# Test Report

# Industrial M12 Series Circular Connector

Tyco Electronics. (Shanghai) Co., Ltd.

## 1. INTRODUCTION

### 1.1 Purpose

Testing was performed on Industrial M8 and M12 Series Circular Connector to determine its conformance to the requirements to product specification 108-106140.

### 1.2 Scope

This specification covers performance, test and quality requirements for Industrial M8 and M12 Series Circular Connector. Testing was performed at TE Connectivity Shanghai Electrical Test Laboratory.

### 1.3 Product Description

| Part Number | Interface | Type | Code | Poles | Cable Outlet |
|---|---|---|---|---|---|
| T411XXXXXXX-XXX | M12 Plug<br>M12 Receptacle | Straight<br>Right Angle | A-Code | 2 Pins<br>3 Pins<br>4 Pins<br>5 Pins | PG7<br>PG9 |
| | | | | 8Pins<br>12 Pins | PG9 |
| | | | B-Code<br>D-Code | 2 Pins<br>3 Pins<br>4 Pins<br>5 Pins | PG7<br>PG9 |

### 1.4 Product Qualification Test Sequence

| Test or Examination | Test Group | | | | |
|---|---|---|---|---|---|
| | A(a) | B | C | D | E |
| | 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 | 2,4 | 2,6 |
| Temperature Rising | | | | 5 | |
| 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 | | |

(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 specimen by 1.
(c) First cycle
(d) Remaining cycles

*** 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 A

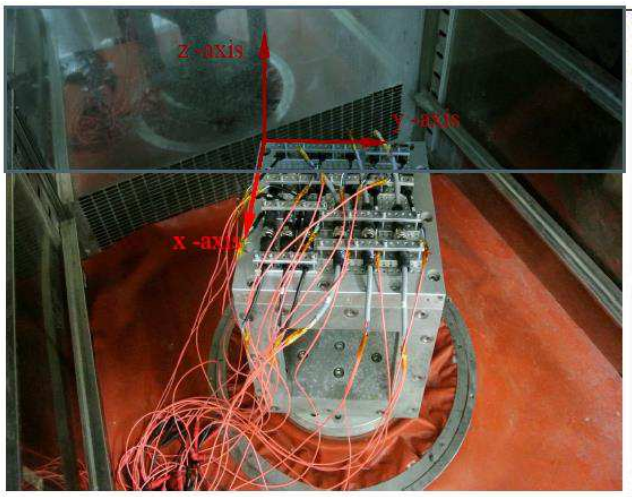
| Group | Test Item | Sample Number | Requirement | Result | | | Conclusion |
|---|---|---|---|---|---|---|---|
| | | | | Max. | Min. | Ave. | |
| A | LLCR | 12 | 8 mΩ Max. | 7.52 | 2.43 | 3.83 | meet spec. |
| | Insulation resistance | 12 | 100MΩ Min | $9.94x10^{10}\Omega$ | $3.83 x10^{10}\Omega$ | $6.61 x10^{10}\Omega$ | meet spec. |
| | Voltage Proof | 12 | No breakdown or flashover | No breakdown and flashover | | | meet spec. |

