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Deutsch Test Report 51672
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TEST REPORT COVERING THE IN-HOUSE QUALIFICATION TESTING OF THE DEUTSCH HEAVY DUTY 10 SERIES ELECTRICAL CONNECTOR IN ACCORDANCE WITH DEUTSCH TEST PROCEDURE 51614

1985

DEUTSCH

SIGNATURE PAGE

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ABSTRACT

This report summarizes the results of in-house qualification testing of Deutsch Heavy Duty 10 Series Electrical Connectors. These Deutsch Heavy Duty 10 Series Electrical Connectors were tested in accordance with Deutsch Test Procedure 51614. Deutsch Test Procedure 51614, which was derived from Automotive and Aerospace Industrial requirements, simulates extreme environmental and electrical conditions.

The following part numbers were subjected to testing in accordance with Deutsch Test Procedure 51614 as described herein.

Deutsch Part Number	Description
HD10-9-16S	Receptacle
HD16-9-16P	Plug
0460-202-16141	Pin contacts, Size 16
0462-201-16141	Socket contacts, Size 16

The results of the testing described herein indicate that the Deutsch Heavy Duty 10 Series Connector are capable of performance to normal specification standards.

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1.0 SPECIFICATION REFERENCES

1.1 Deutsch Test Procedure 51614

Heavy Duty Connectors, Circular, Quick Disconnect (Bayonet Coupling), Environment Resistant, Removable Crimp, General Specification For:

1.2 MIL-STD-1344

Test methods for Electrical Connectors

1.3 MIL-STD-39029

Contacts, Electrical Connector, General Specification For:

1.4 DCPM 2000

Deutsch Calibration Procedures Manual

2.0 TEST CONDITIONS AND EQUIPMENT

2.1 Test Conditions

Unless otherwise specified all tests and measurements were conducted within the following ambient limitations:

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

2.2 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:

3.1 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 8½" 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 (1) day, the ambient test conditions and dates were recorded for each testing day.

Only original laboratory test data or a direct image thereof was submitted as the final report document. Data sheets were not rewritten. In the case of errors accidently recorded on the data forms, the erroneous data was lined out by a single line and the corrected information was inserted and initialed by the technician making the change.

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

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 fixturing that would be used as a method of mounting the test samples that is fabricated exclusively for this test sequence.

4.0 SAMPLE DESCRIPTION AND SELECTION

4.1 Sample Description

The six mated connector pairs tested for this report were assigned the consecutive numbers 1 through 6. The following part numbers constituted the qualification sample lot:

Deutsch Part Number	Quantity	Description
HD16-9-16P	6	Plug
HD10-9-16S	6	Receptacle
0460-202-16141	54	Pin Contacts, Size 16
0462-210-16141	54	Socket Contacts, Size 16

4.2 Sample Selection

The six mated connector parts selected for this test were manufactured utilizing Deutsch Company production methods, procedures and tooling.

5.0 SAMPLE ASSEMBLY

All contact activities of each sample were wired with a nominal guage (16 awg) chemically cross-linked polyethylene insulated wire supplied in lengths sufficient to accommodate testing. The wire was crimped to each contact with a Pico crimp tool Model 400B.

6.0 TEST SEQUENCE

Test Samples were subjected to the following tests in the order shown.

TEST	SAMPLE NUMBER 1	2	3	4	5	6
1. Examination of Product (7.1)	X	X	X	X	X	X
2. Insulation Resistance (7.2)	X	X	X	X	X	X
3. Dielectric Withstanding Voltage (7.3)	X	X	X	X	X	X
4. Maintenance Aging (7.4)	X		X			
5. Temperature Life (7.5)		X		X		X
6. Contact Retention (7.6)	X		X			
7. Durability (7.7)		X	X		X	
8. Tool Abuse (7.8)				X	X	
9. Salt Spray (7.9)		X	X			X
10. Altitude Immersion (7.10)				X	X	X
11. Fluid Immersion (7.11)	X	X	X	X	X	X
12. Thermal Shock (7.12)	(3 additional parts used)					
13. Vibration (7.13)	X		X	X		
14. Shock (7.14)	X		X	X		
15. External Bending Moment (7.15)		X	X			X
16. Insert Retention (7.16)	X			X	X	
17. Low Voltage Resistance (7.17)		X	X			
18. Coupling/Uncoupling Torque (7.18)	X	X			X	
19. Contact Resistance (7.19)	X	X	X	X	X	X
20. Final Examination (7.20)	X	X	X	X	X	X

7.0 TEST METHODS AND RESULTS

7.1 EXAMINATION OF PRODUCT (Items 1 through 6)

7.1.1 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 were considered adequate basis for rejection.

