

---

The product described in this document has not been fully tested to ensure conformance to the requirements outlined below. Therefore, TE Connectivity (TE) makes no representation or warranty, express or implied, that the product will comply with these requirements. Further, TE may change these requirements based on the results of additional testing and evaluation. Contact TE Engineering for further details.

---

## **AMP+ Two-Position HVA280 2phm Inline Cap, Sealed Shielded Connection System**

---

### **1. SCOPE**

#### 1.1. Content

This specification defines the performance, tests, and quality requirements for the TE Connectivity (TE) AMP+ Two-Position HVA280 2phm Inline Cap, Sealed Shielded Connection System.

#### 1.2. Qualification

When tests are performed on the subject product line, procedures specified in Table 1 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

### **2. APPLICABLE DOCUMENTS**

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the latest edition of the document applies. In the event of conflict between the requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

#### 2.1. TE Documents

- 108-18063: Product Specification (2.8x0.8 flat contact)
- 114-18051: Application Specification (2.8x0.8 flat contact)
- 108-18030: Product Specification (Micro Quadlock System)
- 114-18021: Application Specification (Micro Quadlock System)
- 114-32034: Application Specification (HVA280 2phm Inline Cap)
- 501-TBD: HVA280 2phm Inline Cap Qualification Test Report (TBD)

#### 2.2. Industry Documents

- IEC-60529: Degrees of Protection Provided by Enclosures (IP Code)
- USCAR 2: Performance Specification for Automotive Electrical Connector Systems
- USCAR 25: Electrical Connector Assembly Ergonomic Design Criteria
- USCAR 37: High Voltage Connector Performance Supplement to USCAR 2

### **3. REQUIREMENTS**

#### 3.1. Design and Construction

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

#### 3.2. Materials

Materials used in the construction of this product shall be as specified on the applicable product drawing.

#### 3.3. Ratings

- Voltage: 600 volts DC
- Current: 40 amperes maximum (current carrying capability affected by cable size and ambient temperature)
- Temperature: -40 to 125°C

### 3.4. Performance and Test Description

Product is designed to meet the electrical, mechanical and environmental performance requirements specified in Figure 1. Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

### 3.5. Test Requirements and Procedures Summary

| Test Group No. | Test Description  | Requirements   | Procedures                   |
|----------------|---|--|------------------------------|
| 1              | 2.8mm blade<br>- Terminal to Connector Insertion<br>- Forward Stop<br>- Terminal to Connector Extraction (Dry as molded)<br>- Terminal to Connector Extraction (Moisture Conditioned)       | $F \leq 75\text{N}$<br><br>$F \geq 50\text{N}$ or wire buckles<br>$F \geq 110\text{N}$<br><br>$F \geq 110\text{N}$   | USCAR-37 8/2008 Sec. 5.4.1.3 |
| 2              | 0.64mm receptacle<br>- Terminal to Connector Insertion<br>- Forward Stop<br>- Terminal to Connector Extraction (Dry as molded)<br>- Terminal to Connector Extraction (Moisture Conditioned) | $F \leq 30\text{N}$<br><br>$F \geq 50\text{N}$ or wire buckles<br>$F \geq 60\text{N}$<br><br>$F \geq 60\text{N}$   | USCAR-2 Rev 5 Sec 5.4.1.3    |
| 3              | 2phm cap to plug<br>Connector to Connector Mate Force   | $F \leq 75\text{N}$  | USCAR-2 Rev 5 Sec 5.4.2.3    |
|                | Primary Lock Engaged  | $F \geq 110\text{N}$   | USCAR-2 Rev 5 Sec 5.4.2.3    |
|                | Primary Lock Disengage  | $F \leq 75\text{N}$  | USCAR-2 Rev 5 Sec 5.4.2.3    |
| 4              | Misc. component engage<br>Fir tree clip insertion   | $F \leq 60\text{N}$  | USCAR-2 Rev 5 Sec 5.4.5.3    |
|                | Misc. component disengage<br>Fir tree clip retention  | $F \geq 110\text{N}$   | USCAR-2 Rev 5 Sec 5.4.5.3    |
|                | Misc. component disengage<br>Inner housing retention  | $F \geq 110\text{N}$   | USCAR-2 Rev 5 Sec 5.4.5.3    |
| 5              | Vibration/mechanical shock  | Voltage drop initial $\leq 5\text{m}\Omega$<br>Dry circuit initial $\leq 40\text{m}\Omega$<br>No discontinuities. No resistance $>7\Omega$ for $> 1$ microsecond<br>Voltage drop final $\leq 5\text{m}\Omega$<br>Dry circuit final $\leq 40\text{m}\Omega$ | USCAR-2 Rev 5 Sec 5.4.6.3    |
| 6              | Connector drop test   | No damage that would affect functionality  | USCAR-2 Rev 5 Sec 5.4.8.3    |
| 7              | Connector mounting feature mechanical strength  | Force to break mounting feature must be $> 50\text{N}$   | USCAR-2 Rev 5 Sec 5.7.2.3    |
| 8              | Maximum test current capability   | Data only  | USCAR-2 Rev 5 Sec 5.3.3.3    |