2.3 Test Group B

| Group | Test Item | Sample Number | Requirement | Result | | | Conclusion |
|---|---|---|---|---|---|---|---|
| | | | | Max. | Min. | Ave. | |
| B | Vibration | 3 | No physical damage; No electrical discontinuity greater than 1 μs | Refer to fig.1, fig.2 | | | meet spec. |
| | LLCR | 3 | Δ15 mΩ Max. | 6.46 | 1.37 | 2.77 | meet spec. |
| | Mechanical shock | 3 | No physical damage; No electrical discontinuity greater than 1 μs | Refer to fig.3, fig.4 | | | meet spec. |
| | LLCR | 3 | Δ15 mΩ Max. | 10.87 | 4.29 | 7.89 | meet spec. |
| | Rapid change of temperature | 3 | No visual change | Refer to Fig.5 | | | meet spec. |
| | LLCR | 3 | Δ15 mΩ Max. | 4.16 | 1.89 | 2.46 | meet spec. |
| | Insulation resistance | 3 | 100MΩ Min | $6.66x10^{10}\Omega$ | $3.58x10^{10}\Omega$ | $5.11x10^{10}\Omega$ | meet spec. |
| | Voltage Proof | 3 | No breakdown or flashover | No breakdown and flashover | | | meet spec. |
| | Dry Heat | 3 | No visual change | No visual change was found after test. Fig.6 | | | meet spec. |
| | Insulation resistance | 3 | 100MΩ Min | $7.51x10^{10}\Omega$ | $1.2x10^{10}\Omega$ | $4.27x10^{10}\Omega$ | meet spec. |
| | Damp heat, cyclic | 3 | No visual change | Refer to Fig.7 | | | meet spec. |
| | Cold | 3 | No visual change | Refer to Fig.8 | | | meet spec. |
| | Damp heat, cyclic | 3 | No visual change | Refer to Fig.9 | | | meet spec. |
| | LLCR | 3 | Δ15 mΩ Max. | 5.48 | 3.02 | 3.02 | meet spec. |
| | Insulation resistance | 3 | 100MΩ Min | $11.97x10^{10}\Omega$ | $5.01x10^{10}\Omega$ | $8.04x10^{10}\Omega$ | meet spec. |
| | Voltage Proof | 3 | No breakdown or flashover | No breakdown and flashover | | | meet spec. |
| | Impacting water | 3 | No water ingress was found after test. | Refer to Fig.10 | | | meet spec. |

2.3.1 Vibration test

Text Curve (z-axis)



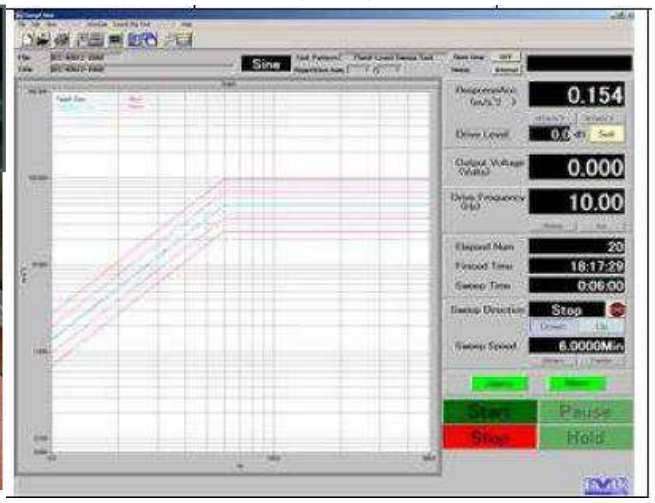
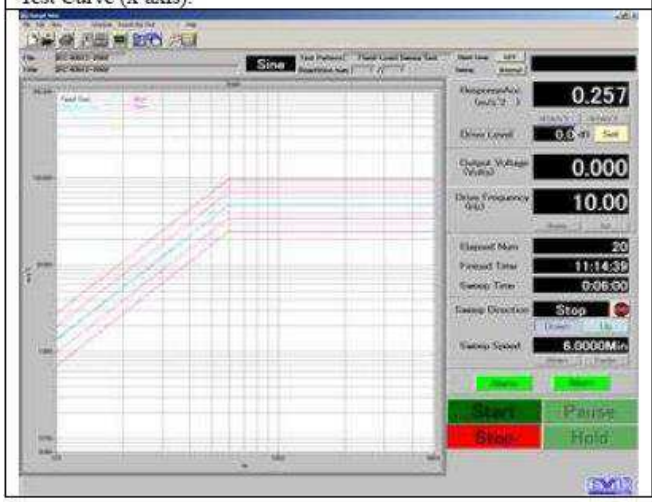




Fig.1

Test Curve (x-axis).

Test Curve (y-axis).



