Power Distribution Module Assembly

1. INTRODUCTION

1.1. Purpose

Testing was performed on the Tyco Electronics Power Distribution Module Assembly (PDM) to determine its conformance to the requirements of Product Specification 108-47001 Revision O.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the PDM. Testing was performed at the Global Automotive Division Product Reliability Center between Aug02 and Sep02. The test file number for this testing is 20020160ACL. This documentation is on file at and available from the Global Automotive Division Product Reliability Center.

1.3. Conclusion

The PDM listed in paragraph 1.5., conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-47001 Revision O.

1.4. Product Description

The PDM is produced for use in Arctic Cat Off Road vehicles and consists of a 4X10 contact pattern base, part number 109853-1, and cover with seal, part number 109854-1. The PDM contact pattern, 8.13 mm contact spacing, is that of Tyco Electronics VJ28-95F24 relay, and automotive MINI fuse system, intended for use in this application.

1.5. Test Specimens

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

Test Group	Quantity	Part Number	Description
1	4	109853-1	40 position base
2,3,5,6,7,8,9	2 each		
1	4	109854-1	40 position cover
2,3,4,5,6,7,8,9	2 each		
1	48	828922-1	2.5 mm System plug
3,5,6,7,9	24 each		
1	88	1-968855-1	MCP2.8 terminal crimped to 18 AWG wire
3,5,6,7,9	44 each		
1	16	1-968857-1	MCP2.8 terminal crimped to 16 AWG wire
2	80		
3,5,6,7,9	8 each		
1	8	1-986857-1	MCP2.8 terminal crimped to 14 AWG wire
3,5,6,7,9	4 each		
1	4	1432223-1	VJ28-95F24-S01 relay
3,5,7,9	2 each		

Figure 1 (cont)

* Trademark
I Indicates change

Test Group	Quantity	Part Number	Description
5,7	8 each	297010	10 ampere Littelfuse MiniFuse
9	60		
5,7	4 each	297015	15 ampere Littelfuse MiniFuse
9	20		
1	48	297020	20 ampere Littelfuse MiniFuse
5	6		
3,7,9	24 each		
5,7	2 each	297030	30 ampere Littelfuse MiniFuse
9	10		
5,7	4 each	12135037	Packard automotive diode

Figure 1 (end)

1.6. Environmental Conditions

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

- Temperature: 15 to 35°C
- Relative Humidity: 25 to 75%

1.7. Qualification Test Sequence

Test or Examination	Test Group (a)								
	1	2	3	4	5	6	7	8	9
	Test Sequence (b)								
Examination of product	1,7	1,5	1,7	1,4	1,4	1,5	1,6	1,3	1,5
Termination resistance, dry circuit	2,6		2,6				2,5		2,4
Dielectric withstanding voltage						2,4			
Temperature rise vs current							3		
Fuse blow									3
Free fall, cover				2					
Free fall, device					2				
Resistance to vibrations	3								
Mechanical shock	4								
Durability	5	4							
Housing locking mechanism strength		3						2	
Contact retention strength		2							
Temperature life							4		
Resistance to thermal shocks.			3						
Humidity						3			
Dust bombardment			4						
Water tightness			5	3	3				

NOTE *(a) See paragraph 1.5.*
(b) Numbers indicate sequence in which tests are performed.

Figure 2

2. SUMMARY OF TESTING

2.1. Examination of Product - All Test Groups

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

2.2. Termination Resistance, Dry Circuit - Test Groups 1, 3, 7 and 9

All termination resistance measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 10 milliohms.

2.3. Dielectric Withstanding Voltage - Test Group 6

No dielectric breakdown or flashover occurred.

2.4. Temperature Rise vs Current - Test Group 7

All specimens had a temperature rise of less than 30°C above ambient.

2.5. Fuse Blow - Test Group 9

No evidence of plastic or terminal interface degradation was observed.

2.6. Free Fall, Cover - Test Group 4

Specimens remained functional with no evidence of damage in the seal area or presence of water in the PDM was observed.

2.7. Free Fall Device - Test Group 5

Specimens remained functional with no evidence of damage in the seal area or presence of water in the PDM was observed.

2.8. Resistance to Vibrations - Test Group 1

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

2.9. 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.

2.10. Durability - Test Groups 1and 2

No physical damage occurred as a result of mounting and unmounting the cover 25 times.

2.11. Housing Locking Mechanism Strength - Test Groups 2 and 8

Covers in Test Group 2 did not disengage when subjected to a force of 88.96 N [20 lbf] for 1 minute. Covers in Test Group 8 were tested to destruction with a minimum recorded force of 404.07 N [90.84 lbf].

