F12 Insert for General Purpose Rectangular Connectors

1. INTRODUCTION

1.1. Purpose

Testing was performed on the F12 Insert used with General Purpose Rectangular Connectors (GPR) to determine their conformance to the requirements of Product Specification 108-32113.

1.2. Scope

This report covers the optical, mechanical, and environmental performance of the GPR F12 insert. Testing was performed at the Harrisburg Fiber Optic Components Test Laboratory between 27Feb15 and 29Jun15. The test file number for this testing is PRJ-12-000006425-004. This documentation is on file at and available from the Harrisburg Fiber Optic Components Test Laboratory.

1.3. Conclusion

The F12 insert for General Purpose Rectangular Connectors listed in paragraph 1.5 conformed to the optical, mechanical, and environmental performance requirements of Product specification 108-32113.

1.4. Product Description

The F12 insert can be used in General Purpose Rectangular Connectors (GPRB1 and GPRB2). The insert has 12 cavities which accept size 16 ARINC 801 optical contacts.

1.5. Test Specimens

Test specimens were representative of normal production lots. Specimens identified with the following part numbers were used for test:

Group Number	Number of Samples in Group	Part Number	Rev	Other Pertinent Sample Information
1	2	2000856-1	3	F12 Insert assy, Key A, without sleeve holder
	2	2000857-1	4	F12 Insert assy, Key B, without sleeve holder
	2	2000858-1	4	F12 Insert assy, Key A, with sleeve holder
	2	2000859-1	5	F12 Insert assy, Key B, with sleeve holder
	2	1738245-1	A	GPRB2 Plug Shell Kit
	2	1738280-1	A	GPRB2 Receptacle Shell Kit
	24	1918160-1	2	LuxCis (ML) to LC multimode cable assembly, 3 meter, 1.8mm cable (except use f/o cable 1938516-2 (50 um) in place of 1828395-1; use LC connector 1828092-1 in place of 1754625-1; use LuxCis connector 1828200-1 in place of 1828199-1 per Factory Order 201713825, (quantity allows 6 active paths per sample)
2	2	2000856-1	3	F12 Insert assy, Key A, without sleeve holder
	2	2000857-1	4	F12 Insert assy, Key B, without sleeve holder
	2	2000858-1	4	F12 Insert assy, Key A, with sleeve holder
	2	2000859-1	5	F12 Insert assy, Key B, with sleeve holder
	2	1738245-1	A	GPRB2 Plug Shell Kit
	2	1738280-1	A	GPRB2 Receptacle Shell Kit

	24	1918160-1	2	LuxCis (ML) to LC multimode cable assembly, 3 meter, 1.8mm cable (except use f/o cable 1938516-2 (50 um) in place of 1828395-1; use LC connector 1828092-1 in place of 1754625-1; use LuxCis connector 1828200-1 in place of 1828199-1 per Factory Order 201713825, (quantity allows 6 active paths per sample)
3	2	2000856-1	3	F12 Insert assy, Key A, without sleeve holder
	2	2000857-1	4	F12 Insert assy, Key B, without sleeve holder
	2	2000858-1	4	F12 Insert assy, Key A, with sleeve holder
	2	2000859-1	5	F12 Insert assy, Key B, with sleeve holder
	2	1738245-1	A	GPRB2 Plug Shell Kit
	2	1738280-1	A	GPRB2 Receptacle Shell Kit
	24	1918160-1	2	LuxCis (ML) to LC multimode cable assembly, 3 meter, 1.8mm cable (except use f/o cable 1938516-2 (50 um) in place of 1828395-1; use LC connector 1828092-1 in place of 1754625-1; use LuxCis connector 1828200-1 in place of 1828199-1 per Factory Order 201713825, (quantity allows 6 active paths per sample)

1.6. Environmental Conditions

Unless otherwise stated, the following environmental conditions prevailed during testing:

- Temperature: 15 to 35°C
- Relative Humidity: 20 to 80%

1.7. Qualification Test Sequence

Test or Examination	Test Group (a)		
	1	2	3
	Test Sequence (b)		
Examination of product	1,14	1,7	1,16
Coupling/Decoupling Force			4
Attenuation	2,5,7,10,13	2,6	2,8,11,13,15
Return Loss		3	3
Random Vibration	8		
Mechanical Shock	9		
Termini Retention Force	3,12		5,14
Termini Insert/Remove Force	4		6
Insert Durability			7
Thermal Cycling		4	10
Temp Life		5	
Humidity	11		
Altitude Immersion			12
Maintenance Aging	6		9

NOTE

(a) Specimens shall be prepared in accordance with applicable instruction sheets and shall be selected at random form current production. A specimen shall consist of a mated pair of GPRB2 connector shells, two mated pair of inserts (key types A and B), installed with optical termini. All test groups shall each consist of a minimum of 2 specimens.

