**Dynamic Ultra Connector**

## 1. Purpose:

This is qualification test. The purpose of this test is to evaluate the performance of Dynamic Ultra connector. Testing was performed on below products to determine it compliance with below requirements:

| | | |
|---|---|---|
| A. | DIN/IEC 60512 | Electromechanical components for electronic equipment, basic testing procedures and measuring methods |
| B. | DIN EN 60068 | Environmental tests |
| C. | DIN IEC 68 | Electrical Engineering, basic environmental testing procedures |
| D. | LV214 | Car Plug connectors – Test procedure |
| E. | USCAR | Performance Specification for Automotive Electrical Connector System |
| F. | EIA-364 | Electrical Connector / Socket Test Procedures Including Environmental Classifications |

## 2. Scope:

This test report is for Dynamic Ultra connector. Testing was performed at TE Connectivity Shanghai Electrical Components Test Laboratory.

## 3. Conclusion:

The product met the electrical, mechanical, and environmental performance requirements of TE product specification. Test result can cover part numbers that position numbers are equal to 2/6/10 POS.

## 4. Test samples:

Samples were taken randomly from current production. The following part numbers were used for test.

| Description | Product Part No. |
|---|---|
| Dynamic Ultra Connector | 1-2834659-0 (10 POS, Header, Tin plated,1.80mm Pitch, X KEY), BLK<br>2834659-6 (6 POS, Header, Tin plated,1.80mm Pitch, X KEY), BLK<br>2834659-2 (2 POS, Header, Tin plated,1.80mm Pitch, X KEY), BLK<br>1-2834663-0(10 POS, Receptacle Assy, 1.80mm Pitch, X KEY), BLK<br>2834663-6(6 POS, Receptacle Assy, 1.80mm Pitch, X KEY), BLK<br>2834663-2(2 POS, Receptacle Assy, 1.80mm Pitch, X KEY), BLK<br>2834666-1 (Receptacle Terminal, Pre Tin plated, 26 AWG)<br>2834666-2 (Receptacle Terminal, Pre Tin plated, 22 & 24 AWG) |

## 5. Test Method:

### *5.1 LV214 Test Items*

| Test Description | Properties | Bemerkung |
|---|---|---|
| **PG0 Inspection of as-received condition** | | |
| **E 0.1 Visual inspection** | Drawing conformity | DIN EN 60512-1-1 |
| **E 0.2.1 Contact resistance in contact area** | $R_{INTTIAL}$ ≤ 10 mΩ | DIN EN 60512-2-1 |
| **E 0.2.2 Contact resistance in connection area** | | DIN EN 60512-2-1 |
| **E 0.3 Insulation resistance** | $R_{ISO}$ > 100MΩ<br>at U = 500V, t = 60s | DIN EN 60512-3-1 |
| **PG7 Functional Reliability of the Housings** | *Error-Proof Design of Housings:*<br>*Keying-Efficiency $F_{COD}$ ≥ 50N:*<br>*Polarization-Efficiency $F_{POL}$ ≥ 80N*<br><br>*Positive-Locking Retention Force*<br>*$F_{RIEG}$ ≥ 40N (1-2 Pos)*<br>*≥ 50N (3-5 Pos)*<br>*≥ 60N (6Pos or more)*<br><br>*Mating/Unmating Force of housing:*<br>*$F_{STECK}$ ≤ 75N*<br>*$F_{ZIEH}$ ≤ 75N* | *DIN EN 60512-13-5*<br><br>*DIN EN 60512-15-6, equipped housing* |
| **PG8 Insertion and Retention Forces** | *Contact Insertion Force $F_{EIN}$ ≤ 5N*<br><br>*Contact Retention Force*<br>*Primary Locking $F_{PRIM}$ ≥ 15N*<br>*Primary Locking + Secondary Locking $F_{SEK}$ ≥ 50N* | *DIN IEC 60512-8, Test 15b*<br>*Testing Speed: 25mm/min* |
| **PG10 Contacts: conductor pull-out strength** | | |
| **E 0.1 Visual inspection** | | DIN EN 60512-1-1 |
| **E 10.1 Conductor pull-out strength** | Conductor pull-out strength:<br><br>0.13mm²: $F_{pull}$ > 20N<br>0.22mm²: $F_{pull}$ > 30N<br>0.35mm²: $F_{pull}$ > 50N | 0.13mm² / 0.22mm² / 0.35mm² wires according to ISO 6722-1 |
| **PG 11 Insertion and removal forces, mating cycle frequency** | | |
| **E 0.1 Visual inspection** | | DIN EN 60512-1-1 |
| **E 11.1 Plugging and removal force** | Mating force 1. cycle:<br>Sn: $F_{mate}$ ≤ 5N<br><br>Unmating force 1. cycle:<br>Sn: $F_{unmate}$ ≤ 5N | |
| **B 11.1 Mating cycle frequency** | Mating cycle frequency<br><br>Sn: min. 20 cycles | |

