC RWOC Samples	LC RWOC Samples
	Minimum	50.5	51.9
	Maximum	53.9	53.2
	Range	3.4	1.3
	Average	52.2	52.4
	Standard Deviation	1.0	0.4
1550 nm Initial Measurements			
Initial Group IL Statistics		SC RWOC Samples	LC RWOC Samples
	Minimum	0.00	0.10
	Maximum	0.13	0.25
	Range	0.13	0.15
	Average	0.05	0.18
	Standard Deviation	0.03	0.04

Initial Group RL Statistics		SC RWOC Samples	LC RWOC Samples
	Minimum	50.5	49.7
	Maximum	53.2	55.4
	Range	2.7	5.7
	Average	51.8	51.9
	Standard Deviation	0.8	1.3
1550 nm 0.5 Pound Measurements			
Group IL Statics - After 0.5 Pound Twist Test		SC RWOC Samples	LC RWOC Samples
	Minimum	0.01	0.11
	Maximum	0.10	0.23
	Range	0.09	0.12
	Average	0.05	0.16
	Standard Deviation	0.03	0.04
Group IL Change Statistics - After 0.5 Pound Twist Test		SC RWOC Samples	LC RWOC Samples
	Minimum	-0.06	-0.06
	Maximum	0.02	0.08
	Range	0.08	0.14
	Average	-0.01	0.00
	Standard Deviation	0.02	0.04
Group RL Statistics - After 0.5 Pound Twist Test		SC RWOC Samples	LC RWOC Samples
	Minimum	50.4	31.1
	Maximum	53.0	52.7
	Range	2.6	21.6
	Average	51.5	48.7
	Standard Deviation	0.7	6.6
1550 nm 1.1 Pound Measurements			
Group IL Statistics - After 1.1 Pound Twist Test		SC RWOC Samples	LC RWOC Samples
	Minimum	0.00	0.13
	Maximum	0.11	0.26
	Range	0.11	0.13
	Average	0.05	0.18
	Standard Deviation	0.03	0.05
Group IL Change Statistics - After 1.1 Pound Twist Test		SC RWOC Samples	LC RWOC Samples
	Minimum	-0.02	-0.04
	Maximum	0.01	0.07
	Range	0.03	0.11
	Average	0.00	0.00
	Standard Deviation	0.01	0.03
Group RL Statistics - After 1.1 Pound Twist Test		SC RWOC Samples	LC RWOC Samples
	Minimum	50.2	50.0
	Maximum	53.1	54.6
	Range	2.9	4.6
	Average	51.3	52.1
	Standard Deviation	0.7	1.3
1550 nm 3.4 Pound Measurements			
Group IL Statistics - After 3.4 Pound Twist Test		SC RWOC Samples	LC RWOC Samples
	Minimum	0.01	0.14
	Maximum	0.12	0.27
	Range	0.11	0.13
	Average	0.05	0.19
	Standard Deviation	0.03	0.05

Group IL Change Statistics - After 3.4 Pound Twist Test		SC RWOC Samples	LC RWOC Samples
	Minimum	-0.02	-0.06
	Maximum	0.01	0.01
	Range	0.03	0.07
	Average	0.00	-0.02
	Standard Deviation	0.01	0.02
Group RL Statistics - After 3.4 Pound Twist Test		SC RWOC Samples	LC RWOC Samples
	Minimum	50.0	51.4
	Maximum	53.5	53.8
	Range	3.5	2.4
	Average	51.7	52.3
	Standard Deviation	0.9	0.9

Comments:

- LC endface damage was recorded after the 0.5 and 1.1 pound twist cycles, no damage after 3.4 pound loads. (see photos). No SC endface damage occurred.
- Acceptable optical performance at the 1.1 and 3.4 pound loads.

