Test Report

Industrial M12 Push-pull A-Code and D-code Panel Female Connector and M12 Push-pull cable assembly

1. INTRODUCTION

1.1 Purpose

Testing was performed on Industrial M12 Push-pull Circular Connector to determine its conformance to the requirements to product specification 108-137420.

1.2 Scope

This specification covers performance, test and quality requirements for Industrial M12 Push-pull Circular Connector. Testing was performed at TE Connectivity Shanghai Electrical Test Laboratory.

1.3 Product Description

Part Number	Interface	Type	Code	Poles
T4141510044-000	M12 Push-pull Panel Mount Female Connector	Shielded	D-Code	4 Pins
T4141010054-000		Un-Shielded	A-Code	5 Pins
T4141010054-001		Shielded		
T4151120015-***	M12 Push-pull Male Straight, Single end	Un-Shielded	A-Code	5 Pins
T4152623015-***	M12 Push-pull Male to Metric Female, Straight	Un-Shielded	A-Code	5 Pins
TAD14744101-***	M12 Push-pull Male Straight, Double end	Shielded	D-Code	4 Pins

***--cable length

1.4 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
Samples(sets)		5	5	5	5

(a) When the initial test group P has been completed, the specimens are divided in the 3 groups AP, BP, CP, DP. 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)

*** Notes:**

Numbers indicate the sequence in which the tests are performed.

1.5 Environmental Conditions

Unless otherwise specified, the following environmental conditions prevailed during testing:

- Temperature: 15 to 35°C
- Relative Humidity: 20 to 80%

2. SUMMARY OF TESTING

2.1. Initial Examination of Product

All specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2 Test Group
2.2.1 Test Group P+AP

Group	Test Item	Sample	Requirement	Test Condition and Result	Conclusion
P	LLCR	See 1.4	10 m Ω Max.	<10 m Ω	meet spec.
	Insulation resistance	See 1.4	100MΩ Min	>100MΩ	meet spec.
	Voltage Proof	See 1.4	No breakdown or flashover	No breakdown and flashover	meet spec.
AP	Sinusoidal vibration	See 1.4	No physical damage; No electrical discontinuity greater than 1μs	See 2.3.1 Fig.1	meet spec.
	LLCR	See 1.4	Δ15mΩ max.	<15 mΩ	meet spec.
	Examination of product	See 1.4	No defect would impair normal operation	Normal	meet spec.
	Mechanical shock	See 1.4	No physical damage; No electrical discontinuity greater than 1μs	See 2.3.2 Fig.2	meet spec.
	LLCR	See 1.4	Δ15mΩ max.	<15 mΩ	meet spec.
	Examination of product	See 1.4	No defect would impair normal operation	Normal	meet spec.
	Rapid change in temperature	See 1.4	No physical damage	See 2.3.3 Fig.3	meet spec.
	LLCR	See 1.4	Δ15mΩ max.	<15 mΩ	meet spec.
	Insulation resistance	See 1.4	100MΩ Min	>100MΩ	meet spec.
	Voltage proof (withstanding voltage)	See 1.4	No breakdown or flashover	No breakdown and flashover	meet spec.

	Examination of product	See 1.4	No defect would impair normal operation	Normal	meet spec.
	Dry heat	See 1.4	No physical damage	Normal	meet spec.
	Insulation resistance	See 1.4	100MΩ Min	>100MΩ	meet spec.
	Damp heat, cyclic	See 1.4	No physical damage	See 2.3.4 Fig.4	meet spec.
	Cold	See 1.4	No physical damage	Normal	meet spec.
	Damp heat, cyclic	See 1.4	No physical damage	See 2.3.4 Fig.4	meet spec.
	LLCR	See 1.4	Δ15mΩ max.	<15 mΩ	meet spec.
	Insulation resistance	See 1.4	100MΩ Min	>100MΩ	meet spec.
	Voltage proof (withstanding voltage)	See 1.4	No breakdown or flashover	No breakdown or flashover	meet spec.
	Examination of product	See 1.4	No defect would impair normal operation	Normal	meet spec.
	Impacting water	See 1.4	No water ingress	No water ingress	meet spec.
	LLCR	See 1.4	Δ15mΩ max.	<15 mΩ	meet spec.
	Insulation resistance	See 1.4	100MΩ Min	>100MΩ	meet spec.
	Voltage proof (withstanding voltage)	See 1.4	No breakdown or flashover	No breakdown or flashover	meet spec.
	Examination of product	See 1.4	No physical damage	Normal	meet spec.