| | | |
|---|---|---|
| **PG15 Electri-cal stress test** | | |
| **E 0.1 Visual inspection** | Drawing conformity | DIN EN 60512-1-1 |
| **B 15.1 The DUTs are inserted and disconnected 2 times** | | Specimen are inserted and disconnected 2 times before |
| **E 0.2 Contact resistance** | See PG0 | DIN EN 60512-2-1 |
| **B 15.2 Temperature current cycle endurance test** | Test current:<br><br>0.13mm²: $I_{test}$ = 1A<br>0.22mm²: $I_{test}$ = 2A<br>0.35mm²: $I_{test}$ = 3A | |
| **B 15.3 Humid heat, cyclic** | | DIN EN 60068-2-30 |
| **B 15.2 Temperature current cycle endurance test** | 0.13mm²: $I_{test}$ = 1A<br>0.22mm²: $I_{test}$ = 2A<br>0.35mm²: $I_{test}$ = 3A | |
| **E 0.2 Contact resistance** | $R_{max}$ ≤ 30mΩ | DIN EN 60512-2-1 |
| **PG17 Dynamic load** | Severity 2 | |
| **E 0.1 Visual inspection** | | DIN EN 60512-1-1 |
| **E 0.2 Contact resistance** | See PG0 | DIN EN 60512-2-1 |
| **B 17.2 Dynamic load, broad-band , random vibration** | Severity2 | DIN EN 60068-2-64 |
| **B 17.3 Endurance shock test** | Severity2 | DIN EN 60068-2-27 |
| **E 0.2 Contact resistance** | $R_{max}$ ≤ 30mΩ | DIN EN 60512-2-1 |
| **PG18A Coastal climate load** | | |
| **E 0.1 Visual inspection** | | DIN EN 60512-1-1 |
| **B 18.1 The DUTs are inserted 2 times** | | Specimen are inserted and disconnected 2 times before |
| **E 0.2 Contact resistance** | See PG0 | DIN EN 60512-2-1 |
| **B 18.2 Salt spray, cyclic** | Severity 3 | DIN EN 60068-2-52 |
| **E 0.2 Contact resistance** | $R_{max}$ ≤ 30mΩ | DIN EN 60512-2-1 |
| **PG19 Environmental simulation** | | |
| **E 0.1 Visual inspection** | | DIN EN 60512-1-1 |
| **E 0.2 Contact resistance**<br>**B 19.0 Inserting and removing** | See PG0 | DIN EN 60512-2-1 |
| **B 19.1 Temperature shock** | | DIN EN 60068-2-14 |
| **B 19.2 Temperature cycle** | | DIN EN 60068-2-14 |
| **B 19.3 Aging in dry heat** | | DIN EN 60068-2-2 |
| **B 19.4 Industrial climate** | | DIN EN 60512-11-14 |
| **B 19.5 Humid heat, cyclic** | | DIN EN 60068-2-30 |
| **B 19.6 Dynamic load, broad-band random vibration** | | DIN EN 60068-2-64 |
| **B 19.7 Mechanical shocks** | | DIN EN 60068-2-27 |

