

DEUTSCH* DT Series Electrical Connectors

1. INTRODUCTION

1.1. Purpose

This report summarizes the results of in-house qualification testing of DEUTSCH DT series electrical connectors. This test, which is derived from DEUTSCH test procedure 51614, simulates extreme environmental and electrical conditions.

1.2. Scope

The following DEUTSCH part numbers were subjected to testing in accordance with DEUTSCH test procedure as described herein.

- DT04-3P (plug)
- DT06-3S (receptacle)
- W3P (pin wedge)
- W3S (socket wedge)
- 0460-202-16141 (size 16 pin contact)
- 0462-201-16141 (size 16 socket contact)

The following documents form a part of this test report to the extent specified herein. Unless otherwise specified, the latest edition of the document applies.

- MIL-STD-1344 Test Methods for Electrical Connectors
- MIL-C-39029 General Specification for Contacts and Electrical Connectors

1.3. Conclusion

DEUTSCH DT series connectors listed in Paragraph 1.4 conform to the electrical, mechanical, and environmental performance requirements given in product specification 108-151009, rev A.

1.4. Sample Description, Selection, and Assembly

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

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	DESCRIPTION	QUANTITY
DT04-3P	Plug	6
DT06-3S	Receptacle	6
W3P	Pin Wedge	6
W3S	Socket Wedge	6
0460-202-16141	Pin Contacts, Size 16	18
0462-210-16141	Socket Contacts, Size 16	18

All contact activities of each sample were wired with a nominal gage (16 AWG) chemically cross-linked polyethylene insulated wire supplied in lengths sufficient to accommodate testing. The wire was crimped to each contact with crimp tool HDT-48-00.

2. TEST CONDITIONS AND EQUIPMENT

2.1. Test Conditions

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

Temperature: +18° to +35°C [+65° 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 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 descriptive name, laboratory identification, and date of last calibration prior to use concerning the test equipment was recorded on the data format for each test.

2.3. Documentation of 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 by 11-in. 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.

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 accidentally 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:

- Electrical hookups that are peculiar to this test program or might prohibit duplication of the test method and results involved if not supplied.
- The orientation of samples to the direct force imparted during any physical shock or vibration testing.
- Any fixturing that would be used as a method of mounting the test samples that is fabricated exclusively for this test sequence.

3. TEST SEQUENCE

Test samples were subjected to the following tests in the order given. Refer to Section 4 for test or examination. Each test group had 1 mated pair test sample.

TEST OR EXAMINATION	TEST GROUP (a)					
	1	2	3	4	5	6
	TEST SEQUENCE (b)					
Examination of Product	1	1	1	1	1	1
Insulation Resistance	2	2	2	2	2	2
Dielectric Withstanding Voltage	3	3	3	3	3	3
Maintenance Aging	4		4			
Temperature Life		4		4		4
Contact Retention	5		5			
Durability		5	6		4	
Salt Spray		6	7			5
Moisture	6			5	5	
Fluid Immersion	7	7	8	6	6	6
Thermal Shock	8	8				7
Vibration	9		9	7		
Shock	10		10	8		
Contact Resistance	11	9	11	9	7	8
Final Examination	12	10	12	10	8	9

(1) See paragraph 1.5

(2) Numbers indicate sequence that tests were performed.

Figure 1

4. TEST METHODS AND RESULTS

4.1. Examination of Product (Groups 1 through 6)

A. Test Method

1. The connectors were visually inspected for correct use of materials, proper construction, correct part number and insert markings and overall quality of workmanship.
2. Poor molding fabrication, loose materials, damaged or improperly manufactured contacts, galling of metal parts, nicks and burrs of metal parts, and torn seals or cracked plastic were considered adequate basis for rejection.

B. Requirements

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

C. 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.

4.2. Insulation Resistance (Groups 1 through 6)

A. 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 megohmmeter 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 three contact points were tested for each connector.

B. Requirements

The insulation resistance shall be greater than 1000 megohms.

