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Qualification Test Report

DRCP 86 Pin Inline

7/6/2012

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3850 Industrial Ave., Hemet, CA 92545 – Telephone (951) 765-2250 Fax (951) 765-2255

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1.0 SPECIFICATION REFERENCES

1.1 DCPM 2000 Deutsch Calibration Procedures Manual

2.0 TEST CONDITIONS AND EQUIPMENT

3.1 Test Conditions

Unless otherwise specified all test and measurements were conducted within the following conditions.

Temperature	+18C to +35C (+65F to +95F)
Relative Humidity	5% to 95%
Barometric Pressure	650 to 800 mm Hg

3.2 Test Equipment

Instrument calibration was performed in accordance with Deutsch Calibration Procedure Manual DCPM 2000 prior to using the instrument for testing. Calibration records are maintained and are directly traceable to the National Bureau of Standards with no more than three levels of separation.

The following data concerning the test equipment was recorded on the data format for each test:

a. Descriptive name.
b. Laboratory identification.
c. Date of last calibration prior to use.

3.0 DOCUMENTATION

4.1 Recorded Data

All measurements were recorded to as many significant digits as are meaningful under the accuracy limits of the equipment used. All data was recorded on 8 ½" x 11" data forms.

The ambient test conditions (temperature and relative humidity) and the date were recorded on the data form.

If a test was conducted on more than one day, the ambient test conditions and dates were recorded for each testing day.

The data includes whenever applicable, any diagrams and sketches of the following:

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a. Electrical hookups that are peculiar to this test program or might prohibit duplication of the test method and results involved if not supplied.

b. The orientation of samples to the direct force imparted during any physical shock or vibration testing.

c. Any fixtures that would be used for mounting the test samples that were fabricated exclusively for this sequence.

4.0 TEST COMPONENTS

5.1 Test Samples

Part Number	Description
DRCPF-86A-1	Inline Frame Key A
DRCP24-86PA	Receptacle Key A
DRCP28-86SA	Plug Key A
1062-20-0377	#20 sleeveless stamped socket – Tin
1062-12-0166	#12/14 stamped socket – Nickel/Tin
1062-12-0222	#10 /12 stamped socket - Nickel
0413-204-2005	#20 Sealing Plug
114017	#12/16 Sealing Plug

5.2 Wire Samples

Each test group was wired with the appropriate wire size for the individual tests. Sealing groups were wired with wire samples representing the full connector sealing range. All wire samples were chemically cross-linked polyethylene insulated per SAE J1128. All samples were crimped to each contact with Deutsch DCT12-02-00 DCT-20-02-00 crimp tooling.

Note: Test wire samples are within sealing range of connector – see Envelope DWG

Connector Sealing Range

SEALING RANGE		
CAVITY SIZE	MINIMUM	MAXIMUM
#20	.063" [1.6mm]	.124" [3.15mm]
#12	.118" [3.0mm]	.210" [5.3mm]

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Test Samples

	Specification Insulation OD - Max		Sample Measurements	
J1128	inch	mm	inch	mm
20 TXL	0.076	1.93	0.068	1.73
18 TXL	0.084	2.13	0.074	1.88
18 SXL	0.12	3.05	0.102	2.59
16 SXL	0.135	3.43	0.120	3.05
14 SXL	0.155	3.94	0.134	3.40
12 SXL	0.18	4.57	0.159	4.04
10 SXL	0.21	5.33	0.200	5.08

6.0 TEST GROUPS

6.1 Group Description

Test groups were created to test the functionality of the DRCP 86 Pin Inline connector system. The test groups include group 1, 2, 3 and 4 qualification groups. The sample parts were divided into test groups as follows:

Group 1 Intended to confirm thermal and sealing performance.

Group 2 Intended to confirm mechanical performance.

Group 3 Intended to confirm vibration and electrical performance.

Group 4 Intended to confirm thermal and chemical resistance.

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7.0 Test Sequence

Each sample group was subjected to the following test methods as outlined below. The tests were conducted in the order shown.

