



# Test Report

## Industrial M12 Panel Mount Series Connector

1. INTRODUCTION

1.1 Purpose

Testing was performed on M12 Series Circular Connector with Panel Mount type to determine its conformance to the requirements of product specification 108-106140.

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                          |
|--|----------------------------|---|----------------------------|--------------------------------------|---|
| T413XXXXXXXX-XXX<br>Solder wire Type   | M12 Plug<br>M12 Receptacle | Straight<br>Front & Rear                | A-Code<br>B-Code<br>D-Code | 2 Pins<br>3 Pins<br>4 Pins<br>5 Pins | PVC(22AWG)<br>PUR(22AWG)                |
| T414XXXXXXXX-XXX<br>Solder PCB Type    | M12 Plug<br>M12 Receptacle | Straight<br>Right Angle<br>Front & Rear | A-Code<br>B-Code<br>D-Code | 2 Pins<br>3 Pins<br>4 Pins<br>5 Pins | PVC(22AWG)<br>PUR(22AWG)                |
| T417XXXXXXXX-XXX<br>Wire Assembly Type | M12 Plug<br>M12 Receptacle | Straight<br>Front & Rear                | A-Code<br>B-Code<br>D-Code | 2 Pins<br>3 Pins<br>4 Pins<br>5 Pins | PVC(22AWG)<br>PUR(22AWG)                |
| T413XXXXXXXX-XXX<br>Solder wire Type   | M12 Plug<br>M12 Receptacle | Straight<br>Front & Rear                | A-Code                     | 8 Pins<br>12Pins                     | PUR(24AWG) for 8P<br>PUR(26AWG) for 12P |
| T414XXXXXXXX-XXX<br>Solder PCB Type    | M12 Plug<br>M12 Receptacle | Straight<br>Right Angle<br>Front & Rear | A-Code                     | 8 Pins<br>12Pins                     | PUR(24AWG) for 8P<br>PUR(26AWG) for 12P |
| T417XXXXXXXX-XXX<br>Wire Assembly Type | M12 Plug<br>M12 Receptacle | Straight<br>Front & Rear                | A-Code                     | 8 Pins<br>12Pins                     | PUR(24AWG) for 8P<br>PUR(26AWG) for 12P |

1.4 Product Qualification Test Sequence

| Test or Examination                 | Test Group    |              |     |      |      |
|-------------------------------------|---------------|--------------|-----|------|------|
|                                     | A(a)          | B            | C   | D    | E(f) |
|                                     | 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   |      |      |

- (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
- (e) Test with additional specimen for over-molding type cable assembly
- (f) This test group should be tested without the screw nut

**\* 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                                | 12                        | 10 m Ω Max.   | <10 m Ω                    | meet spec. |
|                                     | Insulation resistance               | 12                        | 100MΩ Min   | >100MΩ                     | meet spec. |
|                                     | Voltage Proof                       | 12                        | No breakdown or flashover   | No breakdown and flashover | meet spec. |
| B                                   | Sinusoidal vibration                | 3                         | No physical damage;<br>No electrical discontinuity greater than 1μs | See 2.3.1<br>Fig.1         | meet spec. |
|                                     | LLCR                                | 3                         | Δ15mΩ max.  | <15 mΩ                     | meet spec. |
|                                     | Examination of product              | 3                         | No defect would impair normal operation                             | Normal                     | meet spec. |
|                                     | Mechanical shock                    | 3                         | No physical damage;<br>No electrical discontinuity greater than 1μs | See 2.3.2<br>Fig.2         | meet spec. |
|                                     | LLCR                                | 3                         | Δ15mΩ max.  | <15 mΩ                     | meet spec. |
|                                     | Examination of product              | 3                         | No defect would impair normal operation                             | Normal                     | meet spec. |
|                                     | Rapid change in temperature         | 3                         | No physical damage  | See 2.3.3<br>Fig.3         | meet spec. |
|                                     | LLCR                                | 3                         | Δ15mΩ max.  | <15 mΩ                     | meet spec. |
|                                     | Insulation resistance               | 3                         | 100MΩ Min   | >100MΩ                     | 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. |
|                                     | Dry heat                            | 3                         | No physical damage  | Normal                     | meet spec. |
|                                     | Insulation resistance               | 3                         | 100MΩ Min   | >100MΩ                     | meet spec. |
|                                     | Damp heat, cyclic                   | 3                         | No physical damage  | See 2.3.2<br>Fig.4         | meet spec. |
|                                     | Cold                                | 3                         | No physical damage  | Normal                     | meet spec. |
|                                     | Damp heat, cyclic                   | 3                         | No physical damage  | See 2.3.2<br>Fig.4         | meet spec. |
|                                     | LLCR                                | 3                         | Δ15mΩ max.  | <15 mΩ                     | meet spec. |
|                                     | Insulation resistance               | 3                         | 100MΩ Min   | >100MΩ                     | meet spec. |
|                                     | Voltage proof(withstanding voltage) | 3                         | No breakdown or flashover   | No breakdown or flashover  | meet spec. |
|                                     | Examination of product              | 3                         | No defect would impair normal operation                             | Normal                     | meet spec. |
|                                     | Impacting water                     | 3                         | No water ingress  | No water ingress           | meet spec. |
|                                     | LLCR                                | 3                         | Δ15mΩ max.  | <15 mΩ                     | meet spec. |
|                                     | Insulation resistance               | 3                         | 100MΩ Min   | >100MΩ                     | meet spec. |
| Voltage proof(withstanding voltage) | 3                                   | No breakdown or flashover | No breakdown or flashover   | meet spec.                 |            |