2.12. Contact Retention Strength - Test Group 2

All inserted contacts withstood a force of 80 N [17.98 lbf] before disengaging from the cavity.

2.13. Temperature Life - Test Group 7

No evidence of physical damage was visible as a result of exposure to temperature life.

2.14. Resistance to Thermal Shocks - Test Group 3

No evidence of physical damage was visible as a result of exposure to thermal shocks.

2.15. Humidity - Test Group 6

No evidence of physical damage was visible as a result of exposure to humidity-temperature cycling.

2.16. Dust Bombardment - Test Group 3

No ingress of dust into the PDM interior was observed.

2.17. Water Tightness - Test Groups 3, 4 and 5

No ingress of water into the PDM interior was observed.

3. TEST METHODS

3.1. Initial Examination of Product

A Certificate of Conformance 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. Termination Resistance, Dry Circuit

Termination resistance measurements were made using a 4 terminal measuring technique. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

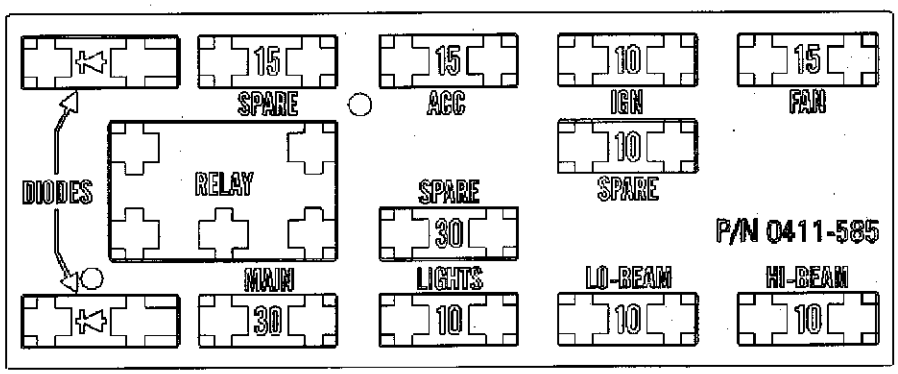
3.3. Dielectric Withstanding Voltage

A test potential of 500 volts DC was applied between adjacent terminals. This potential was applied for 2 minutes and then returned to zero.

3.4. Temperature Rise vs Current

Specimens were placed in a radiant type oven to maintain an ambient condition of 65°C with no external movement of air. Specimens were then powered with the current load configuration shown in Figure 3 and allowed to stabilize for 1 hour. At this time, temperature was taken and recorded for all powered terminals.

Relay, 10A Neutral: 86@C2, 87@B2, 30@C4, 85@B4 and 87a@B3
C2 and B4 coil, no load, 18 AWG
C4 and B2 ignition, no load, 18 AWG
Fuse, 30A Main: A3 and A4 1.42 amperes, wired separately, 14 AWG
Fuse, 15A Accessory: D5 and D6 No load
Fuse, 15A Fan: D9 and D10 5.2 amperes
Fuse, 10A Ignition: D7 and D8 2.07 amperes
Fuse, 10A Lights: A5 and A6 4.52 amperes (with brake lights on)
Fuse, 10A Hi-Beam: A9 and A10 3.67 amperes
Fuse, 10A Lo-Beam: A7 and A8 3.84 amperes
Diode, 1A Neutral: D1 and D2 1.0 ampere
Diode, 1A Reverse: A1 and A2 1.0 ampere
All fuse and diodes 10 amperes and less - 18 AWG wire, 15 amperes - 16 AWG wire, 30 amperes - 14 AWG wire



NOTE *Decal picture provided for illustration only. Spare fuses are not to be used in testing and unused contact cavities to be plugged with Tyco Electronics plugs part number 828922-1.*

Figure 3
Current Load Configuration

3.5. Fuse Blow

Individual circuits under test were connected to a test system capable of supplying 13.5 volts DC at an open circuit potential of 1500 amperes. The fuse under test was then subjected to the full current potential until the fuse opened. This was repeated 5 times for each fuse, until all fuses, with the exception of spare fuses, within the PDM were tested.

3.6. Free Fall, Cover

Two specimens were each dropped 5 times. The first specimen was dropped from a height of 1 m [3.28 ft] onto a concrete floor on corners E, H and A, and the planes of BCGF and ABCD. The second specimen was also dropped from a height of 1 m [3.28 ft] onto a concrete floor on corners C, F and G, and the planes of ADEH and ABCD. See Figure 4.