Group 1	Sealing	Para.
1.	Visual Inspection	9.1.1
2.	Insulation Resistance	9.1.2
3.	Thermal Shock Liquid Dunk	9.1.3
4.	Insulation Resistance	9.1.4
5.	Visual Inspection	9.1.5
6.	Thermal Cycle	9.1.6
7.	Thermal Shock Liquid Dunk	9.1.7
8.	Insulation Resistance	9.1.8
9.	Visual Inspection	9.1.9
10.	Temperature Life	9.1.10
11.	Thermal Shock Liquid Dunk	9.1.11
12.	Insulation Resistance	9.1.12
13.	Visual Inspection	9.1.13
14.	Pressure Washing	9.1.14
15.	Insulation Resistance	9.1.15
16.	Visual Inspection	9.1.16
17.	Sealing, External Air Pressure	9.1.17
18.	Sealing Interior Air Pressure	9.1.18
19.	Visual Inspection	9.1.19

Group 2	Mechanical	Para.
1.	Visual Inspection	9.2.1
2.	Durability	9.2.2
3.	Terminal Retention Axial	9.2.3
4.	Terminal Retention Rotation	9.2.4
5.	Cross Key Mating	9.2.5
6.	Scoop Proof Mating	9.2.6
7.	Connector Coupling Strength	9.2.7
8.	Maintenance Aging	9.2.8
9.	Terminal Retention Axial	9.2.9
10.	Terminal Retention Rotation	9.2.10
11.	Drop	9.2.11
12.	Crimp Tensile	9.2.12
13.	Over Torque	9.2.13
14.	Visual Inspection	9.2.14

Group 3	Vibration	Para.
1.	Visual Inspection	9.3.1
2.	Low Signal Contact Resistance	9.3.2
3.	Voltage Drop	9.3.3
4.	Thermal Cycle	9.3.4
5.	Low Signal Contact Resistance	9.3.5
6.	Voltage Drop	9.3.6
7.	Vibration	9.3.7
8.	Low Signal Contact Resistance	9.3.8
9.	Voltage Drop	9.3.9
10.	Visual Inspection	9.3.10

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Group 4	Chemical	Para.
1.	Visual Inspection	9.4.1
2.	Salt Exposure	9.4.2
3.	Insulation Resistance	9.4.3
4.	Chemical Exposure	9.4.4
	Diesel	
	Bio-Diesel	
	Kerosene	
	Motor Oil	
	Brake Fluid	
	Coolant	
	Transmission Oil	
	Urea	
5.	Sealing Interior Air Pressure	9.4.5
6.	Sealing Interior Air Pressure	9.4.6
7.	Visual Inspection	9.4.7

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8.0 Sample Description

8.1 Group 1 - Sealing

Test samples 1 through 4 wired with crimped 4ft test leads. Test leads to include service connectors for insulation resistance test. Samples 5 and 6 mounted rigidly on the plate fixture with sealing plugs on receptacles and wires on plugs.

Group 1		
Sample Number	Wire Size	
1	18 SXL	12 SXL
2	18 SXL	12 SXL
3	18 SXL	12 SXL
4	18 SXL	12 SXL
5	18 SXL Sealing Plugs	12 SXL Sealing Plugs
6	18 SXL Sealing Plugs	12 SXL Sealing Plugs

8.2 Group 2 – Mechanical

One test sample wired with crimped 2ft test leads.

Group 2		
Sample Number	Wire Size	
1 (Key A)	18 SXL	12 SXL

8.3 Group 3 – Vibration

All test samples wired with crimped 4 ft test leads. Wires to include service connectors and millivolt drop taps. Frame mounted rigidly to vibration fixtures. Wire bundles to be tie-wrapped in the “down” direction for samples 1 and 2, and in the "across" direction for sample 3. Subtract reference wire reading from the total.

Group 3		
Sample Number	Wire Size	
1	18 SXL	12 SXL
2	18 SXL	12 SXL
3	18 SXL	12 SXL

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8.4 Group 4 – Chemical

All test samples wired with crimped 2 ft test leads. Test leads to include service connectors for insulation resistance test.