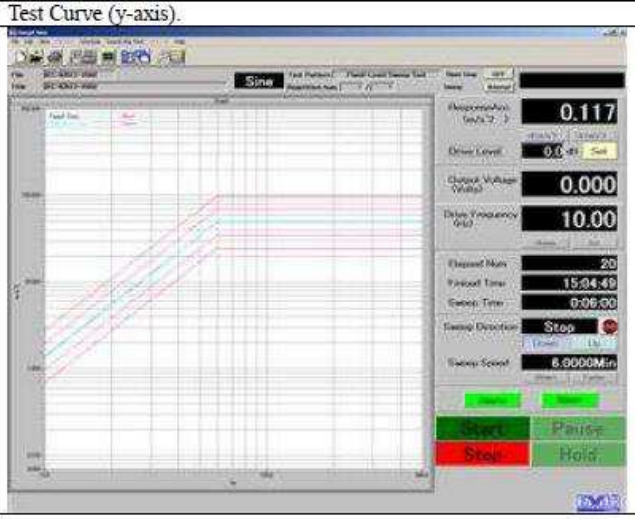




Fig.2

2.3.2 Mechnical shock

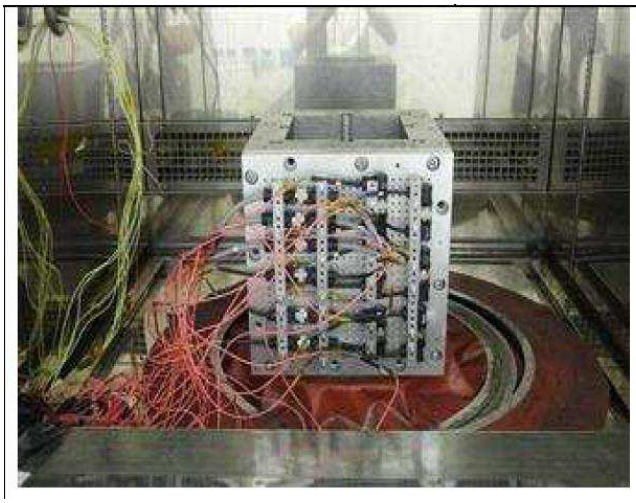
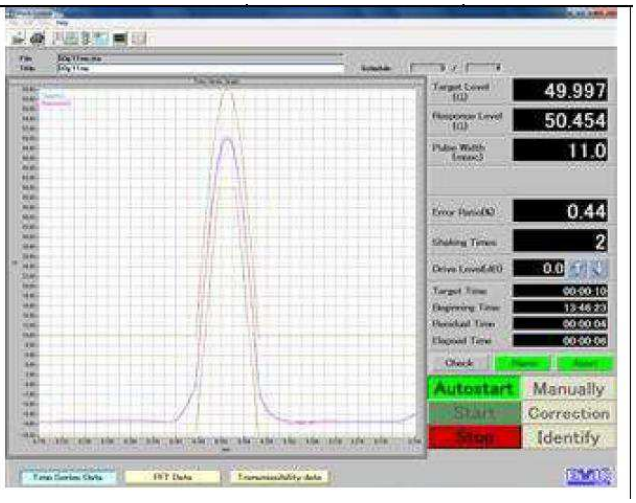
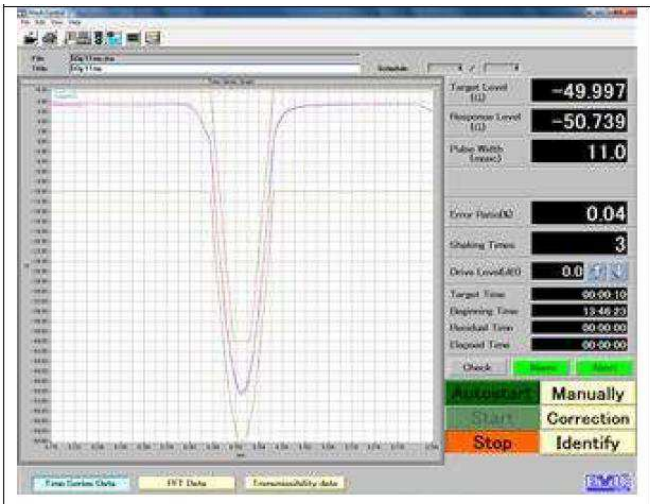


Fig.3




Text Curve(z-axis)




Test Curve (-x-axis). Test Curve (y-axis).

