DEUTSCH* DRB Series Connector System

1. SCOPE

1.1. Content

This specification covers performance, tests and quality requirements for the TE Connectivity (TE) DRB 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 2012. The Qualification Test Report number for this testing is 501-151021. These documents are on file at and available from Product Engineering, Industrial Commercial Transportation (ICT).

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
- 501-151021 DRB Qualification Test Report
- 502-151021 DRB Ingress Protection Engineering Test Report
- Product Drawings

X refers to A, B, C, D keys. XXXX refers to product modification.
Wedge Locks and Interface Flange sold separately but are required for DRB functionality

DRB12-48PXE-XXXX	48pin Receptacle
DRB12-60PXE-XXXX	60pin Receptacle
DRB12-60PXNE-XXXX	60pin Receptacle, Non-Env
DRB12-102PXE-XXXX	102pin Receptacle
DRB12-102PXE-XXXX	128pin Receptacle
DRB12-102PXNE-XXXX	128pin Receptacle, Non-Env
DRB16-48SXE-XXXX	48pin Plug
DRB16-60SXE-XXXX	60pin Plug
DRB16-102SXE-XXXX	102pin Plug
DRB16-128SXE-XXXX	128pin Plug
WB-48PX	48pin Rcpt Wedge Lock
WB-51PXL	102pin Rcpt Wedge Lock, Left
WB-51PXR	102pin Rcpt Wedge Lock, Right
WB-60PX	60pin Rcpt Wedge Lock
WB-64PX	128pin Rcpt Wedge Lock
WB-48SX	48pin Plug Wedge Lock
WB-51SXL	102pin Plug Wedge Lock, Left
WB-51SXR	102pin Plug Wedge Lock, Right
WB-60SX	60pin Plug Wedge Lock
WB-64SX	128pin Plug Wedge Lock
DRBF-1X	Interface Flange, Large
DRBF-2X	Interface Flange, Small
DRBF-3XX	Interface Flange, Small Dual
DRBM-3X	Interface Flange, Power Studs

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
- IEC 60512-4: Electromechanical Components for Electronic Equipment: Basic Testing Procedures and Measuring Methods - Part 4 Dynamic Stress Test
- IEC 60512-5-2: Connectors for Equipment-Test and Measurements-Part 5-2: Current-carrying capacity Tests-Test 5b: Current-temperature derating
- IEC 60512-11-7: Connectors for Equipment-Test and Measurements-Test 11g: Flowing Mixed Gas Corrosion Test
- 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
- ISO 16750-5: Road Vehicles-Environmental Conditions and Testing for Electrical and Electronic Equipment - Part 5: Chemical Loads
- SAE J1128: Low Voltage Primary Cable
- SAE J1455: Recommended Environmental Practices for Electronic Equipment Design in Heavy-Duty Vehicle Applications
- SAE J2030: Heavy-Duty Electrical Connector Performance Standard
- SAE USCAR-2: Performance Specification for Automotive Electrical Connector Systems

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 VAC/VDC
- Current (Amp): See Figure 1

Contact Size	Wire Size AWG [mm²]	All Circuits Energized (A)
4	4 [25.0-21.0]	100
	6 [16.0-13.0]	
8	8 [10.0-8.0]	60
	10 [6.0-5.0]	40
12	10 [6.0-5.0]	25
	12 [4.0-2.5]	
	14 [2.0]	18
16	12 [2.5]	13
	14 [2.0]	
	16 [1.5-1.0]	
	18 [0.8-0.75]	10
	20 [0.5]	7.5
20	16 [1.5-1.0]	7.5
	18 [0.8-0.75]	
	20 [0.5]	
	22 [0.35]	5

Figure 1

- Temperature: -55°C to +125°C
- Ingress Protection (IP): IP67, IP68 and IP6K9K
- Flammability: None