Group 4					
Sample	Fluids	Temperature	Time	Wire Size	
1	Diesel Fuel #2	60ºC	24 hours	18 SXL	12 SXL
2	Bio-Diesel Fuel (including Toyu)	60ºC	24 hours	18 SXL	12 SXL
3	Kerosene	60ºC	24 hours	18 SXL	12 SXL
4	Motor Oil 30wt	120ºC	7 Days	18 SXL	12 SXL
5	Brake Fluid (disc type 1)	25ºC	24 hours	18 SXL	12 SXL
6	50/50 Antifreeze / Water mixture	100ºC	24 hours	18 SXL	12 SXL
7	Transmission Oil 90wt	100ºC	7 Days	18 SXL	12 SXL
8	Urea (32.5%) / Water (67.5%)	25ºC	24 hours	18 SXL	12 SXL

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9.0 TEST METHOD AND RESULTS

The validation test and its results are summarized in the following pages. Refer to the Appendix for the detailed laboratory test forms.

9.1 GROUP 1 -- SEALING

9.1.1 Visual Inspection

Test Method:

1. The connectors were visually inspected for correct use of materials, proper construction, correct part number and insert markings and over-all quality of workmanship.

2. Poor molding fabrication, loose materials, damaged or improperly manufactured contacts, galling of metal parts, nicks and burrs of metal parts, torn seals or cracked plastic are considered adequate basis for rejection.

Requirements:

The connectors shall be correctly constructed, marked and shall show good quality and workmanship. Connector after conditioning shall not show signs of damage or any detectable loss of function.

Results:

The connectors were thoroughly inspected and showed no evidence of cracking, distortion or any defects detrimental to part function.

9.1.2 Insulation Resistance

Test Method:

Checked insulation resistance between each contact to all other contacts and shell using a 1000 VDC Megohmmeter.

Requirements:

The resistance shall be 10 megohms minimum.

Results:

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The insulation resistance exceeded 10 megohms for all the tested samples.

9.1.3 Thermal Shock Liquid Dunk

Test Method:

The wired mated test samples were placed in an oven at +125±3ºC for two hours and then immediately be placed in water with 5% salt by weight content and 0.1g/L wetting solution to a depth of 1 meter for 30 minutes. The free ends of wires were sealed and remained out of the water.

Requirements:

Test samples must meet Insulation Resistance per section 9.1.4 and Visual Inspection per section 9.1.5.

Results:

Inspected samples per section 9.1.4 and 9.1.5.

9.1.4 Insulation Resistance

Test Method:

After thermal shock liquid dunk per section 9.1.3, checked insulation resistance between each contact to all other contacts and shell using a 1000 VDC Megohmmeter.

Requirements:

The resistance shall be 10 megohms minimum.

Results:

The insulation resistance exceeded 10 megohms for all the tested samples.

9.1.5 Visual Inspection

Test Method:

Each sample was visually inspected for anything that could affect the performance or serviceability of the product.

Results:

There was no evidence of leaking, cracking or detrimental damage to the test samples.

9.1.6 Thermal Cycle

Test Method:

Mated test samples were thermal cycled a total of 20 complete cycles between -55±3ºC and +125±3ºC at the rate of 3ºC per minute. Test samples were remained at each temperature extreme for one hour.

Requirements:

There shall be no evidence of cracking, distortion or other damage detrimental to the normal operation of the connector.

Results:

No visual or mechanical degradation was observed following the test.

9.1.7 Thermal Shock Liquid Dunk

Test Method:

After thermal cycle per section 9.1.6, the wired mated test samples were placed in an oven at +125±3ºC for two hours and then immediately be placed in water with 5% salt by weight content and 0.1g/L wetting solution to a depth of 1 meter for 30 minutes. The free ends of wires were sealed and remained out of the water.

Requirements:

Test samples must meet Insulation Resistance per section 9.1.8 and Visual Inspection per section 9.1.9.

Results:

Examined samples per section 9.1.8 and 9.1.9.

9.1.8 Insulation Resistance

Test Method:

Industrial

After thermal shock liquid dunk per section 9.1.7, checked insulation resistance between each contact to all other contacts and shell using a 1000 VDC Megohmmeter.

Requirements:

The resistance shall be 10 megohms minimum.