Fig.4

2.3.3 Rapid Change In Temperature

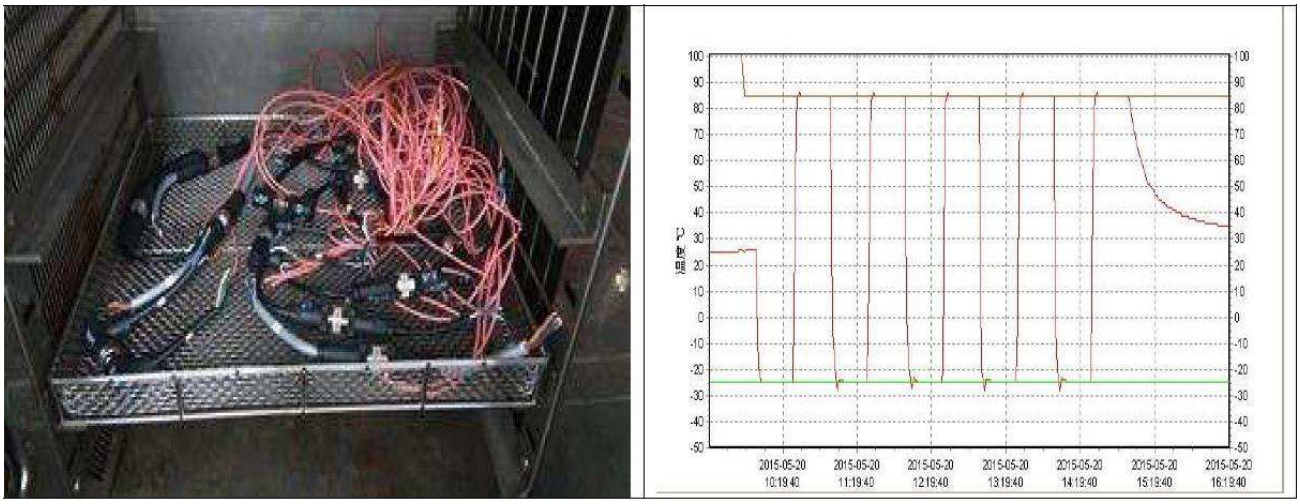



Fig.5

2.3.4 Dry Heat

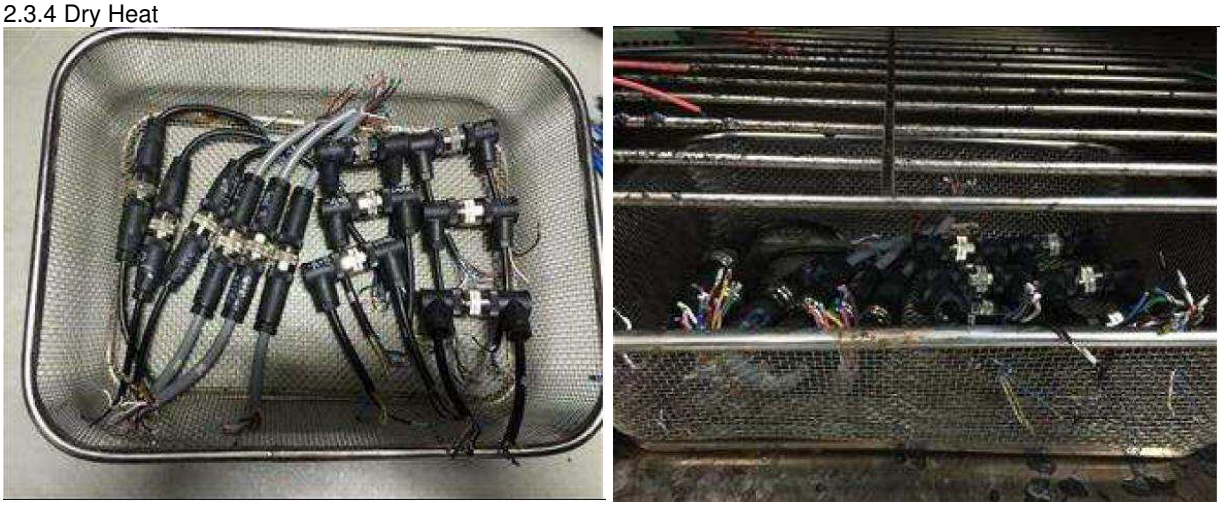


Fig.6

2.3.5 Damp Heat Cyclic

Fig.7

2.3.6 Cold

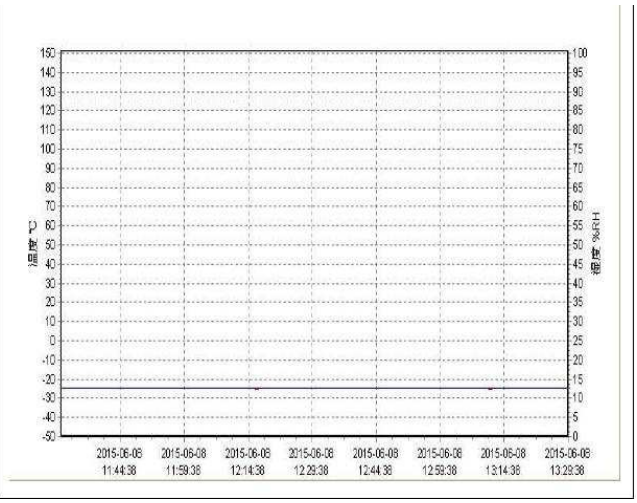


Fig.8

2.3.7 Damp heat, cyclic

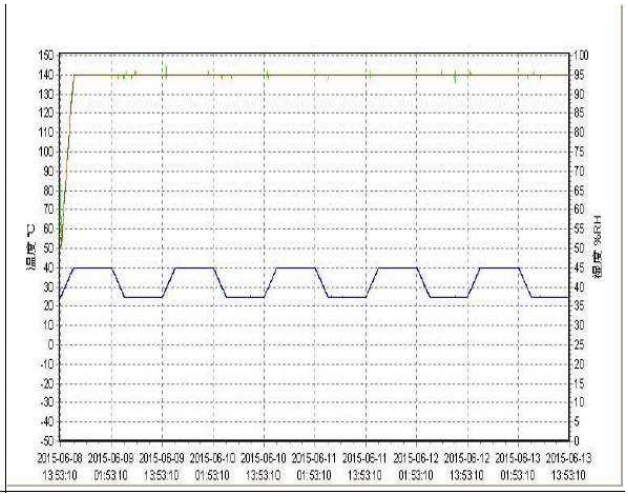


Fig.9

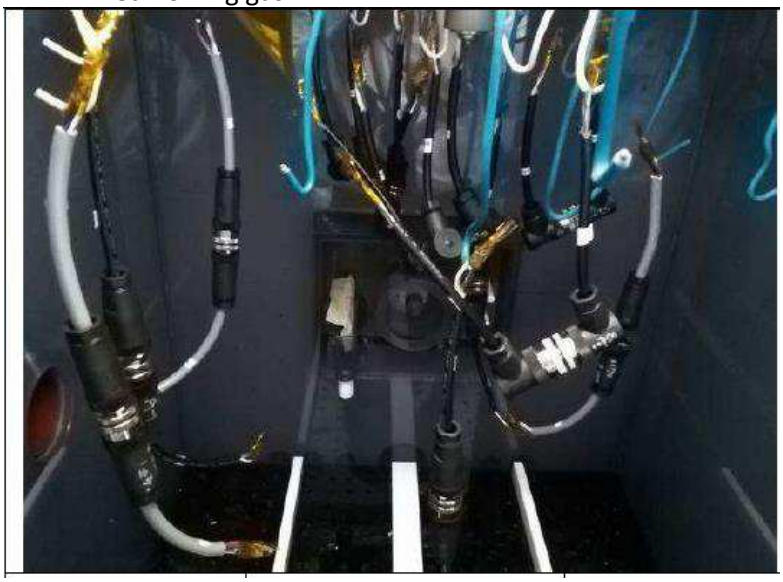
2.3.8 Impacting water

Fig.10

2.4 Test Group C

| Group | Test Item | Sample Numb | Requirement | Result | | | Conclusion |
|---|---|---|---|---|---|---|---|
| | | | | Max. | Min. | Ave. | |
| C | Mixed flowing gas | 3 | No corrosion and defect | Refer to Fig.11 | | | meet spec. |
| | LLCR | 3 | Δ15 mΩ Max. | 4.85 | 1.41 | 2.42 | meet spec. |
| | Insulation resistance | 3 | 100MΩ Min. | $6.24x10^{10}\Omega$ | $1.94x10^{10}\Omega$ | $3.19x10^{10}\Omega$ | meet spec. |
