

INFORMATION

NEC/TOKIN

AUTOMOTIVE RELAY

ET2 SERIES TECHNICAL DATA

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The information in this document is based on documents issued in March, 2006 at the latest.

The information is subject to change without notice. For actual design-in refer to the latest publications of data sheet, etc., for the most up-date specifications of the device.

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While NEC/TOKIN Corporation has been making continuous effort to enhance the reliability of its electronic components, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC/TOKIN electronic component, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features. NEC/TOKIN devices are classified into the following three quality grades:

"Standard," "Special," and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "Quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC/TOKIN devices is "Standard" unless otherwise specified in NEC/TOKIN's Data Sheets or Data Books. If customers intend to use NEC/TOKIN devices for applications other than those specified for Standard quality grade, they should contact an NEC/TOKIN sales representative in advance.

(Note)

- (1) "NEC/TOKIN" as used in this statement means NEC/TOKIN Corporation and also includes its majority-owned subsidiaries.
- (2) "NEC/TOKIN electronic component products" means any electronic component product developed or manufactured by or for NEC/TOKIN (as defined above).

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1. PREFACE

NEC Miniature Power relays are mainly used in automotive electronics applications. This document gives the basic characteristics and test data of NEC/TOKIN's ET2 series miniature power relays.

For Right Use of Miniature Relays

DO NOT EXCEED MAXIMUM RATINGS.

Do not use relays under exceeding conditions such as over ambient temperature, over voltage and over current. Incorrect use could result in malfunctioning, abnormal heating, or cause burning.

READ CAUTIONS IN THE SELECTION GUIDE.

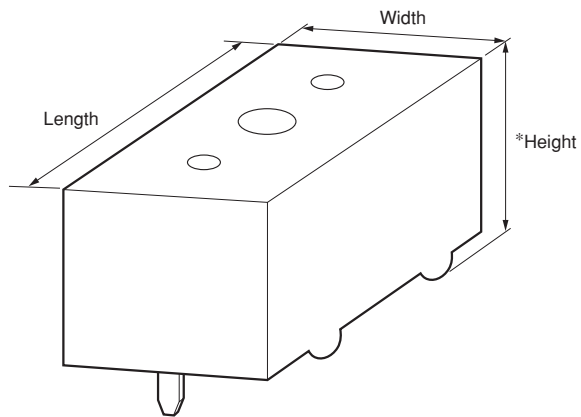
Read the cautions described in NEC/TOKIN's "Miniature Relays" (0123EMDD03VOL01E) when you choose relays for your application.



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2. INITIAL CHARACTERISTICS

Dimension (ET2-B3M1S)



*Including Stand-Off height

| No. | Length [mm] | Width [mm] | Height [mm] |
|-----------|-------------|------------|-------------|
| Spec. | 22.0 ±0.5 | 12.8 ±0.5 | 10.5 ±0.5 |
| 1 | 21.95 | 12.82 | 10.53 |
| 2 | 21.95 | 12.83 | 10.54 |
| 3 | 21.96 | 12.84 | 10.54 |
| 4 | 21.93 | 12.84 | 10.52 |
| 5 | 21.94 | 12.85 | 10.54 |
| 6 | 21.96 | 12.86 | 10.55 |
| 7 | 21.95 | 12.83 | 10.54 |
| 8 | 21.94 | 12.84 | 10.52 |
| 9 | 21.95 | 12.83 | 10.54 |
| 10 | 21.95 | 12.84 | 10.53 |
| Max. | 21.96 | 12.86 | 10.55 |
| \bar{x} | 21.95 | 12.84 | 10.54 |
| Min. | 21.93 | 12.82 | 10.52 |
| σ | 0.009 | 0.011 | 0.010 |

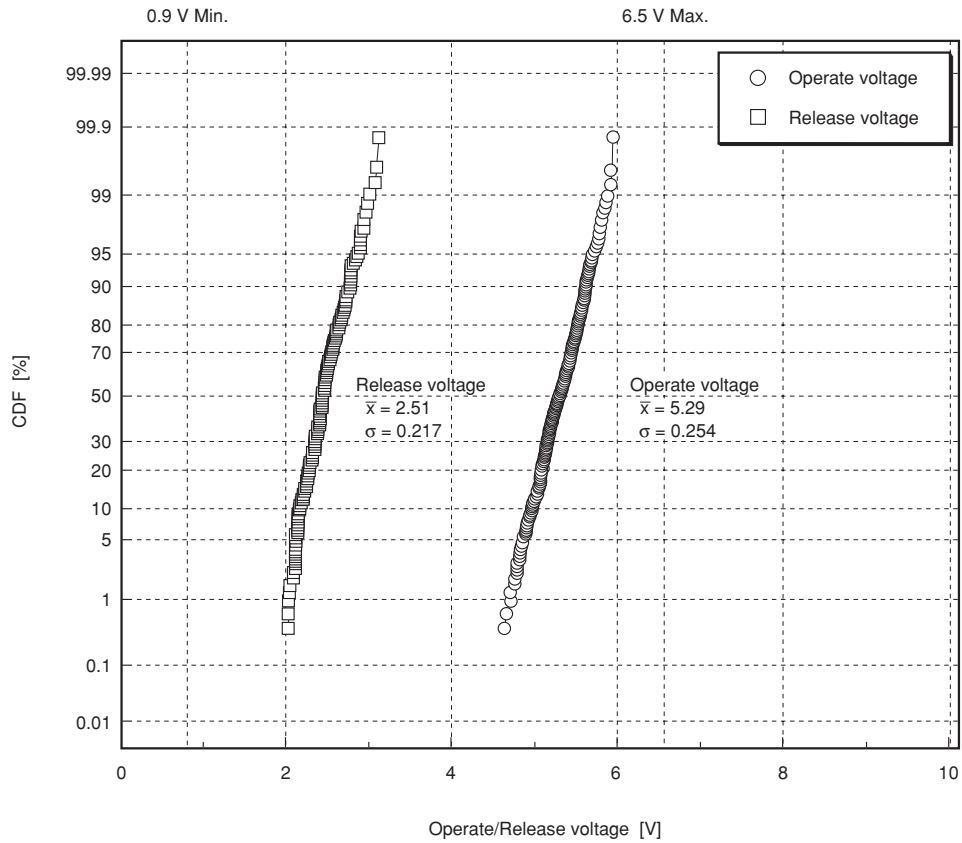


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2. INITIAL CHARACTERISTICS

Operate / Release Voltage

| Test items | Test conditions | Samples |
|--|----------------------------|----------------------|
| 1. Operate voltage 2. Release voltage | Ambient temperature : 20°C | ET2-B3M1S 180 pcs |

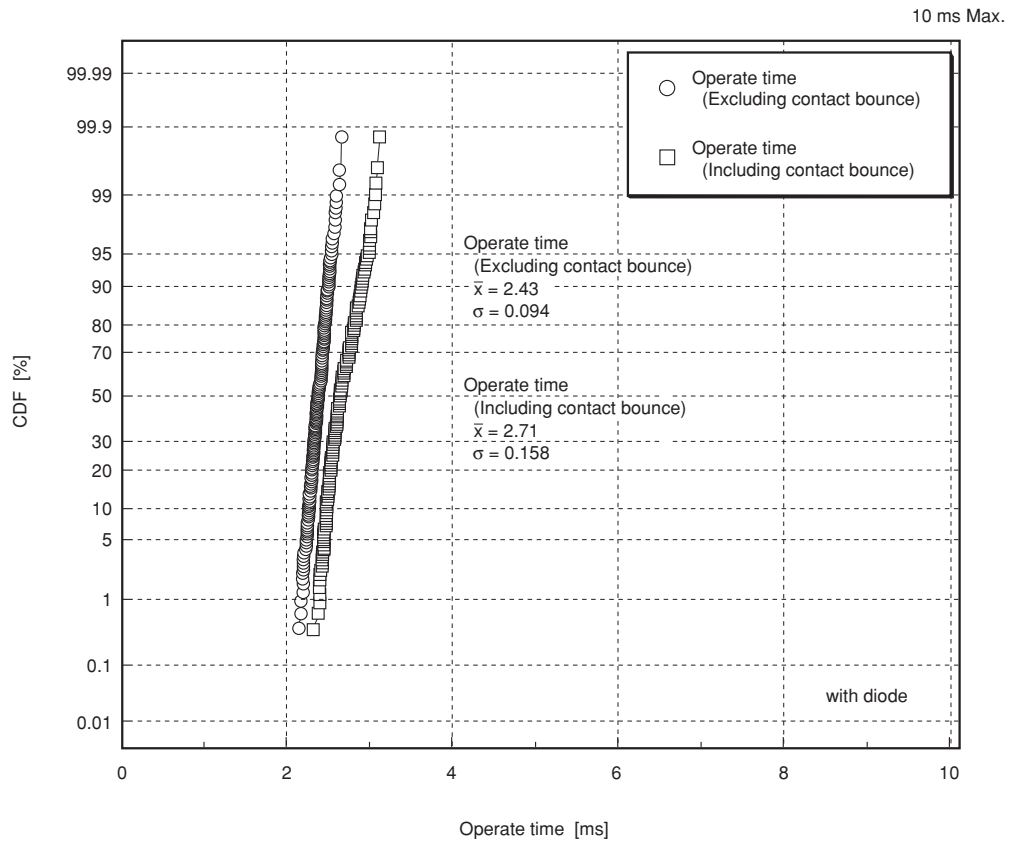


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2. INITIAL CHARACTERISTICS

Operate Time

| Test items | Test conditions | Samples |
|---|----------------------------|----------------------|
| 1. Operate time (Excluding contact bounce) | Ambient temperature : 20°C | ET2-B3M1S 180 pcs |
| 2. Operate time (Including contact bounce) | | |

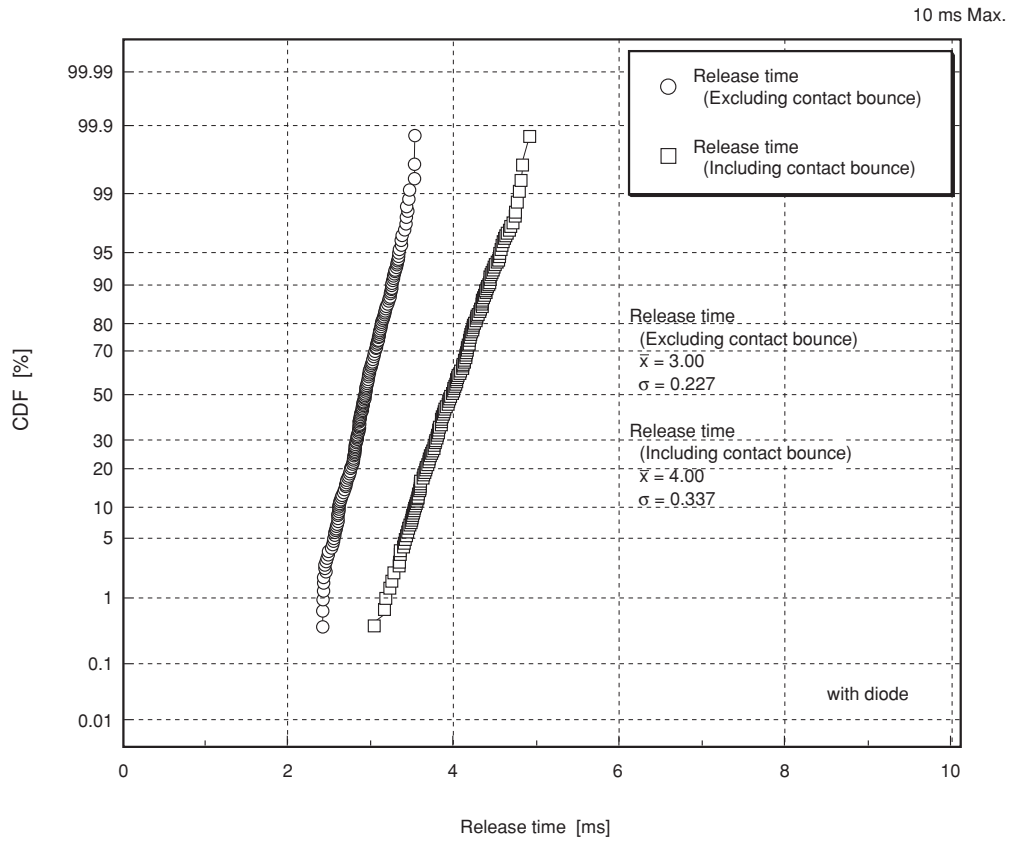


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2. INITIAL CHARACTERISTICS

Release Time

| Test items | Test conditions | Samples |
|---|----------------------------|----------------------|
| 1. Release time (Excluding contact bounce) | Ambient temperature : 20°C | ET2-B3M1S 180 pcs |
| 2. Release time (Including contact bounce) | | |

