DTM Series Connector System

1. SCOPE

1.1. Content

This specification covers performance, tests and quality requirements for the TE Connectivity (TE) DTM Series Connector System.

1.2. Qualification

When tests are performed on the subject product line, procedures specified in Figure 2 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

1.3. Successful qualification testing on the subject product line was completed in 1997 and 2006. The Qualification Test Report number for this testing is 501-151037. This documentation is on file at and available from Engineering Practices and Standards (EPS).

2. APPLICABLE DOCUMENTS AND FORMS

The following documents and forms constitute a part of this specification to the extent specified herein. Unless otherwise indicated, the latest edition of the document applies.

2.1. TE Connectivity (TE) Documents

- 109-1: General Requirements for Testing
- 408-151008: Instruction Guide DEUTSCH Removal Tool DT-RT1
- 501-151037: DTM Qualification Test Report
- Product Drawings

  X refers to A,B,C,D keys. XXXX refers to product modification.

DTM04-2P-XXXX	2pin Receptacle
DTM04-3P-XXXX	3pin Receptacle
DTM04-4P-XXXX	4pin Receptacle
DTM04-6P-XXXX	6pin Receptacle
DTM04-08PX-XXXX	8pin Receptacle
DTM04-12PX-XXXX	12pin Receptacle

DTM06-2S-XXXX	2pin Plug
DTM06-3S-XXXX	3pin Plug
DTM06-4S-XXXX	4pin Plug
DTM06-6S-XXXX	6pin Plug
DTM06-08SX-XXXX	8pin Plug
DTM06-12SX-XXXX	12pin Plug

DTM13-08PX-XXXX	8pin Receptacle, 90° Header
DTM13-12PX-XXXX	12pin Receptacle, 90° Header

DTM15-12PX-XXXX	12pin Receptacle, 180° Header

Wedge Lock PN's sold separately but are required for DTM functionality

WM-2PX	2pin Rcpt Wedge Lock		WM-2SX	2pin Plug Wedge Lock
WM-3P	3pin Rcpt Wedge Lock		WM-3S	3pin Plug Wedge Lock
WM-4P	4pin Rcpt Wedge Lock		WM-4S	4pin Plug Wedge Lock
WM-6P	6pin Rcpt Wedge Lock		WM-6S	6pin Plug Wedge Lock
WM-8P	8pin Rcpt Wedge Lock		WM-8S	8pin Plug Wedge Lock
WM-12P	12pin Rcpt Wedge Lock		WM-12S	12pin Plug Wedge Lock

2.2. Industry Documents

- DIN 40050-9: Road Vehicles Degrees of protection (IP Code)
- DIN 72551-6: Road Vehicles—Low-Tension Cables—Part 6: Single-Core, Unscreened with Thin Insulation Wall; Dimensions, Materials, Marking
- EIA-364: Electrical Connector/Socket Test Procedures Including Environmental Classifications
- IEC-60512: Electronic Equipment - Tests and Measurements
- IEC-60512-3: Electromechanical Components For Electronic Equipment: Basic Testing Procedures And Measuring Methods - Part 3: Current- Carrying Capacity Tests
- IEC-60529: Degrees of protection Provided by Enclosures (IP Code)
- ISO 6722: Road Vehicles—60 V and 600 V Single-Core Cables—Dimensions, Test Methods, and Requirements
- ISO 8092-2:Connections for on-board Electrical Wiring Harness Part 2: Definitions, Test Methods and General Performance Requirements
- ISO 16750-3: Road Vehicles-Environmental Conditions and Testing for Electrical and Electronic Equipment Part 3: Mechanical Loads
- ISO 16750-4: Road Vehicles-Environmental Conditions and Testing for Electrical and Electronic Equipment Part 4: Climatic Loads
- SAE J1128: Low Voltage Primary Cable
- SAE J2030: Heavy-Duty Electrical Connector Performance Standard

3. REQUIREMENTS

3.1. Design and Construction

Product shall be of the design, construction, materials and physical dimensions specified on the applicable product drawing.

