Industrial M8 and M12 Series Circular Connector

1 Scope

1.1 Contents

This specification covers the requirements for product performance, test methods and quality assurance provisions of M8/M12 series 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:

- 501-106140: Qualification Test Report for M12 Screw Type Connector (T411XXXXXXX-XXX)
- 501-106140-1: Qualification Test Report for M12 Cable Assembly (T415XXXXXXX-XXX and T416XXXXXXX-XXX)
- 501-106140-2: Qualification Test Report for M8 Cable Assembly (T405XXXXXXX-XXX and T406XXXXXXX-XXX)
- 501-106140-3: Qualification Test Report for M12 Panel mount (T413XXXXXXX-XXX and T414XXXXXXX-XXX and T417XXXXXXX-XXX)
- 501-106140-4: Qualification Test Report for M8 Screw Type Assembly (T401XXXXXXX-XXX)
- 501-106140-5: Qualification Test Report for M8 Panel mount (T403XXXXXXX-XXX and T404XXXXXXX-XXX and T407XXXXXXX-XXX)
- 501-106140-6: Qualification Test Report for M8 Y/T Distributor (T40811X200X-000 and T40821X200X-000)
- 501-106140-7: Qualification Test Report for M12 Cable Assembly (TAAXXXXXXXX-XXX, TABXXXXXXXX-XXX)
- 501-106140-8: Qualification Test Report for M12 Cable Assembly (TADXXXXXXXX-XXX)
- 501-106140-9: Qualification Test Report for M12 Screw Type Green Connector (T411XXXXXXX-XXX)
- 501-106140-10: Qualification Test Report for Industrial M12 series circular connector (T411XXXXXXX-XXX)
- 501-106140-11: Qualification Test Report for Industrial M12 series cable assembly (TAD14545101-XXX / TAD14541111-XXX / TAD1453A201-XXX / TAD2453A201-XXX)
- 501-106140-12: Qualification Test Report for Industrial M12 series cable assembly (2373341-1)
- 501-106140-13: Qualification Test Report for Industrial M8 series screw assembly (T401XX08XX2-XXX un-shielded type)
- 501-106140-14: Qualification Test Report for Industrial M8 8pin Series Connector (T407X01X08S-XXX, panel mount with wire / T4061XDS0X8-XXX, Cord set, Shielding type)

2.2 Commercial Standards and Specifications:

- IEC 61076-2-101: Detail specification for M12 connectors with screw-locking
- IEC 61076-2-104: Detail specification with M8 screw-locking or snap-locking
- IEC 60512: Electromechanical Components for Electronic Equipment; Basic Testing Procedure and Measuring Methods
- IEC 60529: Degree of Protection Provided by Enclosures (IP Code)
- IEC/EN 60664-1: Insulation coordination for equipment within low-voltage systems

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. Rated Voltage: Refer to Table 3.

B. Rated Current: Refer to Table 3.

C. Insulation Resistance: 100 MΩ Min.

3.3.2 Environmental

- Operation Temperature:

  －25° C to 85° C (For cable assembly & Y/T Distributor Connector / M8 8Pin series)
  －40° C to 85° C (Screw Type Connector & Panel mount Connectors)

- Sealing Requirements: IP67

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 60512-1-1, Test 1a
Electrical Requirements			
3.5.2	Voltage proof (withstanding voltage)	1 minute hold with no breakdown or flashover.	For M8: (3/4pins) 1000 V AC or DC, (5/6/8pins) 650 V AC or DC hold for 1 minute between contacts. (3/4pins) 850 V AC or DC, (5/6/8pins) 650 V AC or DC hold for 1 minute between contacts and metal-housing. For M12: (4 pins) 1400V / (5 pins) 1000V / (8 pins) 650V / (12pins) 500 V AC or DC, hold for 1 minute between adjacent contacts/contacts and shield IEC 60512-4-1, Test 4a
3.5.3	Insulation Resistance	100 MΩ Min.	500 V DC between adjacent contacts IEC 60512-3-1, Test 3a, Method A
3.5.4	LLCR	Initial value: 10mΩ max. After value: Δ15mΩ max. For M8 Y/T Distributor: Initial value: Ref	Subject specimens to 100 milliamps Max. and 20 millivolts Max. open circuit voltage Test points refer to Fig.1 IEC 60512-2-1, Test 2a
3.5.5	Temperature Rising	30° C MAX under loaded rated current. (See Table 3)	Stabilize at rated current level until 3 readings at 5 minutes intervals are within 1°C IEC 60512-5-2, Test 5b
Mechanical Requirements			
3.5.6	Impacting water	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: Δ15mΩ max. For M8 Y/T Distributor: Contact resistance: Δ30mΩ max.	Mate and un-mate specimens for cycles at a Max. speed of operations=10mm/s, Rest:30s, unmated 100 cycles for gold plating 50 cycles for silver plating 20 cycles for tin plating EIA 364-09-1
3.5.9	Mating/Un-mating Force	15N/15N Max. for 2-5 pins 23N/30N Max. for 6-12 pins 30N/30N Max. for 13-17 pins	Operation speed: 10mm/min. Measure force necessary to mate samples. EIA 364-13
3.5.10	Sinusoidal vibration	1: Duration of disturbance 1μs max. 2: Contact resistance: Δ15mΩ max. For M8 Y/T Distributor: Δ30mΩ max. See Note.	10Hz to 500Hz and 0.35mm or 50 m/s^2 Sweep cycles:10 Full duration:6H IEC 60512-6-4, Test 6d

