



DEUTSCH* DRB Series Connector System

1. INTRODUCTION

1.1. Purpose

This report summarizes the results of testing performed on DEUTSCH DRB series connector system to determine conformance to the requirements of product specification 108-151021.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the DEUTSCH DRB series connector system. Testing was performed at the DEUTSCH Industrial Products Division Laboratory in 2011-2012. The test file numbers for this testing are listed in Figure 1. This documentation is on file at, and available from Product Engineering, Industrial Commercial Transportation (ICT) Laboratory.

Test Group	Test Report
1	IPD100418-01
2	IPD100418-02
3	IPD100418-04
4	IPD100418-05
5	IPD100418-07
6	IPD100418-08
7	IPD100418-09
8	IPD100418-10
9	IPD100418-11
10	IPD100418-12
11	IPD100418-13

Figure 1

1.3. Conclusion

The DEUTSCH DRB series connector system products listed in Paragraph 1.4 conform to the electrical, mechanical, and environmental performance requirements given in product specification 108-151021.

1.4. Test Specimens

Test specimens were representative of normal production lots. Specimens identified with the part numbers given in Figure 2 were used for testing.

DEUTSCH PART NUMBER	DESCRIPTION	TEST GROUP
DRB12-128PANE-L018	128-pin, Receptacle	1,6,7,9
DRB16-128SAE-L018	128-pin Plug	
WB-64P	64-pin Receptacle Wedge Lock	
WB-64S	64-pin Plug Wedge Lock	
DRBF-1A	Interface Flange	
0460-202-16141	Size 16 Solid Pin, Nickel	
0460-204-12141	Size 12 Solid Pin, Nickel	
0462-201-16141	Size 16 Solid Socket, Nickel	
0462-203-12141	Size 12 Solid Socket, Nickel	
DRB12-128PANE-L018	128-pin, Receptacle	
DRB16-128SAE-L018	128-pin Plug	
WB-64P	64-pin Receptacle Wedge Lock	
WB-64S	64-pin Plug Wedge Lock	
DRBF-1A	Interface Flange	
1060-16-0622	Size 16 S&F Pin, Nickel	
1060-12-0166	Size 12 S&F Pin, Nickel/Tin	
1062-16-0622	Size 16 S&F Socket, Nickel	
1062-12-0166	Size 12 S&F Socket, Nickel/Tin	

Figure 2

1.5. Environmental Conditions

Unless otherwise stated, the following environmental conditions prevailed during testing:

Temperature: 15° to 35°C

Relative humidity: 25 to 75%

1.6. Qualification Test Sequence

TEST OR EXAMINATION	TEST GROUP (a)										
	1	2	3	4	5	6	7	8	9	10	11
	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
Connection Resistance		2,4	2,4,6	2,4,8	2,5,7			2,4			2,4,10
Insulation Resistance				6			2,4,7	5,7			
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		3					5				11
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	

- (a) Specimens were prepared in accordance production drawings and were selected at random from current production.
- Groups 1,6,7,9 specimens consisted 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.
 - Group 2,3,4,5,8,10,11 specimens consisted of 128-position connectors with DEUTSCH stamped and formed size 12 nickel/tin pins and sockets with 14 AWG wire and size 16 nickel pins and sockets with 18 AWG wire.
- (b) Numbers indicate sequence that tests were performed.

Figure 3

2. TEST METHODS AND RESULTS

2.1. Visual Examination (Groups 1 - 11)

- A. Procedure: SAE USCAR-2
- B. Method: The visual examination should be performed prior to testing, noting in detail any manufacturing or material defects such as cracks, tarnishing, deformities, etc.
- C. Requirement: No physical defects detrimental to product performance.
- D. Result: **PASSED**

2.2. Connection Resistance (Groups 2-5, 8, 11)

- A. Procedure: ISO 8092-2
- B. Method: Applied voltage did not exceed 20 mV open circuit, and the test current was limited to 100 mA. The resistance of an equal length of wire (reference wire) was subtracted from the same reel as what was used for the connector wiring.
- C. Requirement:
 - a. Initial: Size 12 \leq 5 m Ω , size 16 \leq 20 m Ω
 - b. Post: Size 12 and 16 shall be \leq 2.5 times initial resistance.
- D. Result:
 - a. Initial: **PASSED**
 - b. Post: **PASSED**

2.3. Insulation Resistance (Groups 4, 7, 8)

- A. Procedure: ISO 8092-2
- B. Method: Each contact was checked to all other contacts and the shell, if the shell is conductive. Test was performed using a 500 VDC megohmmeter.
- C. Requirement: > 100 M Ω
- D. Result: **PASSED**