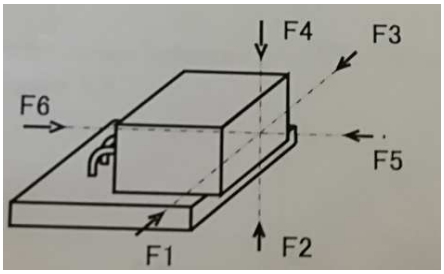
| | | |
|---|---|---|
| **E 0.2 Contact resistance** | $R_{max}$ ≤ 30mΩ | DIN EN 60512-2-1 |
| ***PG20 Climate Load of the housing***<br>**E 0.1 Visual inspection**<br>**E 0.3 Insulation resistance**<br>**B 20.1 Aging in dry heat 130ºC, 120h**<br>**B20.2 Humid head 40ºC, 95%, 10d**<br>**E 0.3 Insulation resistance**<br>**B 20.3 Low-temperature aging -40 ºC, 48h**<br>**B 20.4 Aging in dry heat 80ºC, 48h**<br>**B 20.5 Aging in dry heat**<br>**B 6. Drop test in the unplugged state** | | DIN EN 60512-1-1<br>DIN EN 60512-3-1<br>DIN EN 60068-2-2<br><br>DIN EN 60068-2-30 |
| **PG21 Long-term temperature aging**<br><br>**E 0.1 Visual inspection**<br><br>**E 0.2 Contact resistance**<br><br>**B 21.1 Long term aging dry heat**<br><br>**E 0.2 Contact resistance**<br>**E21.1 Fuctional test with both grous**<br>**B6.1 Drop test (group 1)**<br>**E8.2 Contact pull-out force of all cotacts of group2** | <br><br><br>See PG0<br><br><br>$R_{max}$ ≤ 30mΩ | <br><br>DIN EN 60512-1-1<br><br>DIN EN 60512-2-1<br><br>DIN EN 60068-2-2<br><br>DIN EN 60512-2-1<br><br><br>DIN EN 60068-2-31 |

| **TEST ITEM** | **TEST GROUP** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **PG0 Receiving inspection** | **PG7 Functional Reliability of the Housings** | **PG8 Insertion and retention forces of terminals in housing** | **PG10 Conductor pull-out strength** | **PG11 Insertion and removal forces, mating cycle frequency** | **PG15 Electrical stress test** | | |
| **Visual Inspection** | 1,4 | 1, 4 | 1,4 | 1,3 | 1,3 | 1,10 | | |
| **Contact resistance** | 2 | | | | | 3,8 | | |
| **Insulation resistance** | 3 | | | | | | | |
| **Contact insertion force** | | | 2 | | | | | |
| **Contact retention force** | | | 3 | | | | | |
| **Conductor pull-out strength** | | | | 2 | | | | |
| **Insertion and removal forces, mating cycle frequency** | | | | | 2 | | | |
| **Derating** | | | | | | 4,9 | | |
| **Aging in dry heat** | | | | | | | | |
| **Contact resistance continuous (testing current)** | | | | | | 5,7 | | |
| **Temperature cycle endurance test, current cycle endurance test** | | | | | | 5, 7 | | |
| **Humid heat, cyclic** | | | | | | 6 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Keying/ Polarization Force** | | 2 | | | | | | |
| **Positive-Locking Retention Force / Mating/Unmating Force** | | 3 | | | | | | |
| **Mating an Unamting** | | | | | | 2 | | |

| **TEST ITEM** | **TEST GROUP** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **PG17 Dynamic load** | **PG18A Coastal climate load** | **PG19 Environmental simulation** | **PG20 Long-term temperature storage** | **PG21 Long-term temperature storage** | | |
| **Visual Inspection** | 1,4,6 | 1,6 | 1,14 | 1,10 | 1,8 | | |
| **Contact resistance** | 2,7 | 3,5 | 2,4,13 | | 2; 4 | | |
| **Insulation resistance** | | | | 2,5 | | | |
| **Derating** | | | | | | | |
| **Contact resistance continuous (testing current)** | 3,5 | | 5,6,7,9, 10,11 | | | | |
| **Humid heat, cyclic** | | | 9 | 4 | | | |
| **Dynamic load, broad band random vibration** | 3 | | 10 | | | | |
| **Endurance shock test** | 5 | | 11 | | | | |
| **Salt spray, cyclic (SL3)** | | 4 | | | | | |
| **Temperature shock** | | | 5 | | | | |
| **Temperature cycling** | | | 6 | | | | |
| **Resonance frequency of the contact assembly** | 8 | | | | | | |
| **Aging in dry heat** | | | 7 | 3,8 | 3 | | |
| **Industrial climate (multiple-component climate) /** | | | 8 | | | | |
| **Mating and Unmating** | | 2 | 3,12 | | 5 | | |
| **Drop test** | | | | 9 | 6 | | |
| **Conductor pull-out strength** | | | | | 7 | | |
| **Low-temperature aging** | | | | 6 | | | |
| **Removal and insertion at -20 ℃** | | | | 7 | | | |