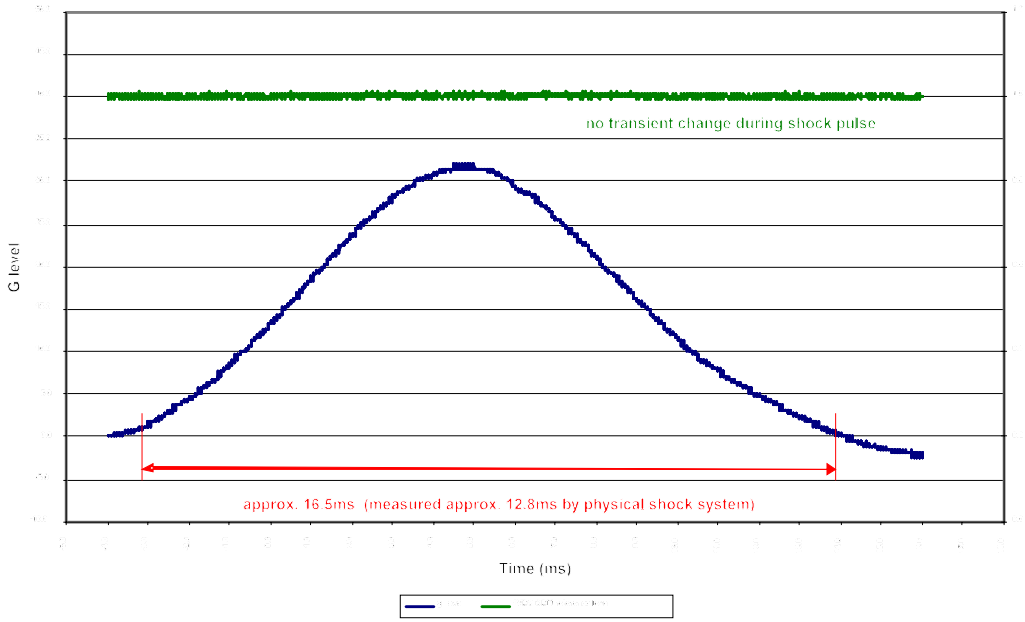


0.5 Pound Load

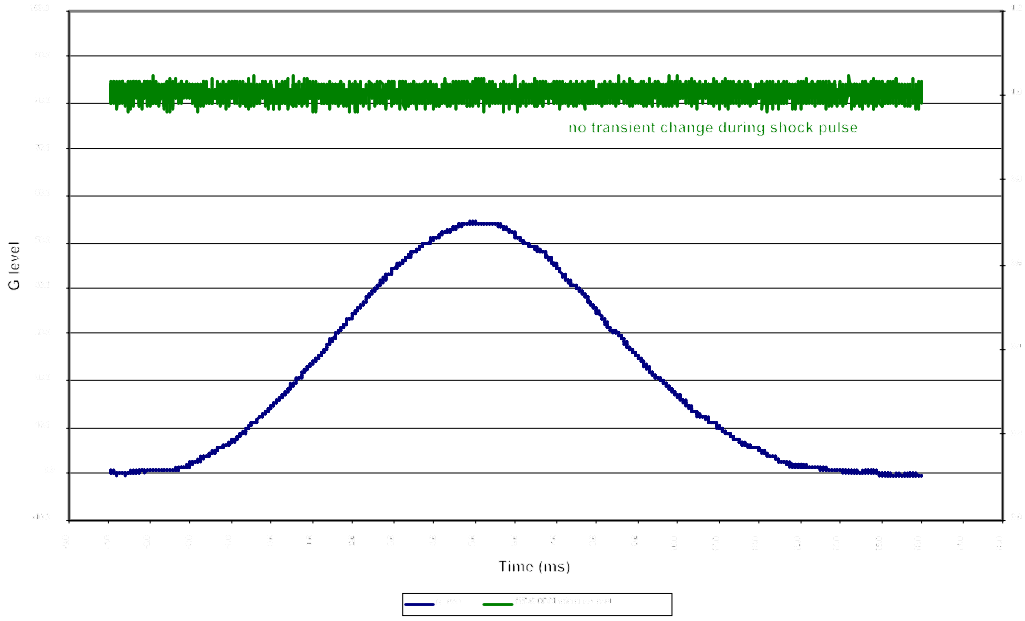
1.1 Pound Load

2.7. Shock: Three impacts in each axis at 30, 50 and 75 g. Random Vibration, Sinusoidal Vibration: The following charts depict the worst case, or typical response from the specified input.