Results:

The insulation resistance exceeded 10 megohms for all the tested samples.

9.1.9 Visual Inspection

Test Method:

Each sample was visually inspected for anything that could affect the performance or serviceability of the product.

Results:

There was no evidence of cracking, distortion or detrimental damage to the test samples.

9.1.10 Temperature Life

Test Method:

The wired and mated connectors were subject to 1000 h at 125°C ±3°C.

Requirements:

No visual or mechanical performance degradation is allowed.

Results:

There was no evidence of cracking, distortion or detrimental damage to the test samples following the test.

9.1.11 Thermal Shock Liquid Dunk

Test Method:

Industrial

The wired mated test samples were placed in an oven at +125±3ºC for two hours and then immediately be placed in water with 5% salt by weight content and 0.1g/L wetting solution to a depth of 1 meter for 30 minutes. The free ends of wires were sealed and remained out of the water.

Requirements:

Test samples must meet Insulation Resistance per section 9.1.12 and Visual Inspection per section 9.1.13.

Results:

Inspected samples per section 9.1.12 and 9.1.13.

9.1.12 Insulation Resistance

Test Method:

After thermal shock liquid dunk per section 9.1.11, checked insulation resistance between each contact to all other contacts and shell using a 1000 VDC Megohmmeter.

Requirements:

The resistance shall be 10 megohms minimum.

Results:

The insulation resistance exceeded 10 megohms for all the tested samples.

9.1.13 Visual Inspection

Test Method:

Each sample was visually inspected for anything that could affect the performance or serviceability of the product.

Results:

There was no evidence of leaking, cracking or detrimental damage to the test samples.

9.1.14 Pressure Washing

Test Method:

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The mated test samples were mounted firmly onto a push cart. Test sample 5 and 6 with fixture plates were mounted onto sealed aluminum boxes with receptacles secluded inside. The inline connectors and plugs of sample 5 and 6 were exposed to the room temperature water spray for about 3 to 5 seconds period per connector for a total of 60 minutes. The fan nozzles, with a source pressure of approximately 1750 psi gage, were located 20 to 30 cm away providing 100% coverage of the test sample.

Requirements:

All test samples must meet Insulation Resistance per section 9.1.15.
Test samples 5 and 6 must also meet Visual Inspection per section 9.1.16.

Results:

Examined samples per section 9.1.15 and 9.1.16.

9.1.15 Insulation Resistance

Test Method:

After pressure washing per section 9.1.14, checked insulation resistance between each contact to all other contacts and shell using a 1000 VDC Megohmmeter.

Requirements:

The resistance shall be 10 megohms minimum.

Results:

The insulation resistance exceeded 10 megohms for all the test samples.

9.1.16 Visual Inspection

Test Method:

Each sample was visually inspected for anything that could affect the performance or serviceability of the product. Test sample 5 and 6 were removed from the aluminum boxes and inspected for leaking inside.

Results:

There was no evidence of leaking or detrimental damage to the test samples.

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9.1.17 Sealing, External Air Pressure

Test Method:

The mated test sample was placed in the sealed pressure chamber with vent tube attached. A 35±5 kPa dry compressed air source was applied to the chamber for 30 minutes minimum.

Requirements:

No air bubbles are allowed to exit the vent tube after the first fifteen minutes.

Results:

Intermittent bubbles were observed coming out of the vent tube after the first fifteen minutes.

9.1.18 Sealing, Interior Air Pressure

Test Method:

The mated test sample was completely submerged in the water with a pressure tubing introduced into the sealed portion of the test sample. Pressure was slowly applied from zero to 35 kPa at a rate about 2 kPa/sec and maintained at the peak for 30 minutes minimum.

Requirements:

After 15 minutes, no air bubbles are allowed to leak from the sample.

Results:

There was no air bubbles observed after the first 15 minutes.

9.1.19 Visual Inspection

Test Method:

This was the last step of this group. Each sample was unmated and visually inspected for evidence of leaking, cracking or anything that could affect the performance or serviceability of the product.

Results:

There was no evidence of leaking, cracking or detrimental damage to the test samples.