3.2. Ratings

- Voltage: 250 VDC
- Current (Amp): See Figure 1

Connector Loading	Wire Size AWG [mm²]			
	16 [1.0]	18 [0.80]	20 [0.50]	22 [0.35]
All Circuits Energized	7.5	7.5	7.5	5.0

Figure 1

- Temperature: -55°C to +125°C
- Ingress Protection (IP) Level: IP68 and IP6K9K (with rear protection, such as backshell)
- Flammability: UL Recognized. Parts have been successfully tested to the 20 mm Flame Test per Standard UL-94

3.3. Test Requirements and Procedures Summary

Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

See Appendix A for Procedure Comparison Chart with ISO standards

<table>
<tr><th>Test Description</th><th>Requirement</th><th>Procedure</th></tr>
<tr><td>Examination of Product</td><td>The connectors shall be correctly constructed, marked and shall show good quality and workmanship</td><td>EIA-364-18.
Visually inspected for use of materials, proper construction, correct part number and insert markings and over-all quality of workmanship. 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.</td></tr>
<tr><td colspan="3">ELECTRICAL</td></tr>
<tr><td>Insulation Resistance</td><td>1000 MΩ minimum</td><td>ISO 8092-2
Check each contact to all other contacts and the shell, if shell is conductive. Test to be performed using a 500 VDC ±10% megohmmeter.</td></tr>
<tr><td>Withstanding Voltage</td><td>Current leakage not to exceed 2.0 mA for mated connectors.</td><td>ISO 8092-2
Apply an AC voltage of 1,000 V (RMS) or a DC voltage of 1600 V for 1-minute across all terminals connected together and a metal film surrounding the housing. In addition, apply the voltage with a different test sample to every two adjacent contacts</td></tr>
<tr><td>Low Level Contact Resistance</td><td><table><tr><th>Wire Size</th><th>Resistance</th></tr><tr><td>AWG [mm²]</td><td>mΩ max</td></tr><tr><td>1.5</td><td rowspan="4">12.5</td></tr><tr><td>16 [1.0]</td></tr><tr><td>18 [0.80]</td></tr><tr><td>20 [0.50]</td></tr></table></td><td>ISO 8092-2
Test with applied voltage not to exceed 20 mV open circuit and the test current shall be limited to 100 mA. The resistance of an equal length of wire (reference wire) shall be subtracted from the same reel as used for the connector wiring.</td></tr>
<tr><td>Contact Resistance (Voltage Drop)</td><td><table><tr><th rowspan="2">Contact Size</th><th>Wire Size</th><th>Test Currrent</th><th colspan="2">Voltage Drop (mV max)</th></tr><tr><td>AWG [mm²]</td><td>Amp</td><td>Solid</td><td>S&F</td></tr><tr><td rowspan="4">20</td><td>16 [1.0]</td><td rowspan="3">7.5</td><td rowspan="4">60</td><td rowspan="4">100</td></tr><tr><td>18 [0.80]</td></tr><tr><td>20 [0.50]</td></tr><tr><td>22 [0.35]</td><td>5</td></tr></table></td><td>EIA-364-06
Using test currents as defined. The resistance of an equal length wire (reference wire) shall be subtracted from the actual readings to determine the added resistance of the terminal. The reference wire shall be from the same reel as used for the connector wiring.</td></tr>
</table>

Figure 2 Cont.

<table>
<tr><th>Test Description</th><th>Requirement</th><th>Procedure</th></tr>
<tr><td>Derating</td><td>Derating curve shall be documented for each terminal system.</td><td>IEC 60512-2
Measurement to be carried out in air as undisturbed as possible. The test samples shall be mounted in an enclosure which protects the immediate environment from external air movement. Assemble thermocouple probes to the test sample to measure temperature increase at the contact as the current increases. Increase current in 1 amp steps. The current shall be maintained for 1-hour after thermal stability at each current levels. Record temperature at each current level</td></tr>
<tr><td colspan="3">MECHANICAL</td></tr>
<tr><td>Connection and Disconnection</td><td>Connection Force Not to exceed 135N.</td><td>ISO 8092-2
Perform connection and disconnection as specified by the connector manufacturer at a constant speed between 25mm/min and 100mm/min. Subject the connector for 10 connections and
disconnections. Measure the force at the first connection, the first disconnection and the tenth disconnection.</td></tr>
<tr><td>Tensile Strength of Conductors</td><td><table><tr><th>Wire Size mm^2</th><th>Tensile Strength Min (N)</th></tr><tr><td>0.50</td><td>70</td></tr><tr><td>0.75</td><td>90</td></tr><tr><td>1.50</td><td>155</td></tr></table></td><td>ISO 8092-2
The tensile strength of the crimped connection shall be tested by using suitable apparatus at a constant speed within the range of 25 mm/min. If the terminal has a cable insulation crimp it shall be rendered mechanically ineffective.</td></tr>
<tr><td>Locking Device Strength</td><td>The housing locking device shall withstand a constant force of 100N for 10 seconds.</td><td>ISO 8092-2
Test to check the ability of locked connectors to withstand a specific static load. Apply a test force of 100 N in the disconnection direction and hold constant for 10-12 seconds</td></tr>
<tr><td>Contact Insertion Force</td><td>Maximum force applied for terminals with attached cables with a nominal cross-sectional area ≤ 1mm² is ≤ 15N. With larger cross-sectional areas than 1mm² the maximum force shall be ≤ 30N.</td><td>ISO 8092-2
Test the insertion force of the contact into the cavity by using the min and max size cable that can be used, placing it in the insertion direction via a test fixture and positioning it as close to the cable attachment. Insure contact is locked in place. Perform at constant 25mm/min.</td></tr>
<tr><td>Contact Retention</td><td>The terminals shall withstand a force of minimum of 60N</td><td>ISO 8092-2
Apply a constant force to the front and/or back of the terminal in an axial direction and hold for 10-12 seconds</td></tr>
</table>

