SPE T1 Industrial M8 Hybrid connectors IP67

1. Scope

.1 Contents

This specification covers the requirements for product performance, test methods and quality assurance provisions SPE M8 Hybrid connector family.

2. Applicable Documents:

The following documents form a part of this specification to the extent specified herein. 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 Specifications:

- 501-137521: Qualification Test Report
- 114-137144-1: Application specification

2.2 Commercial Standards and Specifications:

- IEC 63171-6: Detail specification for SPE M8 Hybrid connector— (IEC FDIS 63171-6 @ IEC 2021)
- IEC 60512: Electromechanical Components for Electronic Equipment; Basic Testing Procedure and Measuring Methods
- IEC 60529: Degree of Protection Provided by Enclosures (IP Code)

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:

Material used in the construction of this product should be as specified on the applicable product drawing.

3.3 Ratings:

3.3.1 Electrical

A. Voltage Rating: SPE M8 Hybrid connector: 60VDC (4 way)

B. Current Rating: 8A Power pin
4A Signal pin

C. Temperature Rating: －40° C to 85° C

D. Insulation Resistance: 500MΩMin.

3.3.2 Environmental

Sealing Requirements: IP67

Durability: 100 cycles

3.4 Performance Requirements and Test Descriptions:

The product shall be designed to meet the electrical, mechanical and environmental performance requirements specified in Table 1

All tests shall be performed at the ambient environmental conditions per IEC 60512, unless otherwise specified.

3.5 Test Requirements and Procedures Summary

Para	Test Items	Requirements	Procedures
3.5.1	Examination of product	No defect would impair normal operation	Visual inspection, No physical damage. IEC 60512, Test 1a
Electrical Requirements			
3.5.2	Withstanding voltage	1-minute hold with no breakdown or flashover.	1000 Volts DC, hold for 1 minute between adjacent contacts and power contacts to shield 2250 volts DC between signal contacts and shield IEC 60512-4-1
3.5.3	Insulation Resistance	500MΩMin.	500V DC between adjacent contacts IEC 60512, Test 3a, Method A
3.5.4	LLCR	Initial value: 20mΩ max. Rise in relation to initial value 20mΩ maximum. Shielding resistance: 100mΩ maximum	Subject specimens to 100 milliamps maximum and 20 millivolts maximum open circuit voltage Test points refer to Fig.1 IEC 60512-2-1, Test 2a
3.5.5	Temperature Rising	The current-carrying capacity of connectors shall comply with the de-rating curve, Figure 2. Power and signal contacts energized respectively.	IEC 60512-5-2, Test 5a
Mechanical Requirements			
3.5.6	Impacting water (IPX7)	No ingress of water	IEC 60529, Test 14.2.7
3.5.7	Dust (IP6X)	No deposit dust on contact	IEC 60529, Test 6, table 7
3.5.8	Durability	Contact resistance: Δ20mΩ max. .	Mate and un-mate specimens for cycles at a maximum speed of operations=10mm/s, Rest: 30s, unmated MPL: 100 cycles. IEC 60512-9-1, Test 9a
3.5.9	Mating/Un-mating Force	50N Max.	Operation speed: 10mm/min. Measure force necessary to mate samples. IEC 60512-13-2, Test 13b

3.5.10	Sinusoidal vibration	1: No discontinuities >1 µs 2: Contact resistance: Δ20mΩ max. 3: There shall be no defect that would impair normal operation 4: Test fixture as Figure 3	10 Hz – 500 Hz, 0,35 mm; 50 m/s2 3 axes, each 2 h IEC60512-6-4, Test 6d
3.5.11	Mechanical Shock	1: No discontinuities > 1 µs microsecond or longer duration 2: There shall be no defect that would impair normal operation 3: Test fixture as Figure 3	Subject mated specimens to 300 m/s2 half-sine shock pulses of 11 ms duration, 3 shocks in both directions of 3 mutually perpendicular directions (totally 18 shocks IEC 60512-6-3
3.5.12	Polarizing method	It shall not be possible to mate the connectors in any other than the correct manner.	IEC 60512-13-5, Test 13e –Engaging force: 1,5 x total insertion force but 50 N minimum
Environmental Requirements			
3.5.13	Rapid change in temperature	no physical damage	IEC 60512-11-4, Test 11d Subject mated specimens to 10 cycles between -40 °C and 85 °C with 30 min dwell at temp. extremes and 1 min transition between temperatures
3.5.14	Dry heat	See Note. Insulation resistance at high temperature	IEC 50512-11-9, Test 11i Subject mated specimens to 85°C for 21 days
3.5.15	Humidity/Temperature cycling	no physical damage.	IEC 60068 -2-38, test Z/AD low temperature 25 °C, high temperature 65 °C, cold sub-cycle –10 °C humidity 93 %, duration 24h/cycle, total 10 cycles
3.5.16	Damp heat, steady state	no physical damage.	IEC 60512-11-3, Test 11c Subject mated specimens to a relative humidity of 93 % at a temperature of 40 °C for 21 day
3.5.17	Cold	no physical damage.	IEC 60512-11-10, Test 11j Subject mated samples to a temperature of -40°C for 2 h Recovery time: 2h
3.5.18	Mixed flowing gas	no physical damage	IEC 60512-11-7, Test 11g Method 4, duration 4 days, half mated And half unmated