2.4. Withstanding Voltage (Group 4)

- A. Procedure: ISO 8092-2
- B. Method: Applied AC voltage was 1000 V (rms) or DC voltage of 1600 V for 1 minute across all terminals connected together and a metal film surrounding the housing. In addition, the voltage was applied with a different test sample to every two adjacent contacts.
- C. Requirement: Neither dielectric breakdown no flashover shall occur.
- D. Result: **PASSED**

2.5. Conditioning of Samples (Groups 1, 3-8, 11)

- A. Procedure: ISO 8092-2
- B. Method: The test sample was placed in a test chamber for 500 hours at +125°C without current flowing.
- C. Requirement: No requirement. Used in test only.
- D. Result: **PASSED**

2.6. Terminal Insertion Force (Group 1)

- A. Procedure: ISO 8092-2
- B. Method: Insert crimped terminal into the cavity using constant speed 25-100 mm/minute.
- C. Requirement: Size 12 \leq 30N, size 16 \leq 15N
- D. Result: **PASSED**

2.7. Terminal Retention in Housing (Group 1)

- A. Procedure: ISO 8092-2
- B. Method: Apply a constant force to the front or back of the terminal in an axial direction and hold for 10 +2/-0 seconds.
- C. Requirement: Size 12 and 16 terminals shall withstand 60N minimum.
- D. Result: **PASSED**

2.8. Influence of Water and Salt (Group 7)

- A. Procedure: SAE J2030
- B. Method: Samples were placed 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.
- C. Requirement: No moisture allowed inside mated connector.
- D. Result: **PASSED**

2.9. Water Tightness (Group 8)

- A. Procedure: ISO 8092-2
- B. Method: Assembled connector with full compliment 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.
- C. Requirement: Current leakage shall not exceed 50 µA at 48V applied voltage.
- D. Result: **PASSED**

2.10. Temperature Rise (Group 5)

- A. Procedure: ISO 8092-2
- B. Method: Attach the test samples to cables of (200 ±5) mm in length in the case of nominal cross-sectional areas up to and including 2.5mm², and (500± 5) 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. See Figure 4 for typical point of measurement.

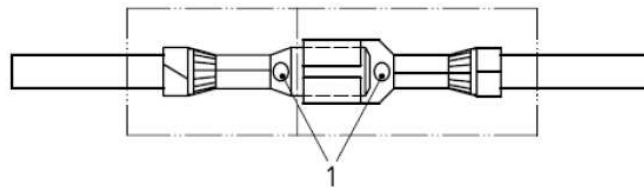


Figure 4

- E. Requirement: Temperature rise of each terminal not to exceed 40°C.
- F. Result: **PASSED**

2.11. Temperature/Humidity Cycling (Groups 4, 11)

- A. Procedure: ISO 8092-2
- B. Method: Subject the mated connectors to 10 cycles of 24 hours using Figure 5 profile. Applicable test temperature is 120°C.

Step	Level of temperature/humidity and time
a	Hold the chamber temperature at 23C° and at 45% to 75% RH for 4h
b	Raise to 55 C° at 95% to 99% RH for 0,5h
c	Hold at 55 C° at 95% to 99% RH for 10h
d	Lower to -40C° within 2,5h
e	Hold at -40C° for 2h
f	Raise to applicable test temperature in Table 2.1 within 1,5h
g	Hold at the applicable test temperature in Table 2.1 for 2h

Figure 5

- C. Requirement: No Requirement. Used in test only.
- D. Result: **PASSED**

2.12. Current Cycling (Group 3)

- A. Procedure: ISO 8092-2
- B. Method: 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.
- C. Requirement: Connection resistance
 - a. Initial: Size 12 ≤ 5 mΩ, size 16 ≤ 20 mΩ
 - b. Post: Size 12 and 16 shall be ≤ 2.5 time initial resistance
- D. Result: **PASSED**

2.13. Thermal Shock (Groups 2, 7, 11)

- A. Procedure: ISO 16750-4
- B. Method: 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.
- C. Requirement: No cracking of materials or seal failures, caused by ageing and different expansion coefficients, is allowed.
- D. Results: **PASSED**

2.14. Resonance Search (Group 11)

- A. Procedure: Not Applicable
- B. Method: 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
- C. Requirement: X, Y, Z axis shall have no significant fixture resonance detected using accelerometer on the fixture.
- D. Result: **PASSED**

2.15. Sinusoidal Vibration (Group 11)

- A. Procedure: ISO 8092-2
- B. Method: See Figure 6 for vibration parameters. 16 hours per X, Y, Z axis.

