



Test Report

Industrial M12 Series Cable Assembly

1. INTRODUCTION

1.1 Purpose

Testing was performed on M12 Series Cable Assembly type to determine its conformance to the requirements of product specification 108-137350.

1.2 Scope

This specification covers performance, test and quality requirements for Industrial M12 Series Circular Connector with cable assembly. Testing was performed at TE Connectivity Shanghai Electrical Test Laboratory.

1.3 Product Description

Part Number	Interface	Type	Code	Poles	Cable Assembly
T415XXX9LXX-XXX Unshielded Type	M12 Plug M12 Receptacle	Straight Right Angle	L-Code	5 Pins 4 Pins	PVC / PUR (14AWG/16AWG) for 4P and 5P
T416XXB9L25-XXX Shielded Type	M12 Plug M12 Receptacle	Straight Right Angle	L-Code	5 Pins	PUR (14AWG) for 5P

1.4 Product Qualification Test Sequence

Test Examination	Test Group					
	A(a)	B	C	D	E(e)	F
	Test Sequence					
Examination of product	1	2,9,18,23	5	8	1	6
Voltage proof (withstanding voltage)	4	8,17,22	4	4,7		5
Insulation resistance	3	7,11,16,21	3	3,6		4
LLCR	2	4,6,15,20	2	2	2,6	2
Temperature Rising				5(d)		
Durability					4	
Mating and Un-Mating Force					3,5	
Sinusoidal vibration		1				
Mechanical Shock		3				
Rapid change in temperature		5		1		
Dry heat		10				
Damp heat, cyclic		12(b),14(c)				
Impacting water		19				3
Dust (IP6X)						1
Cold		13				
Mixed flowing gas			1			

- (a) When the initial test group A has been completed, the specimens are divided in the 5 groups B, C, D, E, F
All connectors in each group shall undergo the tests specified for the relevant group numbers indicate sequence in which tests are performed.
- (b) First cycle
- (c) Remaining cycles
- (d) Test with additional specimen for over-molding type cable assembly
- (e) This test group should be tested without the screw nut and locking latch

*** 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 Group A+B

Group	Test Item	Sample Number	Requirement	Test Condition and Result	Conclusion
A	LLCR	4	5 m Ω Max. (Initial)	<5 m Ω	meet spec.
	Insulation resistance	4	100MΩ Min	>100MΩ	meet spec.
	Voltage Proof	4	No breakdown or flashover	No breakdown and flashover	meet spec.
B	Sinusoidal vibration	4	No physical damage; No electrical discontinuity greater than 1μs	See 2.3.1 Fig.1	meet spec.
	Examination of product	4	No defect would impair normal operation	Normal	meet spec.
	Mechanical shock	4	No physical damage; No electrical discontinuity greater than 1μs	See 2.3.2 Fig.2	meet spec.
	LLCR	4	Δ10mΩ max.	ΔR <10 mΩ	meet spec.
	Rapid change in temperature	4	No physical damage	See 2.3.3 Fig.3	meet spec.
	LLCR	4	Δ10mΩ max.	ΔR <10 mΩ	meet spec.
	Insulation resistance	4	100MΩ Min	>100MΩ	meet spec.

Voltage proof (withstanding voltage)	4	No breakdown or flashover	No breakdown and flashover	meet spec.
Examination of product	4	No defect would impair normal operation	Normal	meet spec.
Dry heat	4	No physical damage	Normal	meet spec.
Insulation resistance	4	100MΩ Min	>100MΩ	meet spec.
Damp heat, cyclic	4	No physical damage	See 2.3.2 Fig.4	meet spec.
Cold	4	No physical damage	Normal	meet spec.
Damp heat, cyclic	4	No physical damage	See 2.3.2 Fig.4	meet spec.
LLCR	4	Δ10mΩ max.	ΔR <10 mΩ	meet spec.
Insulation resistance	4	100MΩ Min	>100MΩ	meet spec.
Voltage proof (withstanding voltage)	4	No breakdown or flashover	No breakdown and flashover	meet spec.
Examination of product	4	No physical damage	Normal	meet spec.
Impacting water	4	No water ingress	No water ingress	meet spec.
LLCR	4	Δ10mΩ max.	ΔR <10 mΩ	meet spec.
Insulation resistance	4	100MΩ Min	>100MΩ	meet spec.
Voltage proof (withstanding voltage)	4	No breakdown or flashover	No breakdown and flashover	meet spec.
Examination of product	4	No physical damage	Normal	meet spec.