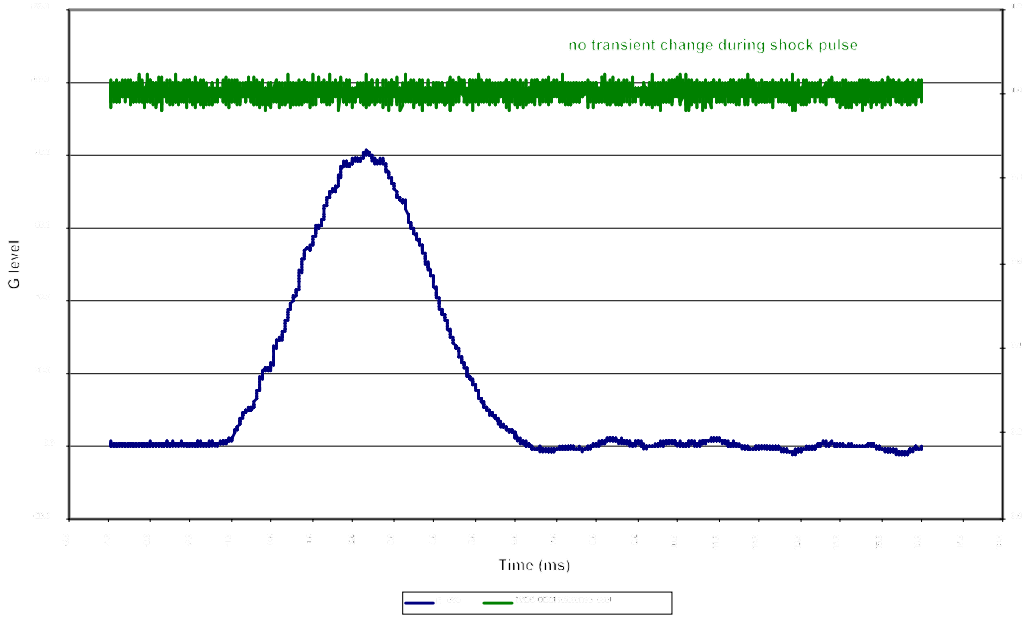
B061295-003 - Physical shock of RWOC SC sample 7 almost per FOTP-14, Method J (30g, 18ms)



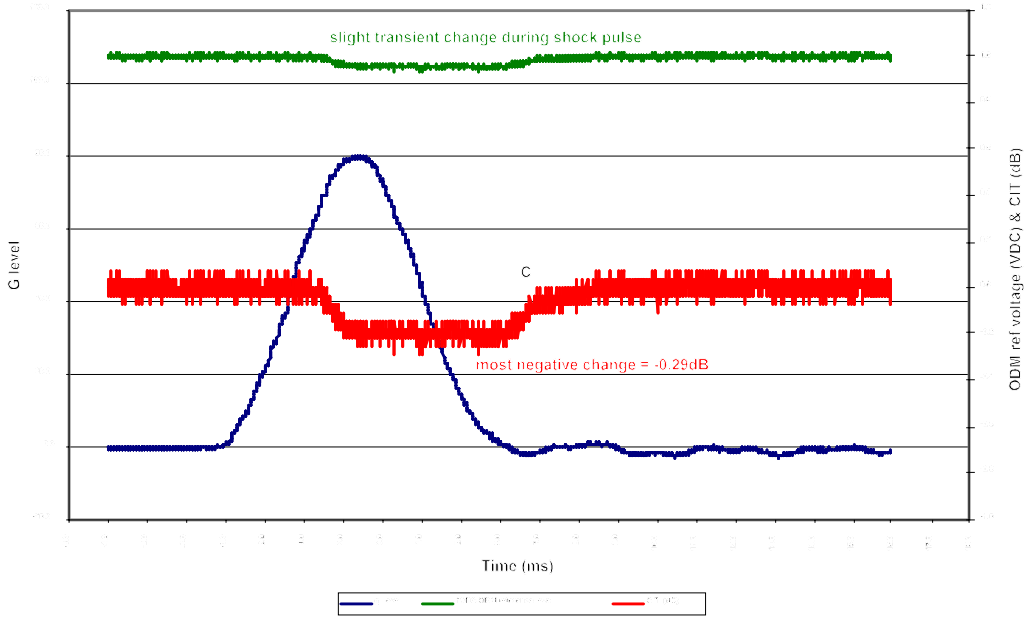
B061295-003 - Physical shock of RWOC SC sample 8 per FOTP-14, Method A (50g, 11ms)



