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LTR	REVISION RECORD	AP	PR	DATE	HVP1100 90DEG 1Pos Plug & Header Connector			

1. Scope

1.1 Content

This Design Objective covers the requirements for product performance, test methods and quality assurance provisions of HVP1100 90DEG 1Pos Plug & Header Connector.

1.2 Qualification

When tests are performed, the following specified specifications and standards 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. In the events of conflict between the requirements of this specification and the product drawing or of conflict between the requirements of this specification and the reference documents, this specification shall take precedence.

2.1 TE Documents

- A. 109-1: Test Specification, General Requirements for specifications
- B. **Customer Drawing and Description**

Single components used at 1Pos HVP1100 Connector

2137704	HVP1100 1Pos Plug Hsg Assy Sld 90 Deg
2137711	Cable Seal Assy
2137715	Terminal Assy 90 Deg 11mm
2137722	Lower Insert Assy
2137735	Upper Insert Assy
2137742	11mm Pin Assy

1 Pos HV 1100 Connector

2137702	HVP1100 1Pos Plug 90 Deg Assy Sld
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Counterpart

2137740	1Pos Header Hsg 90 Deg
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C. Application Specification

HV1100 90DEG 1Pos Plug&Header Connector

114-101010 Application Specification for HVP1100 90DEG 1Pos Plug & Header Connector

2.2 General Documents

- A. SAE/USCAR-2 Performance Specification for Automotive Electrical Connector Systems

Edition: Rev 5 Nov 2007

- B. SAE/USCAR-37 High Voltage Connector Performance Supplement to SAE/USCAR-2

Edition: Aug 2008

- C. LV215-1 Electrical Requirements of HV Connectors

Edition: Edition 1—Feb.2009

- D. IEC 60512: Electromechanical components for electronic equipment, basic testing procedures and measuring methods

Edition: June 1995

- E. DIN 40050 Part 9 Road vehicle, degrees of protection (IP-Code), protection against foreign objects, water and contact, electrical equipment

Edition: March 1983

- F. IEC 60529: Degrees of Protection (IP Code)

Edition: Nov 2004

3. Requirements

3.1 Design and Construction

Products must meet the design, construction and physical dimensions specified in the applicable product drawings.

3.2 Material

Description of the material sees the related product drawings.

3.3 Ratings

- A. Max. Voltage according DIN EN 60664-1 $\leq 1000V$ DC with pollution degree II

Dielectric strength: 4000V

Air gap distance with correction factor for 4000m over sea level: $>3.87mm$

Isolation Group I : CTI ≥ 600

Creepage Distance: $>5mm$

- B. Current carrying capability see applicable current carrying capability

C. Temperature: $-40^{\circ}C \sim 125^{\circ}C$

- D. Degree of Protection unmated IP6K9K, IP67

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- E. Degree of Protection unmated IP2xB
- F. Durability ≤ 50 cycles
- G. EMI Protection ≥ 40 dB *)

*) The displayed 40 dB represents a clue value.
The level of the shielding is dependent on the field of application as well as the appearing disturbances.

3.4 Performance and Test Description

The product is designed to meet the electrical, mechanical and environmental performance requirements specified in Para. 3.5. All tests are performed at ambient environmental conditions per SAE/USCAR 2 or SAE/USCAR 37 unless otherwise specified.