2.2.2 Group A+C

Group	Test Item	Sample Number	Requirement	Test Condition and Result	Conclusion
A	LLCR	2	5 m Ω Max. (Initial)	<5 m Ω	meet spec.
	Insulation resistance	2	100MΩ Min	>100MΩ	meet spec.
	Voltage Proof	2	No breakdown or flashover	No breakdown and flashover	meet spec.
C	Mixed Flowing Gas	2	No corrosion and defect	See 2.3.5 Fig.5	meet spec.
	LLCR	2	Δ10mΩ max.	ΔR <10 mΩ	meet spec.
	Insulation resistance	2	100MΩ Min	>100MΩ	meet spec.
	Voltage proof (withstanding voltage)	2	No breakdown or flashover	No breakdown and flashover	meet spec.
	Examination of product	2	No defect would impair normal operation	Normal	meet spec.

2.2.3 Group A+D

Group	Test Item	Sample Number	Requirement	Test Condition and Result	Conclusion
A	LLCR	3	5 m Ω Max. (Initial)	<5 m Ω	meet spec.
	Insulation resistance	3	100MΩ Min	>100MΩ	meet spec.

	Voltage Proof	3	No breakdown or flashover	No breakdown and flashover	meet spec.
D	Rapid change in temperature	3	No physical damage	See 2.3.3 Fig.3	meet spec.
	LLCR	3	$\Delta 10\text{m}\Omega$ max.	$\Delta R < 10\text{ m}\Omega$	meet spec.
	Insulation resistance	3	100M Ω Min	>100M Ω	meet spec.
	Voltage proof (withstanding voltage)	3	No breakdown or flashover	No breakdown and flashover	meet spec.
	Temperature Rising	3	$\Delta T 30^\circ\text{ C Max.}$	Normal	meet spec
	Insulation resistance	3	100M Ω Min	>100M Ω	meet spec.
	Voltage proof (withstanding voltage)	3	No breakdown or flashover	No breakdown and flashover	meet spec.
	Examination of product	3	No defect would impair normal operation	Normal	meet spec.

2.2.3 Group E

Group	Test Item	Sample Number	Requirement	Test Condition and Result	Conclusion
E	Examination of product	3	No defect would impair normal operation	Normal	meet spec.
	LLCR	3	5 m Ω Max. (Initial)	<5 m Ω	meet spec.
	Mating and Un-Mating Force	3	15N/15N Max. for 2-5pins 23N/30N Max. for 6-12pins	Normal	meet spec.
	Durability	3	100 cycles for gold plating 50 cycles for silver plating 20 cycles for tin plating	Normal	meet spec.
	Mating and Un-Mating Force	3	15N/15N Max. for 2-5pins 23N/30N Max. for 6-12pins	Normal	meet spec.
	LLCR	3	$\Delta 10\text{m}\Omega$ max.	$\Delta R < 10\text{ m}\Omega$	meet spec.

2.2.4 Group F

Group	Test Item	Sample Number	Requirement	Test Condition and Result	Conclusion
F	Dust(IPX6)	3	No defect would impair normal operation	Normal	meet spec.
	LLCR	3	$\Delta 10\text{m}\Omega$ max.	$\Delta R < 10\text{ m}\Omega$	meet spec.
	Impacting water	3	No water ingress	No water ingress	meet spec.
	Insulation resistance	3	100M Ω Min	>100M Ω	meet spec.
	Voltage Proof	3	No breakdown or flashover	No breakdown and flashover	meet spec.
	Examination of product	3	No defect would impair normal operation	Normal	meet spec.