2.2.2 Test Group P+BP

Group	Test Item	Sample Number	Requirement	Test Condition and Result	Conclusion
P	LLCR	See 1.4	10 m Ω Max.	<10 m Ω	meet spec.
	Insulation resistance	See 1.4	100MΩ Min	>100MΩ	meet spec.
	Voltage Proof	See 1.4	No breakdown or flashover	No breakdown and flashover	meet spec.
BP	Latch strength pull-out force	See 1.4	Mating and hold 60s when load 100N	>60s	meet spec.
	Examination of product	See 1.4	No defect would impair normal operation	Normal	meet spec.
	Rotating test	See 1.4	Load 50N, No defects	Normal	meet spec.
	Examination of product	See 1.4	No defect would impair normal operation	Normal	meet spec.
	Durability	See 1.4	No defect would impair normal operation	Normal	
	LLCR	See 1.4	Δ15mΩ max.	<15 mΩ	meet spec.
	Mixed Flowing Gas	See 1.4	No corrosion and defect	See 2.3.5 Fig.5	meet spec.
	LLCR	See 1.4	Δ15mΩ max.	<15 mΩ	meet spec.
	Insulation resistance	See 1.4	100MΩ Min	>100MΩ	meet spec.
	Voltage proof (withstanding voltage)	See 1.4	No breakdown or flashover	No breakdown and flashover	meet spec.
	Impacting water	See 1.4	No water ingress	No water ingress	meet spec.

	Insulation resistance	See 1.4	100MΩ Min	>100MΩ	meet spec.
	Voltage proof (withstanding voltage)	See 1.4	No breakdown or flashover	No breakdown and flashover	meet spec.
	Mating and Un-mating Force (without latch)	See 1.4	15N Max.	<15N	meet spec.
	Mating and Un-mating Force (with latch)	See 1.4	45N Max.	<45N	meet spec.

2.2.3 Test Group P+CP

Group	Test Item	Sample Number	Requirement	Test Condition and Result	Conclusion
A	LLCR	See 1.4	10 m Ω Max.	<10 m Ω	meet spec.
	Insulation resistance	See 1.4	100MΩ Min	>100MΩ	meet spec.
	Voltage Proof	See 1.4	No breakdown or flashover	No breakdown and flashover	meet spec.
CP	Rapid change in temperature	See 1.4	No physical damage	See 2.3.3 Fig.3	meet spec.
	LLCR	See 1.4	Δ15mΩ max.	<15 mΩ	meet spec.
	Insulation resistance	See 1.4	100MΩ Min	>100MΩ	meet spec.
	Voltage proof (withstanding voltage)	See 1.4	No breakdown or flashover	No breakdown and flashover	meet spec.
	Temperature Rising	See 1.4	ΔT 30°C Max.	See 2.3.6 Fig.6	meet spec
	Impacting water	See 1.4	No water ingress	No water ingress	meet spec.
	Insulation resistance	See 1.4	100MΩ Min	>100MΩ	meet spec.
	Voltage proof (withstanding voltage)	See 1.4	No breakdown or flashover	No breakdown and flashover	meet spec.
	Examination of product	See 1.4	No defect would impair normal operation	Normal	meet spec.

2.2.4 Test Group P+DP

Group	Test Item	Sample Number	Requirement	Test Condition and Result	Conclusion
A	LLCR	See 1.4	10 m Ω Max.	<10 m Ω	meet spec.
	Insulation resistance	See 1.4	100MΩ Min	>100MΩ	meet spec.
	Voltage Proof	See 1.4	No breakdown or flashover	No breakdown and flashover	meet spec.
DP	Mixed Flowing Gas	See 1.4	No corrosion and defect	See 2.3.5 Fig.5	meet spec.
	LLCR	See 1.4	Δ15mΩ max.	<15 mΩ	meet spec.
	Insulation resistance	See 1.4	100MΩ Min	>100MΩ	meet spec.
	Voltage Proof	See 1.4	No breakdown or flashover	No breakdown and flashover	meet spec.
	Impacting water	See 1.4	No water ingress	No water ingress	meet spec.
	Insulation resistance	See 1.4	100MΩ Min	>100MΩ	meet spec.
	Voltage Proof	See 1.4	No breakdown or flashover	No breakdown and flashover	meet spec.