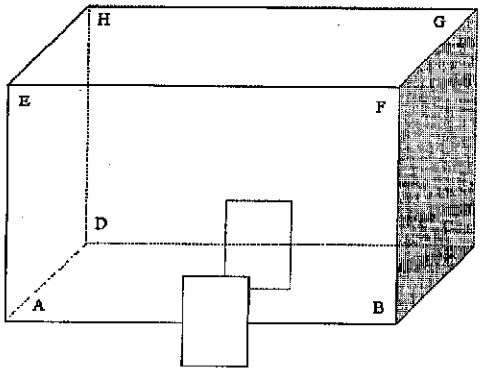


Figure 4

3.7. Free Fall, Device

Two specimens were each dropped 8 times. The specimens were dropped from a height of 750 mm [29.53 in] onto a concrete floor on corners AB, CD, GH and EF, and the planes of ABEF, ABCD, CBGH and EFGH. See Figure 5.

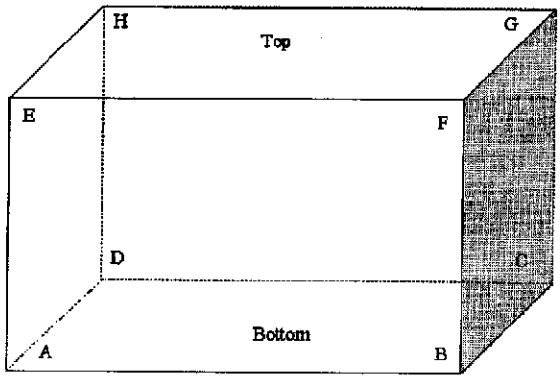


Figure 5

3.8. Resistance to Vibrations

Specimens were subjected to the vibration profile shown in Figure 6. Specimens were monitored for discontinuities of 1 millisecond or greater.

Breakpoint Frequency (Hz)	Magnitude (G^2/Hz)	Slope Between Breakpoints (dB/Octave) see Note (a)
10 see Note (a)	.070	0.0
20 see Note (a)	.070	-5.42
40	.020	0.0
350	.020	-9.20
550	.005	-20.02
700	.001	-100.12
750	.0001	0.0
2000	.0001	

NOTE

(a) Linear slopes on log-log plots only.
(b) RMS G Level - 3.2 G's.
(c) Maximum G level limited to 3 X the RMS level.
(d) Tolerance: ± 4 db from 10 to 2000 Hz.

Figure 6
Vibration Profile

3.9. Mechanical Shock

Specimens were subjected to a mechanical shock test having a half-sine waveform of 30 gravity units (g peak) and a duration of 11 milliseconds. Three shocks in each direction were applied along the 3 mutually perpendicular planes for a total of 18 shocks. Specimens were monitored for discontinuities of 1 millisecond or greater.

3.10. Durability

The PDM cover was manually disengaged from the PDM base 25 times at a maximum rate of 1 cycle every 2 seconds.

3.11. Housing Locking Mechanism Strength

Test Group 2 cover latches were tested by pulling axially on a string passed through a hole drilled in the center of the cover and anchored inside the cover by a metal bar until a force of 88.96 N [20 lbf] was attained. This force was then held for 1 minute. Test Group 8 cover latches were tested to destruction.

3.12. Contact Retention Strength

Each contact was tested by pulling axially on the wire at a rate of 50 mm [1.98 in] per minute until the contact disengaged from the terminal. The wire was gripped at a location 152.4 mm [6 in] from the crimp.

3.13. Temperature Life

Specimens were exposed to a temperature of 55°C for 96 hours.

3.14. Resistance to Thermal Shocks

Specimens were subjected to 50 cycles of thermal shock with each cycle consisting of 1 hour dwells at -55 and 85°C.

3.15. Humidity

Specimens were exposed to 10 cycles of humidity-temperature cycling. Each cycle lasted 24 hours and consisted of cycling the temperature between 25 and 65°C twice while maintaining high humidity. A -10°C cold shock was administered during the 7th cycle.

3.16. Dust Bombardment

Specimens were tested by delivering a 5 second burst of dry air containing fine dust every 15 minutes for 24 hours.

3.17. Water Tightness

Specimens were tested by subjecting them to a water spray delivered at a rate of 0.84 l [0.22 gal] per minute through a tube rotated once every 12 seconds through an arc of 345 degrees.