The optical fibers for testing were LuxCis (ML) to LC multimode cable assemblies. Fibers had 50 µm multimode core, and 125 µm cladding; length is 3 meter.

(b) Numbers indicate sequence in which tests are performed.

2. SUMMARY OF TESTING

2.1. Initial Examination of Product - All Test Groups

All specimens submitted for testing were representative of normal production lots. A Certificate of Conformance (C of C) was issued by Product Assurance. Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2. Coupling/Decoupling Force – Test Group 3

All Coupling/Decoupling force measurements were less than or equal to 10 inch-pounds.

2.3. Attenuation – All Test Groups

All attenuation results were less than 0.5 dB initially and less than 0.6 dB after conditioning.

2.4. Return Loss – Test Groups 2 and 3

All return loss results were greater than 20 dB

2.5. Random Vibration – Test Group 1

All samples met the design objectives during and after the exposure. No optical discontinuities were detected during the test.

2.6. Mechanical Shock – Test Group 1

No discontinuities were detected during mechanical shock testing. Following mechanical shock testing, no cracks, breaks, or loose parts on the specimens were visible.

2.7. Termini Retention Force – Test Groups 1 and 3

All termini met the maximum displacement requirement of .015 inches maximum when subjected to a 12 lbf axial load. There was no dislodging or damage to the insert or the terminus retention mechanism. During testing, some termini were damaged, resulting in a change in optical transmission of greater than .25 dB; however, the cause was determined to be related to the cable jacket pulling out of the termini crimp, and was not related to the insert that was being tested. Refer to Failure Report 8025-430 for further details.

2.8. Termini Insert/Remove Force – Test Groups 1 and 3

The force required to insert each contact into its housing cavity was less than 8 lbs and the force required to remove each contact from its housing cavity was less than 8 lbs.

2.9. Insert Durability – Test Group 3

Following Durability testing all samples met the visual requirements, showed no physical damage, and met the requirements of additional tests.

2.10. Thermal Cycling – Test Groups 2 and 3

No evidence of physical damage was visible as a result of Thermal Cycling testing and the optical transmittance change less than or equal to 0.25 dB.

2.11. Temp Life – Test Group 2

No evidence of physical damage was visible as a result of temperature life testing and the optical transmittance change less than or equal to 0.25 dB.

2.12. Humidity – Test Group 1

No evidence of physical damage was visible as a result of Humidity testing and the optical transmittance change less than or equal to 0.25 dB.

2.13. Altitude Immersion – Test Group 3

No evidence of physical damage was visible as a result of Altitude Immersion testing and the optical transmittance change less than or equal to 0.25 dB.

2.14. Maintenance Aging – Test Groups 1 and 3

Following maintenance aging, all samples met the visual requirements, showed no physical damage, and met the requirements of additional tests.

3. TEST METHODS

3.1. Examination of product

A C of C was issued stating that all specimens in this test package were produced, inspected, and accepted as conforming to product drawing requirements, and were manufactured using the same core manufacturing processes and technologies as production parts.

3.2. Coupling/Decoupling Force

Using a torque screwdriver, the sample was tightened while carefully observing the jackscrew. If movement of the jackscrew was noticed, the screwdriver was set to a higher torque setting (a convenient increment of 0.125 or 0.250 in-lbs). The setting of the torque screwdriver that no longer caused turning of the jackscrew was recorded as the Full Mating Coupling Torque. Using the torque screwdriver at its lowest torque setting, an attempt was made to loosen sample's jackscrew. If the screwdriver's torque mechanism slipped and the jackscrew did not turn, the screwdriver was set to its next torque setting and another attempt was made to loosen the jackscrew. The torque setting that caused the jackscrew to fully loosen and sample to unmate was recorded as the Decoupling Torque.

The steps were repeated twice to produce a total of 3 Optical Coupling Torque values, 3 Full Mating Coupling Torque values, and 3 Decoupling Torque values.

3.3. Attenuation

Reference optical measurements of the specimens' launch side (P_0) were measured. After mating the specimens, optical measurements of the receive side (P_1) were recorded. Attenuation data were calculated from these measurements.

3.4. Return Loss

Discrete RL measurements of the mated specimens were measured. Using optical reflection discrimination equipment, the individual reflections at the specimen interfaces were isolated and quantified.

3.5. Random Vibration

Mated specimens were subjected to a random vibration test with excitation frequency between 50 Hz and 2000 Hz. The Power Spectral Density (PSD) at 50 Hz was 0.015 G^2/Hz, sloping up at +6 dB per octave to a PSD of 0.06 G^2/Hz at 100 Hz, remaining flat at 0.06 G^2/Hz from 100 Hz to 1000 Hz, and then sloping down at -6 dB per octave to a PSD of 0.015 G^2/Hz at 2000 Hz. The excitation amplitude was 9.26 grms. The specimens were exposed for 1.5 hours in each of 3 mutually perpendicular axes for a total exposure time of 4.5 hours. Optical paths were monitored for discontinuities having an amplitude of 0.5 dB or greater and a duration of 1 microsecond or longer.

