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**Manual Service Disconnect**

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**1. SCOPE**

## 1.1. Content

This specification covers performance, tests and quality requirements for the TE Connectivity (TE) Manual Service Disconnect (MSD).

## 1.2. Qualification

When tests are performed on the subject product line, procedures specified in Figure 1 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 June of 2011. The Qualification Test Report number for this testing is 501-127000.

**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 Document

501-127000: Qualification Test Report (Manual Service Disconnect)

## 2.2. Industry Documents

- 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 SAE/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: 450 volts DC
- Temperature:
  - Operating: -40 to 65°C
  - Storage (non-operating): -40 to 85°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 Description	Requirement	Procedure
Visual Inspection.	USCAR-2, Section 5.1.8.4.	USCAR-37, USCAR-2, Section 5.1.8.
Force to engage to the pre-lock position.	USCAR-2, Section 5.4.3.4-1, USCAR-25, Class 3. 75 N maximum.	USCAR-37, USCAR-2, Section 5.4.3.3.A.
Force to disengage from the pre-lock position.	USCAR-2, Section 5.4.3.4-2. 15 N minimum, 75 N maximum.	USCAR-37, USCAR-2, Section 5.4.3.3.A.
Withstanding force to release the lever from the pre-stage position.	USCAR-2, Section 5.4.3.4-3. 50 N.	USCAR-37, USCAR-2, Section 5.4.3.3.B.
Force to release the lever from the pre-stage position.	USCAR-2, Section 5.4.3.4-3. 50 N minimum.	USCAR-37, USCAR-2, Section 5.4.3.3.B.
Lever actuation, force to fully close the lever.	USCAR-2, Section 5.4.3.4-4, USCAR-25, Class 3. 75 N maximum.	USCAR-37, USCAR-2, Section 5.4.3.3.C.
Lever actuation, force to withstand opening the lever from the HV locked position.	USCAR-2, Section 5.4.3.4-5. 60 N.	USCAR-37, USCAR-2, Section 5.4.3.3.C.
Lever actuation, force to release the lever from the HV locked position.	USCAR-2, Section 5.4.3.4-5. 60 N minimum.	USCAR-37, USCAR-2, Section 5.4.3.3.C.
HV latch actuation, force to depress the latch.	USCAR-25, Class 2. 45 N maximum.	USCAR-25, Table 4.1, Class 1.
Lever actuation, force to move the lever from the HV locked position to the HVIL locked position.	USCAR-2, Section 5.4.3.4-4, USCAR-25, Class 3. 75 N maximum.	USCAR-37, USCAR-2, Section 5.4.3.3.C.
Lever actuation, force to withstand opening the lever from the HVIL locked position with latch enabled.	USCAR-2, Section 5.4.3.4-5. 60 N.	USCAR-2, Section 5.4.3.3.C. USCAR-37.
Lever actuation, force to release the lever from the HVIL locked position with the latch enabled.	USCAR-2, Section 5.4.3.4-5. 60 N minimum.	USCAR-37, USCAR-2, Section 5.4.3.3.C.
HVIL latch actuation, force required to depress the latch.	USCAR-25, Class 2. 45 N maximum.	USCAR-25, Table 4.1, Class 1.
Lever actuation, force required to move the lever from the HVIL locked position to the pre-stage position with the latch disabled.	USCAR-2, Section 5.4.3.4-4, USCAR-25, Class 3. 75 N maximum.	USCAR-37, USCAR-2, Section 5.4.3.3.C.
Shorting bar extraction, force to withstand extraction from the plug assembly inner housing.	40 N.	USCAR-2.

Figure 1 (continued)