9.2 GROUP 2 -- MECHANICAL

9.2.1 Visual Inspection

Test Method:

1. The connector was visually inspected for correct use of materials, proper construction, correct part number and insert markings and over-all quality of workmanship.

2. Poor molding fabrication, loose materials, damaged or improperly manufactured contacts, galling of metal parts, nicks and burrs of metal parts, torn seals or cracked plastic are considered adequate basis for rejection.

Requirements:

The connector shall be correctly constructed, marked and shall show good quality and workmanship. Connector after conditioning shall not show signs of damage or any detectable loss of function.

Results:

The connector was thoroughly inspected and showed no evidence of cracking, distortion or any defects detrimental to part function.

9.2.2 Durability

Test Method:

The connector was mated and unmated for a total of 50 complete cycles at room temperature. The connector was re-torqued to the recommended torque 44 - 62 in*lb [5 - 7 N*m] after each cycle.

Requirements:

After 50 cycles, There should be no evidence of damage to the contacts, contact plating, connector housing or seals following the test. No visual or mechanical degradation is permitted.

Results:

There was no visual or mechanical degradation observed after 50 mating cycles.

9.2.3 Terminal Retention Axial

Test Method:

The receptacle pins were axially loaded by the force of 89N (20 lbf) on the 20 size contact and 111 N (25 lbf) on the 12 size contact. The force was applied at a uniform rate of 0.189 in/min. Terminal position assurance device was utilized and in the locked position during the test. Four pins of 20 size contact and one pin of 12 size contact were tested.

Requirements:

1. The contact displacement shall not exceed 0.8mm for both 20 size and 12 size contact.
2. The maximum bearing load for the 20 size contact and 12 size contact before separation shall be greater than 89N (20 lbf) and 111N (25 lbf) respectively.

Results:

Test sample met the force requirement. Please refer to the lab test form Para 9.2.3 in the appendix I for the displacement results.

9.2.4 Terminal Retention Rotation

Test Method:

The wired receptacle was rigidly mounted on the table such that the wires could hang downward vertically. A 4.54 kg (10 lbs) weight was affixed to the end of a 610 mm (2 feet) long wire. Each pin in the cavity was rotated by five full turns by spinning the weighted wire. Eight pins of 20 size contact and one pin of 12 size contact were tested.

Requirements:

There shall be no mechanical degradation or discontinuity following the test.

Results:

Please refer to the lab test form Para 9.2.4 in the appendix I for the results.

9.2.5 Cross Key Mating

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Test Method:

A mating force of 350 N was applied while attempting to cross-key mate by aligning connector halves into each geometric possible position. All key design possibilities were inspected and tested. Electrical contact was monitored during the test.

Requirements:

For all connector key design options, connector halves must only mate in one position. Any partial mating of connectors with electrical contact is considered to be a failure.

Results:

There was no evidence of cracking, distortion or detrimental damage to the key configuration.

9.2.6 Scoop Proof Mating

Test Method:

The wired connector was mated through all kinds of intended improper orientation during assembly.

Requirements:

The connector shall incorporate features preventing its contacts, either male or female, from being touched by the front of the mating connector by improper assembly.

Results:

All the contacts of the connector were untouched due to the scoop proof features.

9.2.7 Connector Coupling Strength

Test Method:

A tensile load of 100 lb [445 N] was applied to the wire bundle of the mated connector for a period of one (1) minute.

Requirements:

Industrial

The mated test sample shall withstand 100 lb [445 N] load for a minimum of 30 sec without any damage or disengagement. No visual or mechanical degradation is permitted.

Results:

There was no evidence of cracking, distortion or detrimental damage to the connector and no uncoupling following the test.

9.2.8 Maintenance Aging

Test Method:

Eight pins of 20 size contact and two pins of 12 size contact in receptacle were subjected to a total of ten cycles of inserting and removing its respective contact. Disassembly of the terminal position assurance device required to remove the contacts was included. The connector was mated and unmated in each cycle. Insertion and removal was performed using manufacturer's recommended tools. The pins tested were different from the ones been tested in Terminal Retention Axial and Rotation per section 9.2.3 and 9.2.4.