3.5 Test Requirements and Procedures Summary

Table 1 - Test Requirements and Procedures Summary

Para.	Test Description	Requirement	Procedure
3.5.1	Visual inspection	USCAR 2, Section 5.1.8.4 Meets requirements of product drawing.	USCAR 2, Section 5.1.8
3.5.2	Terminal assy-to-Connector Insertion, plug	USCAR 37, Section 5.4.1.4. 75N max.	USCAR 37, Section 5.4.1.
3.5.3	Forward stop, Terminal assy, plug	USCAR 37, Section 5.4.1.4. 50N min, or terminal insertion force, which is greater.	USCAR 37, Section 5.4.1.
3.5.4	Terminal assy-to-Connector Extraction: Moisture conditioned, TPA engaged, plug	USCAR 37, Section 5.4.1.4. 450N min.	USCAR 37, Section 5.4.1.
3.5.5	Terminal assy-to-Connector Extraction: After temperature/humidity, plug	USCAR 37, Section 5.4.1.4. 225N min.	USCAR 37, Section 5.4.1.
3.5.6	Terminal 11mm-to-Connector Extraction: Moisture conditioned, header	USCAR 2, Section 5.4.1.4. 200N min. Pullout force, 1st lock,	USCAR 2, Section 5.4.1.
3.5.7	Terminal 11mm-to-Connector Extraction: After temperature/humidity, header	USCAR 2, Section 5.4.1.4. 100N min. Pullout force, 1st lock	USCAR 2, Section 5.4.1.
3.5.8	Forward stop, 0.64mm shunting bar.	USCAR 2, Section 5.4.1.4. 50N min, or terminal insertion force, which is greater.	USCAR 2, Section 5.4.1.
3.5.9	Terminal-to-Connector Extraction: Dry as molded, 0.64mm shunting bar.	USCAR 2, Section 5.7.1.4. 25N min.	USCAR 2, Section 5.7.1.

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Para.	Test Description	Requirement	Procedure
3.5.10	Terminal-to-Connector Extraction: Moisture conditioned, 0.64mm shunting bar.	USCAR 2, Section 5.7.1.4. 20N min.	USCAR 2, Section 5.7.1.
3.5.11	Terminal-to-Connector Extraction: Dry as molded, HVIL 2P receptacles.	USCAR 37, Section 5.4.1.4. 30N min.	USCAR 37, Section 5.4.1.
3.5.12	Terminal-to-Connector Extraction: Moisture conditioned HVIL 2P receptacles.	USCAR 37, Section 5.4.1.4. 60N min.	USCAR 37, Section 5.4.1.
3.5.13	Terminal-to-Connector Extraction: After temp/humidity 0.64 shunting bar.	USCAR 2, Section 5.7.1.4. 25N min.	USCAR 2, Section 5.7.1.
3.5.14	Mating Force	USCAR 2 Section 5.4.2 75N max.	USCAR 2 Section 5.4.2.
3.5.15	Final lock: lock latch disengage force.	USCAR 2, Section 5.4.2.4. 110N min.	USCAR 2, Section 5.4.2
3.5.16	Polarizing feature effectiveness plug to header mis-orientation or mis-coding	USCAR 2, Section 5.4.4.4. 150N min. or 3 times mating force.	USCAR 2, Section 5.4.4.4.
3.5.17	Cable seal retainer Insertion	USCAR 2, Section 5.4.5.4. 60N max.	USCAR 2, Section 5.4.5.
3.5.18	Cable seal retainer Retention	USCAR 2, Section 5.4.5.4. 110N min.	USCAR 2, Section 5.4.5.
3.5.19	CPA insertion, final lock position	USCAR 37 Section 5.4.5.4 22N max. when Connector mated.	USCAR 37 Section 5.4.5.
3.5.20	CPA extraction, final lock to pre-lock	USCAR 2 Section 5.4.5.4 10N min, 30N max.	USCAR 2 Section 5.4.5.
3.5.21	CPA Removal	USCAR 2 Section 5.4.5.4 60N min.	USCAR 2 Section 5.4.5.
3.5.22	TPA insertion	USCAR 2 Section 5.4.5.4 60N max.	USCAR 2 Section 5.4.5.
3.5.23	TPA extraction, final lock to pre-lock	USCAR 2 Section 5.4.5.4 18N min, 60N max.	USCAR 2 Section 5.4.5.
3.5.24	TPA Removal	USCAR 2 Section 5.4.5.4 25N min.	USCAR 2 Section 5.4.5.
3.5.25	Connector-Connector audible Click	USCAR 2, Section 5.4.7.4. 7dBA min. above ambient.	USCAR 2, Section 5.4.7.
3.5.26	Connector-Connector audible Click: Moisture Conditioned	USCAR 2, Section 5.4.7.4. 5dBA min. above ambient.	USCAR 2, Section 5.4.7.
3.5.27	Connector drop test, plug	USCAR 2, Section 5.1.8.4. No damage.	USCAR 2, Section 5.4.8.

