M12 Push-pull Circular Connector

1. Scope

1.1 Contents

This specification covers the requirements for product performance, test methods and quality assurance provisions of M12 Push-pull connector

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:

- 501-137420: Qualification Test Report

2.2 Commercial Standards and Specifications:

- IEC 61076-2-101: Detail specification for M12 connectors with screw-locking
- IEC 61076-2-012: Detail specification with M12 Push-pull connectors
- 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 (IEC Standard)

A. Voltage Rating: M12: 250V (≤4 way)/60V (5 way)
B. Current Rating: 4A Max.
C. Temperature Rating: －40° C to 85° C (Fixed Panel mount Connectors)
D. Insulation Resistance: 100MΩMin.

3.3.2 Environmental

Sealing Requirements: IP65/IP67

Durability: 100 cycles

3.4 Performance Requirements and Test Descriptions:

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

3.4.2 The product shall be designed to meet transmission requirement for D-code as IEC 61076-2-101, all test item refer to test group FP.

3.4.3 All tests shall be performed at the ambient environmental conditions per IEC 512, 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	Voltage proof (withstanding voltage)	1-minute hold with no breakdown or flashover.	1400(4 pins) /1000(5 pins) volts AC or DC, hold for 1 minute between adjacent contacts/ between contacts and shield IEC 60512-4-1
3.5.3	Insulation Resistance	100MΩMin.	500V DC between adjacent contacts IEC 60512-3-1, Test 3a, Method A
3.5.4	LLCR	Initial value: 10mΩ max.	Subject specimens to 100 milliamps maximum and 20 millivolts maximum open circuit voltage Test points refer to Fig.3 IEC 60512-2-1, Test 2a
3.5.5	Temperature Rising	30° C MAX under loaded rating current.	Stabilize at rate current level until 3 readings at 5 minutes intervals are within 1°C IEC 60512-5-2, Test 5a
Mechanical Requirements			
3.5.6	Impacting water (IPX7)	No ingress of water under mating condition	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: Δ15mΩ max. .	Mate and un-mate specimens for cycles at a maximum speed of operations=10mm/s, Rest:30s, un-mated 100 cycles Min. for gold plating IEC 60512-9-1, Test 9a
3.5.9.1	Mating/Un-mating Force (with latch)	Mating force 45N Max. Un-mating force 45N Max.	Operation speed: 10mm/min. Measure force necessary to mate samples. The force should be applied on the locking activation ring IEC 60512-13-1, Test 13a

Para	Test Items	Requirements	Procedures
3.5.9.2	Mating/Un-mating Force (without latch)	15N/15N Max. for 2-5 pins	Operation speed: 10mm/min. Measure force necessary to mate samples. IEC 60512-13-1, Test 13a
3.5.10.1	Latch strength Pull-out force	100N Min. under locked mating condition, and applied for 60S±5S	Operation speed: 10mm/min. Measure force necessary to mate samples. IEC 60512-15-6, Test 15f
3.5.10.2	Rotating test	No defects	Applied the mating products as Fig. 4. Height: Rotating rate: 10±2rpm IEC 60998-2-1, 10.104, item 6.3.2.2
3.5.11	Sinusoidal vibration	1: Duration of disturbance 1μs max. 2: Contact resistance: Δ15mΩ max. 3: There shall be no defect that would impair normal operation	10Hz to 500Hz and 0.35mm or 50 m/s^2 Sweep cycles:10 Full duration:6H IEC 60512-6-4, Test 6d
3.5.12	Mechanical Shock	1: Duration of disturbance 1μs max. 2: Contact resistance: Δ15mΩ max. 3: There shall be no defect that would impair normal operation	Subject mated specimens to 50G's half-sine shock pulses of 11 milliseconds duration with 3.44m/s velocity change. Three shocks in each direction applied along 3 mutually perpendicular planes, 18 total shocks. IEC 60512-6-3, Test 6c
Environmental Requirements			
3.5.13	Rapid change in temperature	See Note.	IEC 60512-11-4 Subject specimens to 5 cycles between -40°C to 85°C with 30 minutes dwells at temperature extremes Refer to 3.3.1.C: Temperature Rating
3.5.14	Dry heat	See Note. Insulation resistance at high temperature	IEC 50512-11-9 Subject mated specimens to 85°C for 16 hours
3.5.15	Damp heat, cyclic	See Note.	IEC 60512-11-12 Subject specimens to 5 cycles (5 days) Temperature:40°C Recovery time:2h