Figure 1 (cont'd)

| Test Group No. | Test Description  | Requirements   | Procedures                            |
|----------------|---|--|---------------------------------------|
| 9              | Dielectric Withstand  | No arcing or flashover @ 2400VDC   | USCAR-37 8/2008 Sec 5.5.2.3           |
|                | Dielectric Withstand  | Test to failure or 5000VDC whichever is first  | USCAR-37 8/2008 Sec 5.5.2.3           |
| 10             | Thermal Shock with Circuit Continuity Monitoring                      | Voltage drop initial $\leq 5\text{m}\Omega$<br>Dry circuit initial $\leq 40\text{m}\Omega$<br>No discontinuities. No resistance $>7\Omega$ for $> 1$ microsecond<br>Voltage drop final $\leq 5\text{m}\Omega$<br>Dry circuit final $\leq 40\text{m}\Omega$ | USCAR-2 Rev 5 Sec 5.6.1.3             |
| 11             | Temperature/Humidity PV leak  | No leaks @ 7psi initial<br>Isolation resistance $R \geq 100\text{M}\Omega$ @ 1000VDC initial<br>No leaks @ 4psi final<br>Isolation resistance $R \geq 100\text{M}\Omega$ @ 1000VDC final<br>Terminal/connector extraction $\geq 50\text{N}$                | USCAR-2 Rev 5 Sec 5.6.2.3             |
| 12             | High Temperature Exposure PV leak                                     | No leaks @ 7psi initial<br>Isolation resistance $R \geq 100\text{M}\Omega$ @ 1000VDC initial<br>No leaks @ 4psi final<br>Isolation resistance $R \geq 100\text{M}\Omega$ @ 1000VDC final   | USCAR-2 Rev 5 Sec 5.6.3.3             |
| 13             | Connector touch safe  | No contact between HV and 12mm dia. finger probe   | IEC 529 2 <sup>nd</sup> ed. 1989 IP2B |
| 14             | High pressure spray   | No leaks   | USCAR-2 Rev 5 Sec 5.8.1.3             |
| 15             | Ensure HV circuit continuity when connectors are in pre-lock position | No loss of HV continuity @ 110N pull   | N/A, self imposed test condition      |

Figure 1 (end)