3.5.11	Mechanical Shock	1: No discontinuities of 1 microsecond or longer duration 2: Contact resistance: Δ15mΩ max. For M8 Y/T Distributor: Δ30mΩ max. See Note.	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. EIA 364-27
Environmental Requirements			
3.5.12	Rapid change in temperature	See Note.	IEC 60512-11-4, Test 11d Subject specimens to 5 cycles between -40°C to 85°C or -25℃ to 85°C with 30 minutes dwells at temperature extremes Refer to 3.3.2: Operation Temperature
3.5.13	Dry heat	See Note. Insulation resistance at high temperature	IEC 50512-11-9, Test 11i Subject mated specimens to 85°C for 16 hours
3.5.14	Damp heat, cyclic	See Note.	IEC 60512-11-12, Test 11m Subject specimens to 5 cycles (5 days) Temperature:40°C Recovery time:2h
3.5.15	Cold	See Note.	IEC 60512-11-10, Test 11j Temp.: -40°C or -25℃ Duration:2h Recovery time:2h Refer to 3.3.2: Operation Temperature
3.5.16	Mixed flowing gas	See Note.	IEC 60068-2-60, Method 4 Subject mated specimens to flowing mixed gas corrosion-4 days
Electrical Transmission Requirements (if any)			
3.6.1	Insertion loss (IL)	All pairs: ≤ 0.04 √f dB from 1MHz to 100MHz. Attenuation at frequencies that correspond to calculated values of less than 0,1 dB shall revert to a requirement of 0,1 dB Max.	Mated connectors IEC60512-29-100, Test 29a
3.6.2	Near end Crosstalk (NEXT)	All pair: ≥ 83-20log(f) dB from 1MHz to 100MHz. NEXT loss at frequencies that correspond to calculated values of greater than 80 dB shall revert to a Min. requirement of 80 dB.	Mated connectors IEC 60512-29-100, Test 29c
3.6.3	Return loss (RL)	All pairs: ≥60-20log(f) dB from 1 MHz to 500MHz. Return loss at frequencies that correspond to calculated values of greater than 30 dB shall revert to a Min. requirement of 30 dB.	Mated connectors IEC 60512-29-100, Test 29b

3.6.4	Far end Crosstalk (FEXT)	All pair: ≥75.1-20log(f) dB from 1MHz to 100MHz. FEXT loss at frequencies that correspond to calculated values of greater than 75 dB shall revert to a Min. requirement of 75 dB.	Mated connectors IEC 60512-29-100, Test 29d
3.6.5	Transverse conversion loss (TCL)	All pairs: ≥ 68-20log (f) dB from 1MHz to 100 MHz. TCL at frequencies that correspond to calculated values of greater than 50 dB shall revert to a Min. requirement of 50 dB.	Mated connectors IEC 60512-29-100, Test 29f
3.6.6	Transverse conversion transfer loss (TCTL)	All pairs: ≥ 68-20 log (f) dB from 1 MHz to 100 MHz. TCTL at frequencies that correspond to calculated values of greater than 50 dB shall revert to a Min. requirement of 50 dB.	Mated connectors IEC 60512-29-100, Test 29g
3.6.7	Transfer impedance	≤ 0,1 x $f^{0.3}$ Ω from 1 MHz to 10 MHz ≤ 0,02 x f Ω from 10 MHz to 100 MHz	Mated connectors IEC 60512-26-100, Test 26e
3.6.8	Input to output Resistance	Measuring points as defined in Fig.1: Screen resistance:100mΩ Max.	Mated connectors IEC 60512-2-1, Test 2a

Table 1 (END)

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 Table 2.

3.6 Product Qualification Test Sequence

Test or Examination	Test Group					
	A(a)	B	C	D	E(f)	F(g)
	Test Sequence					
Examination of product	1	3,6,11,20,26	8	9	1	
Voltage proof (withstanding voltage)	4	10,19,25	4,7	4,8		
Insulation resistance	3	9,13,18,24	3,6	3,7		
LLCR	2	2,5,8,17,23	2	2	2,6	
Temperature Rising				5(e)		
Impacting water		21	5	6		
Dust (IP6X)		22(b)				
Durability					4	
Mating and Un-mating Force					3,5	
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			1			
Electrical transmission						1

Table 2

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) This test group should be tested without the screw nut

(g) Only applicable for M12 D-Coding connector for symmetrical pair cabling following IEC 61076-2-101

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 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.

5 Annex

Series	Code/Pin	Rated Current	Rated Voltage
M12	A-coding 2- 4 ways	4A	250V
	A-coding 5 ways	4A	60V
	6- 8 ways	2A	30V
	9- 17 ways	1.5A	30V
	B-coding 5 ways	4A	60V
	C-coding 3 ways (2+PE)	4A	250V
	4 ways (3+PE)	4A	250V
	5 ways (4+PE)	2A	60V
	6 ways (5+PE)	2A	30V
	D-coding 4 ways	4A	250V
	P-coding 5 ways (4+PE)	4A	60V
M8	A-coding 3/4 ways	3A	50V AC/60V DC
	6/8 ways	1.5A	30V AC/30V DC
	B-coding 5 ways	3A	30V AC/30V DC

Table 3 (Rated Current/ Voltage)

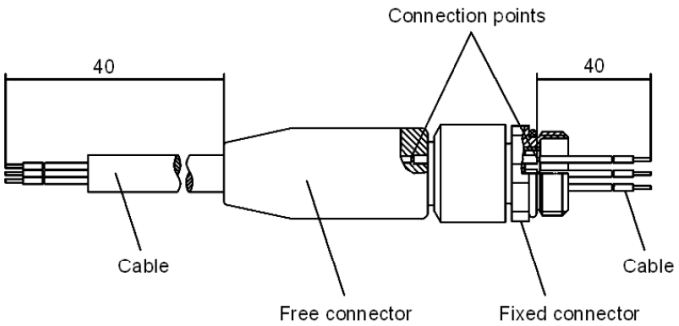

Fig.1 Contact resistance arrangement