Low frequency/amplitude	High frequency/acceleration	
10Hz to 100Hz / 0,75mm	>100- 500 Hz / 300m/s ²	>500- 2000Hz / 100m/s ²

Figure 6

- C. Requirement: No excessive rise of connection resistance and micro interrupts longer than 1µs and with a resistance higher than 7Ω is not acceptable.

D. Results: **PASSED**

2.16. Random Vibration (Group 11)

- A. Procedure: ISO 16750-3
- B. Method: See Figure 7 & 8 for vibration parameters. 94 hours per X, Y, Z axis.

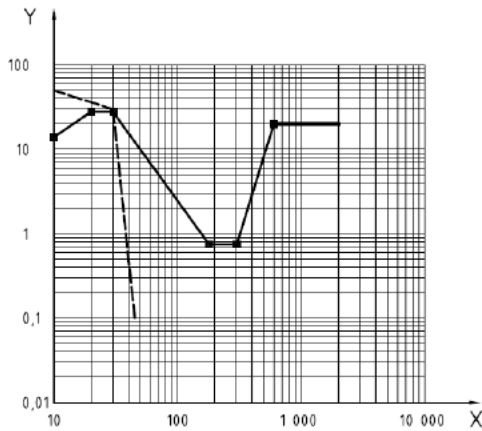


Figure 7

Frequency Hz	PSD (m/s ²) ² /Hz
10	14
20	28
30	28
180	0,75
300	0,75
600	20
2000	20
r.m.s. acceleration value 177 m/s ²	

Figure 8

- C. Requirement: No excessive rise of connection resistance and micro interrupts longer than 1µs and with a resistance higher than 7Ω is not acceptable.

D. Results: **PASSED**

2.17. Mechanical Shock (Group 11)

- A. Procedure: ISO 16750-3
- B. Method: See Figure 9 for test parameters. All mechanical shock tests shall be done in three directions, X,Y,Z axis.

Operating mode of DUT (see ISO 16750-1:2003)	3.2
Pulse shape	half-sinusoidal
Acceleration	500 m/s ²
Duration	6 ms
Temperature	Room temperature
Number of shocks	10 per test direction

Figure 9

- C. Requirement: No excessive rise of connection resistance and micro interrupts longer than 1µs and with a resistance higher than 7Ω is not acceptable.

D. Result: **PASSED**

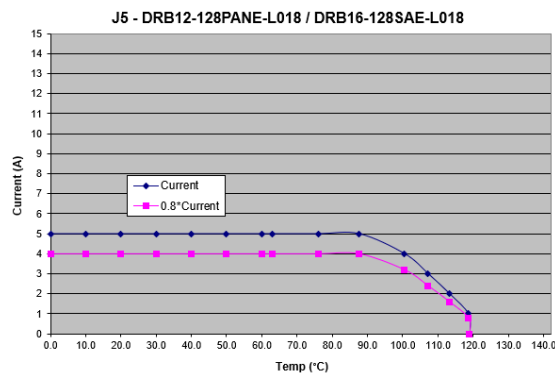
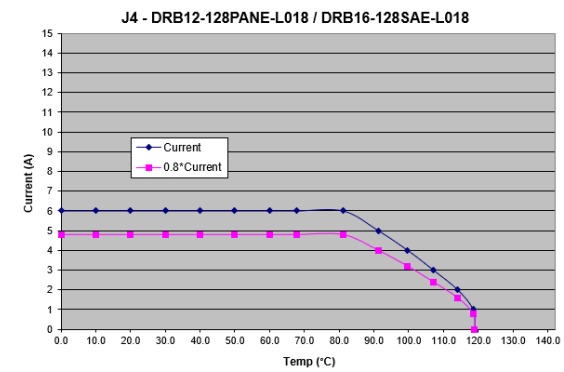
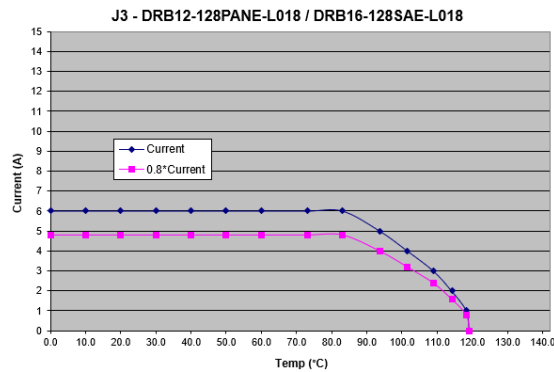
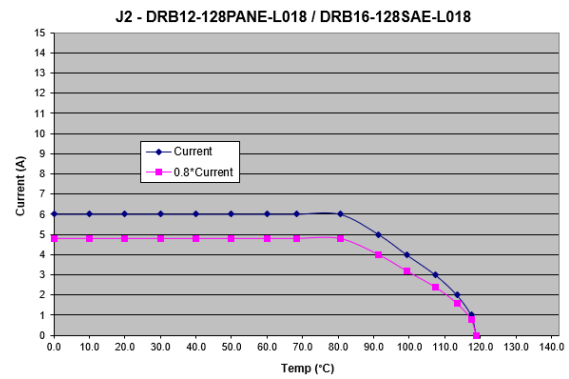
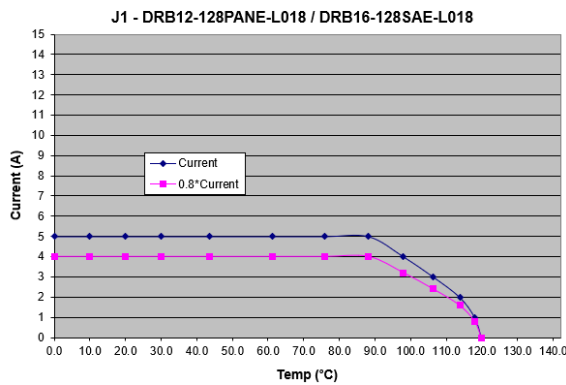
2.18. Derating (Group 6)