Para	Test Items	Requirements	Procedures
3.5.16	Cold	See Note.	IEC 60512-11 Temp.: -40°C Duration:2h Recovery time:2h Refer to 3.3.1.C: Temperature Rating
3.5.17	Mixed flowing gas	See Note.	IEC 60068-2-60, Method 4 Subject mated specimens to flowing mixed gas corrosion-4 days

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

Fig. 1 (END)

3.6 Product Qualification Test Sequence

Test or Examination	Test Group					
	P(a)	AP	BP	CP	DP	
	Test Sequence					
Examination of product	1	3,6,11,20,26	2,4,12	9	8	
Voltage proof (withstanding voltage)	4	10,19,25	11,15	4,8	4,7	
Insulation resistance	3	9,13,18,24	14	3,7	3,6	
LLCR	2	2,5,8,17,23	6,8,10	2	2	
Temperature Rising				5(e)		
Impacting water		21	13	6	5	
Dust (IP6X)		22(b)				
Durability			5(f),9(g)			
Mating and Un-mating Force (with latch)			17			
Mating and Un-mating Force (without latch)			16			
Latch strength pull-out force			1			
Rotating test			3			
Sinusoidal vibration		1				
Mechanical shock		4				
Rapid change in temperature		7		1		
Dry heat		12				
Damp heat, cyclic		14(c),16(d)				
Cold		15				
Mixed flowing gas			7		1	
Specimen QTY	20	5Pcs				

NOTE:

(a) When the initial test group A has been completed, the specimens are divided in the 3 groups B, C, D. 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) First cycle

(d) Remaining cycles

(e) Test with additional specimen for over-molding type cable assembly

(f) Mechanical operation (half of the specified number of operations)

(g) Mechanical operation (remaining of the specified number of operations)

Fig.2

4. QUALITY ASSURANCE PEOVISIONS

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 figure 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 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 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.

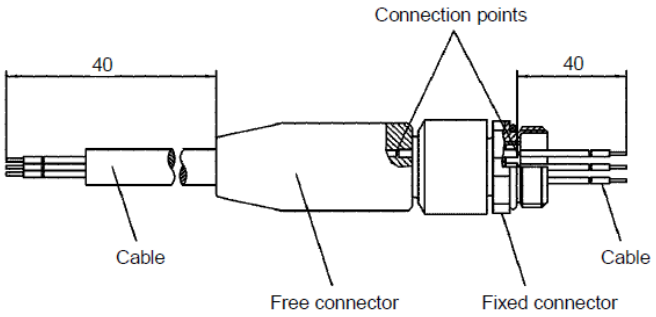

Fig.3 Contact resistance arrangement

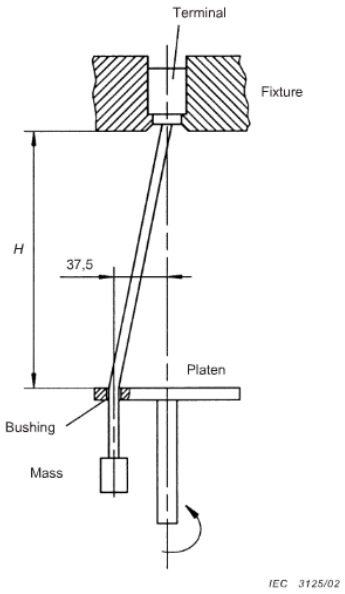

Fig.4 Rotating test arrangement