| | Voltage Proof | 3 | No breakdown or flashover | No breakdown and flashover | | | meet spec. |
| | Impacting water | 3 | No ingress of water | Refer to Fig.10 | | | meet spec. |
| | Insulation resistance | 3 | 100MΩ Min. | 2.84 | 1.17 | 1.97 | meet spec. |
| | Voltage Proof | 3 | No breakdown or flashover | No breakdown and flashover | | | meet spec. |
| | Examination product | 3 | No defect | No visual change | | | meet spec. |

2.4.1 Mixed flowing gas



| Gas | Test Condition | |
|---|---|---|
| | Source(S) | Test Spec.(Ct) |
| $Cl_2$ | 100ppm | 10ppb |
| $NO_2$ | 0.10% | 200ppb |
| $NO_2$ | | |
| $H_2S$ | 99.5ppm | 10ppb |
| $H_2S$ | | |
| $SO_2$ | 1% | 200ppb |
| $SO_2$ | | |
| Dry-bulb Temp. | 30℃ | 30℃ |
| Wet-bulb Temp. | 70% | 25.5℃ |

Fig.11

## 2.5 Test Group D

| Group | Test Item | Sample Number | Requirement | Result | | | Conclusion |
|---|---|---|---|---|---|---|---|
| | | | | Max. | Min. | Ave. | |
| D | Rapid change of temperature | 3 | No visual change | Refer to Fig.5 | | | meet spec. |
| | LLCR | 3 | Δ15 mΩ Max. | 8.00 | 3.21 | 4.06 | meet spec. |
| | Insulation resistance | 3 | 100MΩ Min. | $2.9x10^{10}Ω$ | $5.46x10^{9}Ω$ | $1.16x10^{10}Ω$ | meet spec. |
| | Voltage Proof | 3 | No breakdown or flashover | No breakdown and flashover | | | meet spec. |
| | Temperature rising | 3 | ΔT 30℃ Max | Refer to Fig.12 | | | meet spec. |
| | | | | 17.28℃ | 11.78℃ | 14.78℃ | |
| | Impacting water | 3 | No water ingress was found after test. | Refer to Fig.10 | | | meet spec. |
| | Insulation resistance | | 100MΩ Min. | $7.85x10^{10}Ω$ | $1.32x10^{8}Ω$ | $3.17x10^{10}Ω$ | meet spec. |
| | Voltage Proof | | No breakdown or flashover | No breakdown and flashover | | | meet spec. |
| | Examination product | 3 | No visual change | No visual change | | | meet spec. |