## 5.2 SAE/USCAR-2 Test Items:

| | | |
|---|---|---|
| 3.5.1 Connector Mounting Feature Mechanical Strength | F1 TO F5 DIRECTION:<br>50N MIN<br>F6 DIRECTION:<br>110N MIN | USCAR-2: 5.4.11<br>  |
| 3.5.2 Header Pin retention force | 15N Min<br>within 0.2mm displacement | USCARD-2:5.7.1 |
| 3.5.3 Connector cycling | Mate and un-mate each connector 0times | SAE/USCAR-2 5.1.7 |
| 3.5.4 Circuit continuity monitoring | No exceeds 7.0Ω for more than 1 microsecond | SAE/USCAR-2 5.1.9 |
| 3.5.5 Vibration/Mechanical Shock | Depend on subsequence | SAE/USCAR-2 5.4.6<br>Severity: V2<br>As appendix fig. 2 shown |
| 3.5.6 Voltage Drop | 50mv Max | SAE/USCAR-2 5.3.2 |

| TEST ITEM | | TEST GROUP | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Mounting Feature Mechanical Strength | Header Pin retention | Vibration/Mechanical Shock | | | | | |
| E 0.1 | Visual inspection | 1,3 | 1,3 | 1,7 | | | | | |
| E 0.2 | Contact resistance | | | 3,6 | | | | | |
| 3.5.1 | Connector Mounting Feature Mechanical Strength | 2 | | | | | | | |
| 3.5.2 | Header Pin retention force | | 2 | | | | | | |
| 3.5.3 | Connector cycling | | | 2 | | | | | |
| 3.5.4 | Circuit continuity monitoring | | | 4 | | | | | |
| 3.5.5 | Vibration/Mechanical Shock | | | 5 | | | | | |
| 3.5.6 | Voltage Drop | | | 6 | | | | | |

## 5.3 Appendix

### 5.3.1 Reflow condition.

preheat temperature：150-200℃; preheat time：60 to 120 seconds; Peak temperature: 260℃

Peak temperature time：5+/-5. seconds; Time 25℃ to peak：8 minutes maximum; Per J-STD-020, Table 5-2, Pb-Free.

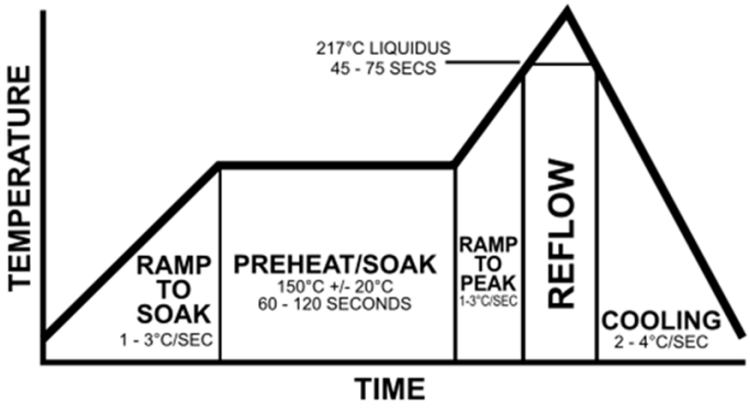



Fig 1. Reflow Profile

### 5.3.2 USCAR Vibration and shock condition.

**Class Schedule for Shock**

| Vibration Class | Shocks per Axis | | Wave Shape | Direction (+/-) | Duration (ms) | Acceleration (g) |
|---|---|---|---|---|---|---|
| V1 | 10 | | Half Sine Wave | Positive | 5 ~ 10 | 35 |
| V2 | 10 | | Half Sine Wave | Positive | 5 ~ 10 | 35 |
| V3<br>V4<br>V5<br>(Perform Both Tests | 1 | 132 x 6 =792 | Half Sine Wave | Positive/Negative | 15 | 25 |
| | 2 | 3 x 6 =18 | Half Sine Wave | Positive/Negative | 11 | 100 |