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Para.	Test Description	Requirement	Procedure
3.5.28	Connector drop test, header	USCAR 2, Section 5.1.8.4. No damage.	USCAR 2, Section 5.4.8.
3.5.29	Connector cycling	USCAR 2, Section 5.1.7.4. No damage.	USCAR 2, Section 5.1.7.4. 50 times.
3.5.30	Maximum test current capability of connector assembly	See to derating curve.	USCAR 2, Section 5.3.3.
3.5.31	1008 hour current cycling	USCAR 2, Section 5.3.4 All resistance measurements were less than 1.5 mΩ.	USCAR 2, Section 5.3.4. 350A using 70mm ² cable.
3.5.32	Voltage drop – HV, conductors only	USCAR 2, Section 5.3.2.4. 1.5mΩ max.	USCAR 2, Section 5.3.2.
3.5.33	Dry circuit – Initial, Shield only	USCAR 2, Section 5.3.2.4. 10mΩ max.	USCAR 2, Section 5.3.1.
3.5.34	Mechanical shock	USCAR 2, Section 5.1.9.4. No loss of continuity	USCAR 2, Section 5.4.6. 35G's half-sine shock pulses 10 ms duration in each axis.
3.5.35	Vibration	USCAR 2, Section 5.4.6.4. No loss of continuity	USCAR 2, Section 5.4.6. 8 hours per axis, profile per Figure 5.4.6.3-D.
3.5.36	Thermal shock, class III	USCAR 2, Section 5.6.1.4. No visible degradation, cracking, or loss of function evident on any test samples, examined at the aid of 10X magnification.	USCAR 2, Section 5.6.1. -40°C~125°C, 100 times.
3.5.37	10A rated resistance, final, shield, only	USCAR 2, Section 5.3.2.4. 10mΩ max.	USCAR 2, Section 5.3.1.
3.5.28	Isolation resistance: circuit to circuit, and each circuit to shield.	USCAR 2, Section 5.5.1.4 all isolation resistance 100MΩ min. at 500VDC.	USCAR 2, Section 5.5.1.4.
3.5.39	Temperature/humidity cycling, class III	USCAR 2, Section 5.6.2 No visible degradation, cracking, or loss of function evident on any test samples, examined at the aid of 10X magnification	USCAR 2, Section 5.6.2 Temperature 125°C, 40 cycles.
3.5.40	High temperature exposure, class II	USCAR 2, Section 5.6.3.4	USCAR 2, Section 5.6.3. Temperature 100°C, for 1008hours.

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Para	Test Description	Requirement	Procedure
3.5.41	Fluid resistance	USCAR 2, Section 5.6.4.3. No visible degradation, cracking, or loss of function evident on any test samples, examined at the aid of 10X magnification.	USCAR 2, Section 5.6.4 Submerge at least 1 sample in each fluid for 30 minutes; leave the samples at lab ambient temperature for 7 days.
3.5.42	Dielectric withstand: circuit to circuit, and each circuit to shield, 4000V.	No arcing or flashover at 4000V DC.	USCAR 37, Section 5.5.2.
3.5.43	Heat soak and submersion	USCAR 2, Section 5.6.5. No fluid ingress.	USCAR 2, Section 5.6.5.3. Heat soak the samples for 2 hours, submerge at a depth of 30~40cm for 30 minutes. Repeat 4 times
3.5.44	Pressure/vacuum leak, initial.	USCAR 2, Section 5.6.6.4. No leaks at 48 Kpa.	USCAR 2, Section 5.6.6
3.5.45	Pressure/vacuum leak, final.	USCAR 2, Section 5.6.6.4. No leaks at 28 Kpa final.	USCAR 2, Section 5.6.6
3.5.46	Header and plug touch, safe when unmated.	No contact between HV and 12mm diameter finger probe.	DIN 40050 Part 9 IEC-60529, IP2B.
3.5.47	Spray exposure at 9K level.	USCAR 2, Section 5.8.1.4. No ingress of water.	USCAR 2, Section 5.8.1
3.5.48	Ferrule retention.	USCAR 37, Section 5.2.4.5 150N min.	USCAR 37, Section 5.2.4
3.5.49	HVIL system	If HVIL system is opened, it must ensure the continuity of power contact system.	LV215-1 4.4.1.