2.3 Test Condition and results

2.3.1 vibration test

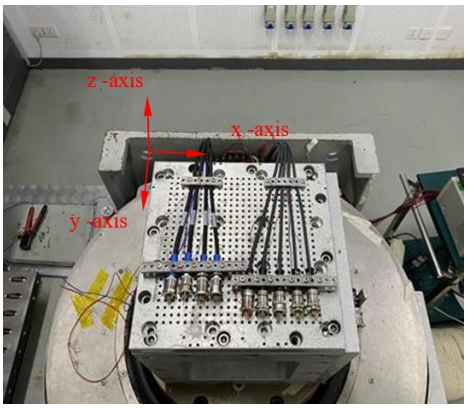


Fig.1

Table 1 - Test condition

Frequency (Hz)	Displacement 0-P（mm）	Acceleration(m/s2)	Direction	Sweep rate	Sweep type	Test Duration
10	0.35	/	X, Y, Z	0.9406Oct/min	Logarithmic	2h/direction
60.1	0.35	50				
500	/	50				

2.3.2 vibration test

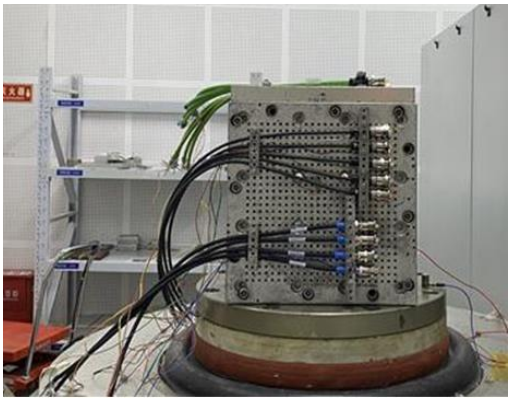
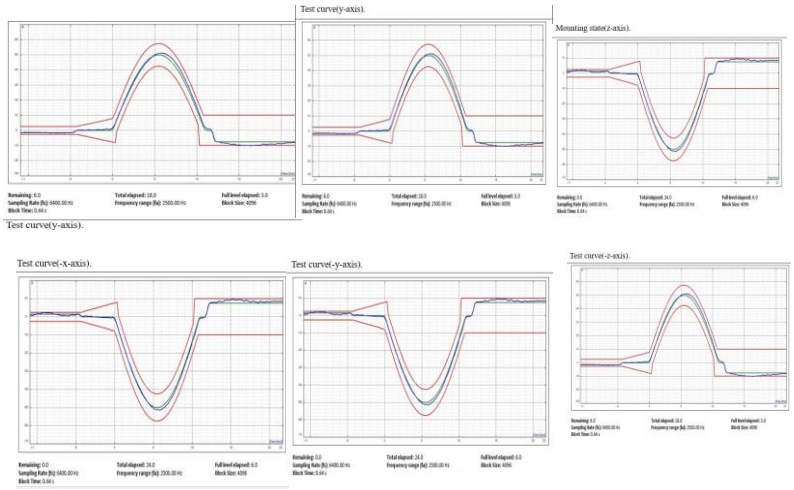
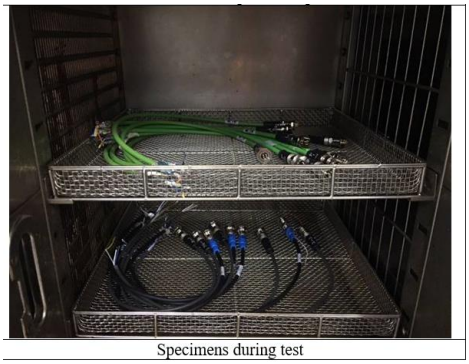