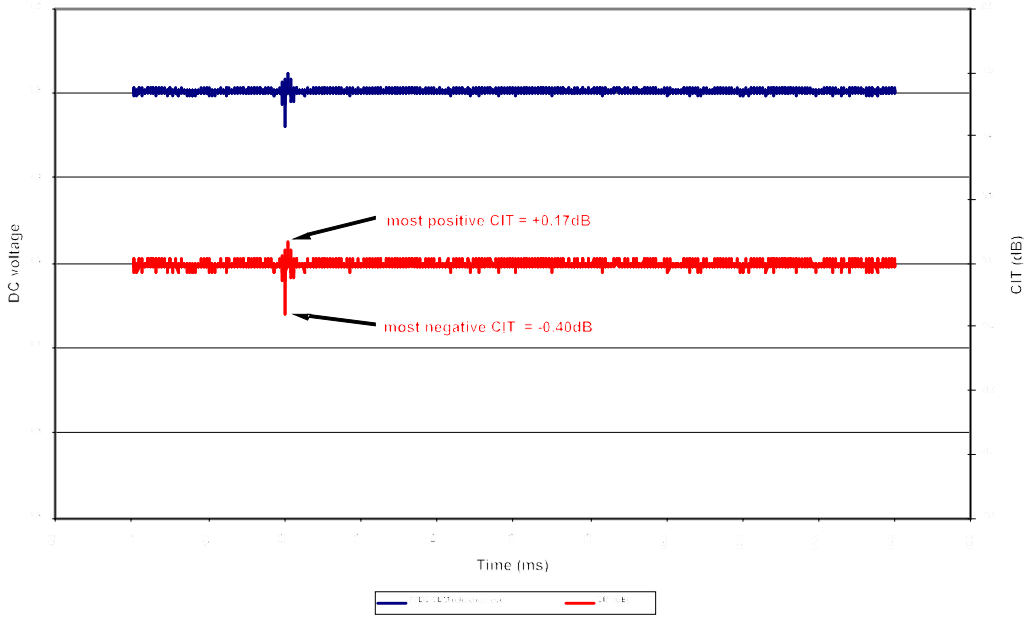
B061295-003 - Physical shock of RWOC SC sample 5 per
FOTP-14, Method B (75g, 6ms)



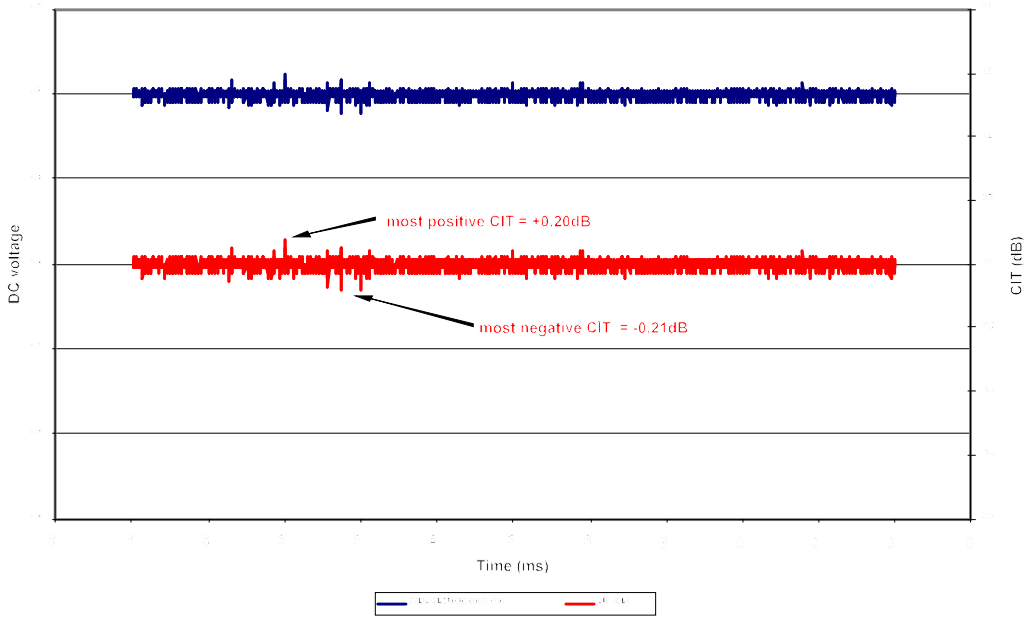
B061295-003 - Worst case transient detected during Mechanical Shock
(FOTP-14, Method B, 75g, 6ms) of RWOC LC sample 13