A. Procedure: IEC 60512-5-2

B. Method: Test measurement shall be carried out in undisturbed air 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 samples to measure temperature rise at the contacts as current increases. Increase the current in 1A steps. The current shall be maintained for approximately 1 hour after thermal stability is achieved at each of the selected current levels. Record the temperature at each current level. Also record the ambient temperature inside the enclosure at each current level.

C. Requirement: Derating curve shall be documented. Using the derating curve, extract the current that gives a 40°C increase in temperature.

D. Results: **COMPLETED**



- 2.19. Dust and Gravel Bombardment (Group 3)
- A. Procedure: SAE J1455
 - B. Method: Dust and gravel bombardment tests done at room temperature. The sample need not be operating, although functional tests should be performed prior to and after testing.
 - a. Dust shall be Arizona type per SAE J726. Place the sample about 15 cm (6 in) from one wall in a 91.4 cm (3 ft) cubical box. The box should contain 4.54 kg (10 lb) of fine powdered cement in accordance with ASTM C 150–56. 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. The dust is then allowed to settle. The cycle is repeated for 5 hours.
 - b. Gravel shall be 0.96 to 1.6 cm (3/8 to 5/8 in) in diameter. Bombard the test sample for a period of approximately 2 min. The sample is positioned about 35 cm (13-3/4 in) from the muzzle of the gravel source. A volume of 470 cm³ (approximately 1 pt) of gravel (250 to 300 stones) is delivered under a pressure of 483 kPa gage (70 lbf/in² gage) over an approximate 10 second period. The process is repeated 12 times for a total exposure of 2 min. Judgment must be used in determining which sides should be exposed to the bombardment.
 - C. Requirement: Test connector must be capable of being disassembled and reassembled after the test. The sealing characteristics must not be compromised.
 - D. Result: **PASSED**
- 2.20. Chemical Fluids (Group 9)
- A. Procedure: ISO 16750-5
 - B. Method: Use chemicals, including urea found in engine compartment.
 - a. See Figure 10 for list of chemicals, Engine Compartment. Excluding FAM test fuel
 - b. See Figure 11 for chemical description and storage temperatures. T_{max} is 120°C.
 - c. Completely immerse one test sample per chemical. Allow excess to drip off after application.
 - d. After immersion application, store the test sample 24 hours at temperature per Figure 11.
 - C. Requirement: No changes that could impair normal performance. Marking and labelling shall remain visible and legible.
 - D. Result: **PASSED**