3.6. Product Qualification and Requalification Test Sequence. See Figure 2.

| TEST OR EXAMINATION   | TEST GROUP (a)    |   |   |   |     |   |   |   |   |     |    |    |    |    |    |
|---|-------------------|---|---|---|-----|---|---|---|---|-----|----|----|----|----|----|
|   | 1                 | 2 | 3 | 4 | 5   | 6 | 7 | 8 | 9 | 10  | 11 | 12 | 13 | 14 | 15 |
|   | TEST SEQUENCE (b) |   |   |   |     |   |   |   |   |     |    |    |    |    |    |
| Visual Inspection   | 1                 | 1 | 1 | 1 | 1   | 1 | 1 | 1 | 1 | 1   | 1  | 1  | 1  | 1  | 1  |
| Terminal to Connector Insertion<br>2.8 blade  | 2                 |   |   |   |     |   |   |   |   |     |    |    |    |    |    |
| Terminal to Connector Fwd<br>Stop<br>2.8 blade                                      | 3                 |   |   |   |     |   |   |   |   |     |    |    |    |    |    |
| Terminal to Connector<br>Extraction<br>2.8 blade                                    | 4                 |   |   |   |     |   |   |   |   |     | 10 |    |    |    |    |
| Terminal to Connector<br>Extraction Moisture Conditioned<br>2.8 blade               | 5                 |   |   |   |     |   |   |   |   |     |    |    |    |    |    |
| Terminal to Connector Insertion<br>0.64 receptacle                                  |                   | 2 |   |   |     |   |   |   |   |     |    |    |    |    |    |
| Terminal to Connector Fwd<br>Stop<br>0.64 receptacle                                |                   | 3 |   |   |     |   |   |   |   |     |    |    |    |    |    |
| Terminal to Connector<br>Extraction<br>0.64 receptacle                              |                   | 4 |   |   |     |   |   |   |   |     |    |    |    |    |    |
| Terminal to Connector<br>Extraction Moisture Conditioned<br>0.64 receptacle         |                   | 5 |   |   |     |   |   |   |   |     |    |    |    |    |    |
| Connector to Connector Mating<br>Force<br>2phi cap to plug                          |                   |   | 2 |   |     |   |   |   |   |     |    |    |    |    |    |
| Connector to Connector Un-<br>mating Primary Lock Engaged<br>2phi cap to plug       |                   |   | 3 |   |     |   |   |   |   |     |    |    |    |    |    |
| Connector to Connector Un-<br>mating Primary Lock<br>Disengaged<br>2phi cap to plug |                   |   | 4 |   |     |   |   |   |   |     |    |    |    |    |    |
| Misc. component engage<br>Fir tree clip insertion                                   |                   |   |   | 2 |     |   |   |   |   |     |    |    |    |    |    |
| Misc. component disengage<br>Fir tree clip retention                                |                   |   |   | 3 |     |   |   |   |   |     |    |    |    |    |    |
| Misc. component disengage<br>Inner housing retention                                |                   |   |   | 4 |     |   |   |   |   |     |    |    |    |    |    |
| Voltage Drop @ 20A<br>2.8mm circuits  |                   |   |   |   | 2,6 |   |   |   |   | 2,6 |    |    |    |    |    |

Figure 2 (cont'd)

| TEST OR EXAMINATION   | TEST GROUP (a)    |   |   |   |     |   |   |   |   |     |                 |                 |    |    |    |
|---|-------------------|---|---|---|-----|---|---|---|---|-----|-----------------|-----------------|----|----|----|
|   | 1                 | 2 | 3 | 4 | 5   | 6 | 7 | 8 | 9 | 10  | 11              | 12              | 13 | 14 | 15 |
|   | TEST SEQUENCE (b) |   |   |   |     |   |   |   |   |     |                 |                 |    |    |    |
| Termination Resistance, dry circuit (HVIL circuits)         |                   |   |   |   | 3,7 |   |   |   |   | 3,7 |                 |                 |    |    |    |
| Termination Resistance, dry circuit (shield circuits)       |                   |   |   |   | 4,8 |   |   |   |   | 4,8 |                 |                 |    |    |    |
| Vibration/Mechanical Shock<br>Circuit Continuity Monitoring |                   |   |   |   | 5   |   |   |   |   |     |                 |                 |    |    |    |
| Connector Drop  |                   |   |   |   |     | 2 |   |   |   |     |                 |                 |    |    |    |
| Connector mounting feature<br>mechanical strength           |                   |   |   |   |     |   | 2 |   |   |     |                 |                 |    |    |    |
| Maximum test current capability                             |                   |   |   |   |     |   |   | 2 |   |     |                 |                 |    |    |    |
| Dielectric Withstand  |                   |   |   |   |     |   |   |   | 2 |     |                 |                 |    |    |    |
| Dielectric Withstand  |                   |   |   |   |     |   |   |   | 3 |     |                 |                 |    |    |    |
| Thermal Shock with<br>Circuit Continuity Monitoring         |                   |   |   |   |     |   |   |   |   | 5   |                 |                 |    |    |    |
| Pressure vacuum @ 7psi                                      |                   |   |   |   |     |   |   |   |   |     | 2               | 2               |    |    |    |
| Isolation resistance @<br>1000VDC                           |                   |   |   |   |     |   |   |   |   |     | 3,5<br>,7,<br>9 | 3,5<br>,7,<br>9 |    |    |    |
| Temperature/Humidity cycling                                |                   |   |   |   |     |   |   |   |   |     | 4               |                 |    |    |    |
| Pressure vacuum @ 4psi                                      |                   |   |   |   |     |   |   |   |   |     | 6               | 6               |    |    |    |
| Submersion  |                   |   |   |   |     |   |   |   |   |     | 8               | 8               |    |    |    |
| High Temperature Exposure                                   |                   |   |   |   |     |   |   |   |   |     |                 | 4               |    |    |    |
| Connector touch safe  |                   |   |   |   |     |   |   |   |   |     |                 |                 | 2  |    |    |
| High pressure spray   |                   |   |   |   |     |   |   |   |   |     |                 |                 |    | 2  |    |
| Prelock HV continuity                                       |                   |   |   |   |     |   |   |   |   |     |                 |                 |    |    | 2  |