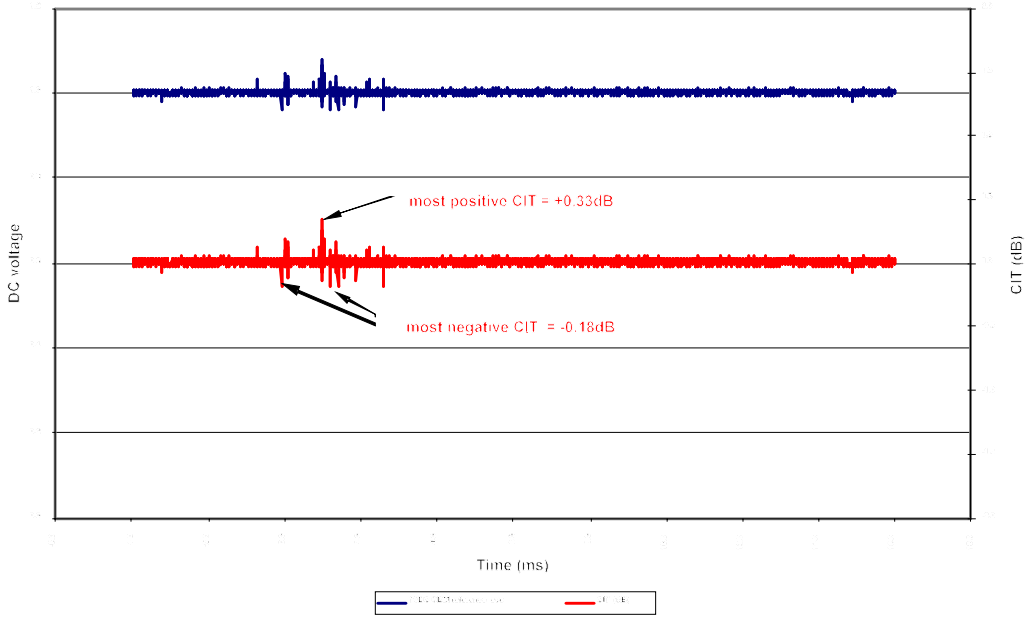
B061295-003 - Worst case transient detected during Random Vibration
(FOTP-11, Condition VI-D) of RWOC LC sample 11 in Z axis



B061295-003 - Transient detected during Random Vibration
(FOTP-11, Condition VI-D) of RWOC LC sample 10 in Y axis



B061295-003 - Worst case transient detected during Sine Vibration
(FOTP-11, Condition II) of RWOC LC sample 11



Change in IL and RL after Shock and Vibration Testing

1310 nm Measurements

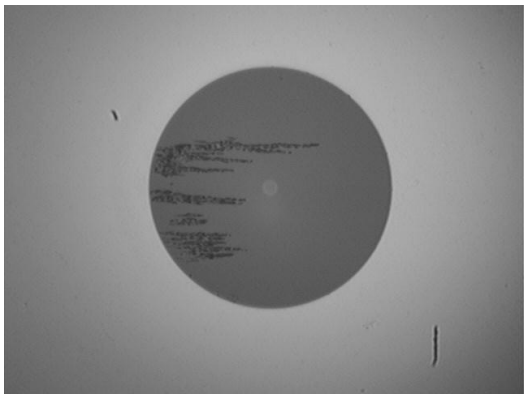
Group IL Change Statistics		SC RWOC Samples	LC RWOC Samples
	Minimum	-0.02	-0.15
	Maximum	0.07	-0.06
	Range	0.09	0.08
	Average	0.01	-0.11
	Standard Deviation	0.03	0.03
Group RL Change Statistics		SC RWOC Samples	LC RWOC Samples
	Minimum	-1.2	-5.0
	Maximum	2.9	8.1
	Range	4.1	13.1
	Average	0.5	-0.4
	Standard Deviation	1.4	3.7

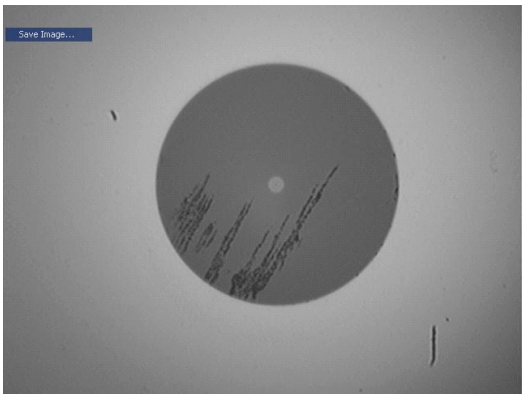
1550 nm Measurements

Group IL Change Statistics		SC RWOC Samples	LC RWOC Samples
	Minimum	-0.04	-0.17
	Maximum	0.03	-0.12
	Range	0.07	0.05
	Average	-0.01	-0.14
	Standard Deviation	0.03	0.02
Group RL Change Statistics		SC RWOC Samples	LC RWOC Samples
	Minimum	-0.2	-2.7
	Maximum	1.8	5.3
	Range	2.0	8.0
	Average	0.6	0.0
	Standard Deviation	0.7	2.4

Comments:

- LC endface damage was recorded as a result of sinusoidal vibration testing (see photos). No SC endface damage occurred.
- Acceptable optical performance.