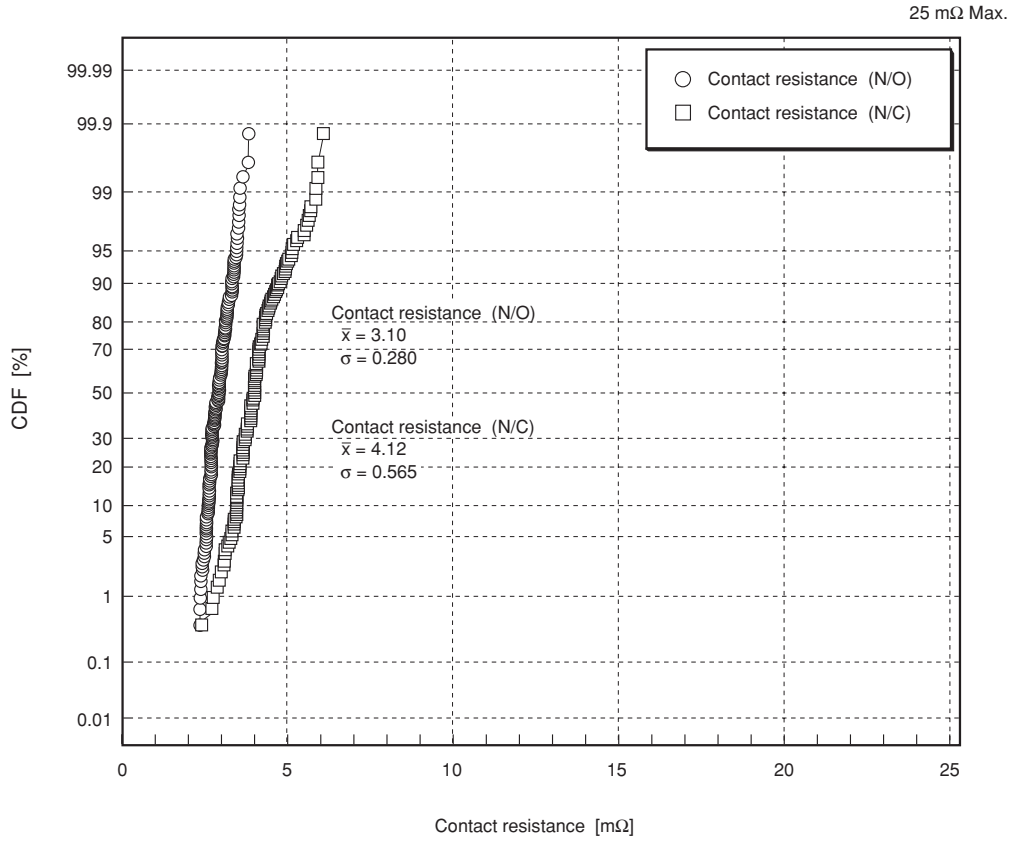


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2. INITIAL CHARACTERISTICS

Contact Resistance

| Test items | Test conditions | Samples |
|----------------------------|------------------------------|-----------|
| 1. Contact resistans (N/O) | Ambient temperature : 20°C | ET2-B3M1S |
| 2. Contact resistans (N/C) | Voltage drop method : 6V, 7A | 180 pcs |

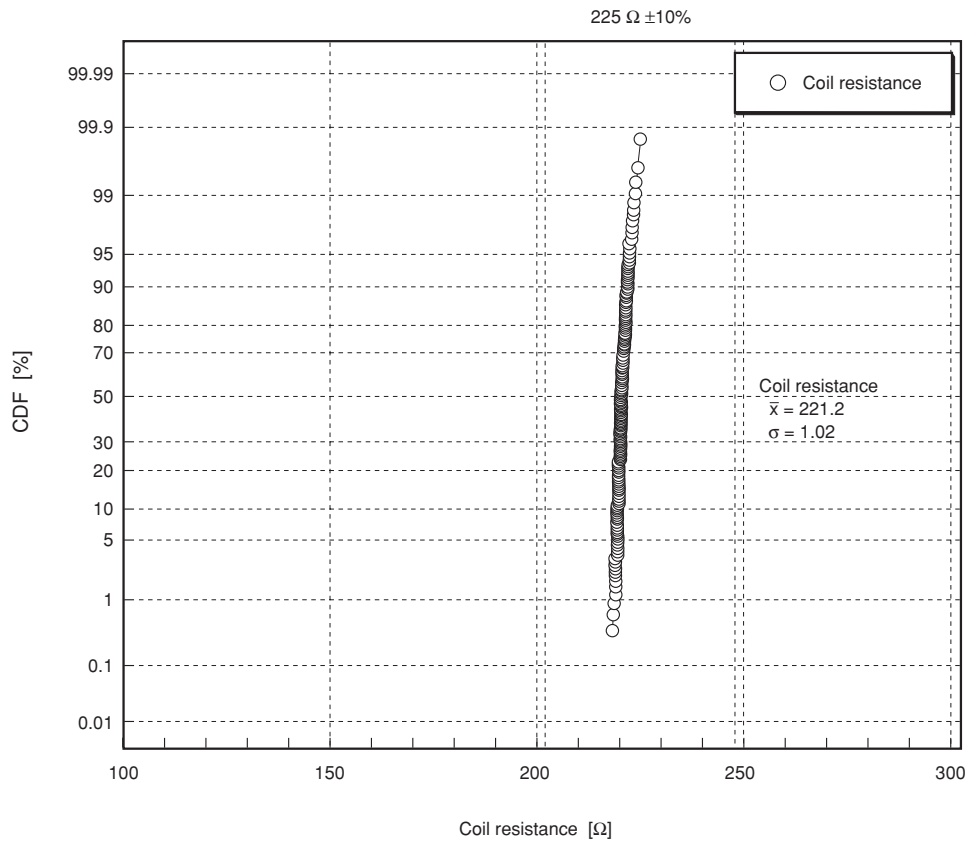


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2. INITIAL CHARACTERISTICS

Coil Resistance

| Test items | Test conditions | Samples |
|--------------------|----------------------------|----------------------|
| 1. Coil resistance | Ambient temperature : 20°C | ET2-B3M1S 180 pcs |

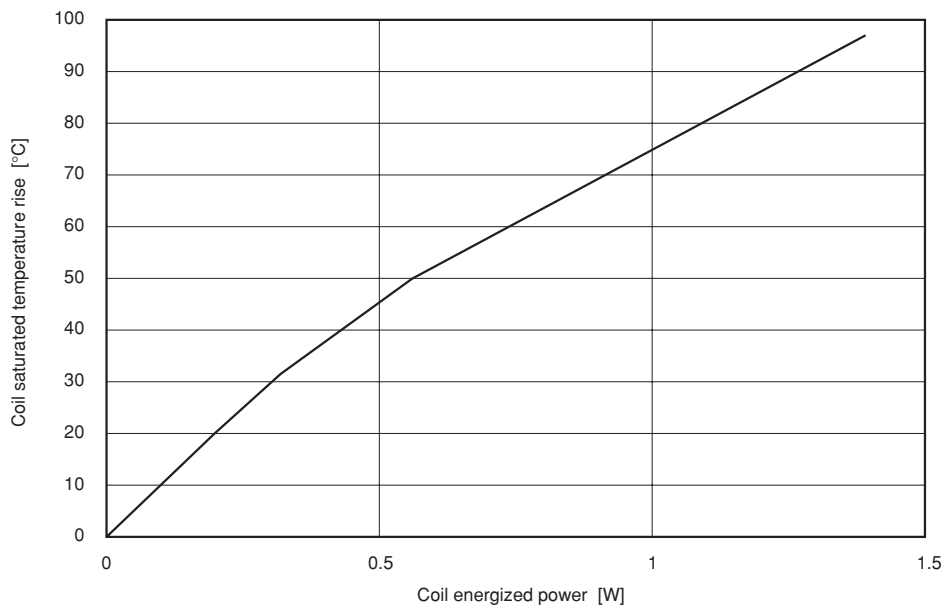
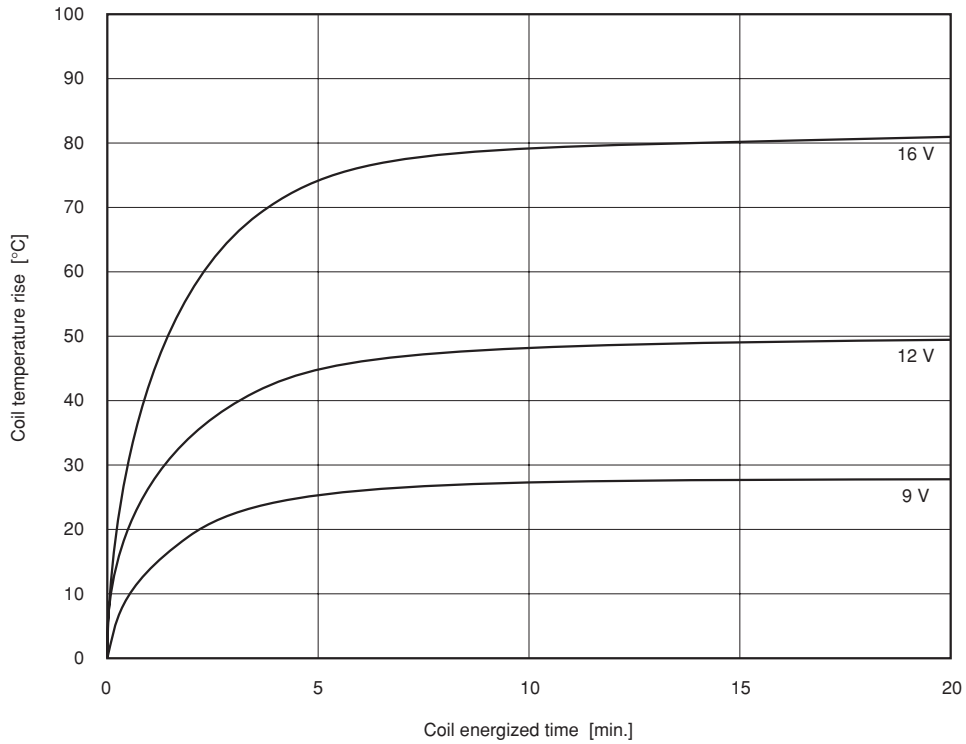


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2. INITIAL CHARACTERISTICS

Coil Temperature Rise

| Test items | Test conditions | Samples |
|--------------------------|--|--------------------|
| 1. Coil temperature rise | Ambient temperature : 20°C Contact carrying current : 0 (A) Coil resistance measuring method | ET2-B3M1S 3 pcs |

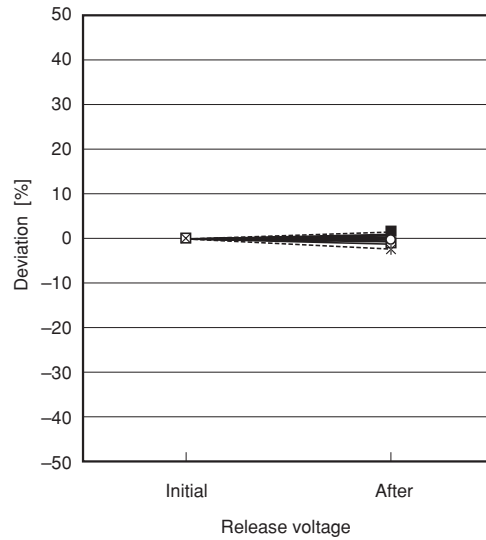
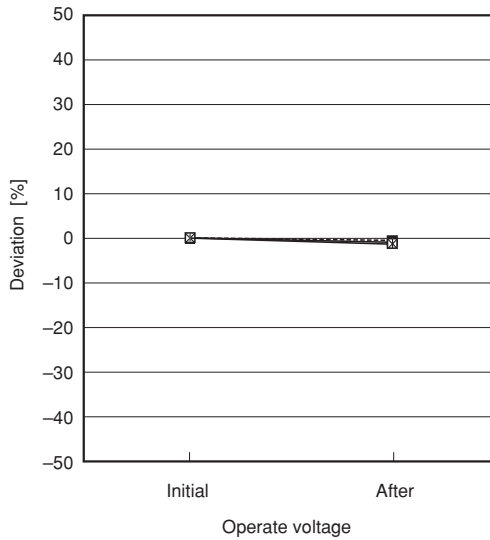
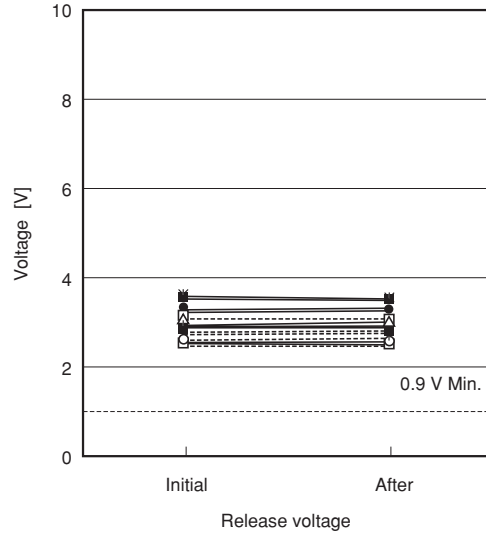
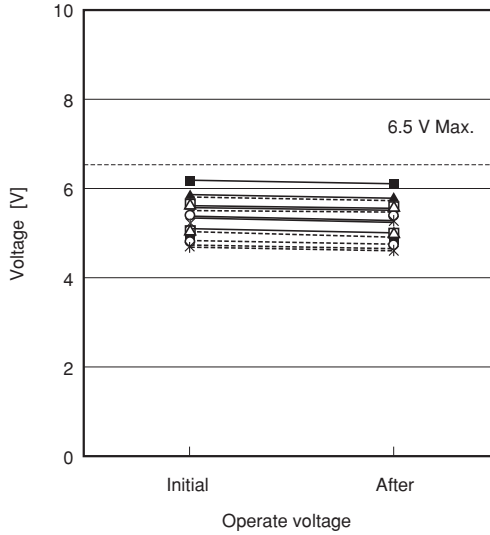


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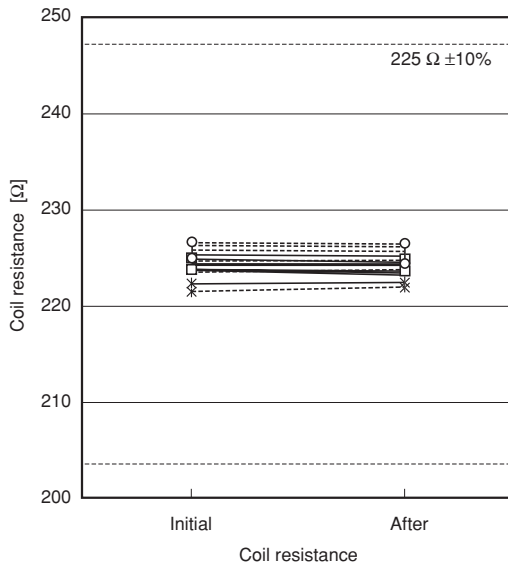
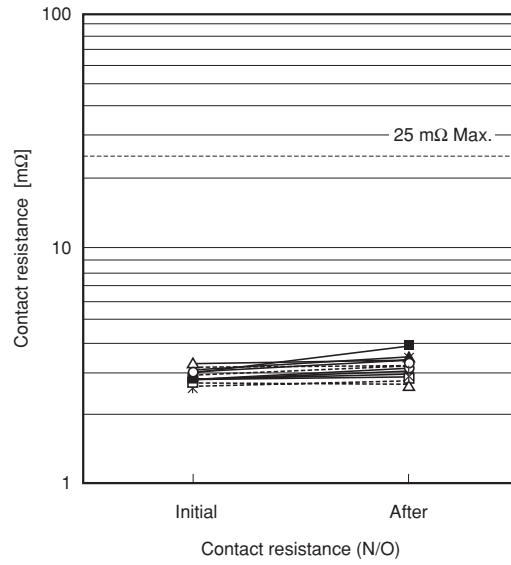
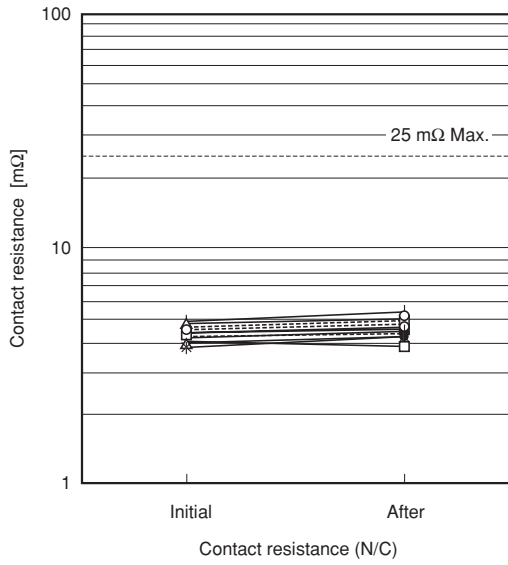
3. ENVIRONMENTAL CHARACTERISTICS

High Temperature Storage Test

| Test items | Test conditions | Samples |
|--|--|---------------------|
| 1. Operate voltage 2. Release voltage 3. Contact resistance 4. Coil resistance @20°C | Storage Temperature : 85°C ±2°C Duration time : 192 Hours | ET2-B3M1S 10 pcs |



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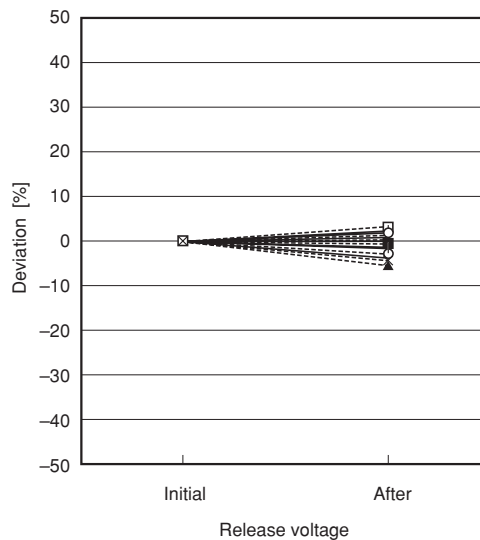
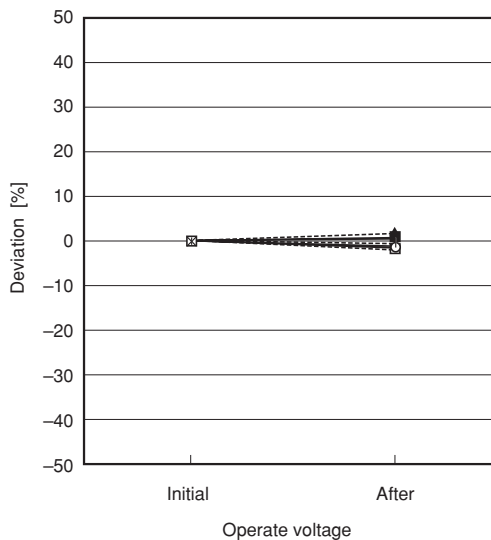
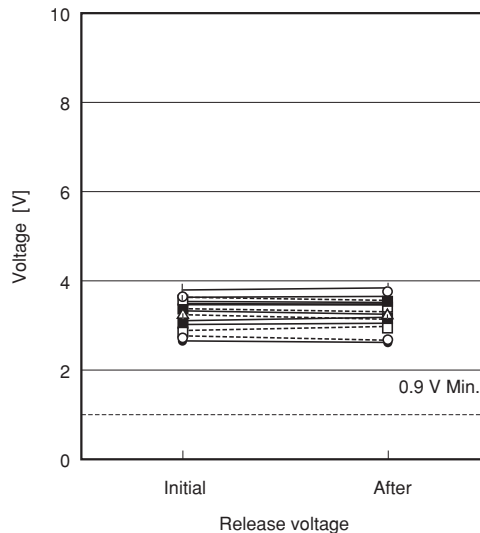
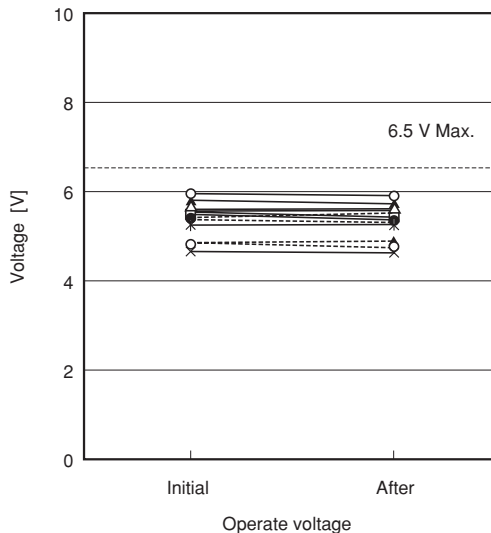


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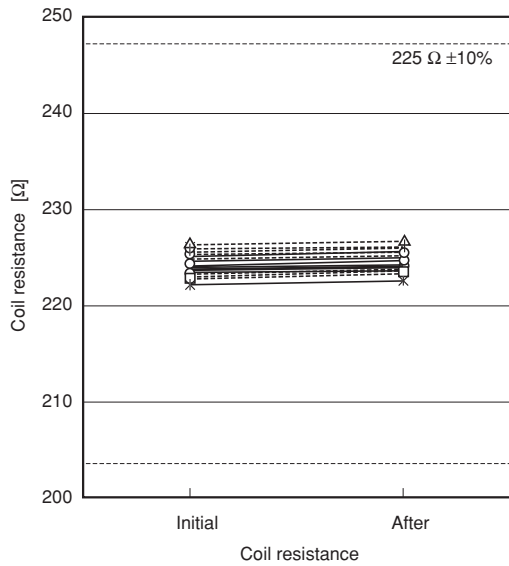
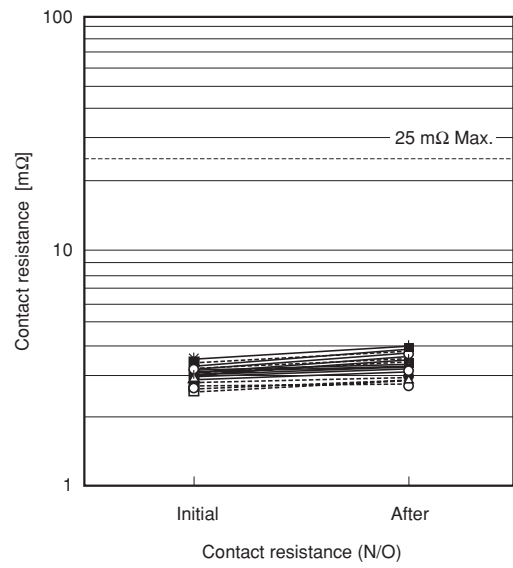
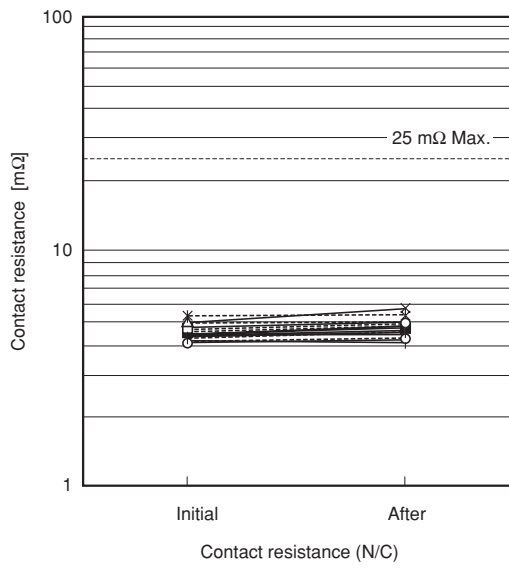
3. ENVIRONMENTAL CHARACTERISTICS

Low Temperature Storage Test

| Test items | Test conditions | Samples |
|--|---|---------------------|
| 1. Operate voltage 2. Release voltage 3. Contact resistance 4. Coil resistance @20°C | Storage Temperature : -40°C ±2°C Duration time : 192 Hours | ET2-B3M1S 10 pcs |



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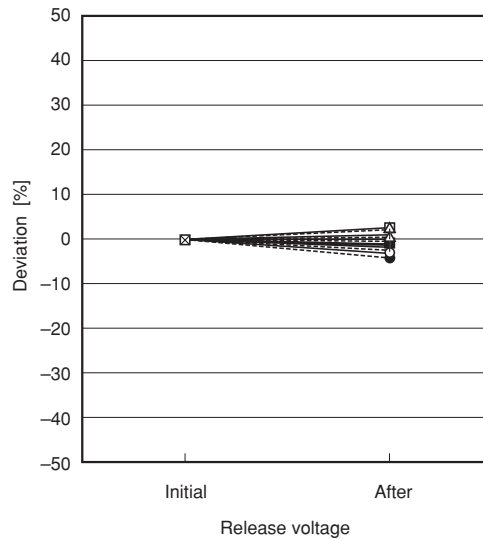
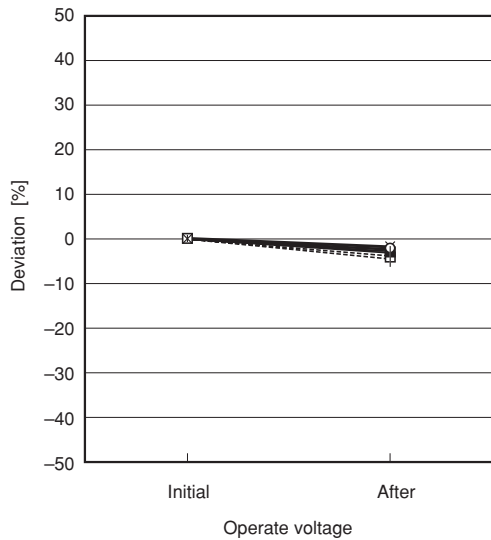
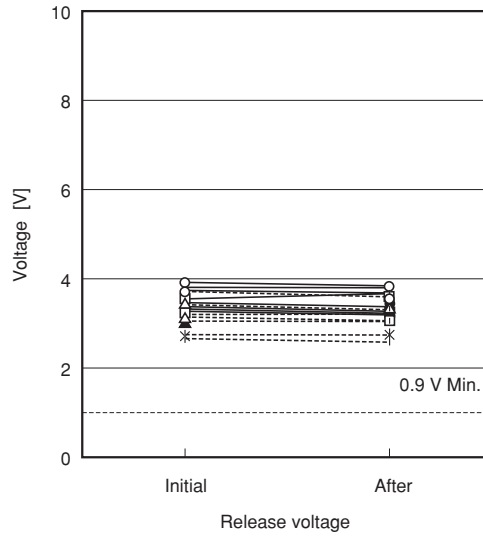
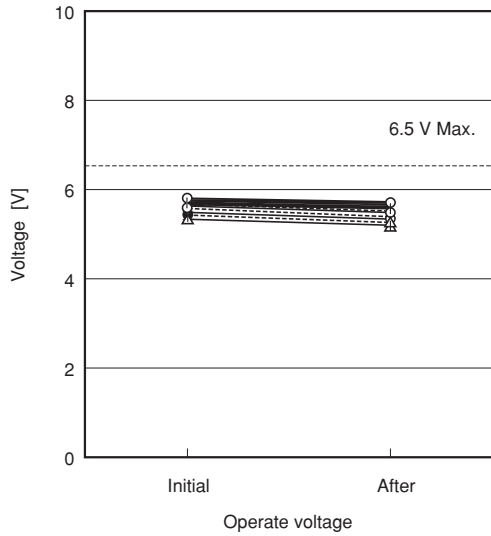


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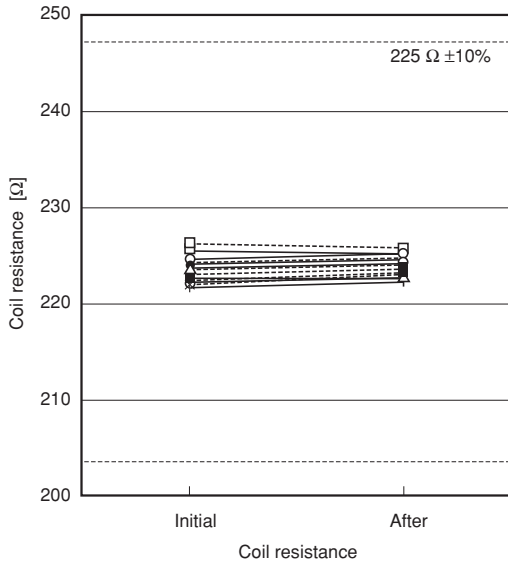
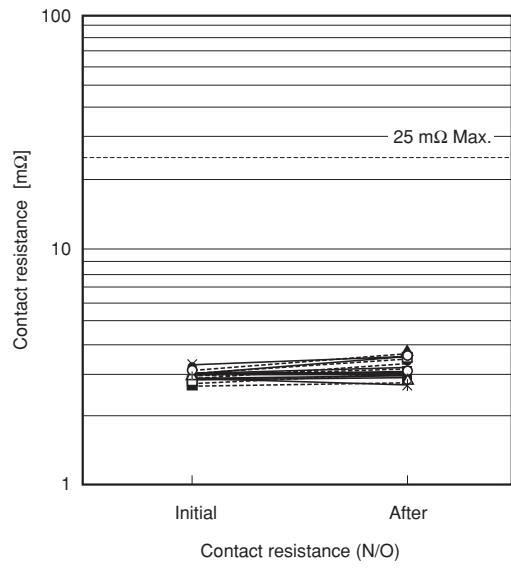
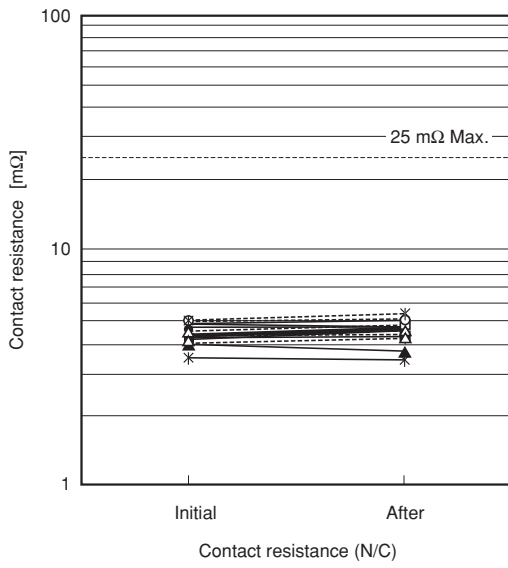
3. ENVIRONMENTAL CHARACTERISTICS

High Temperature And High Humidity Test

| Test items | Test conditions | Samples |
|--|--|---------------------|
| 1. Operate voltage 2. Release voltage 3. Contact resistance 4. Coil resistance @20°C | Temperature : 85°C Humidity : 85% RH Duration time : 192 Hours | ET2-B3M1S 10 pcs |



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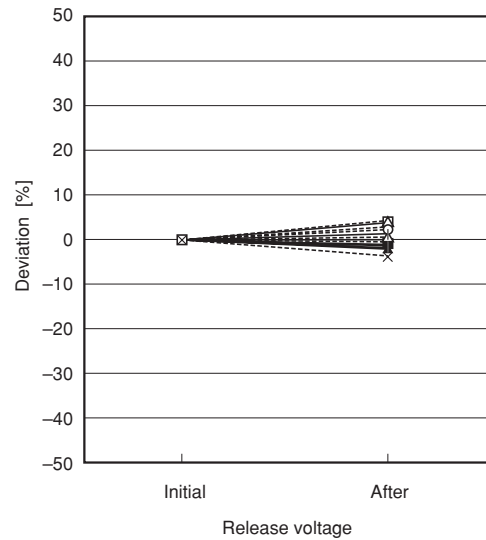
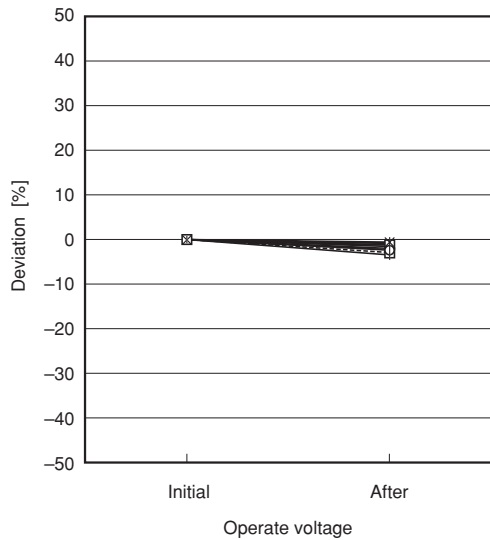
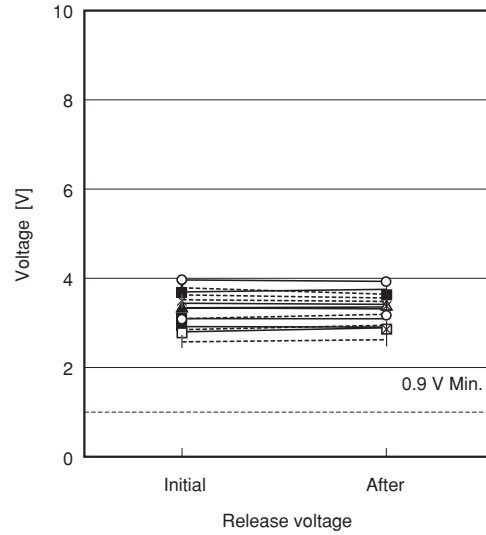
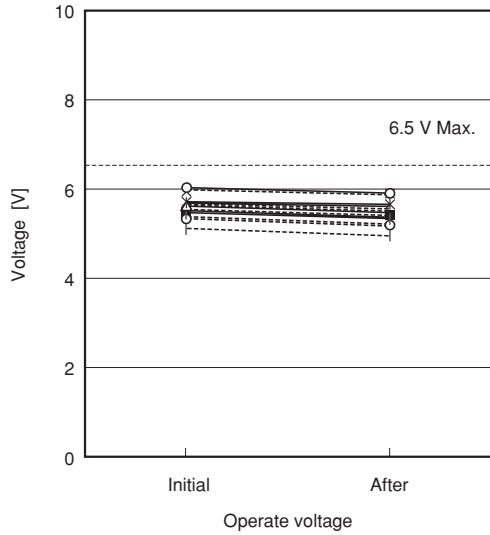


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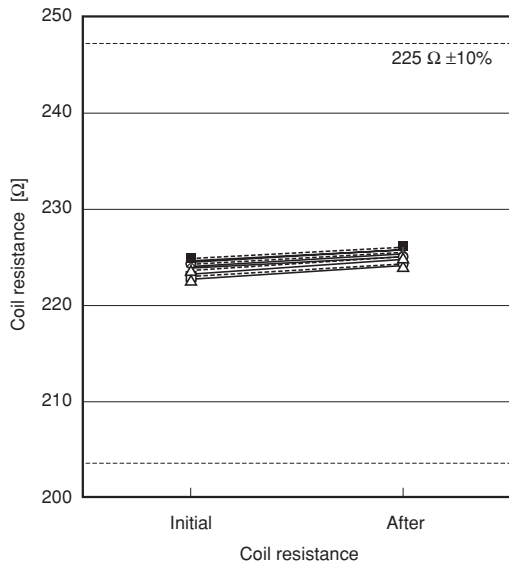
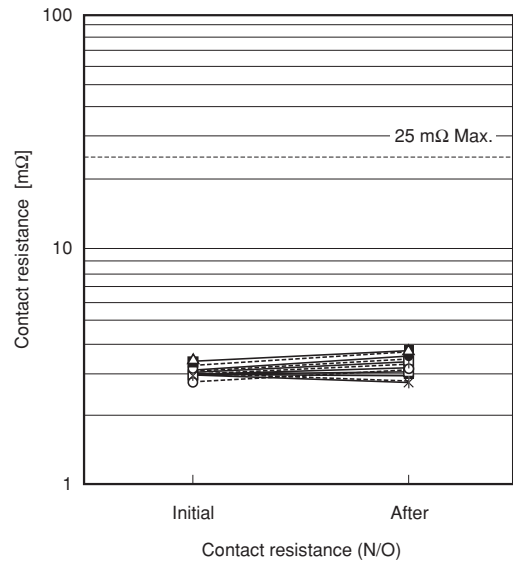
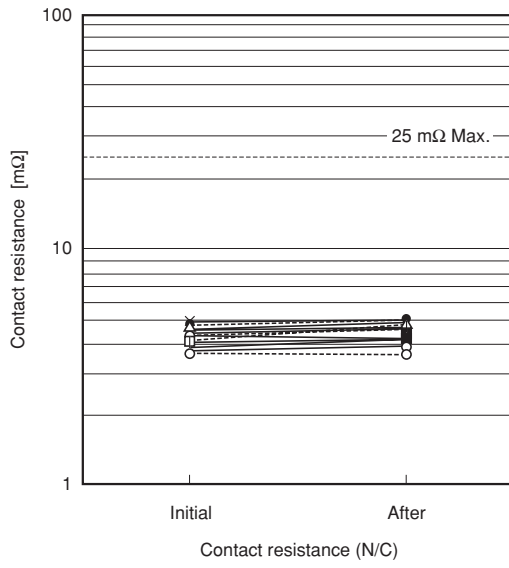
3. ENVIRONMENTAL CHARACTERISTICS

High Temperature And High Humidity Cycle Test

| Test items | Test conditions | Samples |
|---|--|---------------------|
| 1. Operate voltage 2. Release voltage 3. Contact resistance 4. Coil resistance | MIL-STD-202F-106E Number of cycles: 10 cycles | ET2-B3M1S 10 pcs |



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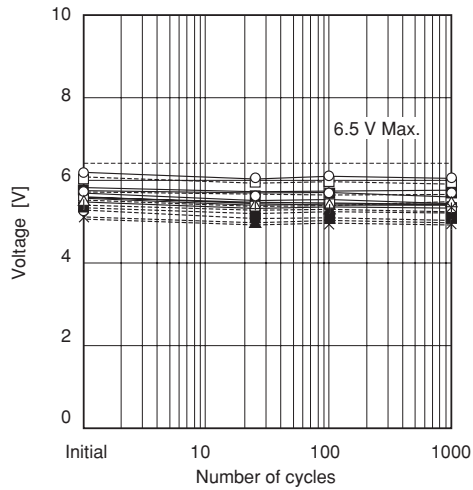


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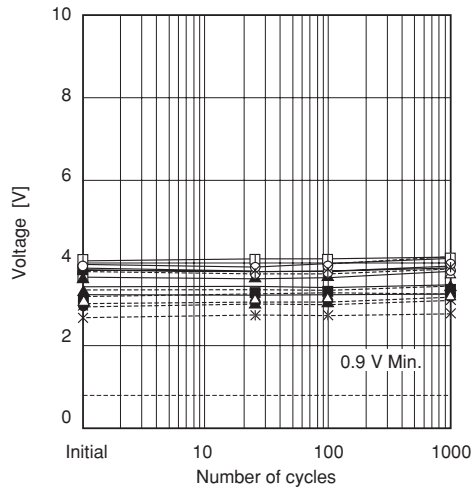
3. ENVIRONMENTAL CHARACTERISTICS

Thermal Shock Test

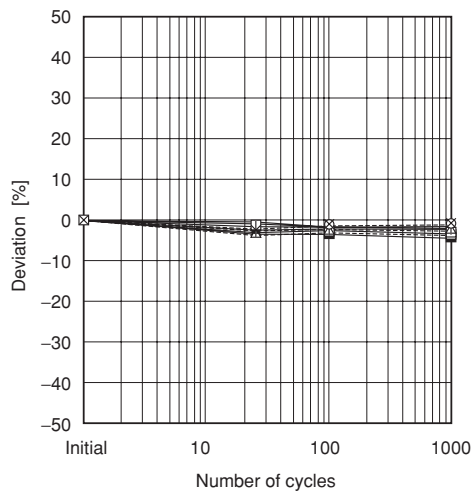
| Test items | Test conditions | Samples |
|---|--|---------------------|
| 1. Operate voltage 2. Release voltage 3. Contact resistance 4. Coil resistance | -40°C : 30 min +85°C : 30 min Transfer time : 10 sec | ET2-B3M1S 10 pcs |



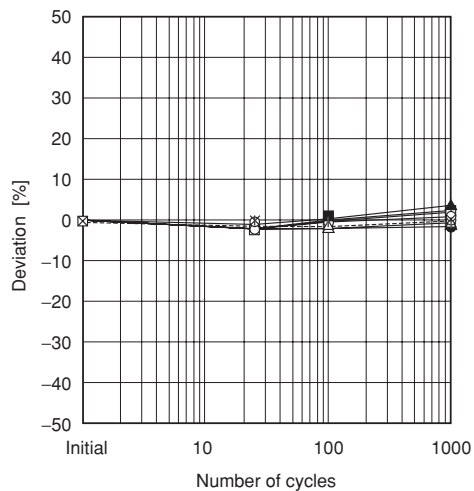
Operate voltage



Release voltage



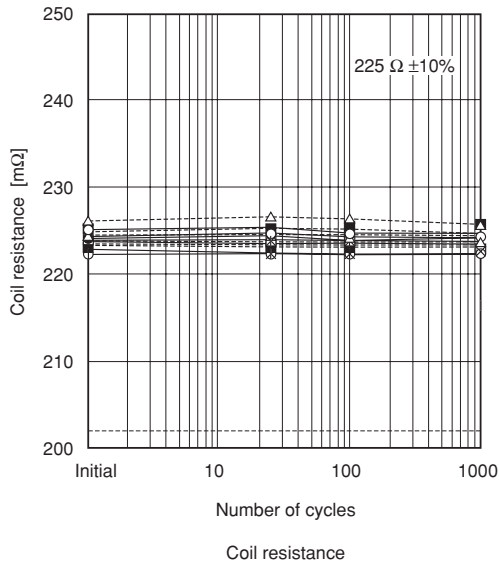
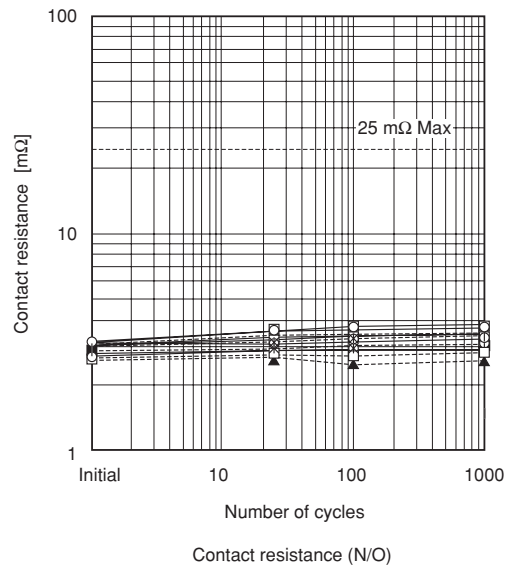
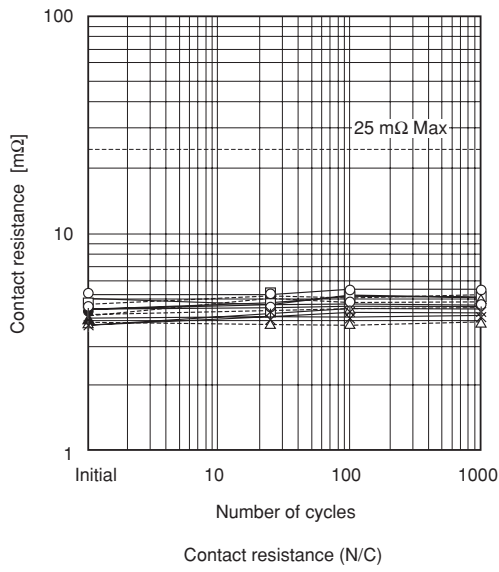
Operate voltage



Release voltage



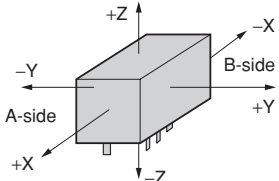
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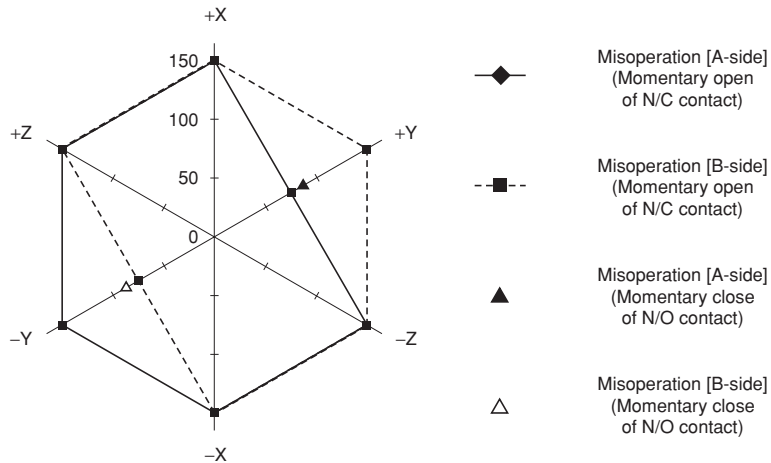
3. ENVIRONMENTAL CHARACTERISTICS

Shock Test (misoperation)

| Test Items | Test Conditions | Samples |
|--|---|--------------------|
| The misoperation of the contact for over 0.1 ms checked by the oscilloscope. | <p>The shock added to 6 directions as follows.</p>  <p>The misoperation means momentary open of N/C contacts and momentary close N/O contacts.</p> | ET2-B3M1S 5 pcs |

The acceleration G of misoperation

| Side | Directions | Spec. | Non-energized | Notes |
|------|------------|---------------|---|---|
| A | +X | More than 10G | More than 150G | Direction of armature and contact operation |
| | -X | | More than 70G momentary close of N/O contact more than 85G | |
| | +Y | | More than 150G | |
| | -Y | | More than 150G | |
| | +Z | | More than 150G | |
| | -Z | | More than 150G | |
| B | +X | | More than 150G | Direction of armature and contact operation |
| | -X | | More than 150G | |
| | +Y | | More than 70G momentary close of N/O contact more than 85G | |
| | -Y | | More than 150G | |
| | +Z | | More than 150G | |
| | -Z | | More than 150G | |

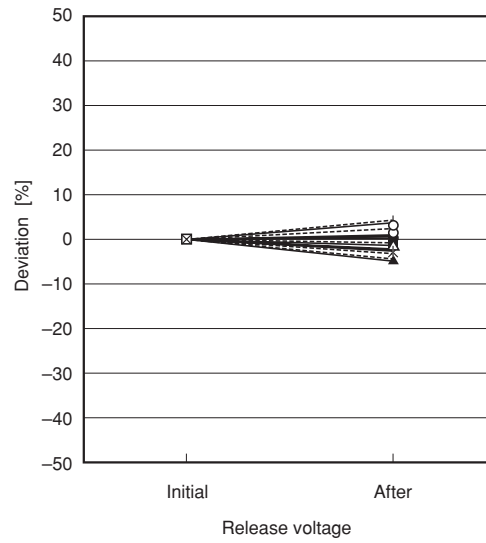
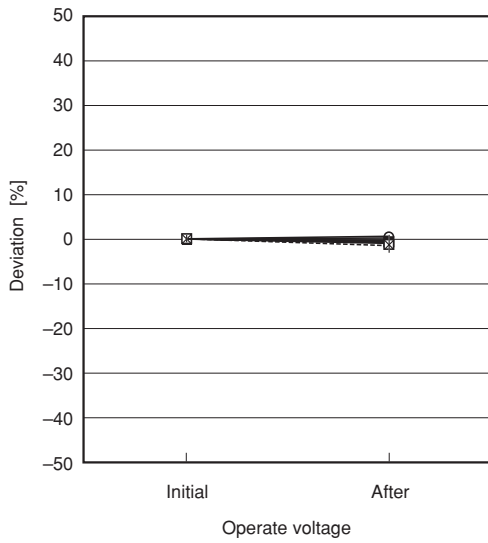
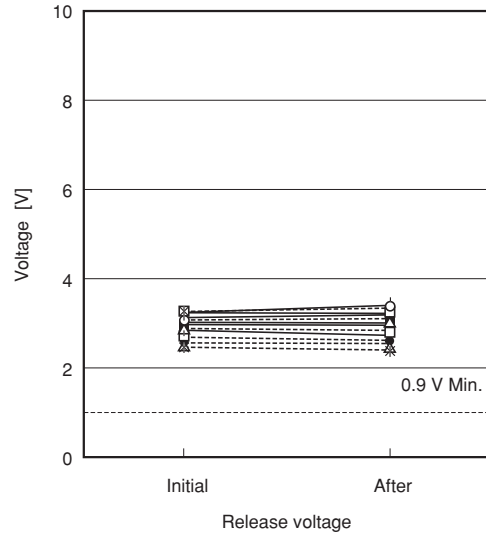
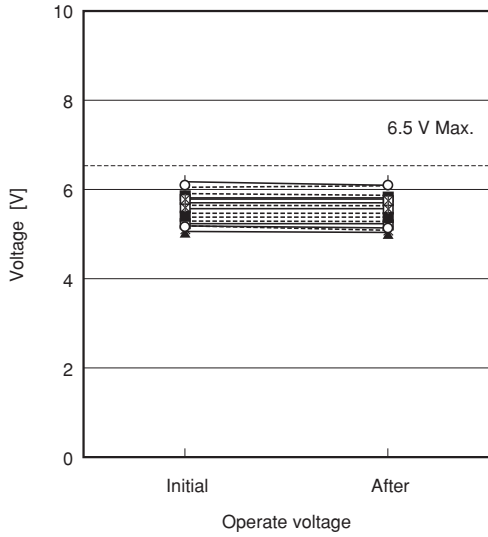


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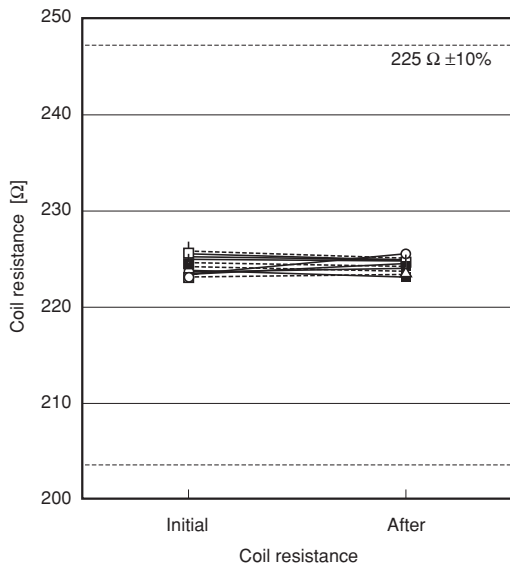
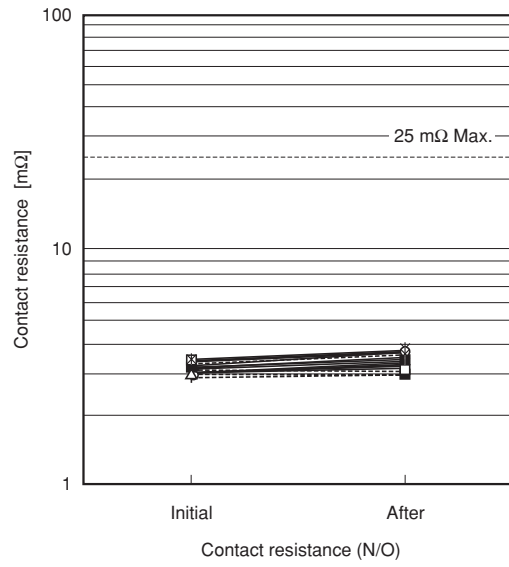
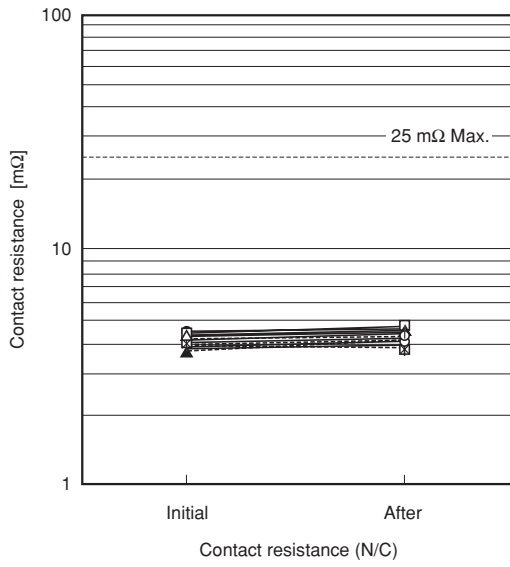
3. ENVIRONMENTAL CHARACTERISTICS

Shock Durability Test

| Test items | Test conditions | Samples |
|-----------------------|---|---------------------|
| 1. Operate voltage | Temperature : 20°C | ET2-B3M1S 10 pcs |
| 2. Release voltage | Shock acceleration : 100G | |
| 3. Contact resistance | Acceleration direction : 6 (+X, -X, +Y, -Y, +Z, -Z) | |
| 4. Coil resistance | Number of operations : 3 times | |



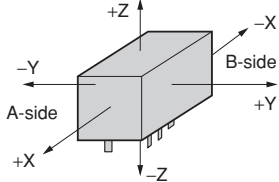
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3. ENVIRONMENTAL CHARACTERISTICS

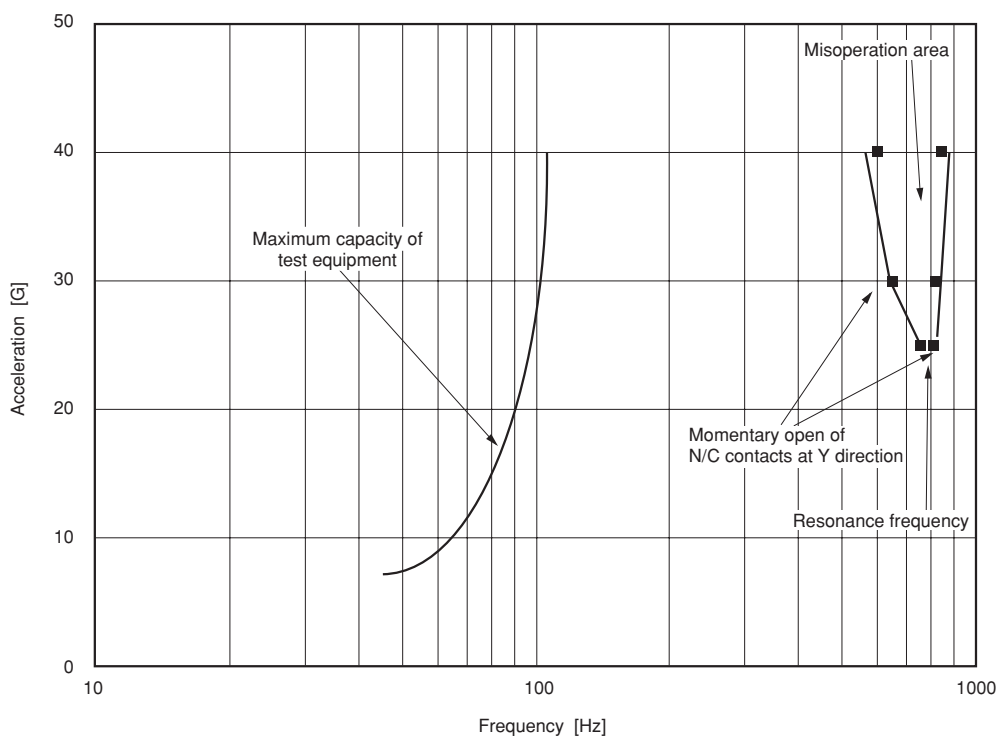
Vibration Test (misoperation)

| Test Items | Test Conditions | Samples |
|---|---|----------------------------|
| <p>The misoperation of the contact for over 0.1 ms checked by the oscilloscope.</p> | <p>Vibration frequency : 10 to 1000 Hz The vibration added to 3 directions as follows.</p>  <p>The misoperation means momentary open of N/C contacts and momentary close N/O contacts.</p> | <p>ET2-B3M1S 5 pcs</p> |

*Energized samples without misoperation until more than 40G at all directions.

*Non-energized samples without misoperation until more than 40G at X, Z directions.

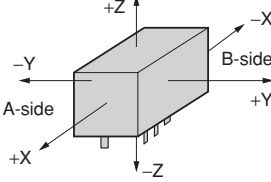
*Misoperation area of Non-energized samples at Y direction as follows.

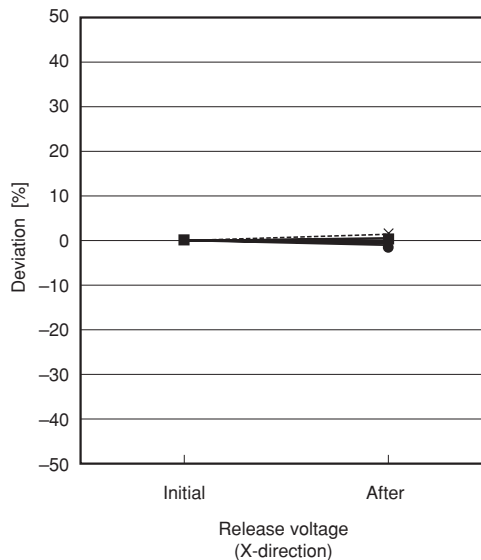
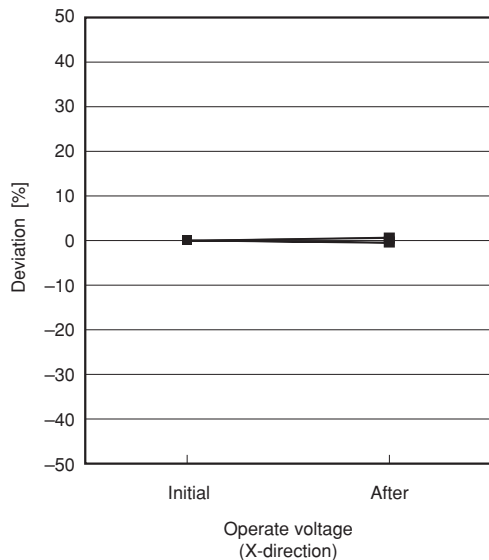
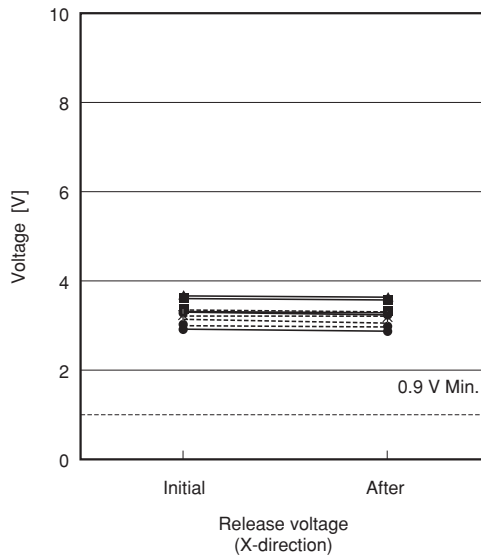
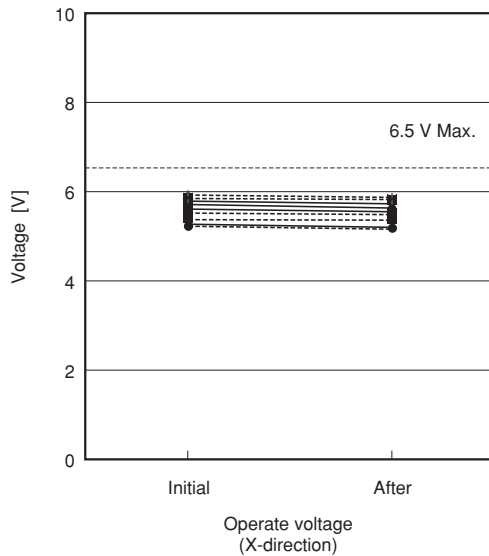


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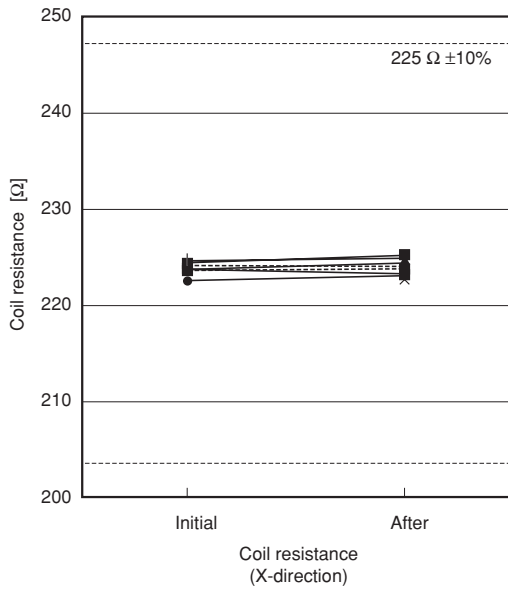
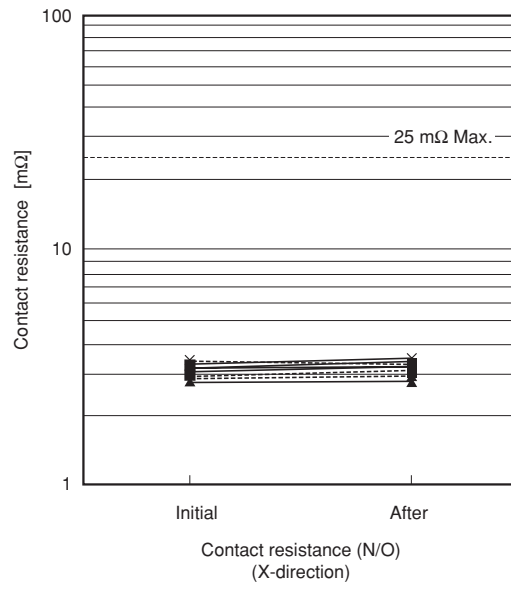
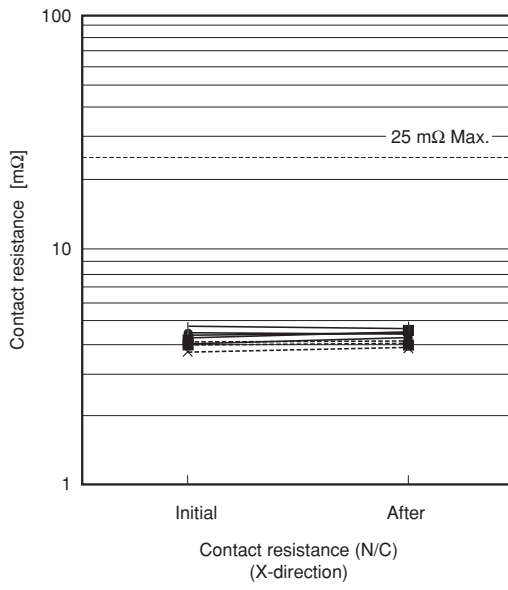
3. ENVIRONMENTAL CHARACTERISTICS

Vibration Durability Test

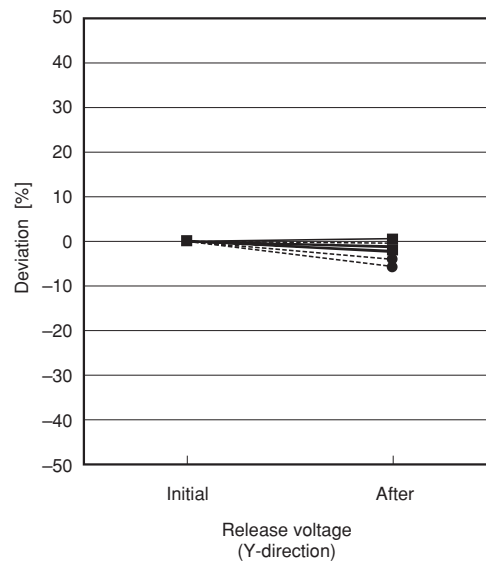
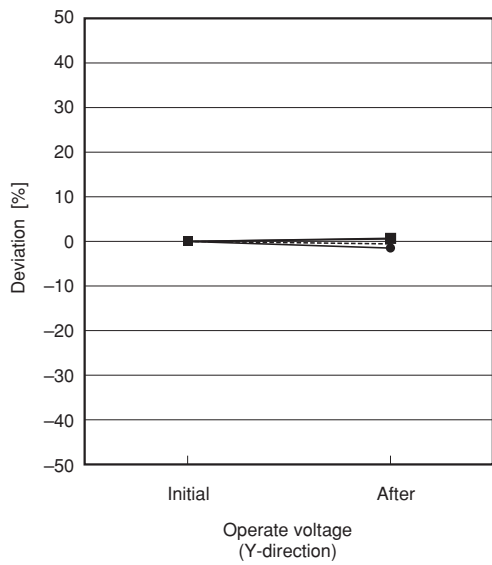
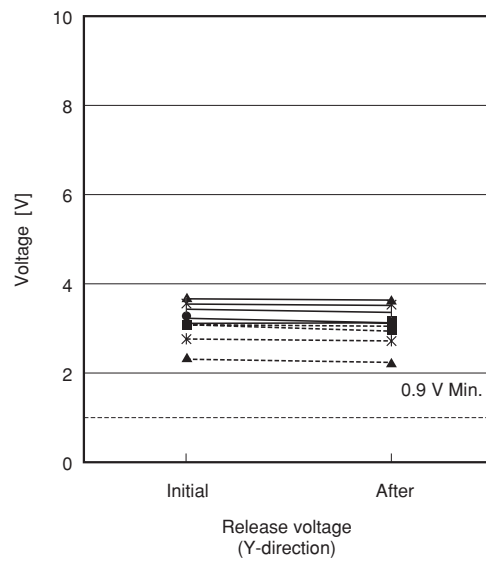
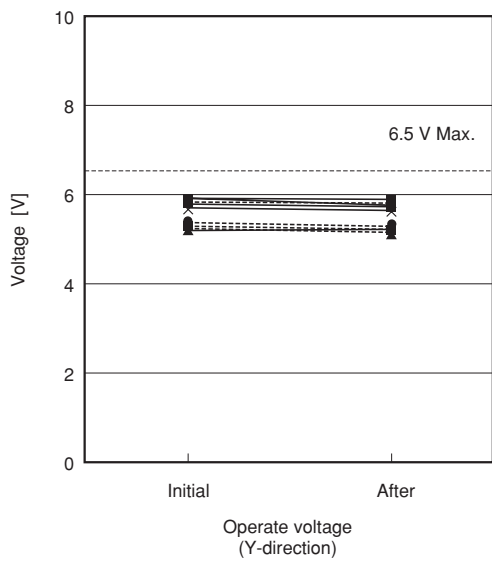
| Test items | Test conditions | Samples |
|---|--|--|
| 1. Operate voltage 2. Release voltage 3. Contact resistance 4. Coil resistance | Vibration frequency : 10 to 500Hz, 4.4G, 192 Hours The vibration added to 3 directions as follows.  | ET2-B3M1S 15 pcs (Each directions : 5 pcs) |



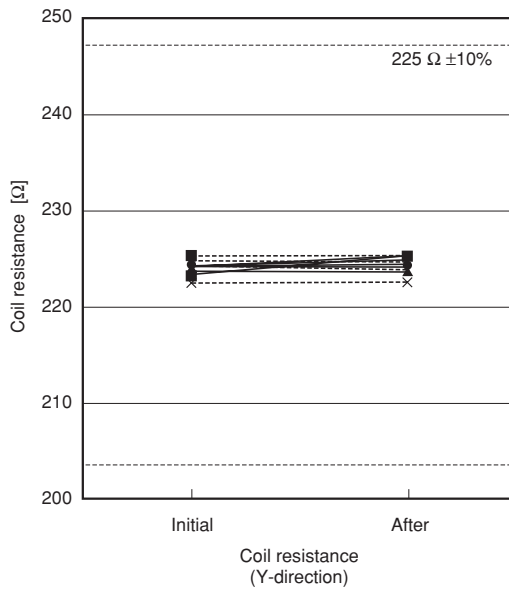
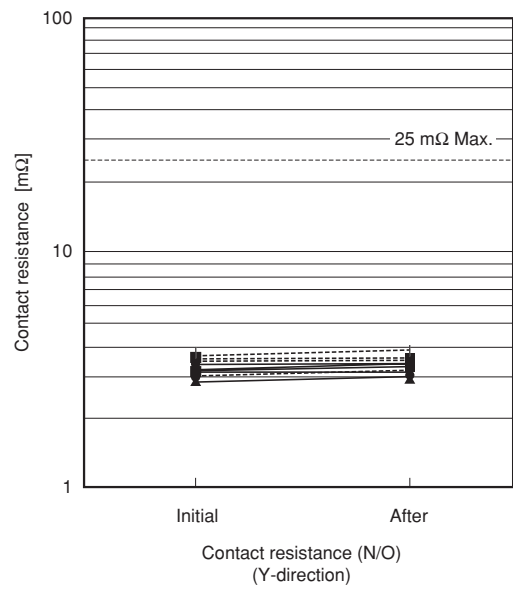
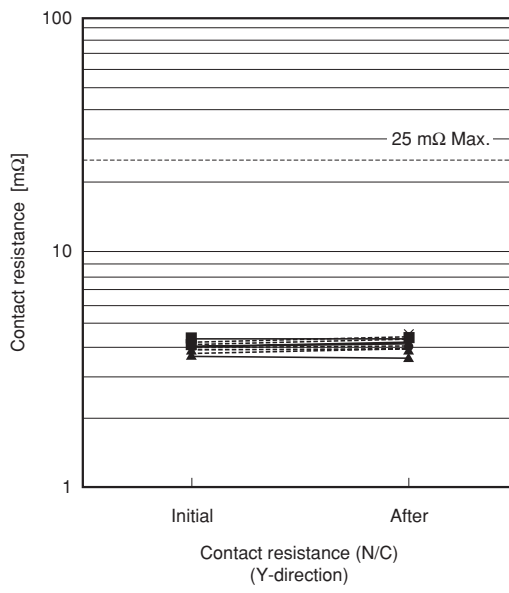
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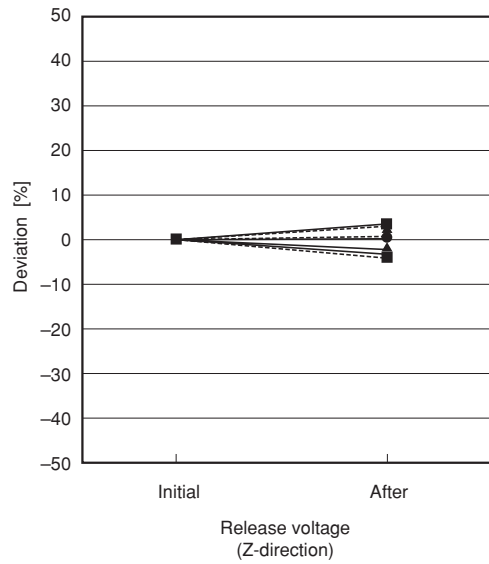
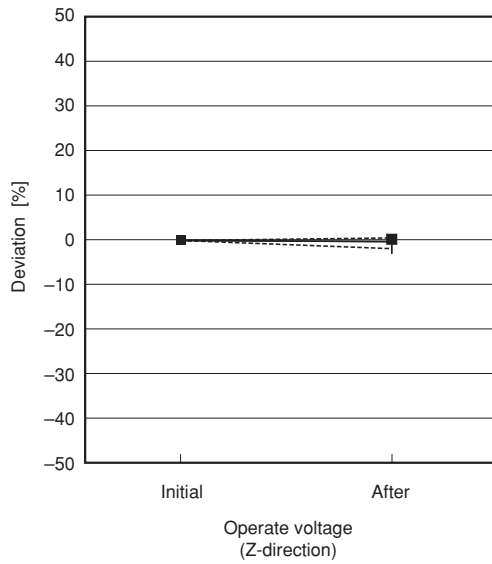
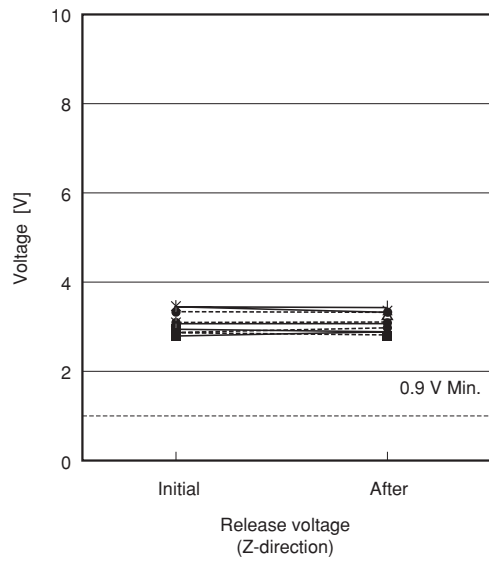
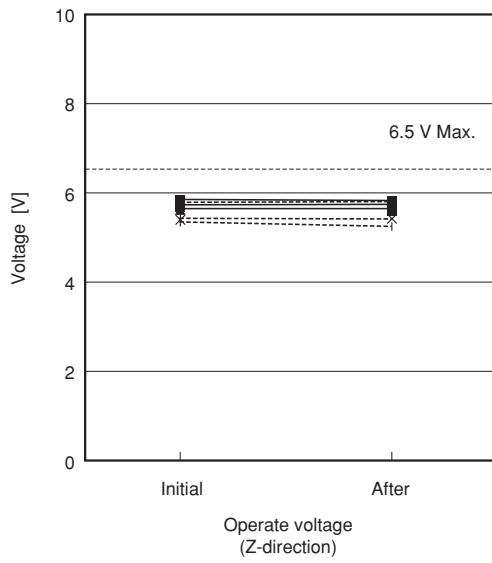
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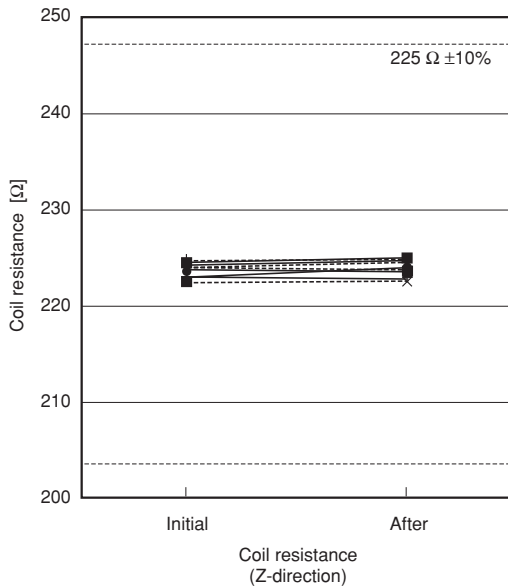
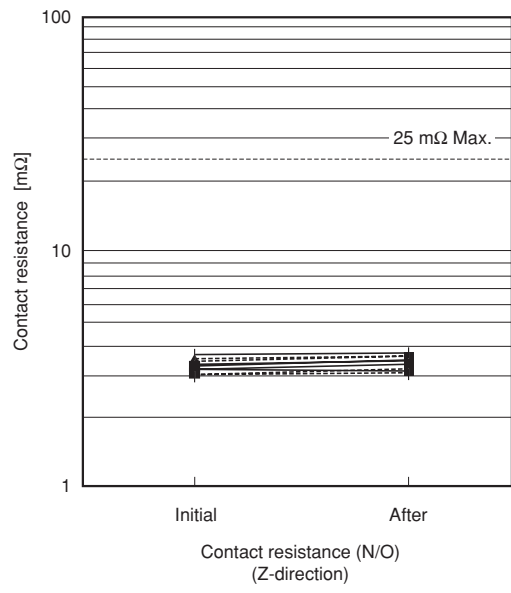
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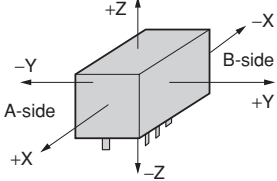
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3. ENVIRONMENTAL CHARACTERISTICS

Drop Test (1)

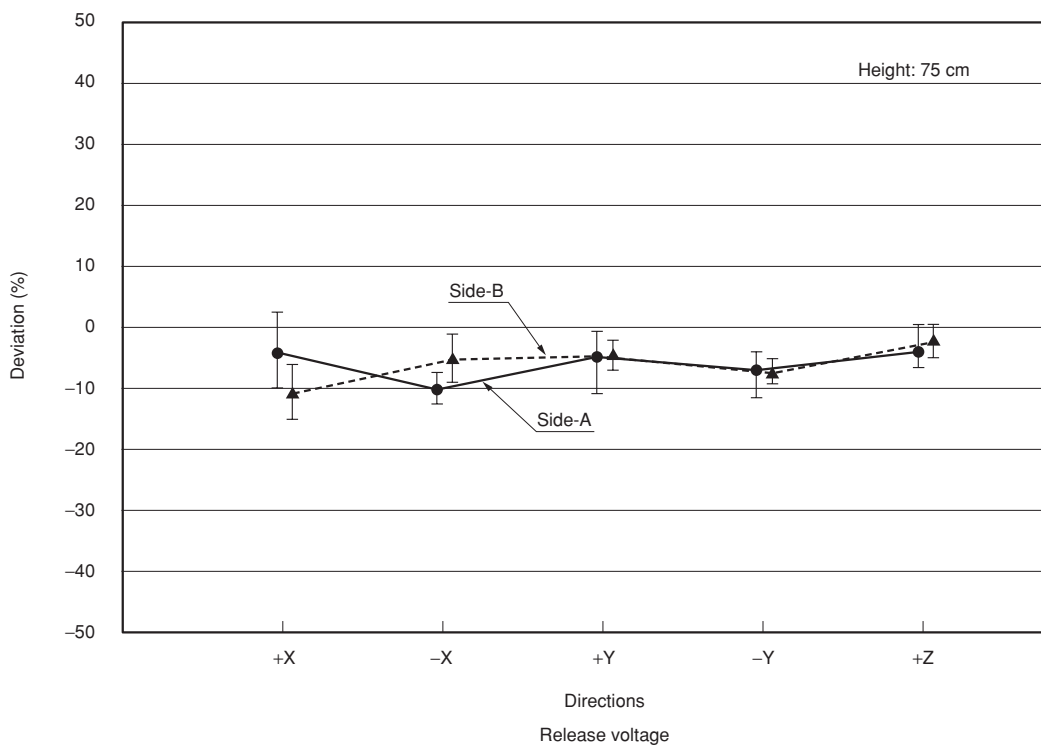
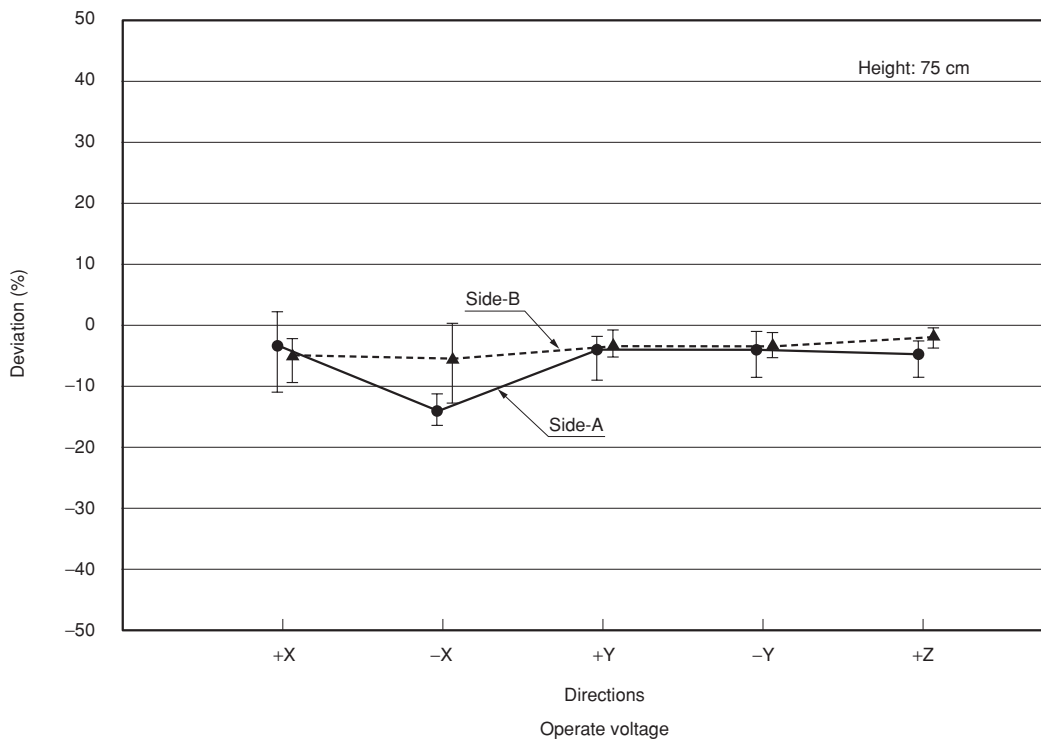
| Test items | Test conditions | Samples |
|--|---|--|
| 1. Operate voltage 2. Release voltage | Dropping number : 1 times Direction : 5 directions as follows Height : 75 cm  | ET2-B3M1S 15 pcs (Each directions : 3 pcs) |

< 75 cm drop height >

1. Deviation of operate/release voltage : 20% max.
2. No constructive failure



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3. ENVIRONMENTAL CHARACTERISTICS

Drop Test (2)

| Test items | Test conditions | Samples |
|--|-----------------|--------------------|
| 1. Operate Voltage 2. Release Voltage | As per below | ET2-B3M1S 8 pcs |

- Drop height : 100 cm
- Relay : as shown below figure
- Drop direction : +X → -X → +Y → -Y → +Z → -Y
(Total 6 times / relay)

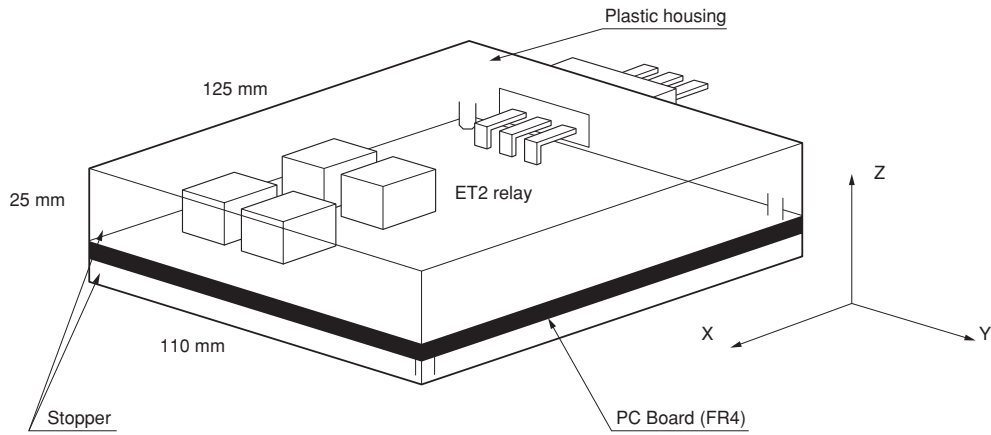
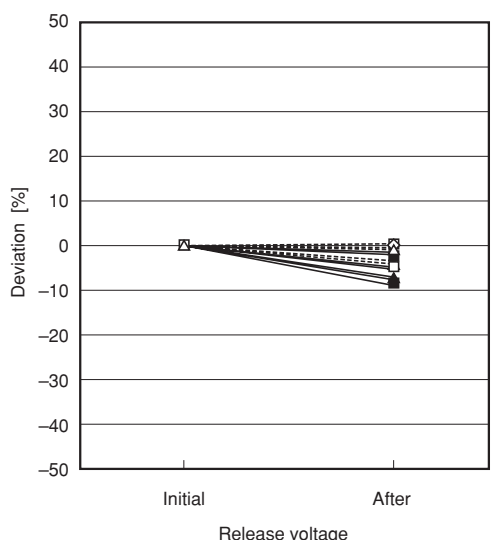
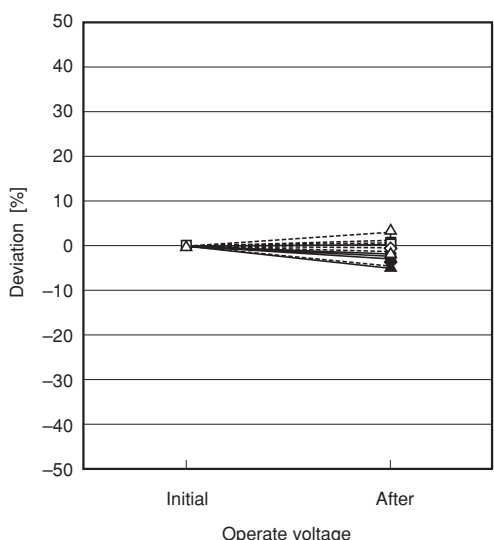
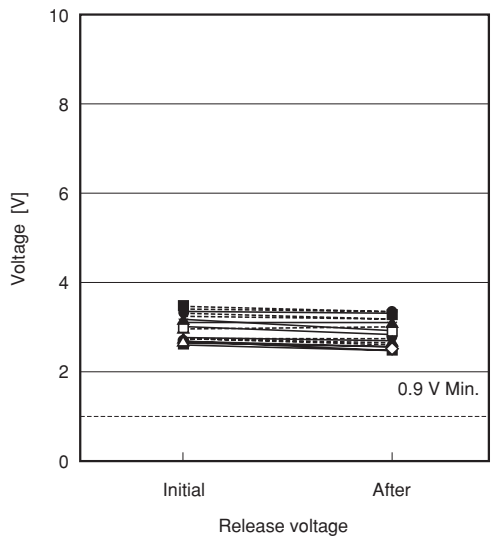
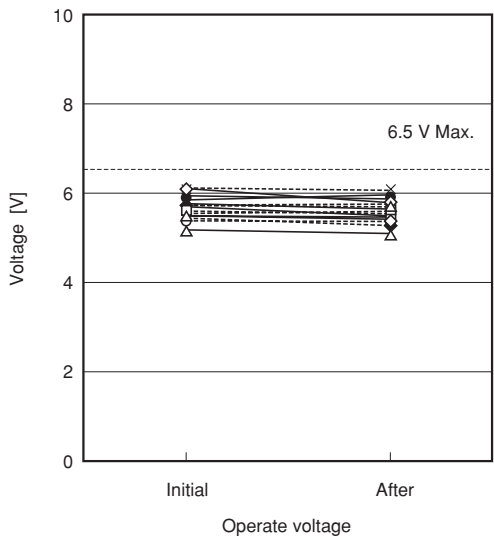