7.1.2 Requirements:

The connectors shall be correctly constructed, marked and shall show good quality and workmanship.

7.1.3 Results:

All test samples were correctly constructed and marked. There were no defects or other evidence of poor workmanship. All samples met required specifications for examination of product.

7.2 INSULATION RESISTANCE (Items 1-6)

7.2.1 Test Method:

The test samples were subjected to the Insulation Resistance Test which was performed in the following manner:

1. The wire, mated connector plugs and receptacles were connected to a meghometer and a switching system.

2. The insulation resistance was measured between each wired contact and all other wired contacts and the shells electrically connected together.

3. The test potential of 500 VDC was applied to each test point of the specimen and each reading was taken after the meter was stabilized. All nineteen contact points were tested for each connector.

7.2.2 Requirements:

The insulation resistance shall be greater than 1000 megohms.

7.2.3 Results:

The insulation resistance at each test point of all specimens was greater than 1000 megohms. All samples met the requirements of insulation resistance.

7.3 DIELECTRIC WITHSTANDING VOLTAGE (Items 1-6)

7.3.1 Test Method:

The test samples were subjected to the dielectric withstanding Voltage Test which was performed in the following manner:

1. The wired, mated connector plugs and receptacles were connected to a hypot tester and switching system.

2. The test potential of 1500 VAC was applied between each contact and all other contacts and the shells electrically connected together for a period of sixty seconds. All nineteen mated contacts were tested for each connector pair.

3. At each test point the voltage was increased from zero to 1500 volts at a rate of 500 volts per second. The voltage was decreased to zero before switching to the next test point.

7.3.2 Requirements:

The connectors shall show no evidence of breakdown or flashover. There shall be no current leakage in excess of 2.0 milliampers.

7.3.3 Results:

There was no evidence of breakdown, flashover or current leakage in excess of 2.0 millamperes in any of the test samples. All samples met the requirements specified for dielectric withstanding voltage.

7.4 MAINTENANCE AGING (Items 1 and 3)

7.4.1 Test Method:

The test samples were subjected to the Maintenance Aging Test which was performed in the following manner:

1. The wired, unmated connector plugs and receptacles had 10% of their contacts (selected at random) completely removed and reinserted ten times.

2. Each contact cavity was visually inspected for damage.

3. All contact removal was done by hand, using the Deutsch #0411-204-1605 (size 16) tool for respective contact size. Insertion of contacts was done by hand without an insertion tool.

7.4.2 Requirements:

There shall be no visible change or damage to the contact cavities.

7.4.3 Results:

There was no visible change or damage to the contact cavities. All samples met the required specifications for maintenance aging.

7.5 TEMPERATURE LIFE (Items 2, 4 and 6)

7.5.1 Test Method:

The test samples were subjected to the Temperature Life Test which was performed in the following manner:

1. The wired, mated connectors were subjected to 100 hours of heat in a circulating air oven at 125°C (257°F).

2. After removal from the oven, the mated connectors shall be subjected to an insulation resistance test as per paragraph 7.2.

7.5.2 Requirements:

There shall be no evidence of cracking, distortion, or other damage detrimental to the normal operation of the connectors. The insulation resistance shall be no less than 500 megohms.

7.5.3 Results:

There was no evidence of cracking, distortion, or other damage detrimental to the normal operation of the connector. The insulation resistance was greater than 500 megohms. All items met the requirements specified for temperature life and the subsequent insulation resistance test.

7.6 CONTACT RETENTION (Items 1 and 3)

7.6.1 Test Method:

The test samples were subjected to the Contact Retention Test which was performed in the following manner:

1. All contacts in each unmated connector were tested. The connectors tested had all contacts in place during the test.

2. An axial load of 25 lbs. for the sixteen (16) contact was applied to the individual contacts in a direction tending to push the contact out of the rear of the connector. The axial load was applied for a period of 15 seconds.

7.6.2 Requirements:

The contacts shall not be dislodged from the connector when the specified axial load is applied.

7.6.3 Results:

The contacts were not dislodged from the connector when the specified axial load was applied. All samples met the requirements specified for contact retention.