**Table 1. Class schedule for Shock for USCAR-2**

**Vibration Duration by Vibration Class**

| Vibration Class | Sine Duration (Hrs./axis) | Random Duration (Hrs./axis) | Thermal Cycling |
|---|---|---|---|
| V1 | n/a | 8 | n/a |
| V2 | n/a | 8 | n/a |
| V3 | 22 | 22 | Per 5.4.6.3 #6 |
| V4 | 32 | 50 | Per 5.4.6.3 #6 |
| V5 | n/a | 22 | n/a |

**Table 2. Class schedule for Vibration for USCAR-2**

**V2 - Random**

| F (Hz) | PSD[1] | PSD $g^2$/Hz |
|---|---|---|
| 60.0 | 0.096 | 0.00100 |
| 200.0 | 144 | 1.50000 |
| 210.0 | 9.60 | 0.10000 |
| 1200.0 | 9.60 | 0.10000 |
| $g_{rms}$ | **119** | **12.1 g** |

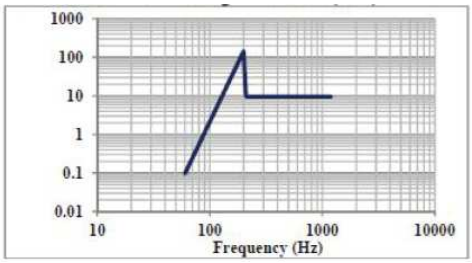



Fig 2. Vibration test profile for USCAR-2

## 6. Test Result

### 6.1 LV214 Test Item Result

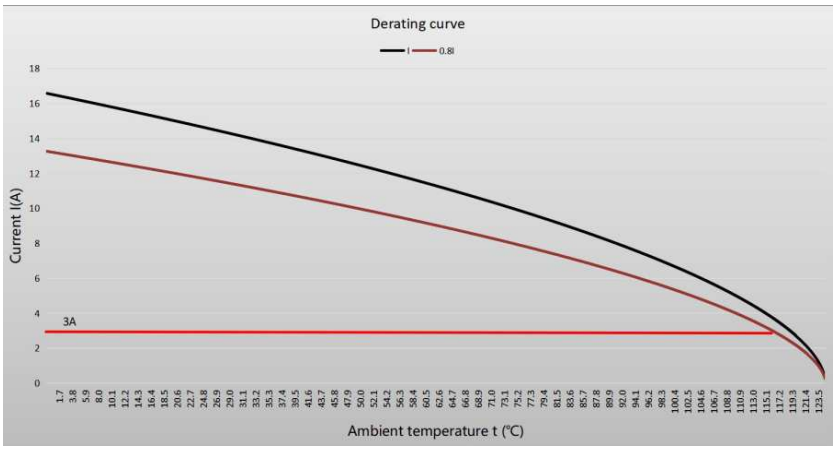
| Test Group | Test Items | | | Unit | Result | | | Spec. | Judgment |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Max | Min | Ave | | |
| PG0 | Inspection of as-received condition | Contact resistance | | mΩ | 4.73 | 4.16 | 4.49 | 10 mΩ Max | Acceptable |
| | | Insulation resistance | | Ω | 5.42E11 | 0.92E11 | 3.87E11 | 100MΩMin | Acceptable |
| PG7 | Handling and functional reliability of the housing | Polarizing | | N | PASS | | | 80N Min | Acceptable |
| | | Key-ing | | N | PASS | | | 50N Min | Acceptable |
| | | Retention force of the housing latch/lock-2P | | N | 71.4 | 62.3 | 65.0 | 40N Min | Acceptable |
| | | Retention force of the housing latch/lock-6P | | N | 69.4 | 66.3 | 67.3 | 60N Min | Acceptable |
| | | Retention force of the housing latch/lock-10P | | N | 71.3 | 68.1 | 69.6 | 60N Min | Acceptable |
| PG8 | Insertion and retention forces of the contact parts in the housing | Insertion force | | N | 3.58 | 2.11 | 2.72 | 5N Max | Acceptable |
| | | Retention force first lock | | | 28.0 | 22.8 | 28.3 | 15N Min | Acceptable |
| | | Retention force first and second lock | | | 87.2 | 73.2 | 79.1 | 50N Min | Acceptable |
| PG10 | Conductor Pull-out Strength | AWG #22 | | N | 60.2 | 53.3 | 56.7 | 50N Min | Acceptable |
| | | AWG #24 | | | 56.9 | 48.1 | 53.3 | 30N Min | Acceptable |
| | | AWG #26 | | | 33.3 | 40.8 | 36.5 | 20N Min | Acceptable |
| PG11 | Insertion and removal forces, mating cycle frequency | Mating force (Initial) | | N | 2.51 | 2.11 | 2.31 | 5N MAX | Acceptable |
| | | Mating force (Final) | | | 2.66 | 1.37 | 2.15 | 5N MAX | Acceptable |
| | | Unmating force (Initial) | | | 2.30 | 1.58 | 1.93 | 5N MAX | Acceptable |
| | | Unmating force (Final) | | | 2.99 | 1.71 | 2.29 | 5N MAX | Acceptable |