Test Description	Requirement	Procedure
Shorting bar extraction, force to extract the shorting bar from the plug assembly inner housing.	40 N minimum.	Test to failure.
M6 studs torque out force.	14 N•m minimum.	Test to failure.
M6 inserts torque out force.	15 N•m minimum.	Test to failure.
MSD mate to fully locked position.	See Note.	Conditioning step.
Voltage drop.	0.600 milliohm maximum.	USCAR-2.
MSD mate cycling.	USCAR-37, Table 5.1.4.5 Class M2. 50 mating/unmating cycles.	USCAR-37, Section 5.1.7.
1008 hour current cycling.	0.600 milliohm maximum. 50°C maximum temperature rise.	USCAR-2, USCAR-37.
Dry circuit resistance, HVIL only.	USCAR-2, Section 5.3.1.4. 40 milliohms maximum.	USCAR-37, USCAR-2, Section 5.3.1.
Vibration/mechanical shock.	No discontinuities greater than 1 microsecond.	USCAR-2, Section 5.1.9.4.
Age specimens at room ambient.	48 hours.	USCAR-37, USCAR-2, Section 5.4.6.
Thermal shock, unpowered.	USCAR-2, Section 5.6.1.4 per USCAR-2, Section 5.1.4.1. Class 1, -40 to 85°C.	USCAR-37, USCAR-2, Section 5.6.1.
Temperature/humidity cycling, unpowered.	USCAR-2, Section 5.6.2.4.	USCAR-2.
Pressure/vacuum leak, 48 kPa.	USCAR-2, Section 5.6.6.4.	USCAR-37, USCAR-2, Section 5.6.6.
Dielectric withstanding voltage.	USCAR-37, Section 5.5.2.	USCAR-37, Section 5.5.2.4.
Isolation resistance.	USCAR-37, Section 5.5.1.4. 100 megohms at 1000 volts DC.	USCAR-37, USCAR-2, Section 5.5.1.
Submersion.	USCAR-2, Section 5.6.5.4.	USCAR-37, USCAR-2, Section 5.6.5.
Pressure/vacuum leak, 28 kPa.	USCAR-2, Section 5.6.6.4.	USCAR-37, USCAR-2, Section 5.6.6.
1008 hour high temperature exposure.	USCAR-2, Section 5.6.3.4 per USCAR-2, Section 5.1.4.1. Class1, -40 to 85°C.	USCAR-2, Section 5.6.3. USCAR-37.
High pressure spray.	USCAR-2, Section 5.8.1.4.	USCAR-2, Section 5.8.1. USCAR-37.
Condition at ambient.	168 hours.	USCAR-2, Section 5.8.1.3-9.

**NOTE**

*Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as specified in the Product Qualification and Requalification Test Sequence shown in Figure 2.*

Figure 1 (end)

3.6. Product Qualification and Requalification Test Sequence

Test or Examination	Test Group (a)										
	A	B	C	D	E	F	G	H	I	J	K
	Test Sequence (b)										
Visual Inspection	1,19	1,8	1,11	1,10	1,10	1,10	1,10	1,8	1,10	1,9	1,8,11
Force to engage to the pre-lock position	2										
Force to disengage from the pre-lock position	3										
Withstanding force to release the lever from the pre-stage position	4										
Force to release the lever from the pre-stage position	5										
Lever actuation, force to fully close the lever	6										
Lever actuation, force to withstand opening the lever from the HV locked position	7										
Lever actuation, force to release the lever from the HV locked position	8										
HV latch actuation, force to depress the latch	9										
Lever actuation, force to move the lever from the HV locked position to the HVIL locked position	10										
Lever actuation, force to withstand opening the lever from the HVIL locked position with latch enabled	11										
Lever actuation, force to release the lever from the HVIL locked position with the latch enabled	12										
HVIL latch actuation, force required to depress the latch	13										
Lever actuation, force required to move the lever from the HVIL locked position to the pre-stage position with the latch disabled	14										
Shorting bar extraction, force to withstand extraction from the plug assembly inner housing	15						9				
Shorting bar extraction, force to extract the shorting bar from the plug assembly inner housing	16										
M6 studs torque out force	17										
M6 inserts torque out force	18										
MSD mate to fully locked position		2	2	2	2						2
Voltage drop		3,5,7	3,5,10	3,5,9	3,5,9			3,7			3,10
MSD mate cycling		4	4	4	4	2	2	2	2	2	9
1008 hour current cycling		6									
Dry circuit resistance, HVIL only			6,9	6,8	6,8			4,6			
Vibration/mechanical shock			7								
Age specimens at room ambient			8								
Thermal shock, unpowered				7							
Temperature/humidity cycling, unpowered					7	5	5				
Pressure/vacuum leak, 48 kPa						3	3		3	3	
Dielectric withstanding voltage						4,9	4,8		4,9	4,8	
Isolation resistance						6,8	7		6,8	7	4,6
Submersion						7			7		
Pressure/vacuum leak, 28 kPa							6			6	
1008 hour high temperature exposure								5	5	5	
High pressure spray											5
Condition at ambient											7

**NOTE** (a) See paragraph 4.1.A.  
 (b) Numbers indicate sequence in which tests are performed.

Figure 2

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#### 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 A shall consist of 12 specimens. Test groups B, D, E, H and K shall consist of 6 specimens each. Test group C shall consist of 7 specimens. Test groups F, G, I and J shall consist of 3 specimens each.

###### 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.