Requirements:

No mechanical degradation or failure is permitted.

Results:

No failure was observed. Examined connector for mechanical degradation per section 9.2.9 and 9.2.10.

9.2.9 Terminal Retention Axial

Test Method:

The pin in receptacle was axially loaded by the force of 89N (20 lbf) on 20 size contact and 111 N (25 lbf) on 12 size contact. The force was applied at a uniform rate of 0.189 in/min. Terminal position assurance device was utilized and in the locked position during the test. Half of the contacts been tested in Maintenance Aging per section 9.2.8 were selected.

Requirements:

1. The contact displacement shall not exceed 0.8mm for both 20 size and 12 size contact.

2. The maximum bearing load for the 20 size contact and 12 size contact before separation shall be greater than 89N (20 lbf) and 111N (25 lbf) respectively.

Results:

There was no obvious mechanical degradation observed following Maintenance Aging test per section 9.2.8. Please refer to the lab test form Para 9.2.9 in the appendix I for the results.

9.2.10 Terminal Retention Rotation

Test Method:

The wired receptacle was rigidly mounted on the table such that the wires could hang downward vertically. A 4.54 kg (10 lbs) weight was affixed to the end of a 610 mm (2 feet) long wire. Each pin in the cavity was rotated by five full turns by spinning the weighted wire. The other half contacts been tested in Maintenance Aging per section 9.2.8 were selected.

Requirements:

There shall be no mechanical degradation or discontinuity following the test.

Results:

There was no obvious mechanical degradation observed following Maintenance Aging test per section 9.2.8. Please refer to the lab test form Para 9.2.10 in the appendix I for the results.

9.2.11 Drop

Test Method:

Wired receptacle was attached to free end of a 5 feet long cord. The other end of the cord was fixed to a wall at a height of 2.5 feet above concrete floor. The test sample was held so that the cord was horizontal and then fell to the concrete floor eight times. Test sample was rotated approximately 45 degrees at its fixing each time.

Requirements:

There shall be no evidence of cracking, distortion or detrimental damage to the connector. Small chips and dents that do not affect connector's performance or serviceability are disregarded.

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Results:

Only small chips and dents were observed on the backshell following the test.

9.2.12 Crimp Tensile

Test Method:

The tensile strength of the crimped connection was tested using a tensile tester without the influence of an insulation strain relief crimp. An axial force was applied to the wire and terminal at a speed of 25.4 ± 6mm per minute separating the contact and conductor. 18 SXL and 12 SXL wires were tested.

Requirements:

The minimum crimp tensile force for the 18 SXL and 12 SXL wires are 111 N and 311 N respectively.

Results:

All tested terminals met the minimum force values.

9.2.13 Over Torque

Test Method:

The connector was torqued to 92 in*lb [10.5 N*m] which is 1.5 times of the maximum allowable torque.

Requirements:

There should be no evidence of cracking, distortion or detrimental damage to the test samples.

Results:

No cracking, distortion or detrimental damage to the test sample observed following the test.

9.2.14 Visual Inspection

Test Method:

Industrial

This was the last step of this group. Each sample was visually inspected for evidence of cracking, distortion or anything that could affect the performance or serviceability of the product.

Results:

The connectors were thoroughly inspected and showed no evidence of cracking, distortion or any defects detrimental to the part function.

9.3 GROUP 3 -- VIBRATION

9.3.1 Visual Inspection

Test Method:

1. The connectors were visually inspected for correct use of materials, proper construction, correct part number and insert markings and over-all quality of workmanship.

2. Poor molding fabrication, loose materials, damaged or improperly manufactured contacts, galling of metal parts, nicks and burrs of metal parts, torn seals or cracked plastic are considered adequate basis for rejection.

Requirements:

The connectors shall be correctly constructed, marked and shall show good quality and workmanship. Connector after conditioning shall not show signs of damage or any detectable loss of function.

Results:

The connectors were thoroughly inspected and showed no evidence of cracking, distortion or any defects detrimental to part function.