7.7 DURABILITY (Items 2, 3 and 5)

7.7.1 Test Method:

The test samples were subjected to the Durability Test which was performed in the following manner:

Fully wired counterpart plugs and receptacles were mated and unmated by hand 100 times, in a way as to simulate actual service. The plugs and receptacles were completely separated during each cycle.

7.7.2 Requirements:

The connectors shall show no evidence of damage detrimental to their normal operation.

7.7.3 Results:

There was no evidence of damage detrimental to the normal operation of the test samples. All the samples met the requirements specified for durability.

7.8 TOOL ABUSE(Items 4 and 5)

7.8.1 Test Method:

The test samples were subjected to the Tool Abuse Test which was performed in the following manner:

1. Five cavities from each sample mated pair were selected for testing. Deutsch removal tools #0411-204-1605 (size 16) were used for their respective contact sizes.

2. The applicable tool shall be inserted as if to remove the contact and an axial load of 5 pounds shall be applied. With the force applied, the tool shall be rotated 180° and then removed, also removing the contact. The contact shall then be reinserted into the cavity by hand.

3. This constitutes one cycle. There was a total of three cycles to each of the five selected cavities in each mated sample.

7.8.2 Requirements:

There shall be no visible damage to the connector seals or contact cavities.

7.8.3 Results:

There was no visible damage to the connector seals or contact cavities. All samples met the requirements specified for tool abuse.

7.9 SALT SPRAY - CORROSION (Item 2, 3 and 6)

7.9.1 Test Method:

The test samples were subjected to the Salt Spray-Corrosion Test which was performed in the following manner:

1. The salt solution concentration was 5% salt by weight.

2. The mated connectors were placed in the chamber so that they were completely engulfed by the salt spray.

3. The connectors were subjected to 96 hours of continuous exposure.

4. Immediately following the 96 hours exposure, the connectors were removed from the chamber and thoroughly washed with tap water. A soft bristle brush was used to aid cleaning.

5. The connectors were dried in an air circulating oven at a temperature of 38° ±3°C for a maximum of twelve hours. They were then removed and inspected.

7.9.2 Requirements:

The connectors shall show no evidence of corrosion which will affect performance in subsequent tests.

7.9.3 Results:

The connectors showed no evidence of corrosion. The samples met the requirements of subsequent tests. All samples met the requirements specified for Salt Spray.

7.10 ALTITUDE IMMERSION (Items 4, 5, and 6)

7.10.1 Test Method:

The test samples were subjected to the Altitude Immersion Test which was performed in the following manner:

1. The wired and mated connectors were placed in a test container and completely covered with tap water such that the water covers the connectors being tested. The container shall then be placed in an altitude chamber and the pressure reduced to 32.68 torr and maintained for 30 minutes. The pressure in the chamber shall then be returned to the standard room pressure and maintained for 30 minutes. The above cycle shall be repeated for a total of 3 minutes. The above cycle shall be repeated for a total of 3 cycles. After the 3rd cycle while the connectors are still immersed in water, they shall be tested for DWV per paragraph 4.3.

7.10.2 Requirements:

The connectors shall show no evidence of breakdown or flashover. There shall be no current leakage in excess of 2.0 milliamperes.

7.10.3 Results:

There was no evidence of breakdown or flashover nor was there current leakage in excess of 2.0 milliamperes in any of the test samples. All samples met the requirements specified for altitude immersion.

7.11 FLUID IMMERSION (Item 1 through 6)

7.11.1 Test Method:

The test samples were subjected to the fluid Immersion Test which was performed in the following manner:

1. Each wired, mated connector was subjected to immersion in one fluid only. The connectors were subjected to the following fluids in the order shown:

ITEM NO.	TEST FLUID
1	Motor Oil 30W - Detergent
2	Hydraulic Brake Fluid (disc type 1)
3	5% soap solution
4	Diesel Fuel #2
5	Antifreeze Solution (maximum protection)
6	Gear Oil 90W

2. The mated, wired connectors were subjected to five consecutive cycles of fluid immersion. Each cycle was performed as follows:

a. The mated connector was submerged in its corresponding fluid at ambient conditions for five minutes.

b. The mated connector was then removed and allowed to air dry 24 ±2 hours.

3. After completion of the fifth cycle of fluid immersion, the connector was visually inspected for any damage.

7.11.2 Requirements:

The connectors shall show no visible evidence of damage detrimental to their normal operation.