### 2.5.1 Temperature rising

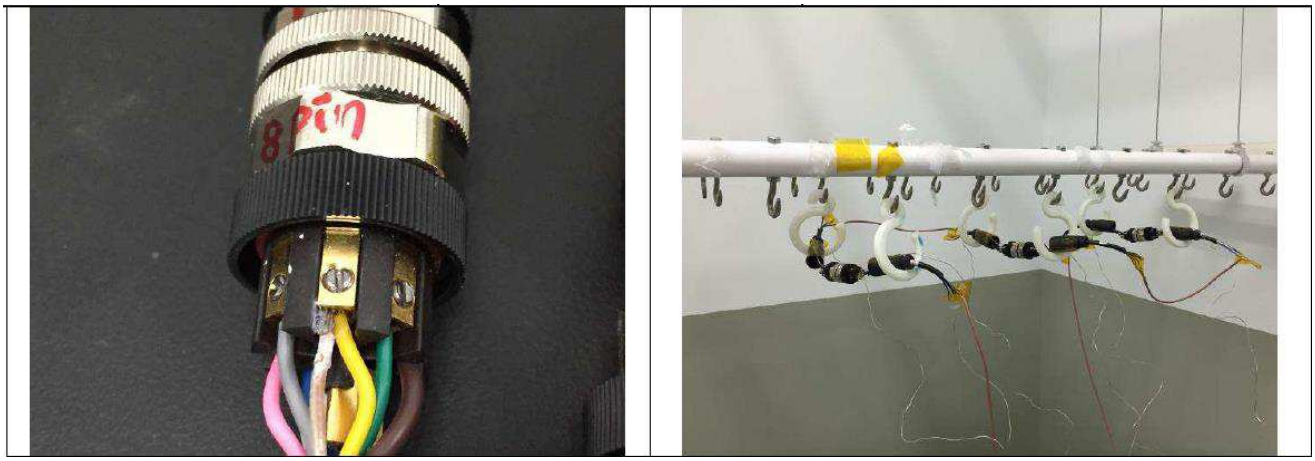



Fig.12

## 2.6 Test Group E

| Group | Test Item | Sample Number | Requirement | Result | | | Conclusion |
|---|---|---|---|---|---|---|---|
| | | | | Max. | Min. | Ave. | |
| E | LLCR | 3 | Δ15 mΩ Max. | 6.04 | 3.83 | 5.06 | meet spec. |
| | Mating and Unmating Force | 3 | Refer to 108-106140 | Refer to Fig.13 | | | meet spec. |
| | Durability | 3 | No physical damage | No physical damage | | | meet spec. |
| | Mating and Unmating Force | 3 | Refer to 108-106140 | Refer to Fig.14 | | | meet spec. |
| | LLCR | 3 | Δ15 mΩ Max. | 6.84 | 2.53 | 3.56 | meet spec. |