2.8. 90 Degree Cable Pull: 4.4 and 7.5 Pound

1310 nm Data - 90 Degree Pull

Final Group IL Statistics		SC RWOC Samples	LC RWOC Samples
	Minimum	0.03	0.09
	Maximum	12.75	7.58
	Range	12.72	7.49
	Average	1.66	2.13
	Standard Deviation	4.48	2.55
Group IL Change Statistics - During/After 90 Degree Pull		**SC RWOC Samples**	**LC RWOC Samples**
	Most Negative Change	-44.26	-41.54
	Most Positive Change	0.05	0.07
	Range	44.31	41.61
	Average Change	-0.48	-1.39
	Standard Deviation	4.19	5.71
Final Group RL Statistics		**SC RWOC Samples**	**LC RWOC Samples**
	Minimum	50.7	28.2
	Maximum	56.6	54.9
	Range	5.9	26.7
	Average	53.3	49.0
	Standard Deviation	1.9	9.0

1550 nm Data - 90 Degree Pull

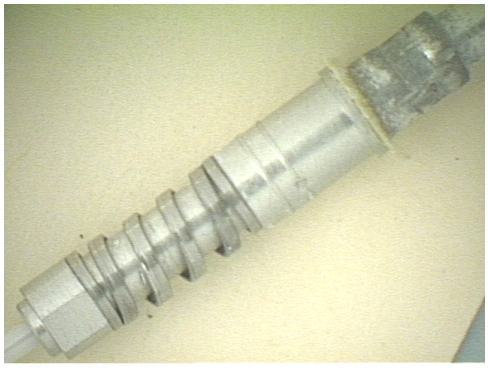
Final Group IL Statistics		SC RWOC Samples	LC RWOC Samples
	Minimum	0.04	0.13
	Maximum	10.59	5.86
	Range	10.55	5.73
	Average	1.39	1.77
	Standard Deviation	3.72	1.98
Group IL Change Statistics - During/After 90 Degree Pull		**SC RWOC Samples**	**LC RWOC Samples**
	Most Negative Change	-44.23	-38.59
	Most Positive Change	0.03	0.10
	Range	44.26	38.69
	Average Change	-0.46	-1.21
	Standard Deviation	4.14	5.24
Final Group RL Statistics		**SC RWOC Samples**	**LC RWOC Samples**
	Minimum	50.4	27.6
	Maximum	57.9	56.2
	Range	7.5	28.6
	Average	52.9	49.2
	Standard Deviation	2.4	9.2

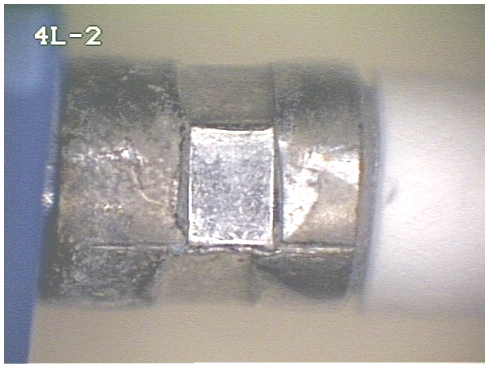
Comments

- All samples passed optical requirements at 4.4 pounds for 5 seconds:
  - IL < 0.75 dB before/after
  - CIT< 0.50 dB during
  - RL > 40 dB before/after
- One SC sample failed during the 7.5 pound load due to a cracked ceramic sleeve in the adapter. The remaining 7 samples passed all three phases. The data in the summary tables includes the out of specification that resulted from the failed adapter.
- Six LC samples survived 7.5 pounds for 5 seconds 2 LC samples survived 7.5 pounds beyond 20 seconds (1 of those samples survived 60 second duration) 4 out of the 8 failed samples had broken ceramic sleeves in the adapter.

2.9. Salt Spray: 48 Hour Exposure

All LC and SC samples passed salt spray exposure. There were no signs of detrimental effects. Photos are typical of both SC and LC connectors after exposure.





2.10. Strength of Coupling: 15 lb Load

Comments:

- All SC samples met the requirements; connectors remain latched during load application.
- All LC samples met the requirements; connectors remain latched during load application.