7.11.3 Results:

There was no visible evidence of damage detrimental to the normal operation of the connectors. All samples met the requirements specified for fluid immersion.

7.12 THERMAL SHOCK (Item 1, 2 and 6)

7.12.1 Test Method:

The test samples were subjected to the Thermal Shock Test was performed in the following manner:

1. The wired mated connectors were subjected to five consecutive cycles of thermal shock. Each cycle was performed as follows:

a. A cold chamber was stabilized at -167°F, and an oven was stabilized at +257°F.

b. The specimens were placed in the cold chamber for 30 minutes, and then transferred to the oven for 30 minutes. A maximum of 2 minutes transfer time was allowed between cold chamber and oven.

2. During the last cycle with the connector exposed to +257°F, the insulation resistance was measured between each wired contact and all other wired contacts and the shell while a test potential of 500 volts D.C. was applied.

3. After five cycles the specimens were allowed to return to room temperature and were visually examined for cracking, chipping or other damage detrimental to the normal operation of the test specimen.

7.12.2 Requirements:

There shall be no evidence of cracking, chipping or other damage detrimental to the normal operation of the connectors. The insulation resistance shall be greater than 500 megohms.

7.12.3 Results:

There was no visible evidence of cracking, chipping or other damage detrimental to the normal operation of any connector. The insulation resistance was greater than 500 megohms. All the items met the requirements specified for thermal shock.

2. During the last cycle with the connector exposed to +257°F, the insulation resistance was measured between each wired contact and all other wired contacts and the shell with a test potential of 500 bolts D.C. was applied.

7.13 VIBRATION (Items 1, 3 and 4)

7.13.1 Test Method:

The test samples were subjected to the Vibration Test which was performed in the following manner:

1. The test samples were mounted to a fixture capable of transmitting the vibration conditions specified and designed so that there was no resonant vibration inherent in the fixture within the specified frequency range. Vibration input was monitored on the mounting fixture in the proximity of the support points of the test samples.

2. Sine vibration test levels were applied in each of the three mutually perpendicular directions using the following parameters:

Amplitude: .07 inch double amplitude or 20g (peak), whichever is less.

Frequency: 10-2,000 Hz, varied logarithmically.

Cycle Sweep Time: (From 10Hz to 2,000 Hz to 10 Hz) 20 minutes.

No. of Cycles: 4 hours per axis (12 hours).

3. During the first three hours of vibration in each axis, a current of 23 amperes for size 12 contacts and 13 Amperes for size 16 contacts must be applied.

4. During the last hours of vibration in each axis discontinuity must be monitored. There shall be no discontinuity greater than 1.0 microsecond with a current of 100 milliamps.

7.13.2 Requirements:

The test samples shall have no electrical discontinuity in excess of 1 microsecond and shall have no disengagement of the mated connectors, backing off of the coupling mechanism, evidence of cracking, breaking, or loosening of parts.

7.13.3 Results:

The test samples had no electrical discontinuity in excess of 1 microsecond and had no disengagement of the mated connectors, backing off of the coupling mechanism, evidence of cracking, breaking or loosening of parts. All items met the requirements for vibration.

7.14 SHOCK (Items 1, 3 and 4)

7.14.1 Test Method:

The test samples were subjected to the Shock Test which was performed in the following mannner:

1. The test samples were subjected to ten shocks in each of two perpendicular axis. The pulse was an approximate half since wave of 50g ±15 percent with a duration of 11 ±1 milliseconds.

2. The test samples were mounted on a shock fixture by normal means. The wire bundle was clamped to fixed points at least 8 inches for the rear of the connector.

3. All contacts had a maximum of 100 milliamperes flowing through them and were individually monitored for discontinuities in excess of 1 microsecond.

7.14.2 Requirements:

The test samples shall show no electrical discontinuity and shall have no disengagement of the mated connectors, evidence of cracking, breaking or loosening of parts.

7.14.3 Results:

The test samples had no electrical discontinuity, disengagement of the mated connectors, evidence of cracking, breaking or loosening of parts. All items met the requirements for shock.

7.15 EXTERNAL BENDING MOMENT (Items 2, 3 and 6).

7.15.1 Test Method:

The External Bending Moment test was conducted in the following manner:

1. The connector was mounted as in normal service to a rigid panel.

2. The testing bending moment of 250 inch-pounds was applied at a rate of approximately 1 pound per second. This bending moment was applied for 60 seconds.