3.5.19	Electrical load and temperature	no physical damage.	IEC 60512-9-2, Test 9b 500 h 85 °C Recovery period 2 h
Signal integrity			
3.5.20	Insertion loss	All pairs: ≤ 0,02 $\sqrt{f}$ dB from 0.1 MHz to 600 MHz And 0.1dB is minimum	IEC 60512-28-100, test 28a Mated connectors
3.5.21	Return loss	≥ 74-20log (f) dB from 0.1 MHz to 600 MHz And 30dB is maximum	IEC 60512-28-100, test 28b Mated connectors
3.5.22	Transverse conversion loss	≥ 68-20log (f) dB from 0.1 MHz to 600 MHz And 50dB is maximum	IEC 60512-28-100, test 28f Mated connectors
3.5.23	Transverse conversion transfer loss	≥ 68-20log (f) dB from 0.1 MHz to 600 MHz And 50dB is maximum	IEC 60512-28-100, test 28g Mated connectors
3.5.24	Transfer impedance	Z ≤ 0.05 x $f^{0,5}$ Ω from 0.1 MHz to 10 MHz and Z ≤0.01 x f Ω from 10 MHz to 80 MHz	IEC 60512-26-100, Test 26e Mated connectors
3.5.25	Coupling attenuation	All types: ≥ 65–20log (f/100) dB, from 0.1 MHz to 600 MHz And 65dB is maximum Note: The coupling attenuation requirement is assumed to be fulfilled when the transfer impedance and unbalance attenuation requirements are met on the full bandwidth.	IEC 62153-4-15 For coupling attenuation with triaxial cell. Mated connectors
3.5.26	Input to output resistance	Signal contact resistance 50 mΩ maximum Screen resistance 100 mΩ max	IEC 60512-2-1, Test 2a Mated connectors Arrange according to Fig. 1
3.5.27	Input to output resistance unbalance	Among all signal conductors, maximum difference between maximum and minimum 25 mΩ maximum	IEC 60512-2-1, Test 2a Mated connectors Arrange according to Fig.1

3.6 Product Qualification Test Sequence

TEST OR EXAMINATION	TEST GROUP								
	P(a)	AP	BP	CP	DP	EP	FP	GP	HP
	Test Sequence								
Examination of product	1	15	10	7	6	2,7			2
Withstanding voltage	4	3,12	9	5	5	6			
Insulation resistance	3	4,13	8	4	4	5			
LLCR	2	5,11	3,5,7	3	3	4			
Derating Temperature Rising									1
Impacting water (IPX7)		9							
Dust (IP6X)		10(b)							
Durability			2(c),6(c)		1				
Mating and Un-mating Force		1,14	1	1,6					
Sinusoidal vibration						1			
Mechanical shock						3			
Polarizing method		16							
Rapid change in temperature		2							
Dry heat		6						1	
Humidity/Temperature cycling		7						2(c)	
Damp heat, steady state				2					
Cold		8							
Mixed flowing gas			4						
Electrical load and temperature					2				
Insertion loss							1		
Return loss							2		
Transverse conversion loss							3		
Transverse conversion transfer loss							4		
Transfer Impedance							5	3	
Coupling attenuation							6	4	
Input to output resistance							7		
Input to output resistance unbalance							8		
Test specimens	20	3	3	6	3	3	2	2	2

NOTE:

(a) When the initial test group P has been completed, the specimens are divided in the 7 groups AP, BP, CP, DP, EP, HP, All connectors in each group shall undergo the tests specified for the relevant group numbers indicate sequence in which tests are performed.