Figure 2 Cont.

<table>
<tr><th>Test Description</th><th>Requirement</th><th>Procedure</th></tr>
<tr><td>Sinusoidal Vibration 1</td><td>There shall be no discontinuity in excess of one (1) µs at 20mV and 100 mA during the last hour of each axis.
Shall meet visual requirements, show no physical damage and meet requirements of additional tests as needed.</td><td>EIA-364-28
Sine Sweep: 10 to 2000 Hz
Initial Displacement: 1.78 mm DA
Maximum Acceleration: 20g
Test Duration: 12-hours
Time Per Axis X, Y, Z
Test Current first 3-hours each axis:
<table>
<tr><td rowspan="2">Contact Size</td><td>Wire Size</td><td>Test Currrent</td></tr>
<tr><td>AWG [mm²]</td><td>Amp</td></tr>
<tr><td rowspan="4">20</td><td>16 [1.0]</td><td rowspan="3">5</td></tr>
<tr><td>18 [0.80]</td></tr>
<tr><td>20 [0.50]</td></tr>
<tr><td>22 [0.35]</td><td>3</td></tr>
</table></td></tr>
<tr><td>Sinusoidal Vibration 2</td><td>There shall be no discontinuity in excess of one (1) µs at 20mV and 100 mA during the last hour of each axis.
Shall meet visual requirements, show no physical damage and meet requirements of additional tests as needed.</td><td>ISO 8092-2
Low Frequency/amplitude
10 Hz to 100 Hz/0.75mm
High Frequency/acceleration
>100 Hz to 500 Hz / 30g
>500 Hz to 2000 Hz / 20g
Test duration is 16-hours per axis
No current applied</td></tr>
<tr><td>Random Vibration</td><td>There shall be no discontinuity in excess of one (1) µs at 20mV and 100 mA during the last hour of each axis.
Shall meet visual requirements, show no physical damage and meet requirements of additional tests as needed.</td><td>ISO 16750-3
Test duration is 94-hours per axis
<table>
<tr><th>Frequency (Hz)</th><th>PSD $(m/s^2)s^2/Hz$</th></tr>
<tr><td>10</td><td>14</td></tr>
<tr><td>20</td><td>28</td></tr>
<tr><td>30</td><td>28</td></tr>
<tr><td>180</td><td>0.75</td></tr>
<tr><td>300</td><td>0.75</td></tr>
<tr><td>600</td><td>20</td></tr>
<tr><td>2000</td><td>20</td></tr>
<tr><td colspan="2">rms acceleration value 177 m/s^2</td></tr>
</table></td></tr>
<tr><td>Mechanical Shock</td><td>There shall be no discontinuity in excess of one (1) µs at 20mV and 100 mA during the last hour of each axis.
Shall meet visual requirements, show no physical damage and meet requirements of additional tests as needed.</td><td>ISO 16750-3
Three shocks are applied along the three mutually perpendicular axis for a total of 18 shock. The pulse shall be approximately half sine wave of 300g magnitude with a duration of 3 ms</td></tr>
<tr><td>Drop</td><td>There shall be no evidence of cracking, distortion or detrimental damage to the connector following the test. Small chips and dents that do not adversely affect the connector shall be disregarded.</td><td>ISO 8092-2
The length of the cable shall be 1250mm long. Attach the cable to a fixed point 1000mm above floor. Allow a free swinging of test sample. Hold the test sample horizontal and let it swing down to hit a steel plate. Repeat 5 times</td></tr>
<tr><td>Durability</td><td>No evidence of damage to the contacts, contact plating, connector housing or seals which may be detrimental to reliable connector performance.</td><td>EIA-364-09
Test samples shall be mated and unmated 20 complete cycles at room temperature.</td></tr>
</table>

Figure 2 Cont.

<table>
<tr><th>Test Description</th><th>Requirement</th><th>Procedure</th></tr>
<tr><td colspan="3">ENVIRONMENTAL</td></tr>
<tr><td>Conditioning of Samples</td><td>There shall be no evidence of cracking, distortion or detrimental damage to the connector following the test.</td><td>ISO 8092-2
Place the test sample in a test chamber for 500 hours at +120°C without current flowing</td></tr>
<tr><td>Temperature Life</td><td>There shall be no evidence of cracking, distortion or detrimental damage to the connector following the test.</td><td>EIA-364-17
The wired mated connectors shall be subjected to 1000 hours at +125°C without current flowing</td></tr>
<tr><td>Chemical Fluid</td><td>There shall be no evidence of cracking, distortion or detrimental damage to the connector following the test.</td><td>ISO 16750-5
One fluid was applied to each test sample. Chemicals were dipped, sprayed or brushed on the sample depending on the most convenient application system. Any excess fluid was allowed to drip off the specimen. Store the sample for 24 hours in accordance with the aging temperature per chart below
<table>
<tr><th>Fluid</th><th>Aging Temp</th></tr>
<tr><td>Diesel Fuel</td><td>120°C</td></tr>
<tr><td>Bio Diesel Fuel</td><td>120°C</td></tr>
<tr><td>Unleaded Gasloline</td><td>26°C</td></tr>
<tr><td>Battery Fluid</td><td>80°C</td></tr>
<tr><td>Methanol</td><td>26°C</td></tr>
<tr><td>Engine Oil</td><td>120°C</td></tr>
<tr><td>Transmission Fluid</td><td>120°C</td></tr>
<tr><td>Hydraulic Fluid</td><td>120°C</td></tr>
</table></td></tr>
<tr><td>Thermal Cycle</td><td>There shall be no evidence of cracking, distortion or detrimental damage to the connector following the test.</td><td>Cycle mated connectors from –55°C to +125°C. Connectors to remain at each temperature extreme for one (1) hour minimum. Mated connectors are to be cycled a total of 20 complete cycles.</td></tr>
<tr><td>Thermal Shock 1</td><td>There shall be no evidence of cracking, distortion or detrimental damage to the connector following the test.</td><td>SAE J2030
Subjected test sample to 10 cycles. One cycle shall consist of a soak time at –55°C then a transition within 2 min to an ambient of +125°C, with a soak time there and then a transition back to -55°C within 2 min. The soak times shall be established as the time necessary to bring the internal connector temperature on test to within 5°C of each of the ambient temperatures.</td></tr>
<tr><td>Thermal Shock 2</td><td>There shall be no evidence of cracking, distortion or detrimental damage to the connector following the test.</td><td>ISO 16750-4
Subject the sample:
(1) 20 minutes at -40°C
(2) ≤ 30 second transition time
(3) 20 minutes at +125°C
(4) ≤ 30 second transition time
Repeat 100 times</td></tr>
</table>

Figure 2 Cont.

Test Description	Requirement	Procedure
Plastic Bag Test	No moisture is allowed inside the connector. Additionally, no cracking of materials or seal failures caused by ageing and different expansion coefficients, is allowed.	Place the sample on a support inside an airtight container. Beneath the support is a saline solution of H_2O with 3% NaCl and the volume used is approx. 2% of the total volume of the airtight container. Place the sample in a thermal shock chamber. The three chambers shall be set to three different temperature (1) -20°C, (2) +5°C, (3) +85°C. Time exposed at each temperature is 20 minutes. Transition time should be less than 60 seconds. Repeat 200 times
Temperature/Humidity Cycling	No requirement, used in sequence testing only.	ISO 8092-2 Subject the sample to 10 cycles of 24 hours as follows: a) Hold at +23°C at 45% RH for 4 hours b) Raise to +55°C at 95% RH for 0.5 hours c) Hold at +55°C at 95% RH for 10 hours d) Lower to -40°C within 2.5 hours e) Hold at -40°C for 2 hours f) Raise to +120°C within 1.5 hours g) Hold at +120°C for 2 hours
Influence of Water and Salt	Test samples must meet insulation resistance of 100 MΩ minimum when tested at 500 VDC.	SAE J2030 Place samples in an oven at +125°C for 1-hour then immediately place in water with 5% salt in weight content and 0.1 g/L wetting agent to a depth of 1 meter for 4-hours
Water Immersion	Test samples must meet insulation resistance of 1000 MΩ minimum when tested at 500 VDC.	The wired mated connectors shall be placed in an oven at +125°C for two (2) hours minimum then immediately be placed in water with a 5% salt by weight content and 0.1 g/L wetting solution to a depth of 914mm for four (4) hours minimum. The free ends of the mated connectors must remain out of the water to prevent wicking of the water through the open wires. Water temperature to be +23°C.