Fig.2



.3.3 Rapid change in temperature



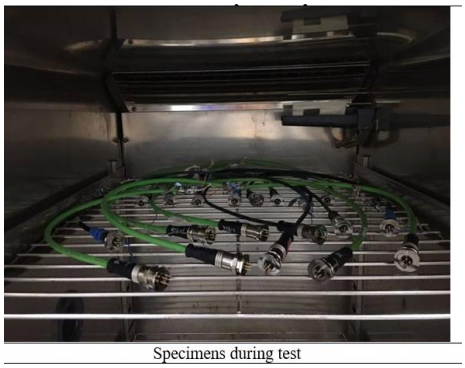
Specimens during test

Fig.3

Table 1 - Test condition

Test step	Temperature	Test duration
1	-40 °C	30 minutes
2	85 °C	30 minutes
Temperature transfer time: ≤5 minutes Cycles: 5		

2.3.4 Damp heat, cyclic



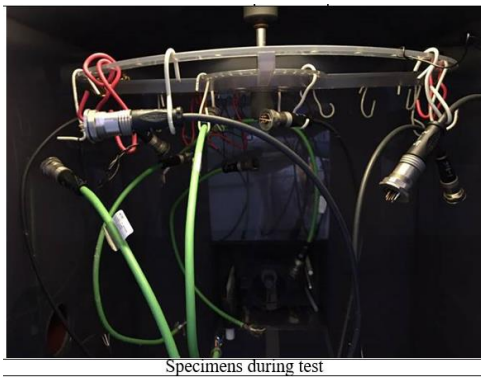
Specimens during test

Fig.4

Table 1 - Test condition

Test Step	Initial	Final	Duration
1	25℃/50%RH	25℃/93%RH	0.5 hour
2	25℃/93%RH	40℃/93%RH	3 hours
3	40℃/93%RH	40℃/93%RH	9 hours
4	40℃/93%RH	25℃/93%RH	3 hours
5	25℃/93%RH	25℃/93%RH	9 hours
6	25℃/93%RH	25℃/50%RH	0.5 hour

2.3.5 Mixed Flowing Gas



Specimens during test

Fig.5

Table 2 - Gas content daily examination record

Gas	Test Condition		Actual Gas Concentration				
	Source(S)	Test Spec. (Ct)	Data1 Set(q)	Data2 Set(q)	Data3 Set(q)	Data4 Set(q)	Data5 Set(q)
Cl_2	100ppm	10ppb	100 0.1	100 0.1	100 0.1		
NO_2	0.10%	200ppb	1000 0.2	1000 0.2	1000 0.2		
H_2S	99.5ppm	10ppb	100 0.1	100 0.1	100 0.1		
SO_2	0.10%	200ppb	1000 0.2	1000 0.2	1000 0.2		
Dry-bulb Temp.	25℃	25.0℃	24.9℃	24.8℃	25.0℃	/	/
Wet-bulb Temp.	75%RH	21.5℃	21.5℃	21.5℃	21.4℃	/	/

2.3.6 Temperature Rising

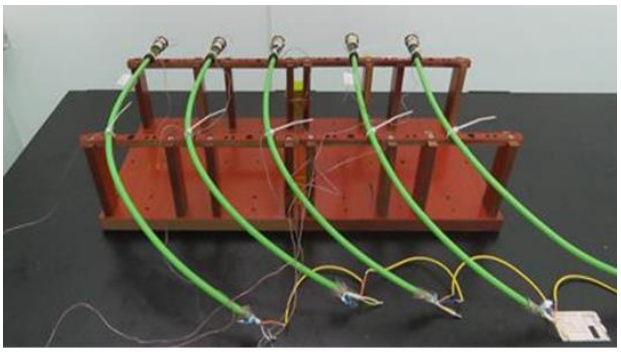


Fig.6

Temperature Rise Value		
Current: 4.0A		T-room
T		24.8 Ref
ΔT	<30℃	/

3. Conclusion

Based on the test results Industrial M12 Push-pull Circular Connectors meet all requirements according to TE CONNECTIVITY product specification 108-137420.