(b) It's allowed to perform with an additional specimen, extending the total number of specimens by 1.

(c) Half of specimens

Table 2

4. Quality Assurance Provisions

4.1 Qualification Testing

A. Specimen Selection

Plugs and receptacles should be prepared in accordance with applicable Instruction Sheet and should be elected at random from current production. Each test group shall consist of 3 specimens Min. unless otherwise stated.

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 or controlling industry specification, 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.

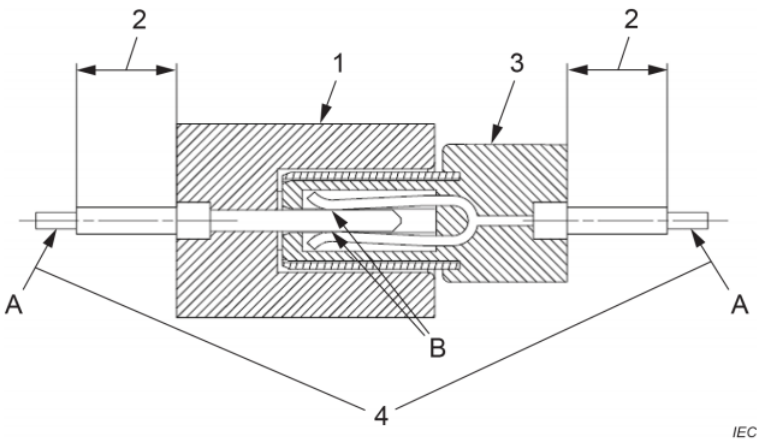
4.3 Acceptance

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 samples resubmitted for qualification. Testing to confirm corrective action is required before resubmitted.

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.