2.3 Test Condition and results

2.3.1 Vibration test

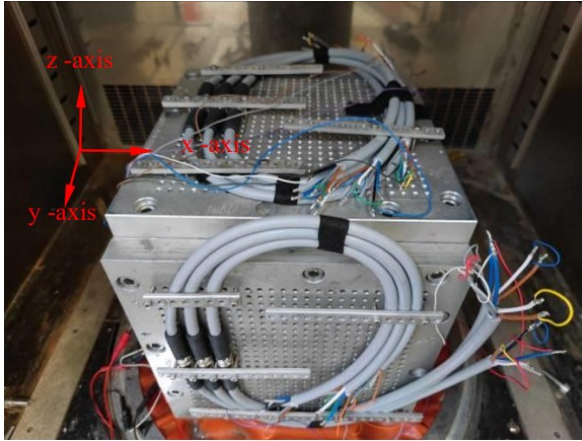
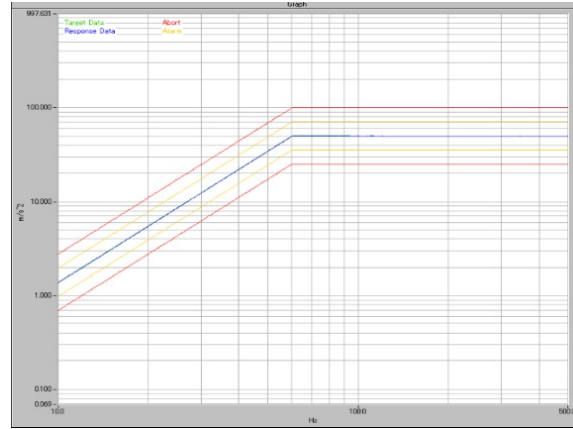
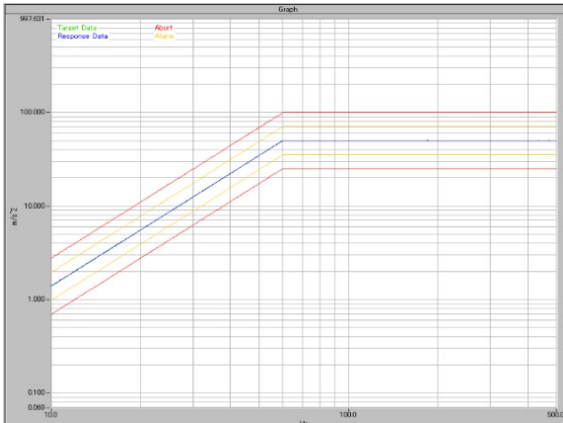