3. Continuity of the contacts was monitored during the test. The test circuit to monitor this was capable of detecting any discontinuity greater than one (1) microsecond.

7.15.2 Requirements:

The connectors shall show no evidence of damage detrimental to their normal operation. There shall be no interruption of electrical continuity in excess of one (1) microsecond.

7.15.3 Results:

The connectors showed no evidence of damage detrimental to their normal operation. They exhibited no interruption of electrical continuity in excess of one (1) microsecond. All items met the requirements for external bending moment.

7.16 INSERT RETENTION (Items 1, 4 and 5)

7.16.1 Test Method:

The test samples were subjected to the Insert Retention Test which was performed in the following manner:

1. The wired and mated connectors were mounted on a tension pulling device such that the wire bundle of the receptacle was tied rigidly to a fixed panel and the wire bundle of the plug was tied rigidly to the force pulling crosshead of the tension device the mated connector suspended in between.

2. A pulling force load of 100 pounds was applied to the mounted connectors at the rate of 10 pounds a second. The full load of 100 pounds was applied for 30 seconds.

7.16.2 Requirements:

The qualification samples shall retain their inserts in their proper location in the shell. Evidence of cracking, breaking, separation from shell, or loosening of parts shall be cause for rejection.

7.16.3 Results:

The qualification samples retained their inserts in the proper location in the shell. There was no evidence of cracking, breaking, separation from the shell or loosening of parts. All samples met the requirements of insert retention.

7.17 LOW LEVEL CONTACT RESISTANCE (Items 2 and 3)

7.17.1 Test Method:

The test samples were subjected to the Low Level Contact Resistance Test which was performed in the following manner:

1. The qualification samples were mated and connected to a power supply and a millivolt meter in accordance with method 3002.1 of MIL-STD-1344.

2. The circuit was energized from zero until the required test current of 100 milliamperes was reached. The test sample was allowed to stabilize at the test current.

3. The voltmeter probes (leads) were connected to the test sample. The voltage drop was measured and recorded. The resistance was calculated.

7.17.2 Requirements:

The calculated resistance across a mated contact pair shall not exceed 6 milliohms.

7.17.3 Results:

The calculated resistance across each mated contact did not exceed 6 milliohms. All test samples met the requirements specified for low voltage resistance.

7.18 COUPLING TORQUE (Items 1, 2 and 5)

7.18.1 Test Method:

The test samples were subjected to the Coupling Torque Test which was performed in the following manner:

1. Mating halves of the completely assembled connectors were coupled and uncoupled.

2. The forces which were applied (torque) to facilitate full coupling and uncoupling were measured and recorded.

7.18.2 Requirements:

The coupling torque for mating and unmating counterpart connectors shall be within the following ranges:

Shell Size	Minimum Uncoupling Torque	Maximum Coupling Torque
9 pin arrangement	7 inches-pounds	48 inches-pounds

7.18.3 Results:

The test specimens met the requirements for coupling torque for mating and unmating counter part connectors.

7.19 CONTACT RESISTANCE (Items 1 through 6)

7.19.1 Test Method:

The test samples were subjected to the Contact Resistance Test which was performed in the following manner:

1. The qualification samples were mated and connected to a power supply and a millivolt meter in accordance with MIL-C-39029.

2. The circuit was energized from zero and increased until the required current of 13 amperes for size 16 contacts was attained.

3. The millivolt meter probes (leads were connected to the test sample). The millivolt drop was measured and recorded.

7.19.2 Requirements:

The millivolt drop across a mated contact pair shall not exceed 89 millivolts for size 16 contacts.

7.19.3 Results:

The millivolt drop across the mated contact pairs shall not exceed 89 millivolts for size 16 contacts. All sample items passed the requirements for contact resistance.

7.20 FINAL EXAMINATION (Items 1 through 6)

7.20.1 Test Method:

1. The tested connectors were examined to determine the effects of previous testing.

2. Any evidence of torn seals, cracked plastic, loosening of parts, excessive wear, carbon tracking, or missing parts was recorded.

7.20.2 Requirements:

The test connectors shall show no evidence of damage detrimental to normal operation. All markings shall be legible.

7.20.3 Results:

The test connectors showed no evidence of any damage detrimental to normal operation and all markings were legible. The test samples passed all previous tests and fulfilled the requirements for the final examination.