|                        |   |                    |        |            |
|------------------------|---|--------------------|--------|------------|
| Examination of product | 3 | 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                                | 3             | 10 m Ω Max.                             | <10 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. |
| C     | Mixed Flowing Gas                   | 3             | No corrosion and defect                 | See 2.3.5 Fig.5            | meet spec. |
|       | LLCR                                | 3             | Δ15mΩ max.                              | <15 mΩ                     | meet spec. |
|       | Insulation resistance               | 3             | 100MΩ Min                               | >100MΩ                     | meet spec. |
|       | Voltage proof(withstanding voltage) | 3             | No breakdown or flashover               | No breakdown and flashover | meet spec. |
|       | Impacting water                     | 3             | No water ingress                        | No water ingress           | meet spec. |
|       | Insulation resistance               | 3             | 100MΩ Min                               | >100MΩ                     | 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 A+D

| Group | Test Item                            | Sample Number | Requirement                             | Test Condition and Result  | Conclusion |
|-------|--------------------------------------|---------------|---|----------------------------|------------|
| A     | LLCR                                 | 3             | 10 m Ω Max.                             | <10 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             | Δ15mΩ max.                              | <15 mΩ                     | meet spec. |
|       | Insulation resistance                | 3             | 100MΩ Min                               | >100MΩ                     | meet spec. |
|       | Voltage proof(withstanding voltage)  | 3             | No breakdown or flashover               | No breakdown and flashover | meet spec. |
|       | Temperature Rising                   | 3             | ΔT 30° C Max.                           | Normal                     | meet spec. |
|       | Impacting water                      | 3             | No water ingress                        | No water ingress           | meet spec. |
|       | Insulation resistance                | 3             | 100MΩ Min                               | >100MΩ                     | 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             | 10 m $\Omega$ Max.   | <10 m $\Omega$            | meet spec. |
|       | Mating and Un-mating Force | 3             | 15N/15N Max. for 2-5pins<br>23N/30N Max. for 6-12pins                                    | Normal                    | meet spec. |
|       | Durability                 | 3             | 100 cycles for gold plating<br>50 cycles for silver plating<br>20 cycles for tin plating | Normal                    | meet spec. |
|       | Mating and Un-mating Force | 3             | 15N/15N Max. for 2-5pins<br>23N/30N Max. for 6-12pins                                    | Normal                    | meet spec. |
|       | LLCR                       | 3             | $\Delta$ 15m $\Omega$ max.   | $\Delta$ R<15 m $\Omega$  | meet spec. |