3.3. Test Requirements and Procedures Summary

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

Test Description	Requirement	Procedure
Visual Examination	No physical defects detrimental to product performance.	SAE USCAR-2 Perform prior to testing, noting in detail any manufacturing or material defects such as cracks, tarnishing, deformities, etc.
ELECTRICAL		
Connection Resistance	Prior to Test: Size 12 ≤ 5 mΩ, size 16 ≤ 20 mΩ After Test: Size 12 and 16 shall be ≤ 2.5 times of prior to test resistance.	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.
Insulation Resistance 1	100 MΩ minimum	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 megohmmeter.
Insulation Resistance 2	20 MΩ minimum	SAE J2030 Check each contact to all other contacts and the shell, if shell is conductive. Test to be performed using a 1000 VDC megohmmeter.
Withstanding Voltage	Neither dielectric breakdown no flashover shall occur.	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.
Temperature Rise	Temperature rise of each terminal not to exceed 40°C.	ISO 8092-2 Attach the test samples to cables of 200 mm in length in the case of nominal cross-sectional areas up to and including 2.5mm², and 500 mm in length for cables with larger nominal cross sectional areas. Perform the test with the full complement of contacts fitted, each loaded with calculated test current for size 12 (2.7A) and size 16 (2.2A). Actual test current is calculated using rated test current for size 12 (13.5A) and size 15 (11A) multiplied by reduction coefficient size 12 and 16 of 0.20. (i.e. size 12: 13.5A x 0.20 = 2.7A). Measure the temperature of the terminals and ambient temperature after thermal equilibrium has been established.

Figure 2

ELECTRICAL		
Test Description	Requirement	Procedure
Derating	Derating curve shall be documented	IEC 60512-5-2, Test 5b 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 level. Record temperature at each current level
Fretting Corrosion	Prior to Test: Size 12 ≤ 5 mΩ, size 16 ≤ 20 mΩ After Test: Size 12 and 16 shall be ≤ 2.5 times of prior to test resistance.	A suitable number of connector pairs populated with terminals shall be exposed to 200 temperature cycles between -20°C and +120°C. Test all contacts in series. A voltage supply with a maximum open loop voltage of 20mV and a maximum short circuit current of 100mA is connected to the test loop. The transition resistance for every contact pair is monitored continuously during the test. Subject the test samples per below profile. • 30 min rise time to max temp (+85°C or 120°C) • 60min dwell time in max temp • 30min fall time to -20°C • 60min dwell time in -20°C
Current Cycling	Prior to Test: Size 12 ≤ 5 mΩ, size 16 ≤ 20 mΩ After Test: Size 12 and 16 shall be ≤ 2.5 times of prior to test resistance.	ISO 8092-2 Use the test setup same as temperature rise place the test samples in a thermal chamber at 120°C and apply 500 test cycles, each with 45 minutes current on and 15 minutes current off.

Figure 2 (cont)

MECHANICAL		
Test Description	Requirement	Procedure
Terminal Insertion Force	Size 12 ≤ 30N Size 16 ≤ 15N	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 25-100 mm/min.
Terminal Retention in Housing	Size 12 and 16 terminals shall withstand 60N minimum.	ISO 8092-2 Apply a constant force to the front or back of the terminal in an axial direction and hold for 10-12 seconds.
Resonance Search	X, Y, Z axis shall have no significant fixture resonance detected using accelerometer on the fixture.	Performed before any vibration tests to secure that the fixture used for the vibration test does not display any significant resonance frequencies. a) Frequency: 1-2000 Hz b) Swept sine peak acceleration: 3G c) Logarithmic sweep d) Sweep rate 1 octave/minute
Sinusoidal Vibration	No excessive rise of connection resistance and micro interrupts longer than 1µs and with a resistance higher than 7Ω is not acceptable.	ISO 8092-2 Low Frequency/amplitude 10 Hz to 100 Hz/0.75mm High Frequency/acceleration >100 Hz to 500 Hz / 300 m/s^2 >500 Hz to 2000 Hz / 100 m/s^2 Test duration is 16-hours per axis No current applied
Random Vibration	No excessive rise of connection resistance and micro interrupts longer than 1µs and with a resistance higher than 7Ω is not acceptable.	ISO 16750-3 Test duration is 94-hours per axis Frequency (Hz) / PSD $(m/s^2)s^2/Hz$ 10 / 14 20 / 28 30 / 28 180 / 0.75 300 / 0.75 600 / 20 2000 / 20 rms acceleration value 177 m/s^2
Mechanical Shock	No excessive rise of connection resistance and micro interrupts longer than 1µs and with a resistance higher than 7Ω is not acceptable.	ISO 16750-3 10 shocks are applied along the three mutually perpendicular axis for a total of 30 shock. The pulse shall be approximately half sine wave of 500 m/s^2 magnitude with a duration of 6 ms. Test at room temperature.