| PG15 | Electrical stress test | Contact resistance | Initial | mΩ | 5.18 | 3.12 | 4.53 | 10 mΩ Max | Acceptable |
| | | | Final | | 6.19 | 4.29 | 5.68 | 30 mΩ Max | Acceptable |
| PG17 | Dynamic load | Contact resistance | Initial | mΩ | 4.31 | 2.45 | 3.63 | 10 mΩ Max | Acceptable |
| | | | Final | | 6.37 | 3.30 | 4.36 | 30 mΩ Max | Acceptable |
| PG18A | Coastal climate load | Contact resistance | Initial | mΩ | 3.10 | 2.47 | 2.92 | 10 mΩ Max | Acceptable |
| | | | Final | | 4.36 | 2.72 | 4.11 | 30 mΩ Max | Acceptable |
| PG19 | Environmental | Contact resistance | G1 Initial | mΩ | 3.82 | 3.12 | 3.43 | 10 mΩ Max | Acceptable |
| | | | G1 Final | | 11.75 | 4.86 | 7.69 | 30 mΩ Max | Acceptable |
| | | | G2 Initial | | 3.86 | 3.53 | 3.76 | 10 mΩ Max | Acceptable |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | simulation | | | Final | | 11.84 | 4.56 | 7.81 | 30 mΩ Max | Acceptable |
| | | | G3 | Initial | | 3.89 | 3.53 | 3.72 | 10 mΩ Max | Acceptable |
| | | | | Final | | 10.72 | 4.85 | 6.51 | 30 mΩ Max | Acceptable |
| PG20 | Climate load of the housing | Insulation resistance | Initial | | MΩ | ≥9999 | ≥9999 | ≥9999 | 1000MΩMin | Acceptable |
| | | | Final | | | ≥9999 | ≥9999 | ≥9999 | 100MΩMin | Acceptable |
| PG21 | Long-term temperatur e aging | Contact resistance | Initial | | mΩ | 3.28 | 2.62 | 3.03 | 10 mΩ Max | Acceptable |
| | | | Final | | | 10.03 | 3.96 | 5.98 | 30 mΩ Max | Acceptable |
| | | Conductor Pull-out Strength | AWG#22 | | N | 82.2 | 55.6 | 71.1 | 50N Min | Acceptable |

### 6.2 USCAR Test Item Result

| Test Group | Test Items | | | Unit | Result | | | Spec. | Judgment |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Max | Min | Ave | | |
| 1 | Connector Mounting Feature Mechanical Strength | | | N | PASS | | | F1:50N Min | Acceptable |
| | | | | | PASS | | | F2:50N Min | Acceptable |
| | | | | | PASS | | | F3:50N Min | Acceptable |
| | | | | | PASS | | | F4:50N Min | Acceptable |
| | | | | | PASS | | | F5:50N Min | Acceptable |
| | | | | | PASS | | | F6:110N Min | Acceptable |
| 2 | Header Pin retention force | | | N | 27.4 | 22.5 | 24.6 | 15N Min | Acceptable |
| 12 | Vibration/M echanical Shock | Contact resistance | Initial | mΩ | 6.95 | 3.18 | 4.85 | 10 mΩ Max | Acceptable |
| | | | Final | | 5.48 | 3.61 | 4.08 | 30 mΩ Max | Acceptable |
| | | Voltage Drop | | mv | 10.50 | 7.25 | 8.59 | 50 mv Max | Acceptable |

## 7. Appendix--- PG 15 Derating Cuvre

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*END*