Figure 2 (end)

#### 4. QUALITY ASSURANCE PROVISIONS

##### 4.1. Qualification Testing

###### A. Specimen Selection

Specimens shall be prepared in accordance with applicable instruction sheets and shall be selected at random from current production.

- Test group 1 shall consist of 10 2103170-1 inner housings, 10 MCP 2.8 blade terminations on 300mm of 4mm sq. shielded cable, 10 2103170-1 moisture conditioned inner housings and 10 MCP 2.8 blade terminations on 300mm of 4mm sq. shielded cable.
- Test group 2 shall consist of 10 2103170-1 inner housings, 10 2103170-1 moisture conditioned inner housings and 20 MQS .64 receptacle terminations on 300mm of 0.5mm sq. wire.
- Test group 3 shall consist of 20 HVA280 2phm cap harnesses with 300mm of 4mm sq. shielded cable and 20 HVA280 2phm plug harnesses with 300mm of 4mm sq. shielded cable.
- Test group 4 shall consist of 10 2103169-1 outer housings, 10 1642656-1 fir tree clips and 10 HVA280 2phm cap harnesses on 300mm of 4mm sq. wire.

- Test group 5 shall consist of 10 HVA280 2phm cap harnesses on 600mm of 4mm sq. wire and 10 HVA280 2phm plug harnesses on 600mm of 4mm sq. wire.
- Test group 6 shall consist of 10 HVA280 2phm cap harnesses on 300mm of 4mm sq. wire.
- Test group 7 shall consist of 20 2103169-1 outer housings, 20 2103168-1 seal retainers and 20 1642656-1 fir tree clips.
- Test group 8 shall consist of 5 HVA280 2phm cap harnesses on 300mm of 4mm sq. cable and 5 HVA280 2phm plug harnesses on 300mm of 4mm sq. cable with integrated thermocouples
- Test group 9 shall consist of 5 HVA280 2phm cap harnesses on 300mm of 4mm sq. cable.
- Test group 10 shall consist of 10 HVA280 2phm cap harnesses on 300mm of 4mm sq. cable and 10 HVA280 2phm plug harnesses on 300mm of 4mm sq. wire.
- Test group 11 shall consist of 10 HVA280 2phm cap harnesses on 600mm of 4mm sq. wire, 10 HVA280 2phi plug harnesses on 600mm of 4mm sq. wire, 6 2103170-1 inner housings, 3 MCP 2.8 blade terminations on 300mm of 4mm sq. unshielded wire and 3 MQS receptacle terminations on 300mm of 0.5mm sq. wire.
- Test group 12 shall consist of 10 HVA280 2phm cap harnesses on 600mm of 4mm sq. wire and 10 HVA280 2phi plug harnesses on 600mm of 4mm sq. wire.
- Test group 13 shall consist of 1 HVA280 2phm cap harness on 300mm of 4mm sq. wire.
- Test group 14 shall consist of 10 HVA280 2phm cap harnesses on 300mm of 4mm sq. wire and 10 HVA280 2phm plug harnesses on 300mm of 4mm sq. wire.
- Test group 15 shall consist of 3 HVA280 2phm cap harnesses with 300mm of 4mm sq. shielded cable and 3 HVA280 2phm plug harnesses with 300mm of 4mm sq. shielded cable.

#### B. Test Sequence

Qualification inspection shall be verified by testing specimens as specified in Table 2.

#### 4.2. Requalification Testing

If changes significantly affecting form, fit or function are made to the product or manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by development/product, quality and reliability engineering.

#### 4.3. Acceptance

Acceptance is based on verification that the product meets the requirements of Table 1. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken and specimens resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

#### 4.4. Quality Conformance Inspection

The applicable quality inspection plan shall specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification.