
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 2phi 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 2phi 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

- [108-18030](#): Product Specification (Micro Quadlok System)
- [108-18063](#): Product Specification (2.8x0.8 flat contact)
- [108-18782](#): Product Specification (MCON 1.2 Contact System)
- [114.18021](#): Application Specification (Micro Quadlok System)
- [114-18051](#): Application Specification (2.8x0.8 flat contact)
- [114-18464](#): Application Specification (MCON 1.2 Contact System)
- [114-32033](#): Application Specification (HVA280 2phi Inline Cap)
- 501-TBD: Qualification Test Report HVA280 2phi Inline Cap

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: 500 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 - Terminal to Connector Insertion - Forward Stop - Terminal to Connector Extraction (Dry as molded) - Terminal to Connector Extraction (Moisture Conditioned)	$F \leq 75N$ $F \geq 50N$ or wire buckles $F \geq 110N$ $F \geq 110N$	USCAR-37 8/2008 Sec. 5.4.1.3
2	0.64mm receptacle - Terminal to Connector Insertion - Forward Stop - Terminal to Connector Extraction (Dry as molded) - Terminal to Connector Extraction (Moisture Conditioned)	$F \leq 30N$ $F \geq 50N$ or wire buckles $F \geq 60N$ $F \geq 60N$	USCAR-2 Rev 5 Sec 5.4.1.3
3	1.2mm blade - Terminal to Connector Insertion - Forward Stop - Terminal to Connector Extraction (Dry as molded) - Terminal to Connector Extraction (Moisture Conditioned)	$F \leq 30N$ $F \geq 50N$ or wire buckles $F \geq 60N$ $F \geq 60N$	USCAR-2 Rev 5 Sec 5.4.1.3
4	2phi cap to plug Connector to Connector Mate Force	$F \leq 75N$	USCAR-2 Rev 5 Sec 5.4.2.3
	Primary Lock Engaged	$F \geq 110N$	USCAR-2 Rev 5 Sec 5.4.2.3
	Primary Lock Disengage	$F \leq 75N$	USCAR-2 Rev 5 Sec 5.4.2.3
5	2phi cap to MCON plug Connector to Connector Mate Force	$F \leq 75N$	USCAR-2 Rev 5 Sec 5.4.2.3
	Primary Lock Engaged	$F \geq 110N$	USCAR-2 Rev 5 Sec 5.4.2.3
	Primary Lock Disengaged	$F \leq 75N$	USCAR-2 Rev 5 Sec 5.4.2.3
6	2phi cap to MCON plug Polarization Feature Effectiveness	$F \geq 150N$ or 3x the average insertion force value.	USCAR-2 Rev 5 Sec 5.4.4.3
7	Misc. component disengage MCON insert retention	$F \geq 60N$	USCAR-2 Rev 5 Sec 5.4.5.3
	Misc. component engage Fir tree clip insertion	$F \leq 60N$	USCAR-2 Rev 5 Sec 5.4.5.3
	Misc. component disengage Fir tree clip retention	$F \geq 110N$	USCAR-2 Rev 5 Sec 5.4.5.3
	Misc. component disengage Inner housing retention	$F \geq 110N$	USCAR-2 Rev 5 Sec 5.4.5.3

Figure 1 (cont'd)

TEST GROUP NO.	TEST DESCRIPTION	REQUIREMENTS	PROCEDURES
8	Vibration/mechanical shock	Voltage drop initial $\leq 5\text{m}\Omega$ Dry circuit initial $\leq 80\text{m}\Omega$ No discontinuities. No resistance $>7\Omega$ for > 1 microsecond Voltage drop final $\leq 5\text{m}\Omega$ Dry circuit final $\leq 80\text{m}\Omega$	USCAR-2 Rev 5 Sec 5.4.6.3
9	Connector drop test	No damage that would affect functionality	USCAR-2 Rev 5 Sec 5.4.8.3
10	Connector mounting feature mechanical strength	Force to break mounting feature must be $> 50\text{N}$	USCAR-2 Rev 5 Sec 5.7.2.3
11	Maximum test current capability	Data only	USCAR-2 Rev 5 Sec 5.3.3.3
12	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
13	Thermal Shock with Circuit Continuity Monitoring	Voltage drop initial $\leq 5\text{m}\Omega$ Dry circuit initial $\leq 80\text{m}\Omega$ No discontinuities. No resistance $>7\Omega$ for > 1 microsecond Voltage drop final $\leq 5\text{m}\Omega$ Dry circuit final $\leq 80\text{m}\Omega$	USCAR-2 Rev 5 Sec 5.6.1.3
14	Temperature/Humidity PV leak 4mm sq. cable	No leaks @ 7psi initial Isolation resistance $R \geq 100\text{M}\Omega$ @ 1000VDC initial No leaks @ 4psi final Isolation resistance $R \geq 100\text{M}\Omega$ @ 1000VDC final Terminal/connector extraction $\geq 50\text{N}$	USCAR-2 Rev 5 Sec 5.6.2.3
15	Temperature/Humidity PV leak 3mm sq. cable	No leaks @ 7psi initial Isolation resistance $R \geq 100\text{M}\Omega$ @ 1000VDC initial No leaks @ 4psi final Isolation resistance $R \geq 100\text{M}\Omega$ @ 1000VDC final	USCAR-2 Rev 5 Sec 5.6.2.3
16	High Temperature Exposure PV leak 4mm sq. cable	No leaks @ 7psi initial Isolation resistance $R \geq 100\text{M}\Omega$ @ 1000VDC initial No leaks @ 4psi final Isolation resistance $R \geq 100\text{M}\Omega$ @ 1000VDC final	USCAR-2 Rev 5 Sec 5.6.3.3

Figure 1 (cont'd)

TEST GROUP NO.	TEST DESCRIPTION	REQUIREMENTS	PROCEDURES
17	High Temperature Exposure PV leak 3mm sq. cable	No leaks @ 7psi initial Isolation resistance R ≥ 100MΩ @ 1000VDC initial No leaks @ 4psi final Isolation resistance R ≥ 100MΩ @ 1000VDC final	USCAR-2 Rev 5 Sec 5.6.3.3
18	Connector touch safe	No contact between HV and 12mm dia. finger probe	IEC 529 2 nd ed. 1989 IP2B
19	High pressure spray	No leaks	USCAR-2 Rev 5 Sec 5.8.1.3
20	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

TEST OR EXAMINATION	TEST GROUP (a)																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	TEST SEQUENCE (b)																			
Visual Inspection	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Terminal to Connector Insertion 2.8 blade	2																			
Terminal to Connector Fwd Stop 2.8 blade	3																			
Terminal to Connector Extraction 2.8 blade	4													10						
Terminal to Connector Extraction Moisture Conditioned 2.8 blade	5																			
Terminal to Connector Insertion 0.64 receptacle		2																		
Terminal to Connector Fwd Stop 0.64 receptacle		3																		
Terminal to Connector Extraction 0.64 receptacle		4																		
Terminal to Connector Extraction Moisture Conditioned 0.64 receptacle		5																		
Terminal to Connector Insertion 1.2 tab in MCON Insert			2																	
Terminal to Connector Fwd Stop 1.2 tab in MCON Insert			3																	
Terminal to Connector Extraction 1.2 tab in MCON Insert			4																	

Figure 2 (cont'd)

Terminal to Connector Extraction Moisture Conditioned 1.2 tab in MCON Insert			5																	
Connector to Connector Mating Force 2phi cap to plug				2																
Connector to Connector Un-mating Primary Lock Engaged 2phi cap to plug				3																
Connector to Connector Un-mating Primary Lock Disengaged 2phi cap to plug				4																
Connector to Connector Mating Force 2phi cap to MCON plug					2															
Connector to Connector Un-mating Primary Lock Engaged 2phi cap to MCON plug					3															
Connector to Connector Un-mating Primary Lock Disengaged 2phi cap to MCON plug					4															
Polarization Feature Effectiveness 2phi cap to MCON plug						2														
Misc. component disengage MCON insert retention							2													
Misc. component engage Fir tree clip insertion								3												
Misc. component disengage Fir tree clip retention									4											
Misc. component disengage Inner housing retention										5										

Figure 2 (cont'd)

Voltage Drop @ 20A 2.8mm circuits								2,6									2,6					
Termination Resistance, dry circuit (HVIL circuits)								3,7									3,7					
Termination Resistance, dry circuit (shield circuits)								4,8									4,8					
Vibration/Mechanical Shock Circuit Continuity Monitoring								5														
Connector Drop									2													
Connector mounting feature mechanical strength										2												
Maximum test current capability											2											
Dielectric Withstand												2										
Dielectric Withstand													3									
Thermal Shock with Circuit Continuity Monitoring																	5					
Pressure vacuum @ 7psi																2	2	2	2			
Isolation resistance @ 1000VDC																3,5, 7,9	3,5, 7,9	3,5, 7,9	3,5, 7,9			
Temperature/Humidity cycling																4	4					
Pressure vacuum @ 4psi																6	6	6	6			
Submersion																8	8	8	8			
High Temperature Exposure																		4	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 2103191-1 subassemblies, 10 MCP 2.8 blade terminations on 300mm of 4mm sq. shielded cable, 10 2103191-1 moisture conditioned subassemblies and 10 MCP 2.8 blade terminations on 300mm of 4mm sq. shielded cable.

- Test group 2 shall consist of 10 1587939-1 inner housings, 10 2103249-1 MQS/MCON terminations, 10 1587939-1 moisture conditioned inner housings and 10 2103249-1 MQS/MCON terminations.
- Test group 3 shall consist of 10 2103195-1 MCON inserts, 10 2103249-1 MQS/MCON terminations, 10 2103195-1 moisture conditioned MCON inserts and 10 2103249-1 MQS/MCON terminations.
- Test group 4 shall consist of 15 HVA280 2phi cap harnesses with 300mm of 4mm sq. shielded cable, 15 HVA280 2phi plug harnesses with 300mm of 4mm sq. shielded cable, 5 HVA280 2phi cap harnesses with 300mm of 4mm sq. shielded cable and 5 HVA280 2phi plug harnesses with 300mm of 4mm sq. shielded cable.
- Test group 5 shall consist of 15 2103191-1 subassemblies, 15 MCON 2P plug harnesses with 300mm of 0.5mm sq. wire, 5 2103191-1 subassemblies and 5 MCON 2P plug harnesses with 300mm of 0.5mm sq. wire.
- Test group 6 shall consist of 1 1587937-1 outer housing, 1 1587940-3 seal retainer and 1 MCON 2P plug harness with 300mm of 0.5mm sq. wire.
- Test group 7 shall consist of 10 1587937-1 outer housings, 10 2103195-1 MCON inserts, 10 1587937-1 outer housings and 10 1642656-1 fir tree clips.
- Test group 8 shall consist of 10 HVA280 2phi cap harnesses on 600mm of 4mm sq. wire, 10 MCON 2p plug harnesses on 600mm of 0.5mm sq. wire and 10 HVA280 2phi plug harnesses on 600mm of 4mm sq. wire.
- Test group 9 shall consist of 10 2103191-1 HVA280 cap subassemblies and 10 1587940-3 seal retainers.
- Test group 10 shall consist of 20 1587937-1 outer housings, 20 1587940-3 seal retainers and 20 1642656-1 fir tree clips.
- Test group 11 shall consist of 5 HVA280 2phi cap harnesses on 300mm of 4mm sq. cable, 5 MCON 2p plug harnesses on 300mm of 0.5mm sq. wire and 5 HVA280 2phi plug harnesses on 300mm of 4mm sq. cable with integrated thermocouples
- Test group 12 shall consist of 5 HVA280 2phi cap harnesses on 300mm of 4mm sq. cable and 5 MCON 2p plug harnesses on 300mm of 0.5mm sq. wire.
- Test group 13 shall consist of 10 HVA280 2phi cap harnesses on 300mm of 4mm sq. cable, 10 MCON 2p plug harnesses on 300mm of 0.5mm sq. wire and 10 HVA280 2phi plug harnesses on 300mm of 4mm sq. wire.
- Test group 14 shall consist of 10 HVA280 2phi cap harnesses on 600mm of 4mm sq. wire, 10 MCON 2p plug harnesses on 600mm of 0.5mm sq. wire, 10 HVA280 2phi plug harnesses on 600mm of 4mm sq. wire, 6 1587939-1 inner housings, 3 2103195-1 MCON inserts, 6 2103249-1 MQS to MCON terminations and 6 MCP 2.8 blade terminations on 300mm of 4mm sq. wire.
- Test group 15 shall consist of 10 HVA280 2phi cap harnesses on 600mm of 3mm sq. wire, 10 MCON 2p plug harnesses on 600mm of 0.5mm sq. wire and 10 HVA280 2phi plug harnesses on 600mm of 3mm sq. wire.
- Test group 16 shall consist of 10 HVA280 2phi cap harnesses on 600mm of 4mm sq. wire, 10 MCON 2p plug harnesses on 600mm of 0.5mm sq. wire and 10 HVA280 2phi plug harnesses on 600mm of 4mm sq. wire.
- Test group 17 shall consist of 10 HVA280 2phi cap harnesses on 600mm of 3mm sq. wire, 10 MCON 2p plug harnesses on 600mm of 0.5mm sq. wire and 10 HVA280 2phi plug harnesses on 600mm of 3mm sq. wire.
- Test group 18 shall consist of 1 HVA280 2phi cap harness on 300mm of 4mm sq. wire.
- Test group 19 shall consist of 10 HVA280 2phi cap harnesses on 300mm of 4mm sq. wire, 10 MCON 2p plug harnesses on 300mm of 0.5mm sq. wire and 10 HVA280 2phi plug harnesses on 300mm of 4mm sq. wire.
- Test group 20 shall consist of 5 HVA280 2phi cap pigtail harnesses with 300mm of 4mm sq. shielded cable and 5 HVA280 2phi plug pigtail harnesses with 300mm of 4mm sq. shielded cable.

B. Test Sequence

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