Figure 2 (cont)

ENVIRONMENTAL		
Test Description	Requirement	Procedure
Conditioning of Samples	No Requirement. Used in test only	ISO 8092-2 Place the test sample in a test chamber for 500 hours at +125°C without current flowing
Temperature/Humidity Cycling	No Requirement. Used in test only.	ISO 8092-2 Subject the mated connectors to 10 cycles of 24 hours using profile below. Applicable test temperature is 120°C. <table><tr><th>Step</th><th>Level of temperature/humidity and time</th></tr><tr><td>a</td><td>Hold the chamber temperature at 23C° and at 45% to 75% RH for 4h</td></tr><tr><td>b</td><td>Raise to 55 C° at 95% to 99% RH for 0,5h</td></tr><tr><td>c</td><td>Hold at 55 C° at 95% to 99% RH for 10h</td></tr><tr><td>d</td><td>Lower to -40C° within 2,5h</td></tr><tr><td>e</td><td>Hold at -40C° for 2h</td></tr><tr><td>f</td><td>Raise to applicable test temperature in Table 2.1 within 1,5h</td></tr><tr><td>g</td><td>Hold at the applicable test temperature in Table 2.1 for 2h</td></tr></table>
Thermal Shock 1	No cracking of materials or seal failures, caused by ageing and different expansion coefficients, is allowed.	ISO 16750-4 Subject the samples to 300 cycles. One cycle shall consist of 90 minutes at -55°C followed by 90 minutes at 125°C with a maximum transfer time 2 minutes.
Thermal Shock 2	No cracking of materials or seal failures, caused by ageing and different expansion coefficients, is allowed.	SAE J2030 Subjected 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.
Chemical Fluid	There shall be no evidence of cracking, distortion or detrimental damage to the connector following the test.	ISO 16750-5 See 501-151021 for list of chemicals, including urea found in engine compartment. Completely immerse one test sample per chemical. Samples were dipped, sprayed or brushed on the sample depending on the most convenient application system. Allow excess to drip off after application. Store the sample for 24 hours per ISO 16750-5 requirement. Tmax is 120°C.
Influence of Water and Salt	No moisture allowed inside mated connector.	SAE J2030 Place sample in an oven at +125°C for 1 hour, then immediately placed in water (23°F) with 5% salt in weight content and 0.1 g/L wetting agent to a depth of 1 meter for 4 hours.
Water Tightness	Current leakage shall not exceed 50 µA at 48V applied voltage.	ISO 8092-2 Assembled connector with full complement of contacts fitted. The cables attached shall be of the minimum and maximum overall diameter that the connector sealing system allows. The cable ends shall be sealed.

Figure 2 Cont.

ENVIRONMENTAL		
Test Description	Requirement	Procedure
Dust and Gravel Bombardment	Test connector must be capable of being disassembled and reassembled after the test. The sealing characteristics must not be compromised.	SAE J1455 Perform at room temperature. Dust shall be Arizona type per SAE J726. Place the sample about 15cm from one wall in a 91.4cm cubical box. The box should contain 4.54 kg of dust. At intervals of 15 min, the dust must be agitated by compressed air or fan blower. Blasts of air for a 2 second period in a downward direction assure that the dust is completely and uniformly diffused throughout the entire cube. Allowed dust to settle. The cycle is repeated for 5 hours. Gravel shall be 0.96 to 1.6cm in diameter. Bombard the test sample for a period of approximately 2 min. The sample is positioned about 35cm from the muzzle of the gravel source. A volume of 470cm^3 of gravel (250 to 300 stones) is delivered under a pressure of 483 kPa over an approximate 10 second period. The process is repeated 12 times for a total exposure of 2 minutes.
Flowing Gas Corrosion	No physical defects detrimental to product performance.	IEC 60512-11-7, Method 1 A. See below table for test parameters B. Test apparatus per IEC 60068-2-60. C. Hang test samples on support rods in gas chamber. D. Test duration 21 days

Parameters	Method 1
H_2S (10^{-9} vol/vol)	100 ± 20
SO_2 (10^{-9} vol/vol)	500 ± 100
Temperature C	25 ± 1
Relative humidity	75 ± 3
Volume changes per hour	3-10
Weight increase of copper coupons mg/dm^2/day	1,0 – 2,0

Figure 2 Cont.

ENVIRONMENTAL		
Test Description	Requirement	Procedure
Protection Against Dust (IP6X)	No dust visible inside mated connectors.	DIN 40050-9 Subject specimens to 20 cycles of 6 seconds movement of air/dust mixture, pause of 15 minutes.
Protection Against Water (IPX7)	Insulation Resistance: 20 MΩ minimum.	IEC 60529 Subject specimens to immersion in water: 1m for 30 minutes.
Protection Against Water (IPX8)	Insulation Resistance: 20 MΩ minimum.	IEC 60529 Subject specimens to immersion in water: 1m for 3 hours.
Protection Against High Pressure/Steam Jet Cleaning (IPX9K)	Insulation Resistance: 20 MΩ minimum.	DIN 40050-9 Subject specimens to water fan with rotational speed 5±1°/min, water flow 14- 16 l/min, water pressure 800-1000 kP, water temperature 80±5 °C for 30 seconds per position. Spray positions: 0°, 30°, 60°, 90°

Figure 2 end

NOTE

a) *All cavities wired with the minimum approved wire gauge per SAE J1128 suitable for the terminal size and with enough 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
	TEST SEQUENCE (b)												
Visual Examination	1,7	1,5	1,8	1,9	1,8	1,4	1,8	1,8	1,3	1,3	1,14	1,5	1
Connection Resistance		2,4	2,4,6	2,4,8	2,5,7			2,4			2,4,10		
Insulation Resistance 1				6			2,4,7	5,7					
Insulation Resistance 2												2	2,6,8
Withstanding Voltage				7									
Conditioning of Samples	4		3	3	3	2	3	3			3		
Terminal Insertion Force	2,5												
Terminal Retention in Housing	3,6												
Influence of Water and Salt							6						
Water Tightness								6					
Temperature Rise					4								
Temperature/Humidity Cycling				5							5		
Current Cycling			5										
Thermal Shock 1		3					5				11		
Thermal Shock 2												3	4
Resonance Search											6		
Sinusoidal Vibration											7		
Random Vibration											8		
Mechanical Shock											9		
De-Rating						3							
Dust and Gravel Bombardment			7								13		
Chemical Fluids									2				
Flowing Gas Corrosion					6						12		
Fretting Corrosion										2			
Protection Against Dust (IP6KX)												4	
Protection Against Water (IPX7)													3
Protection Against Water (IPX8)													5
Protection Against High Pressure/Steam Jet Cleaning (IPX9K)													7

NOTE

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

- *Groups 1,6,7,9. Specimens shall consist of 128 position connectors with DEUTSCH Solid Terminal System size 12 nickel pins and sockets with 14 AWG wire and size 16 nickel pins and sockets with 18 AWG wire.*
- *Groups 2,3,4,5,8,10,11. Specimens shall consist of 128 position connectors with DEUTSCH Stamped and Formed Terminal System size 12 nickel/tin pins and sockets with 14 AWG wire and size 16 nickel pins and sockets with 18 AWG wire.*
- *Groups 12,13. Specimens shall consist of 48,60,102,128 position connectors with DEUTSCH Solid Terminal System size 4 nickel pins and sockets with 6 AWG wire, size 8 nickel pins and sockets with 12 AWG, size 12 nickel pins and sockets with 14 AWG, size 16 nickel pins and sockets with 20 AWG and size 20 nickel pins and sockets with 20 AWG*

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

3.5 Revision History

Rev Ltr	Brief Description of Change	Date	Dwn	Apvd
A	Initial Release	30-Sep-2019	DM	DM
A1	Page 8. Remove incorrect Temp/Humidity Cycling test. Error	01-Oct-2019	DM	DM