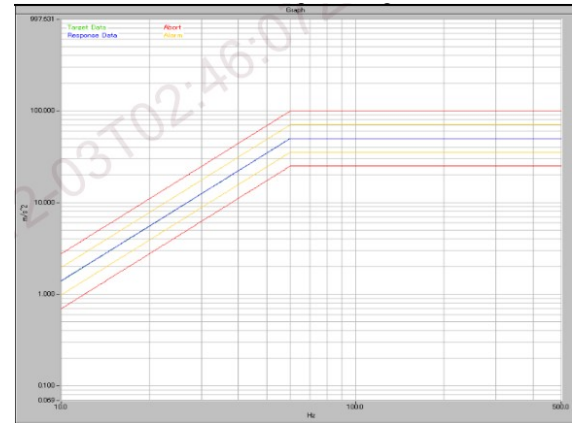
Fig.1



X axis



Y axis



Z axis

2.3.2 Mechanical shock

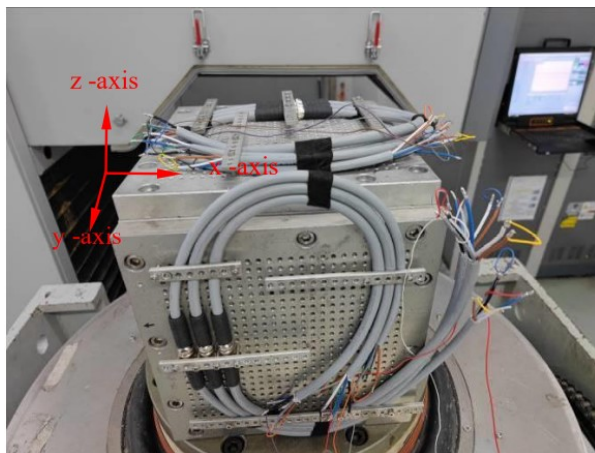
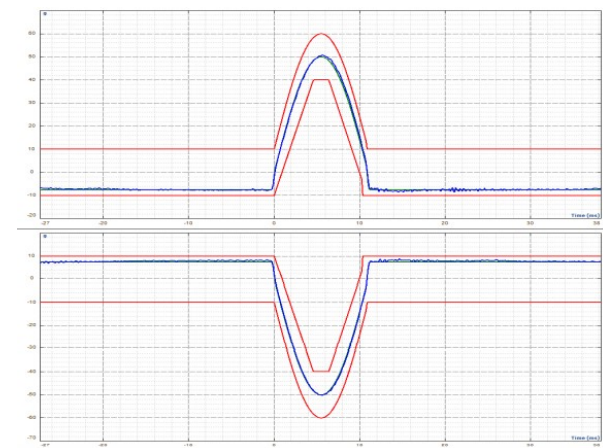
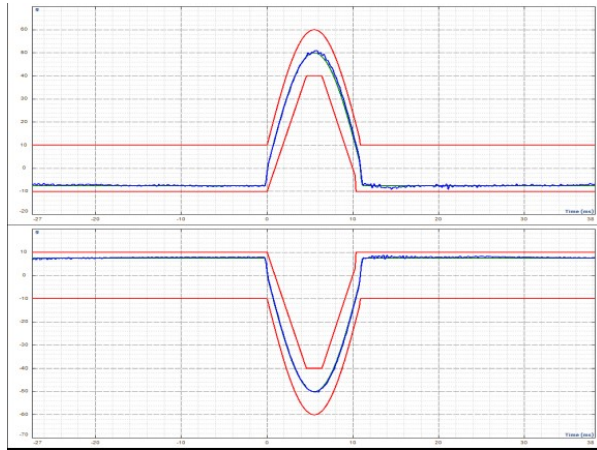


Fig.2



Direction X



Direction Y



Direction Z

2.3.3 Rapid change in temperature



Fig.3

Test Step	Temperature	Period
1	-40°C	30Minutes
2	85°C	30 Minutes
Temperature transfer time: ≤5min		
Cycles: 5		

2.3.4 Damp heat, cyclic

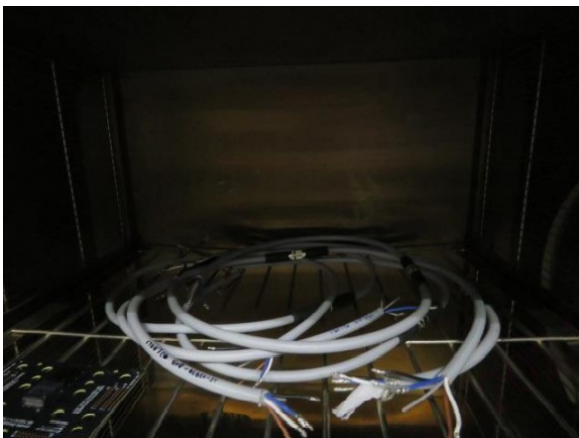


Fig.4

Test Step	Initial	Final	Period
1	23°C/95%RH	40°C/95%RH	3h
2	40°C/95%RH	40°C/95%RH	9h
3	40°C/95%RH	23°C/95%RH	3h
4	23°C/95%RH	23°C/95%RH	9h
Cycles: 5			

2.3.5 Mixed Flowing Gas



Fig.5

Gas	Test condition		Actual gas concentration				
	Source(S)	Test spec.(Cl)	Data1 Set(q)	Data2 Set(q)	Data3 Set(q)	Data4 Set(q)	Data5 Set(q)
Cl2	100 ppm	10 ppb	100 0.1	100 0.1	100 0.1		
NO2	0.10 %	200 ppb	1000 0.2	1000 0.2	1000 0.2		
H2S	99.5 ppm	10 ppb	100 0.1	100 0.1	100 0.1		
SO2	0.1 %	200 ppb	1000 0.2	1000 0.2	1000 0.2		
Dry-bulb temp.	25 °C	25 °C	25.1°C	25.1°C	25.0°C	/	/
Wet-bulb temp.	75 %RH	21.5 °C	21.5°C	21.5°C	21.5°C	/	/
Tester	/	/	Cassie Han	Cassie Han	Cassie Han	/	/
Date	/	/	2021-11-11	2021-11-12	2021-11-15	/	/

3. Conclusion

Based on the test results Industrial M12 Series Cable Assembly meet all requirements according to Tyco Electronics product specification 108-137350.