2.3 Test Condition and results

2.3.1 Vibration test

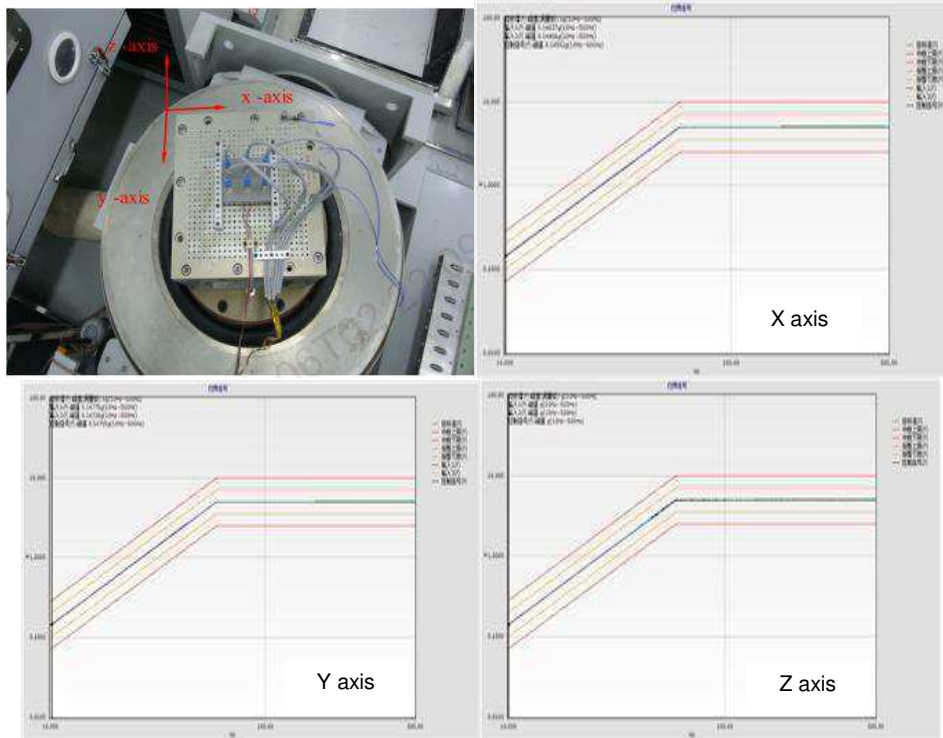


Fig.1

2.3.2 Mechanical shock

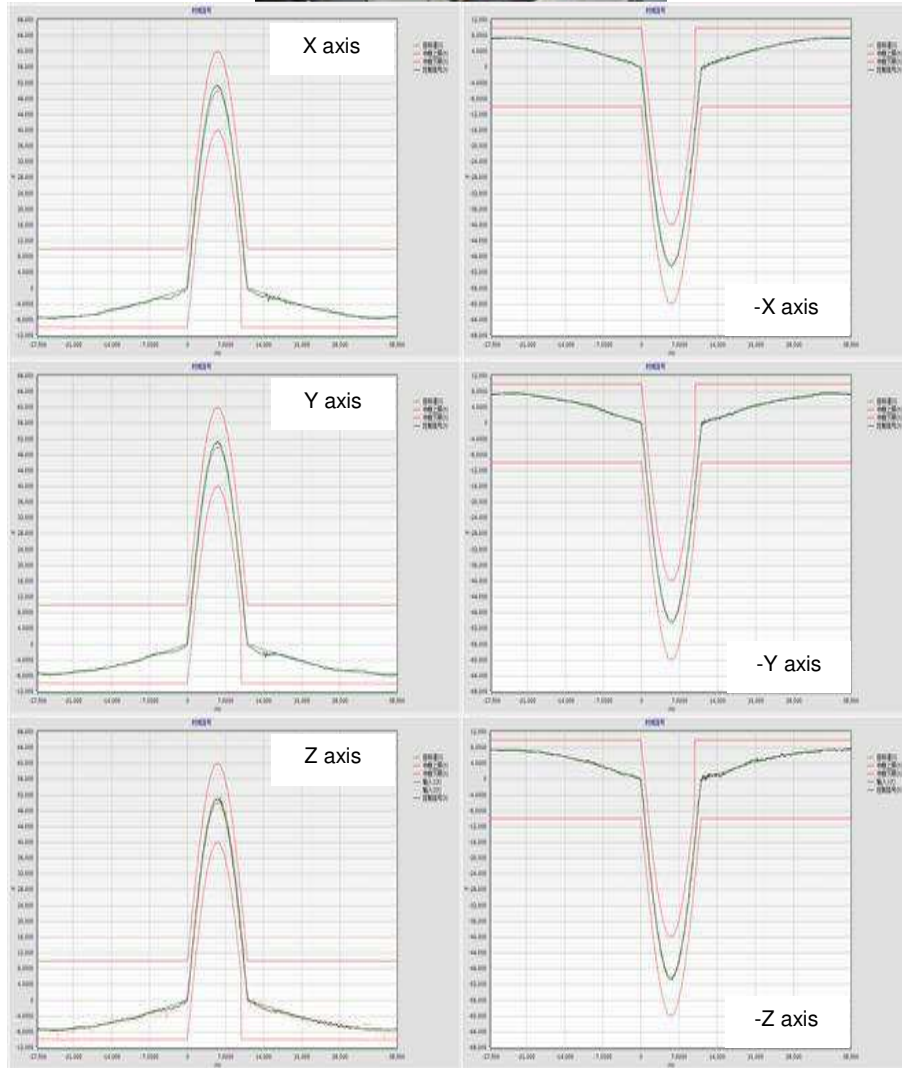
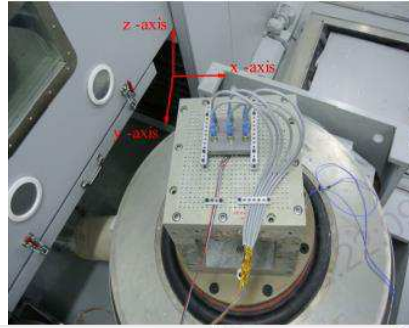