Identification	Chemical agent	Mounting location							
		Engine compartment		Passenger area/compartment		Cargo/luggage area/compartment		Mounting on exterior	
	Example for code ^a	A	Z _A ^b	B	Z _B ^b	C	Z _C ^b	D	Z _D ^b
A	Diesel fuel	X		—		—		—	
B	"bio" Diesel fuel	X		—		—		—	
C	Premium (unleaded) petrol	X		—		—		—	
D	M15	X		—		—		—	
E	FAM test fuel	X		—		—		—	
F	Battery fluid	X		X		X		—	
G	Brake fluid	X		—		—		—	
H	Coolant additive (undiluted antifreeze fluid)	X		—		—		—	
I	Protective lacquer	X		—		—		X	
J	Protective lacquer remover	X		—		—		X	
K	Engine oil (multi-grade oil)	X		—		—		—	
L	Cold-cleaning agent	X		—		X		X	
M	Methanol	X		—		—		—	
N	Differential oil	X		—		—		X	
O	Transmission fluid	X		—		—		—	
P	Interior cleaner	—		X		X		—	
Q	Refreshment containing caffeine and sugar	—		X		X		X	
R	Hydraulic fluid	X		—		X		—	
S	Car wash chemicals	X		—		—		X	
T	Windshield washer fluid	X		—		X		X	
U	Glass cleaner	—		X		X		X	
V	Wheel cleaner	—		—		—		X	
W	Engine cleaner	X		—		—		—	
X	Kerosene	—		—		X		—	
Y	Denatured alcohol	X		X		X		X	
Z	Cavity protection	—		—		—		X	
0	Additional agents								

Chemical loading can vary significantly depending on type and use of the vehicle. Users of this part of ISO 16750 should chose from this list according to the application.

Additional agents may be agreed upon between manufacturer and user.

^a Depending on the combination.

^b As agreed upon.

Figure 10

Identification	Chemical agent	Description	Temperature for ageing of DUT ^{a, b}
A	Diesel fuel	According to ISO 3170 (EN 590)	T_{max}
B	"bio" Diesel fuel	According to DIN 51606	T_{max}
C	Petrol/gasoline (unleaded)	According to ISO 3170 (EN 228)	RT
D	Gasoline with 15 % methanol	According to DIN 53245	RT
E	Test fuel FAM	According to DIN 51604 B	RT
F	Battery fluid	37 % sulphuric acid or KOH	80°C
G	Brake fluid	DOT 4 (see SAE J 1709)	T_{max}
H	Coolant additive (undiluted antifreeze fluid)	^c	T_{max}
I	Protective lacquer	^c	T_{max}
J	Protective lacquer remover	^c	RT
K	Engine oil (multi-grade oil)	See SAE 10 W 50	T_{max}
L	Cold-cleaning agent	^c	TA
M	Methanol	According to DIN 53245	RT
N	Differential oil	^c	T_{max}
O	Transmission fluid	^c	T_{max}
P	Interior cleaner	^c	T_{max}
Q	Refreshment containing caffeine and sugar	^c	T_{max}
R	Hydraulic fluid	^c	T_{max}
S	Car wash chemicals	^c	RT
T	Windscreen washer fluid	^c	T_{max}
U	Glass cleaner	^c	T_{max}
V	Wheel cleaner	^c	T_{max}
W	Engine cleaner	^c	T_{max}
X	Kerosene	^c	RT
Y	Denatured alcohol	^c	RT
Z	Cavity protection	^c	T_{max}
0	Additional agents	^c	

^a T_{max} shall be chosen from ISO 16750-4:2003, Table 1.

^b RT, see ISO 16750-1:2003, 7.2

^c Composition to be agreed upon between manufacturer and customer.

Additional directions:

- For substances A, B and F use 60°C
- For substances G, K, N, O, Q and R use 80°C
- For substance H use 110°C
- For all other substances including UREA, use RT according to note (b) in the table
- The interpretation of note (c) in the table shall be that it is allowed for the testing laboratory to use an appropriate commercially available product, stating in the report what product was used.

Figure 11

2.21. Flowing Gas Corrosion (Group 5)

- A. Procedure: IEC 60512-11-7, Method 1
- B. Test Method:
 - a. See Figure 12 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 ₂ S (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 12

- C. Requirement: No physical defects detrimental to product performance.
- D. Result: **PASSED**

2.22. Fretting Corrosion (Group 10)

- A. Procedure: Not Applicable
- B. Method: 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
 - a. 30min rise time to max temp (+85°C or +120°C)
 - b. 60min dwell time in max temp
 - c. 30min fall time to -20°C
 - d. 60min dwell time in -20°C
- C. Requirement: Connection resistance
 - a. Initial: Size 12 ≤ 5 mΩ, size 16 ≤ 20 mΩ
 - b. Post: Size 12 and 16 shall be ≤ 2.5 time initial resistance
- D. Result: **PASSED**

3. REVISION HISTORY

Rev Ltr	Brief Description of Change	Date	Dwn	Apvd
A	Initial Release	23-Sep-2019	DM	DM