C. Results

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

4.3. Dielectric Withstanding Voltage (Groups 1 through 6)

A. 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 60 seconds. All three mated contacts were tested for each connector pair.
3. At each test point the voltage was increased from 0 to 1500 volts at a rate of 500 volts per second. The voltage was decreased to 0 before switching to the next test point.

B. Requirements

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

C. Results

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

4.4. Maintenance Aging (Groups 1 and 3)

A. 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 one of each contact (selected at random) completely removed and re-inserted 10 times.
2. Each contact cavity was visually inspected for damage.
3. All contact removal was done by hand. Insertion of contacts was done by hand with no insertion tool.

B. Requirements

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

C. Results

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

4.5. Temperature Life (Groups 2, 4, and 6)

A. 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 100°C [212°F].
2. After removal from the oven, the mated connectors shall be subjected to an insulation resistance test according to paragraph 4.2.

B. 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.

C. 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 groups met the requirements specified for temperature life and the subsequent insulation resistance test.

4.6. Contact Retention (Groups 1 and 3)

A. 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 size 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.

B. Requirements

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

C. 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.

4.7. Durability (Groups 2, 3, and 5)

A. 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.

B. Requirements

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

C. 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.

4.8. Salt Spray—Corrosion (Groups 2, 3, and 6)

A. Test Method

The test samples were subjected to the salt spray 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.

B. Requirements

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

C. 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.

4.9. Moisture (Groups 1, 4, and 5)

A. Test Method

The test samples were subjected to the moisture test, which was performed in the following manner:

1. The qualification samples were mated and sealed with contact and wire.
2. The samples were immersed into 3 ft of water for a period of 24 hours.
3. The samples were blown dry with pressurized air and unmated.

B. Requirements

The connectors shall show no sign of moisture inside the cavities or connector interior.

C. Results

The connectors had no sign of moisture inside the cavities or connector interior.

4.10. Fluid Immersion (Groups 1 through 6)

A. 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 given:
 - 1 gasoline
 - 2 hydraulic brake fluid (disc type 1)
 - 3 gear oil 90 W, transmission oil 90 W
 - 4 motor oil 30 W, detergent
 - 5 diesel fuel No. 2
 - 6 antifreeze solution (maximum protection)

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 \pm 2 hours.
3. After completion of the fifth cycle of fluid immersion, the connector was visually inspected

B. Requirements

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

C. 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.

4.11. Thermal Shock (Groups 1, 2, and 6)

A. Test Method

The test samples were subjected to the thermal shock test, which 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 -55°C [-67°F], and an oven was stabilized at 125°C [$+257^{\circ}\text{F}$].
 - b. The specimens were placed in the cold chamber for 30 minutes, then transferred to the oven for 30 minutes. A maximum of two minutes transfer time was allowed between cold chamber and oven.
2. During the last cycle with the connector exposed to $+125^{\circ}\text{C}$, the insulation resistance was measured between each wired contact and all other wired contacts and the shell while a test potential of 500 volts DC 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.

B. 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.

C. 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 groups met the requirements specified for thermal shock.

During the last cycle with the connector exposed to $+125^{\circ}\text{C}$, the insulation resistance was measured between each wired contact and all other wired contacts and the shell with a test potential of 500 volts DC was applied.

4.12. Vibration (Groups 1, 3, and 4)

A. 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-in. double amplitude or 20 g (peak), whichever is less
Frequency: 10 to 2,000 Hz, varied logarithmically
Cycle sweep time (from 10 to 2,000 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, 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.

B. Requirements

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

C. Results

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

4.13. Shock (Groups 1, 3, and 4)

A. Test Method

The test samples were subjected to the shock test, which was performed in the following manner:

The test samples were subjected to 10 shocks in each of two perpendicular axis. The pulse was an approximate half sine wave of 50 g \pm 15 percent with a duration of 11 \pm 1 milliseconds.

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

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

B. Requirements

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

C. Results

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

4.14. Contact Resistance (Groups 1 through 6)

A. 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 0 and increased until the required current of 15 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.

B. Requirements

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

C. Results

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

4.15. Final Examination (Groups 1 through 6)

A. 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.

B. Requirements

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

C. 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.