2.6.1 Mating & unmating force

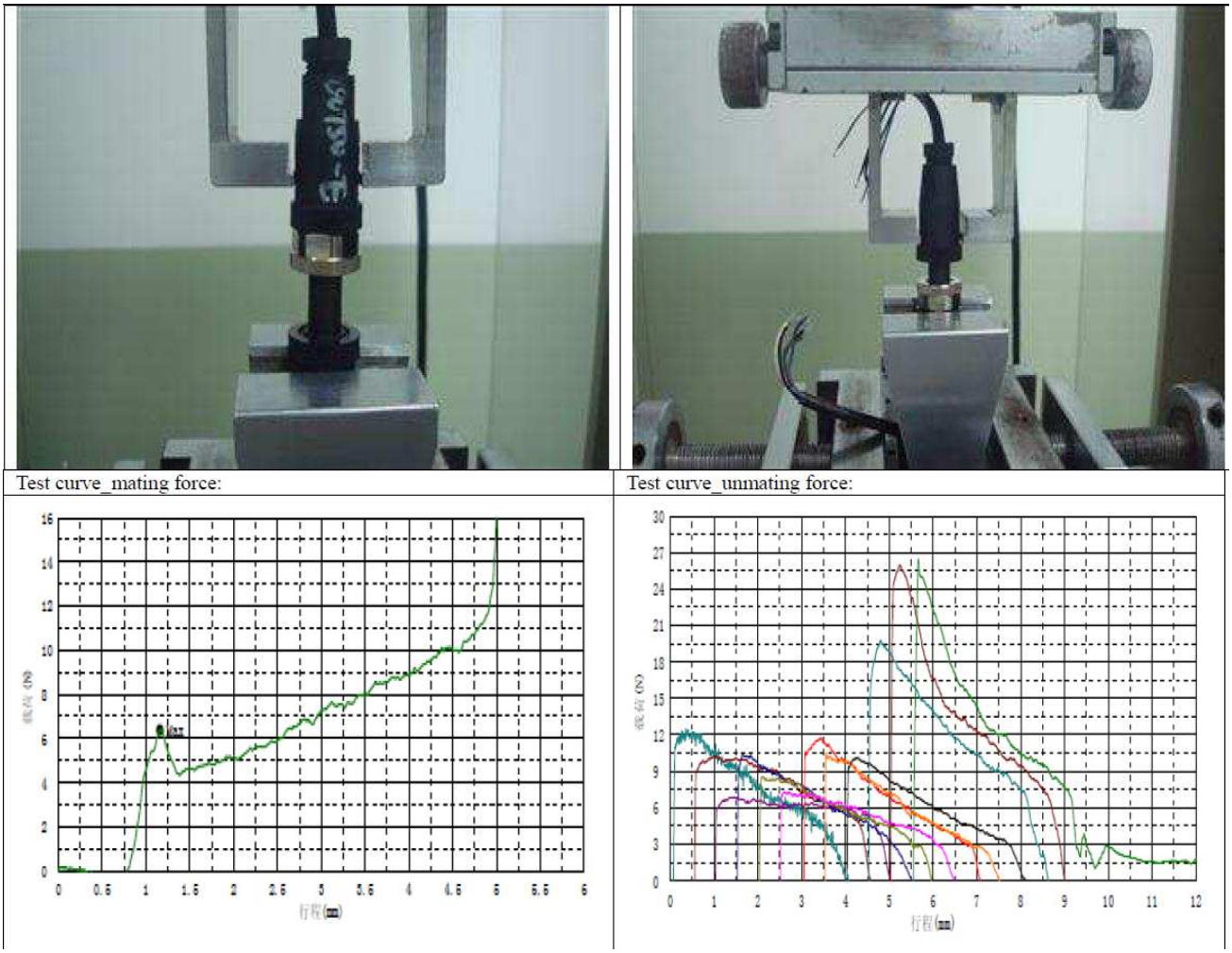



Fig.13

2.6.2 After durability test the mating & unmating force

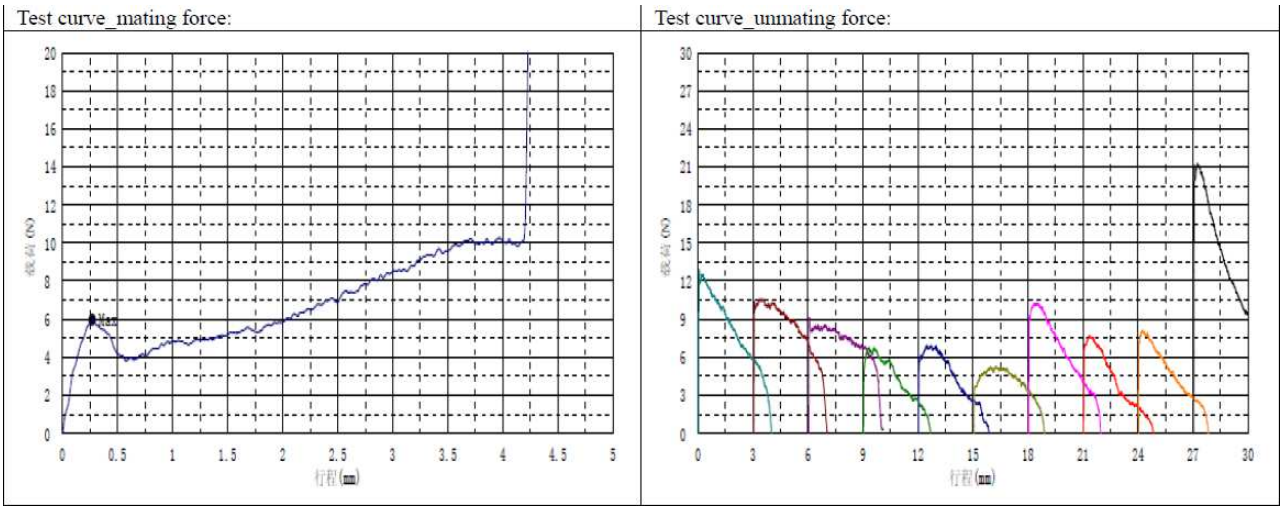



Fig.14

## 3. Conclusion

Based on the test results Industrial M12 Series Circular Connectors meet all requirements according to Tyco Electronics product specification 108-106140.