2.11. 0 degree Cable Pull: 10 and 15 Pound Loads

1310 nm With 10 Pound Load

Initial Group IL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	0.01	0.08
Maximum	0.27	0.32
Range	0.26	0.24
Average	0.12	0.20
Standard Deviation	0.08	0.07

Final Group IL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	0.02	0.07
Maximum	0.26	0.29
Range	0.24	0.22
Average	0.13	0.19
Standard Deviation	0.09	0.08

Initial Group RL Statics	RWOC SC Samples	RWOC LC Samples
Minimum	50.7	53.7
Maximum	58.2	58.4
Range	7.5	4.7
Average	55.5	56.5
Standard Deviation	2.5	1.5

Final Group RL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	51.4	54.1
Maximum	58.9	58.2
Range	7.5	4.1
Average	56.1	56.8
Standard Deviation	2.6	1.5

1550 nm With 10 Pound Load

Initial Group IL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	0.06	0.13
Maximum	0.26	0.36
Range	0.20	0.23
Average	0.14	0.22
Standard Deviation	0.06	0.06

Final Group IL Statics	RWOC SC Samples	RWOC LC Samples
Minimum	0.07	0.11
Maximum	0.27	0.29
Range	0.20	0.18
Average	0.15	0.22
Standard Deviation	0.07	0.06

Initial Group RL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	52.6	55.4
Maximum	59.9	61.8
Range	7.3	6.4
Average	57.1	58.1
Standard Deviation	2.4	1.9

Final Group RL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	52.7	55.2
Maximum	60.1	61.6
Range	7.4	6.4
Average	57.4	58.3
Standard Deviation	2.6	2.0

1310 With 15 Pound Load

Initial Group IL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	0.01	0.02
Maximum	0.08	0.07
Range	0.07	0.05
Average	0.04	0.04
Standard Deviation	0.05	0.04

Final Group IL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	0.03	0.28
Maximum	0.26	0.28
Range	0.23	0.00
Average	0.12	0.28
Standard Deviation	0.09	NA

Initial Group RL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	50.7	53.7
Maximum	58.2	58.4
Range	7.5	4.7
Average	55.5	56.5
Standard Deviation	2.5	1.5

Final Group RL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	51.5	54.6
Maximum	59.1	54.6
Range	7.6	0.0
Average	56.0	54.6
Standard Deviation	2.6	NA

1550 With 15 Pound Load

Initial Group IL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	0.06	0.07
Maximum	0.13	0.11
Range	0.07	0.04
Average	0.10	0.09
Standard Deviation	0.05	0.03

Final Group IL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	0.05	0.30
Maximum	0.28	0.30
Range	0.23	0.00
Average	0.14	0.30
Standard Deviation	0.07	NA

Initial Group RL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	52.6	55.4
Maximum	59.9	61.8
Range	7.3	6.4
Average	57.1	58.1
Standard Deviation	2.4	1.9

Final Group RL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	52.9	56.2
Maximum	60.1	56.2
Range	7.2	0.0
Average	57.4	56.2
Standard Deviation	2.5	NA

Comments:

- All SC samples met the requirements with both the 10 and 15 pound loads applied.
- All LC samples met the requirements with the 10 pound load applied.
- Only one LC sample met the requirements with the 15 pound load applied, the data above represents that one sample. All other samples had a mechanical failure during the test.

2.12. Mating Durability: 500 Cycles

11310 IL/RL Data

Initial Group IL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	0.03	0.06
Maximum	0.23	0.39
Range	0.20	0.33
Average	0.11	0.21
Standard Deviation	0.05	0.09

Final Group IL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	0.02	0.02
Maximum	0.24	0.35
Range	0.22	0.33
Average	0.14	0.21
Standard Deviation	0.07	0.12

Group IL Change Statistics	RWOC SC Samples	RWOC LC Samples
Most Negative Change	-21.82	-0.56
Most Positive Change	0.10	0.27
Range	21.92	0.83
Average Change	-1.98	0.02
Standard Deviation	4.35	0.13

Initial Group RL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	52.7	53.4
Maximum	58.6	61.5
Range	5.9	8.1
Average	57.0	57.4
Standard Deviation	1.8	1.7

Final Group RL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	44.8	26.9
Maximum	64.6	58.0
Range	19.8	31.1
Average	54.1	43.0
Standard Deviation	6.0	14.3