Fig.2



2.3.3 Rapid change in temperature



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

Fig.3

2.3.4 Damp heat, cyclic



| 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 |            |            |        |

Fig.4

2.3.5 Mixed Flowing Gas



| Gas <sup>1)</sup>              | Test Condition <sup>2)</sup> |                               | Actual Gas Concentration <sup>3)</sup> |                       |                     |                      |                     |                      |                     |                      |                     |                      |
|--------------------------------|------------------------------|-------------------------------|--|-----------------------|---------------------|----------------------|---------------------|----------------------|---------------------|----------------------|---------------------|----------------------|
|                                | Source(S) <sup>4)</sup>      | Test Spec. (Ct) <sup>5)</sup> | Data1 <sup>6)</sup>                    | Set(q) <sup>7)</sup>  | Data2 <sup>6)</sup> | Set(q) <sup>7)</sup> | Data3 <sup>6)</sup> | Set(q) <sup>7)</sup> | Data4 <sup>6)</sup> | Set(q) <sup>7)</sup> | Data5 <sup>6)</sup> | Set(q) <sup>7)</sup> |
| Cl <sub>2</sub> <sup>8)</sup>  | 100ppm <sup>9)</sup>         | 10ppb <sup>10)</sup>          | 80                                     | 0.15 <sup>11)</sup>   | 80                  | 0.15 <sup>11)</sup>  | ∅ <sup>12)</sup>    | ∅ <sup>12)</sup>     | ∅ <sup>12)</sup>    | ∅ <sup>12)</sup>     | ∅ <sup>12)</sup>    | ∅ <sup>12)</sup>     |
| NO <sub>2</sub> <sup>8)</sup>  | 0.10% <sup>9)</sup>          | 200ppb <sup>10)</sup>         | 1000                                   | 0.2 <sup>11)</sup>    | 1000                | 0.2 <sup>11)</sup>   | ∅ <sup>12)</sup>    | ∅ <sup>12)</sup>     | ∅ <sup>12)</sup>    | ∅ <sup>12)</sup>     | ∅ <sup>12)</sup>    | ∅ <sup>12)</sup>     |
| NO <sub>2</sub> <sup>8)</sup>  | ∅ <sup>9)</sup>              | ∅ <sup>10)</sup>              | ∅ <sup>11)</sup>                       | ∅ <sup>12)</sup>      | ∅ <sup>11)</sup>    | ∅ <sup>12)</sup>     | ∅ <sup>11)</sup>    | ∅ <sup>12)</sup>     | ∅ <sup>11)</sup>    | ∅ <sup>12)</sup>     | ∅ <sup>11)</sup>    | ∅ <sup>12)</sup>     |
| H <sub>2</sub> S <sup>8)</sup> | 99.5ppm <sup>9)</sup>        | 10ppb <sup>10)</sup>          | 100                                    | 0.1 <sup>11)</sup>    | 100                 | 0.1 <sup>11)</sup>   | ∅ <sup>12)</sup>    | ∅ <sup>12)</sup>     | ∅ <sup>12)</sup>    | ∅ <sup>12)</sup>     | ∅ <sup>12)</sup>    | ∅ <sup>12)</sup>     |