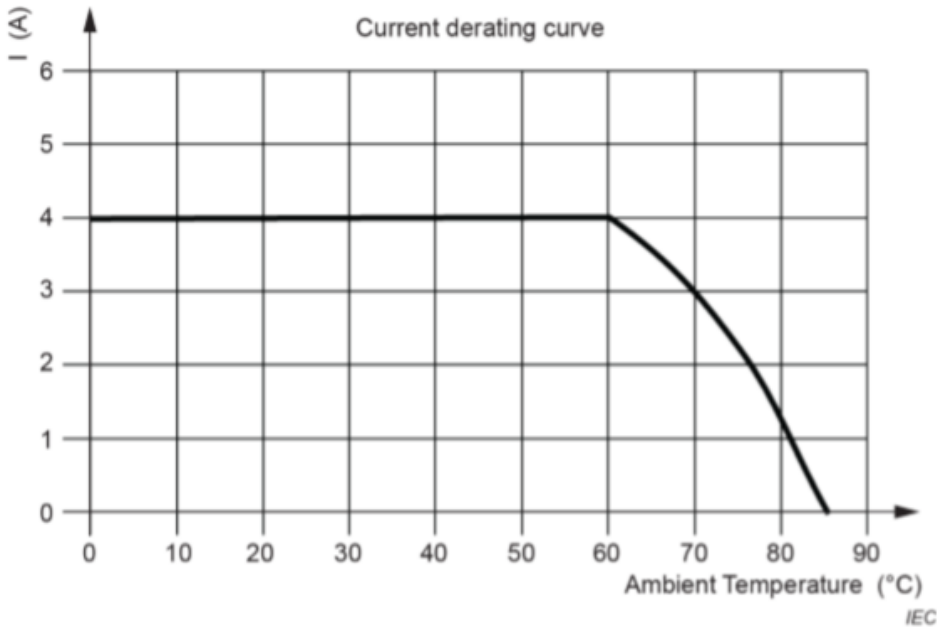
4.5 Test fixture illustration



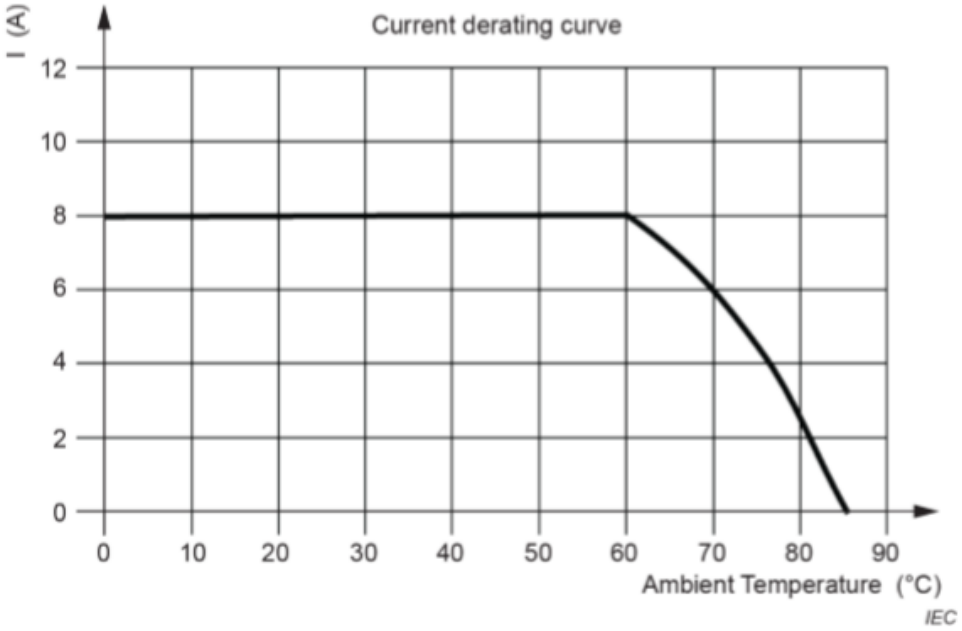
Key

1	Fixed connector
2	Attached wires: as short as practical
3	Free connector
4	Contact resistance measuring points
A	Fixed connector contact point
B	Contact resistance point
C	Free connector contact point

Fig.1 Contact resistance arrangement

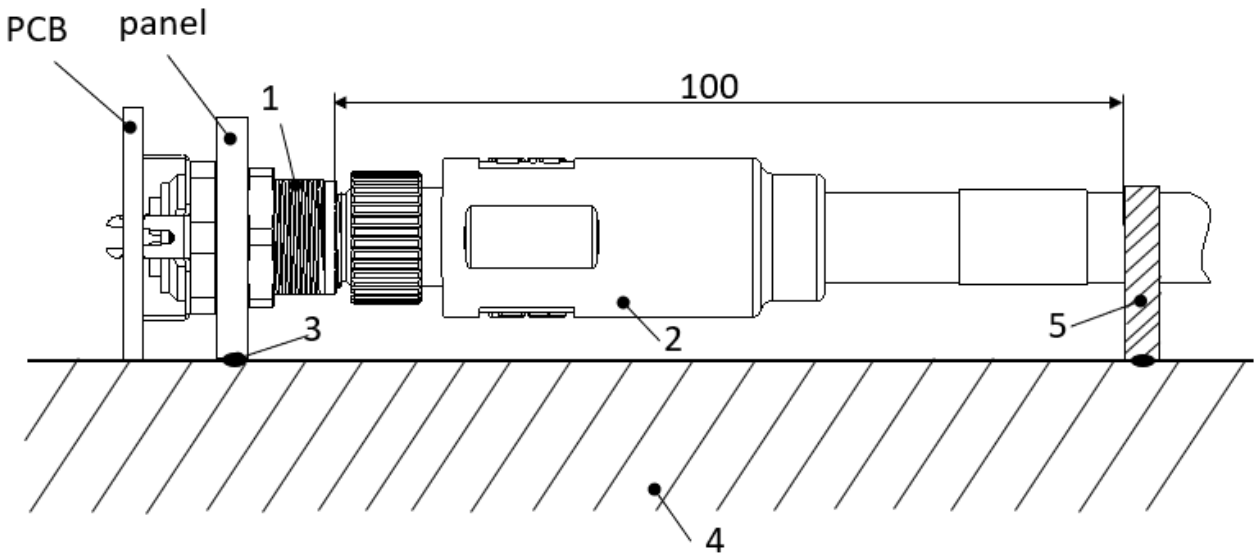


Derating diagram for the 0.5mm data pin



Derating diagram for the 1mm power pin

Fig.2 Derating diagrams



Key

1. Fixed connector
2. Free connector
3. Secure to the vibration
4. Mounting plate
5. Cable clamp

Fig.3 Arrangement for vibration and mechanical shock tests