1310 nm RL Raw Data

RWOC LC Samples

JDS switch channel	9	10	11	12	13	14	15	16
Sample measurement number 1	58.4	57.3	59.1	57.4	56.7	55.5	59.2	58.5
Sample measurement number 2	58.3	58.2	61.5	56.7	55.3	55.2	58.1	58.2
Sample measurement number 3	58.4	56.9	57.1	54.9	56.1	53.4	57.7	58.4
After 99 cycles	49.2	54.9	55.4	53.4	57.7	45.7	34.7	61.0
After cleaning/inspection 100 cycles	61.2	54.0	56.1	55.6	55.8	52.9	36.9	57.4
After 199 cycles	35.0	53.4	54.2	55.3	55.6	57.5	51.6	51.4
After cleaning/inspection 200 cycles	36.9	55.8	55.9	55.7	58.1	50.7	53.8	62.4
After 299 cycles	38.4	36.2	51.1	54.9	53.4	56.9	52.7	29.7
After cleaning/inspection 300 cycles	29.1	54.3	58.7	56.8	53.6	52.1	35.9	32.4
After 399 cycles	28.7	27.0	49.9	55.3	21.8	28.5	46.8	33.2
After cleaning/inspection 400 cycles	41.7	56.0	54.5	56.8	58.1	30.0	49.9	35.1
After 499 cycles	38.2	52.8	56.1	50.1	24.2	30.7	50.3	39.3
After cleaning/inspection 500 cycles	28.5	56.8	58.0	54.1	56.2	31.1	26.9	32.2

1550 IL/RL Data

Initial Group IL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	0.07	0.07
Maximum	0.24	0.38
Range	0.17	0.31
Average	0.12	0.21
Standard Deviation	0.04	0.09

Final Group IL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	0.08	-0.28
Maximum	0.23	0.49
Range	0.15	0.77
Average	0.15	0.19
Standard Deviation	0.05	0.23

Group IL Change Statistics	RWOC SC Samples	RWOC LC Samples
Most Negative Change	-23.98	-0.49
Most Positive Change	0.10	0.51
Range	24.08	1.00
Average Change	-1.90	0.05
Standard Deviation	4.45	0.20

Initial Group RL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	52.9	57.5
Maximum	60.4	65.4
Range	7.5	7.9
Average	57.6	60.3
Standard Deviation	1.8	2.1

Final Group RL Statistics	RWOC SC Samples	RWOC LC Samples
Minimum	46.6	28.6
Maximum	67.3	59.3
Range	20.7	30.7
Average	67.3	59.3
Standard Deviation	6.4	14.8

1550 nm RL Raw Data

RWOC LC Samples

JDS switch channel	9	10	11	12	13	14	15	16
Sample measurement number 1	58.6	59.6	62.1	60.9	60.4	64.1	60.9	60.4
Sample measurement number 2	58.8	58.3	65.4	59.2	58.4	62.9	59.2	60.5
Sample measurement number 3	58.6	59.2	58.8	57.5	58.9	64.3	59.8	60.2
Affter 99 cycles	50.7	56.7	52.0	57.6	54.5	43.8	36.4	63.3
After cleaning/inspection 100 cycles	69.7	56.0	57.4	58.8	59.6	76.3	38.0	59.2
After 199 cycles	36.0	58.4	55.9	57.9	57.6	76.3	56.9	52.3
After cleaning/inspection 200 cycles	38.2	58.1	57.8	58.4	58.0	60.5	54.6	67.7
After 299 cycles	39.1	37.3	52.3	56.0	50.8	76.3	53.3	30.5
After cleaning/inspection 300 cycles	29.9	55.9	60.4	61.8	54.9	64.2	37.4	34.0
After 399 cycles	29.8	24.8	46.7	58.1	19.5	26.7	48.7	34.7
After cleaning/inspection 400 cycles	42.5	56.2	61.9	60.3	66.9	27.4	50.6	36.7
After 499 cycles	38.9	54.7	57.9	51.6	24.3	28.7	50.9	40.7
After cleaning/inspection 500 cycles	29.6	58.9	57.2	55.9	59.3	28.9	28.6	34.6

Comments:

- LC Samples:
  - One sample (#9) failed RL after 300 cycles, passed after 400 cycles, failed again after 500 cycles at 1310 and 1550 nm.
  - One sample (#15) failed RL after 500 cycles at 1310 and 1550 nm.
  - One sample (#14) failed RL after 400 and 500 cycles at 1550 nm.
- SC Samples:
  - No SC failures.