| H <sub>2</sub> S <sup>8)</sup> | ∅ <sup>9)</sup>              | ∅ <sup>10)</sup>              | ∅ <sup>11)</sup>                       | ∅ <sup>12)</sup>      | ∅ <sup>11)</sup>    | ∅ <sup>12)</sup>     | ∅ <sup>11)</sup>    | ∅ <sup>12)</sup>     | ∅ <sup>11)</sup>    | ∅ <sup>12)</sup>     | ∅ <sup>11)</sup>    | ∅ <sup>12)</sup>     |
| SO <sub>2</sub> <sup>8)</sup>  | 0.1% <sup>9)</sup>           | 100ppb <sup>10)</sup>         | 1100                                   | 0.2 <sup>11)</sup>    | 1100                | 0.2 <sup>11)</sup>   | ∅ <sup>12)</sup>    | ∅ <sup>12)</sup>     | ∅ <sup>12)</sup>    | ∅ <sup>12)</sup>     | ∅ <sup>12)</sup>    | ∅ <sup>12)</sup>     |
| SO <sub>2</sub> <sup>8)</sup>  | ∅ <sup>9)</sup>              | ∅ <sup>10)</sup>              | ∅ <sup>11)</sup>                       | ∅ <sup>12)</sup>      | ∅ <sup>11)</sup>    | ∅ <sup>12)</sup>     | ∅ <sup>11)</sup>    | ∅ <sup>12)</sup>     | ∅ <sup>11)</sup>    | ∅ <sup>12)</sup>     | ∅ <sup>11)</sup>    | ∅ <sup>12)</sup>     |
| Dry-bulb Temp. <sup>13)</sup>  | 25°C <sup>14)</sup>          | 25°C <sup>14)</sup>           | 25.1°C <sup>15)</sup>                  | 25.0°C <sup>15)</sup> | ∅ <sup>16)</sup>    | ∅ <sup>16)</sup>     | ∅ <sup>16)</sup>    | ∅ <sup>16)</sup>     | ∅ <sup>16)</sup>    | ∅ <sup>16)</sup>     | ∅ <sup>16)</sup>    | ∅ <sup>16)</sup>     |
| Wet-bulb Temp. <sup>13)</sup>  | 75%RH <sup>14)</sup>         | 21.5°C <sup>14)</sup>         | 21.5°C <sup>15)</sup>                  | 21.4°C <sup>15)</sup> | ∅ <sup>16)</sup>    | ∅ <sup>16)</sup>     | ∅ <sup>16)</sup>    | ∅ <sup>16)</sup>     | ∅ <sup>16)</sup>    | ∅ <sup>16)</sup>     | ∅ <sup>16)</sup>    | ∅ <sup>16)</sup>     |
| Tester <sup>17)</sup>          | ∅ <sup>18)</sup>             | ∅ <sup>18)</sup>              | <i>Jashy</i>                           | <i>Jashy</i>          | ∅ <sup>19)</sup>    | ∅ <sup>19)</sup>     | ∅ <sup>19)</sup>    | ∅ <sup>19)</sup>     | ∅ <sup>19)</sup>    | ∅ <sup>19)</sup>     | ∅ <sup>19)</sup>    | ∅ <sup>19)</sup>     |
| Date <sup>20)</sup>            | ∅ <sup>21)</sup>             | ∅ <sup>21)</sup>              | 3/11 <sup>22)</sup>                    | 3/14 <sup>22)</sup>   | ∅ <sup>23)</sup>    | ∅ <sup>23)</sup>     | ∅ <sup>23)</sup>    | ∅ <sup>23)</sup>     | ∅ <sup>23)</sup>    | ∅ <sup>23)</sup>     | ∅ <sup>23)</sup>    | ∅ <sup>23)</sup>     |

Fig.5