9.3.2 Low Signal Contact Resistance

Test Method:

The mated connector was tested with applied voltage not to exceed 20 millivolts open circuit and the current limited to 100 milliamps. The contact resistance was obtained by subtracting the reference wire resistance from the test reading.

Requirements:

The maximum contact resistance shall be 6 milliohms for 16 AWG wire and 9 milliohms for 18 AWG wire.

Results:

All the contacts of each connector were tested and passed the requirements.

9.3.3 Voltage Drop

Test Method:

The mated connector was tested using 7.5 amps on 18 AWG wire and 20 amps on 12 AWG wire with the test voltage set to be 4.50 ± 0.25 VDC open circuit. The voltage drop was recorded by deducting the reference wire measurements.

Requirements:

The voltage drop shall not exceed 100 millivolts.

Results:

All the samples tested passed the requirements.

9.3.4 Thermal Cycle

Test Method:

Mated test samples were thermal cycled a total of 20 complete cycles between -55±3ºC and +125±3ºC at the rate of 3ºC per minute. Test samples were remained at each temperature extreme for one hour.

Requirements:

There shall be no evidence of cracking, distortion or other damage detrimental to the normal operation of the connector.

Results:

No visual or mechanical degradation was observed following the test.

9.3.5 Low Signal Contact Resistance

Industrial

Test Method:

The mated connector was tested with applied voltage not to exceed 20 millivolts open circuit and the current limited to 100 milliamps. The contact resistance was obtained by subtracting the reference wire resistance from the test reading.

Requirements:

The maximum contact resistance shall be 6 milliohms for 16 AWG wire and 9 milliohms for 18 AWG wire.

Results:

All the contacts of each connector were tested and passed the requirements.

9.3.6 Voltage Drop

Test Method:

The mated connector was tested using 7.5 amps on 18 AWG wire and 20 amps on 12 AWG wire with the test voltage set to be 4.50 ± 0.25 VDC open circuit. The voltage drop was recorded by deducting the reference wire measurements.

Requirements:

The voltage drop shall not exceed 100 millivolts.

Results:

All the samples tested passed the requirements.

9.3.7 Vibration

Test Method:

Three wired and mated connectors were rigidly mounted to three mutually perpendicular axis and randomly vibrated for 20 hours in each axis. Vibration profile was attached in the appendix I Para. 9.3.7. The wire harness was bent 90 degree and firmly tied to the router with tie-wraps. Backshell was included during vibration. The free end was hooked up to the discontinuity monitor from which 100 milliamps load was applied.

Requirements:

There shall be no discontinuity greater than 10 ohms in excess of 1 microsecond. Any physical damage or loosening of components are not allowed.

Results:

All the samples passed the vibration test.

9.3.8 Low Signal Contact Resistance

Test Method:

The mated connector was tested with applied voltage not to exceed 20 millivolts open circuit and the current limited to 100 milliamps. The contact resistance was obtained by subtracting the reference wire resistance from the test reading.

Requirements:

The maximum contact resistance shall be 6 milliohms for 16 AWG wire and 9 milliohms for 18 AWG wire.

Results:

All the contacts of each connector were tested and passed the requirements.

9.3.9 Voltage Drop

Test Method:

The mated connector was tested using 7.5 amps on 18 AWG wire and 20 amps on 12 AWG wire with the test voltage set to be 4.50 ± 0.25 VDC open circuit. The voltage drop was recorded by deducting the reference wire measurements.

Requirements:

The voltage drop shall not exceed 100 millivolts.

Results:

All the samples tested passed the requirements.

9.3.10 Visual Inspection

Test Method:

This was the last step of this group. Each sample was visually inspected for evidence of cracking, distortion, terminal fretting or anything that could affect the performance or serviceability of the product.

Results:

The connectors were thoroughly inspected and showed no evidence of cracking, distortion or any defects detrimental to the part function.

9.4 GROUP 4 -- CHEMICAL

9.4.1 Visual Inspection

Test Method:

1. The connectors were visually inspected for correct use of materials, proper construction, correct part number and insert markings and over-all quality of workmanship.

2. Poor molding fabrication, loose materials, damaged or improperly manufactured contacts, galling of metal parts, nicks and burrs of metal parts, torn seals or cracked plastic are considered adequate basis for rejection.