3.6. Mechanical Shock

Mated specimens were subjected to a mechanical shock test having a half-sine waveform of 50 gravity units (g peak) and a duration of 11 milliseconds. Three shock were applied in 3 mutually perpendicular planes (6 orientations) for a total of 18 shocks. Optical paths were monitored for discontinuities having an amplitude of 0.5 dB or greater and a duration of 1 microsecond or longer.

3.7. Termini Retention Force

An "optically live" contact (terminus) was selected for testing and its optical cable wrapped around a 3-inch mandrel weight hanger at a point 12 inches from the rear of the F12 insert. The total load of the mandrel weight hanger was 53.4N [12lbf]. A digital timer was used to confirm that the load was applied for a minimum period of 1 hour. This was repeated for the remaining "optically live" contacts of each sample.

3.8. Termini Insert/Remove Force

The insertion forces were measured while manually installing and properly seating the “optically live” contacts into their respective F12 insert positions. The removal forces were measured while manually removing the contacts from their positions.

3.9. Insert Durability

F12 insert specimens were removed from their connector shells using a removal tool. The inserts were manually reinstalled into their shells. The removal and reinstallation was performed a total of 10 times.

3.10. Thermal Cycling

Two environmental chambers were used; one set at +85°C and the other set at -55°C. The specimens were manually transferred between the 2 chambers. The dwell time at each temperature extreme was 30 minutes, which resulted in an exposure time of 1 hour for each cycle. The specimens were subjected to a total of 5 thermal cycles for a total exposure time of 5 hours.

3.11. Temp Life

The chamber was raised from 23°C to 101°C by manually increasing the set point in 6.5°C increments every 5 minutes over a 60-minute period. After stabilization the samples remained at 101°C for approximately 504 hours. Optical measurements were automatically recorded every 5 minutes during the exposure. After 504-hour dwell, the temperature was lowered from 101°C to 23°C by manually decreasing the set point in 6.5°C increments every 5 minutes over a 60-minute period.

3.12. Humidity

The environmental chamber was programmed to ramp from room ambient condition to 25°C, 45%RH in 1 minute, followed by a 1-hour ramp to 50°C, 30%RH. The samples were preconditioned at 50°C, 30%RH for a 24-hour period and the chamber was ramp to 25°C, uncontrolled humidity. The chamber remained at 25°C, uncontrolled humidity for a 2-hou r period. A temperature/humidity sensor automatically recorded the chamber condition every 15 minutes. The optical measurement at the end of the 2-hour, 25°C, uncontrolled humidity period served as the baseline measurement for the Humidity exposure.

The chamber program then ramped from 25°C, uncontrolled humidity to 65°C, 95%RH in 2.5 h ours, followed by a 3-hour dwell at 65°C, 95%RH, followed by a 2.5-hour ramp to 25°C, 95%RH, followed by a 2.5 hour ramp to 65°C, 95%RH, followed by a 3-hour dwell at 65°C, 95%RH, followed by a 2.5-hour ramp to 25°C, 95%RH, followed by a 2-hour dwell at 25°C, 95%RH, followed by a 1-minute ramp (as fast as the chamber would allow) to -10°C, uncontrolled humidity, followed by a 3-hour, 58-minute dwell (actual dwell determined by the speed of the chamber ramp) at -10°C, uncontrolled humidity, followed b y a 1-minute ramp (as fast as the chamber would allow) to 25°C, 95%RH, followed by a 2-hour dwell at 25°C, 95%RH. These steps represented 1 Humidity cycle.

3.13. Altitude Immersion

The specimens were placed in a vessel of deionized water inside the altitude chamber. The uppermost parts of the specimens were approximately 1 inch below the surface of the DI water. The chamber pressure was reduced from lab ambient [760mm of mercury or 760 torr] to 25.0mm of mercury [25 torr] within a maximum period of 5 minutes. The low pressure level of the chamber was maintained for a minimum period of 30 minutes. The chamber pressure was returned to lab ambient within a maximum period of 1 minute. This constituted 1 Altitude Immersion (AI) cycle. The samples were subjected to 2 additional cycles for a total of 3 AI cycles.

3.14. Maintenance Aging

One of the samples was unmated and the GPRB2 plug shell selected for test. The plug shell was mounted in a machine vise. Each of the 6 “live” contacts (termini) was individually removed and inserted 9 times using the Daniels removal and AMP installation tools. The tenth removal & reinstallation cycle was performed during the follow-up Termini Insert/Remove Force test.