3.6 Qualification and Test Sequence

Table 2 – Qualification and Test Sequences

Test or Examination	Test Group(a)									
	1	2	3	4	5	6	7	8	9	10
	Test Group(b)									
Visual inspection	1,6	1,4	1,8	1,4	1,3	1,10	1,3	1,3	1,3	1,3
Terminal assy-to-Connector Insertion, plug	2									
Forward stop, Terminal assy, plug	3									
Terminal assy-to-Connector Extraction: Moisture conditioned, TPA engaged, plug	4									
Terminal assy-to-Connector Extraction: After temperature/humidity, plug	5									
Terminal 11mm-to-Connector Extraction: Moisture conditioned, header		2								
Terminal 11mm-to-Connector Extraction: After temperature/humidity, header		3								
Forward stop, 0.64mm shunting bar.			2							
Terminal-to-Connector Extraction: Dry as molded, 0.64mm shunting bar.			3							
Terminal-to-Connector Extraction: Moisture conditioned, 0.64mm shunting bar.			4							
Terminal-to-Connector Extraction: Dry as molded, HVIL 2P receptacles.			5							
Terminal-to-Connector Extraction: Moisture conditioned HVIL 2P receptacles.			6							
Terminal-to-Connector Extraction: After temp/humidity 0.64mm shunting bar.			7							
Mating Force				2						
Final lock: lock latch disengage force.				3						
Polarizing feature effectiveness, plug to header mis-orientation or mis-coding					2					
Cable seal retainer Insertion						2				
Cable seal retainer Retention						3				
CPA insertion force, final lock position						4				
CPA extraction, final lock to pre-lock						5				
CPA Removal						6				
TPA insertion						7				
TPA extraction, final lock to pre-lock						8				
TPA Removal						9				
Connector-Connector audible Click							2			
Connector-Connector audible Click: moisture Conditioned								2		
Connector drop test, plug									2	
Connector drop test, header										2

Figure 2 (continued)

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Test or Examination	Test Group(a)												
	11	12	13	14	15	16	17	18	19	20	21	22	23
	Test Group(b)												
Visual inspection	1,9	1,9	1,8	1,10	1,8	1,5	1	1,6	1,8	1	1	1	1
Connector cycling	2	2	2	2	2			2	2				
Maximum test current capability of connector assembly	3,7												
1008 hour current cycling	5												
Voltage drop – HV conductors only	4,6,8	3,7	3,6	3,7	3,6								
Dry circuit – Initial, Shield only		4	4	4	4								
Mechanical shock		5											
Vibration		6											
Thermal shock, class III			5					3					
10A rated resistance, final, shield, only		8	7	8	7								
Isolation resistance:Ckt 1 to ckt 2, ckt 1 and ckt 2 to shield,				5,9		2,4		5	3,5,7				
Temperature/humidity cycling, class III				6									
High temperature exposure, class II					5								
Fluid resistance						3							
Dielectric withstand:Ckt 1 to ckt 2, and ckt 1 and ckt 2 to shield, 4000V							2						
Heat soak and submersion								4					
Pressure/vacuum leak, initial									4				
Pressure/vacuum leak, final									6				
Header and plug touch, safe when unmated										2			
Spray exposure at 9K level											2		
Ferrule retention												2	
HVIL system													2

Note (a) See paragraph 4.1 A.

(b) Numbers indicate sequence in which tests are performed.

Figure 2 (end)

4. Quality Assurance Provisions

4.1 Qualification Testing

A. Sample Selection

All specimens must be prepared in accordance with applicable specifications, at least 3 PCS for each test group.

B. Test Sequence

Qualification inspection must be conducted as the sequence specified in Table 2.

4.2 Requalification Testing

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

4.3 Acceptance

Acceptance is based on verification that product meets requirements of Table 1. Failures attributes to equipment, test setup, or operator deficiencies shall disqualify the product. When product failure occurs, corrective action shall be taken and samples resubmitted for qualification. Testing to confirm corrective action is required before resubmitted.

4.4 Quality Conformance Inspection

The applicable TE quality inspection plan will 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.