Requirements:

The connectors shall be correctly constructed, marked and shall show good quality and workmanship. Connector after conditioning shall not show signs of damage or any detectable loss of function.

Results:

The connectors were thoroughly inspected and showed no evidence of cracking, distortion or any defects detrimental to part function.

9.4.2 Salt Exposure

Test Method:

The fully mated connectors were submerged in a fine mist of 5% by weight of salt solution for 240 hours. The salt spray chamber was maintained at 35 ± 2°C. The free ends of wires were sealed in the service connectors with sealing plugs.

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Requirements:

No evidence of corrosion on the connector or terminals after the connector is removed from the test. Test samples must meet Insulation Resistance per section 9.4.3.

Results:

No detrimental evidence of corrosion observed on the connector or terminals. Test samples were examined per section 9.4.3.

9.4.3 Insulation Resistance

Test Method:

After Salt Exposure per section 9.4.2, checked insulation resistance between each contact to all other contacts and shell using a 1000 VDC Megohmmeter.

Requirements:

The resistance shall be 10 megohms minimum.

Results:

The insulation resistance exceeded 10 megohms for all the tested samples.

9.4.4 Chemical Exposure

Test Method:

Each test sample in the wired and mated condition was submerged in one fluid only as in the following table. All the fluids used in the test were not previously used.

Fluids	Temperature	Time
Diesel Fuel #2	60ºC	24 hours
Bio-Diesel Fuel (including Toyu)	60ºC	24 hours
Kerosene	60ºC	24 hours
Motor Oil 30wt	120ºC	7 Days
Brake Fluid (disc type 1)	25ºC	24 hours
50/50 Antifreeze / Water mixture	100ºC	24 hours
Transmission Oil 90wt	100ºC	7 Days
Urea (32.5%) / Water (67.5%)	25ºC	24 hours

Requirements:

There shall be no evidence of cracking, distortion or detrimental damage to the connector following the test.

Results:

The connector shown compatibility with all the fluids as specified. No degradation to the connector appearance or performance was observed.

9.4.5 Sealing, External Air Pressure

Test Method:

The mated test sample was placed in the sealed pressure chamber with vent tube attached. A 35±5 kPa dry compressed air source was applied to the chamber for 30 minutes minimum.

Requirements:

No air bubbles are allowed to exit the vent tube after the first fifteen minutes.

Results:

Intermittent bubbles were observed coming out of the vent tube after the first fifteen minutes.

9.4.6 Sealing, Interior Air Pressure

Test Method:

The mated test sample was completely submerged in the water with a pressure tubing introduced into the sealed portion of the test sample. Pressure was slowly applied from 0 to 35 kPa at a rate about 2 kPa/sec and maintained at the peak for 30 minutes minimum.

Requirements:

After 15 minutes, no air bubbles are allowed to leak from the sample.

Results:

There was no air bubbles observed after the first 15 minutes.

9.4.6 Visual Inspection

Industrial

Test Method:

This was the last step of this group. Each sample was unmated and visually inspected for evidence of corrosion or anything that could affect the performance or serviceability of the product.

Results:

There was no evidence of corrosion, leaking or detrimental damage to the test samples.

Industrial

10.0 CONCLUSION

10.1 Group 1 -- Sealing

Group 1 contained six samples that were tested to confirm thermal and sealing performance.

All the samples in group 1 passed all aspects of the tests.

10.2 Group 2 -- Mechanical

Group 2 contained one sample that was tested to confirm mechanical performance.

The sample in group 2 passed all aspects of the tests.

10.3 Group 3 -- Vibration

Group 3 contained three samples that were tested to determine the effects of vibration within the predominant or random vibration frequency ranges and magnitudes that may be encountered during the life of the connector.

All the samples in group 3 passed all aspects of the tests.

10.4 Group 4 -- Chemical

Group 4 contained eight samples that were tested to determine the ability of an electrical connector to resist degradation when exposed to specific fluids and salt laden atmosphere with which the connector may come into contact during its service life.

All the samples in group 4 passed all aspects of the tests.