Figure 2 end

NOTE

a) All cavities wired with the minimum approved wire gauge per SAE J1128 suitable for the terminal size and with sufficient length to accommodate testing. Wire insulation shall be minimum diameter per SAE J1128 and shall be verified to be within the connector wire sealing range. Crimp characteristics (i.e. height, width, etc.) shall be checked prior to testing.

All unsealed cavities shall be secured with sealing plugs. To prevent capillary action on the sealed connector, all free wire ends and test points (i.e. millivolt test connection) shall be sealed with alcohol-based RTV silicone or equivalent and covered with heat shrink tubing.

b) Specimens shall be prepared in accordance with applicable production drawings and shall be selected at random from current production.

3.4. Product Qualification and Requalification Test Sequence

TEST OR EXAMINATION	TEST GROUP (a)													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	TEST SEQUENCE (b)													
Examination of Product	1	1	1	1	1,5	1,5	1,8	1,3	1,4	1,7	1,6	1,6	1,6	1,15
Low Level Contact Resistance	4	4	4	2,5,8			3.7				3,5			3,6,8, 10,12
Contact Resistance	3	3	3	3,6,9										
Insulation Resistance				11			5			3,6		5	4,6	
Withstanding Voltage							6							
Conditioning of Samples					2	2	2		2	2	2	2	2,3	2
Temperature Life		2		4										
Connection and Disconnection														4
Tensile Strength of Conductor								2						
Locking Device Strength												4		
Contact Insertion Force					3									
Contact Retention					4									
Water Immersion				10										
Influence of Water and Salt										5			5	
Temperature/Humidity Cycling							4							5
Thermal Cycle	2													
Thermal Shock 1			2											
Thermal Shock 2														13
Sinusoidal Vibration 1				7										
Sinusoidal Vibration 2														7
Random Vibration														9
Mechanical Shock														11
De-Rating									3					
Drop						4								
Chemical Fluids										4		3		
Plastic Bag Test											4			14
Durability					3									

NOTE

(a) Specimens shall be prepared in accordance with applicable Instruction Sheets and shall be selected at random form current production.

a. Groups 1-3. Specimens shall consist of 12 position connectors with DEUTSCH Solid Terminal System size 20 nickel and gold pin and socket contacts with 18, 20 AWG.

b. Group 4. Specimens shall consist of 2 and 12 position connectors with DEUTSH Solid Terminal System size 20 nickel pin and socket contacts with 20 AWG.

c. Groups 5-14. Specimens shall consist of 2, 3, 4, 6, 8 and 12 position connectors with DEUTSCH Stamped & Formed Terminal System size 20 nickel pin and socket contacts with 0.50mm^2, 0.75mm^2 and 1.50mm^2

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

3.5. Appendix A

Test Procedure Comparison Chart

Test	EIA-364 Dash No.	Similar to SAE J2030 Paragraph	Similar to ISO 8092-2 Paragraph
Examination of product	18	6.1	4.2
Insulation Resistance	21	6.3	4.12
Dielectric Withstanding Voltage	20	-	4.13
Low Level Contact Resistance	23	6.2	4.8
Contact Resistance	06	6.4	4.8
Maintenance Aging	24	6.6	-
Contact Retention	29	6.18	4.7
Durability	09	6.11	4.3
Vibration	28	6.15	-
Impact	42	6.17	4.20
Connector Retention	-	6.20	-
Temperature Life	17	6.7	4.18
Salt Spray	26	6.12	4.16
Fluid Immersion	10	6.14	4.23
Thermal Cycle	-	-	-
Water Immersion	-	6.19	4.9