Fig.1 Module for drop test



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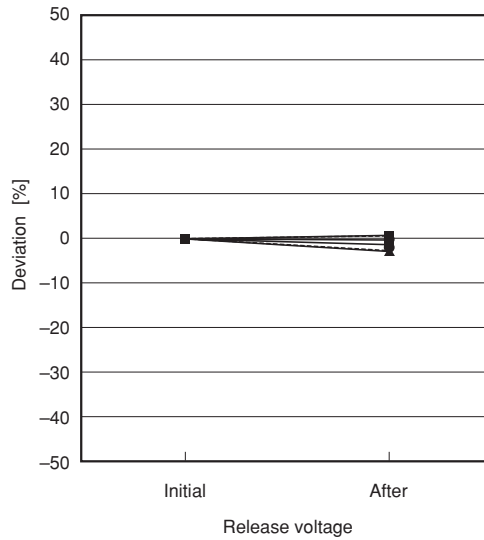
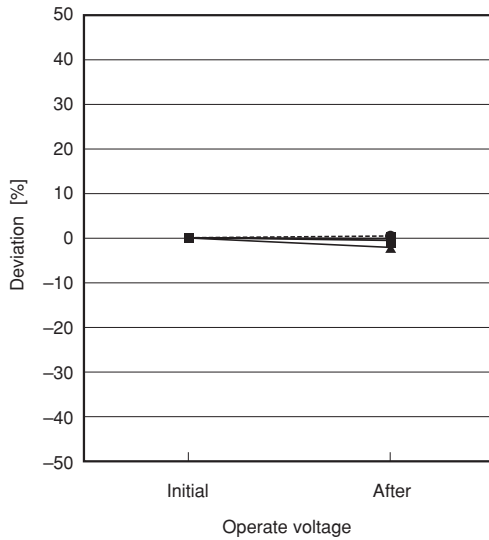
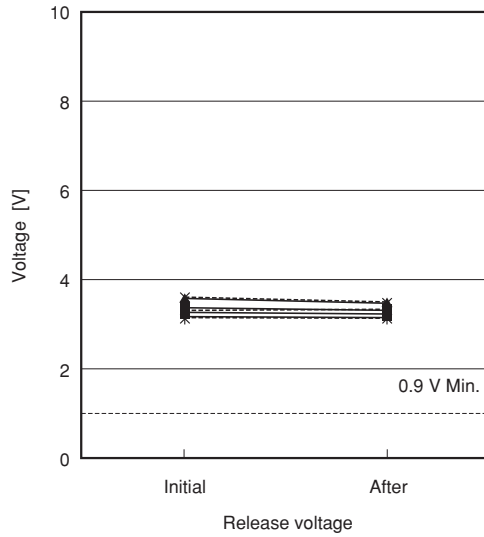
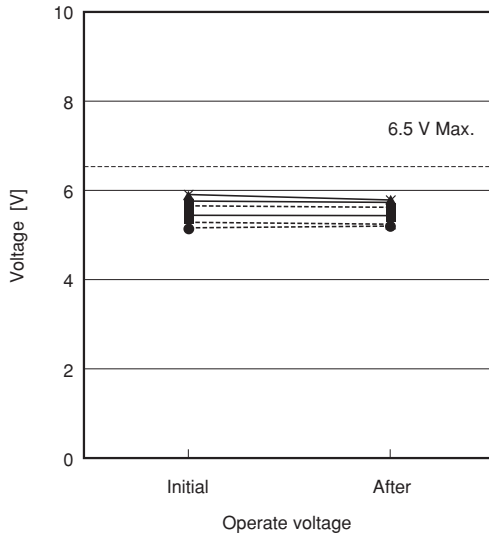


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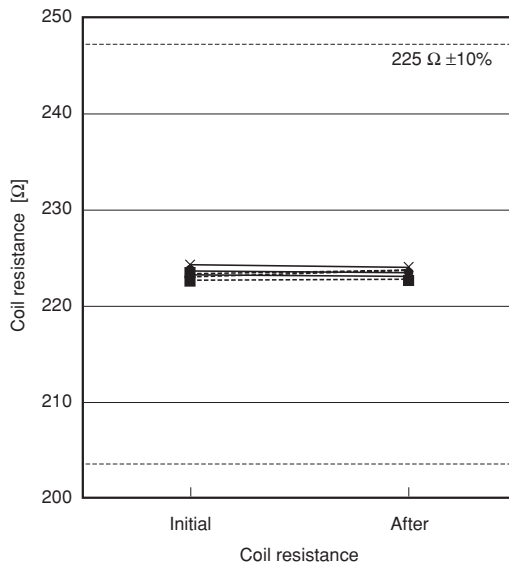
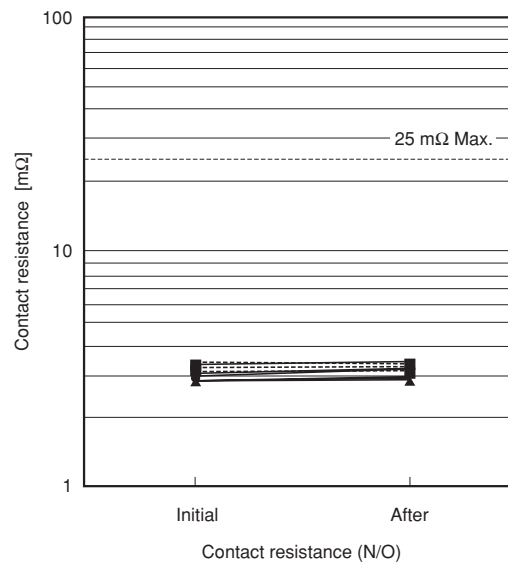
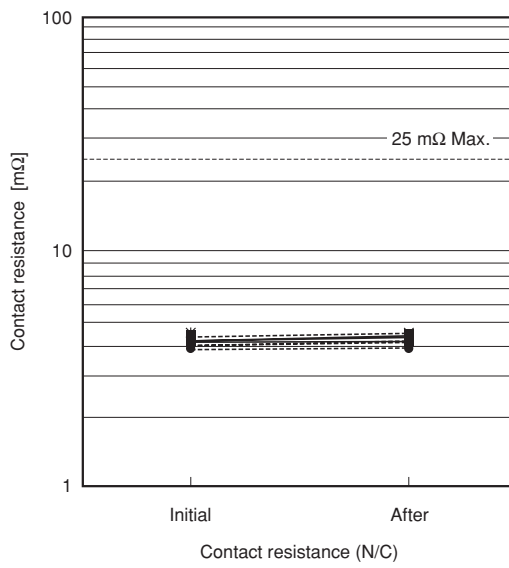
3. ENVIRONMENTAL CHARACTERISTICS

Terminal Strength Test

| Test items | Test conditions | Samples |
|---|---|--------------------|
| 1. Operate voltage 2. Release voltage 3. Contact resistance 4. Coil resistance | All terminals Force : 1 Kg Time : 10 sec. | ET2-B3M1S 5 pcs |



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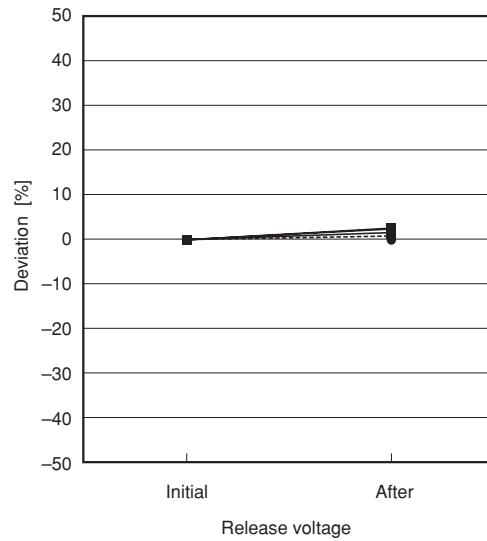
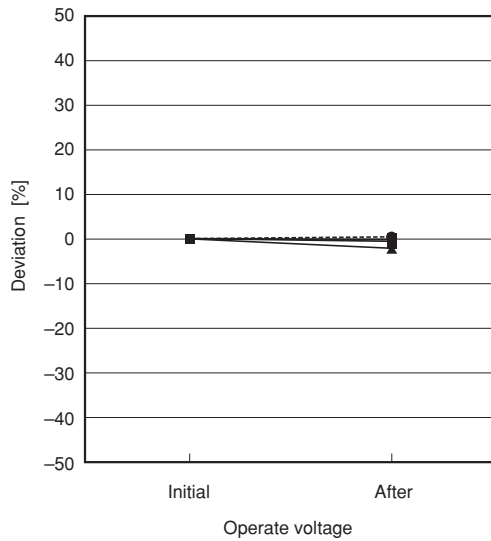
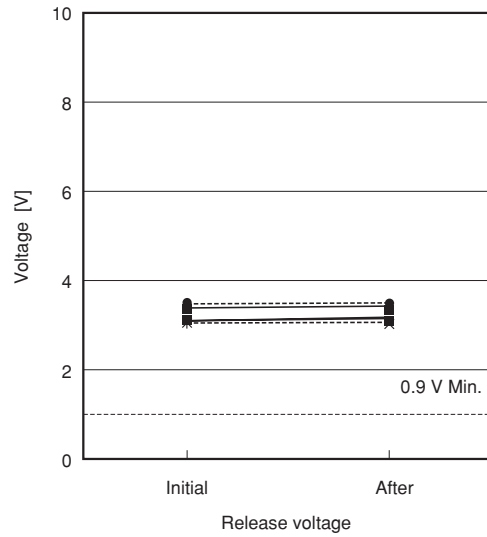
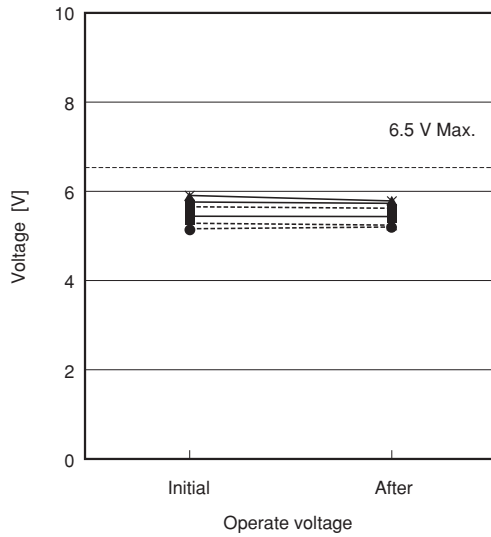


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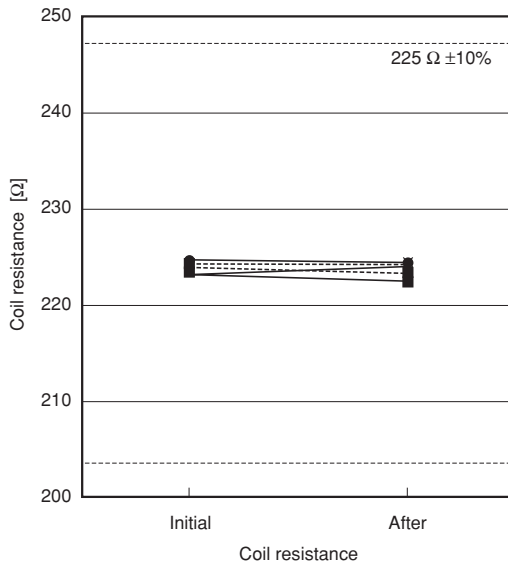
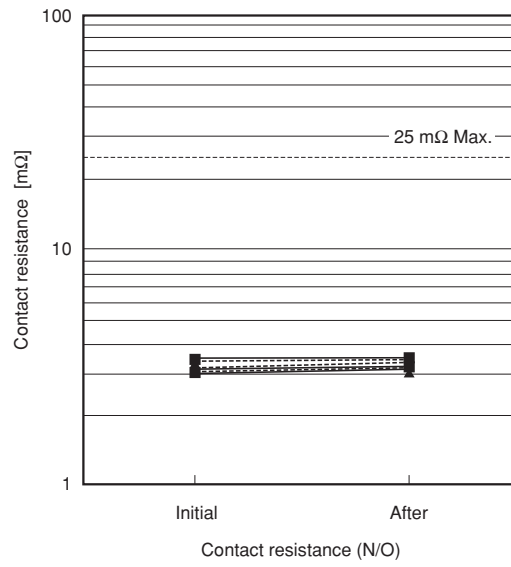
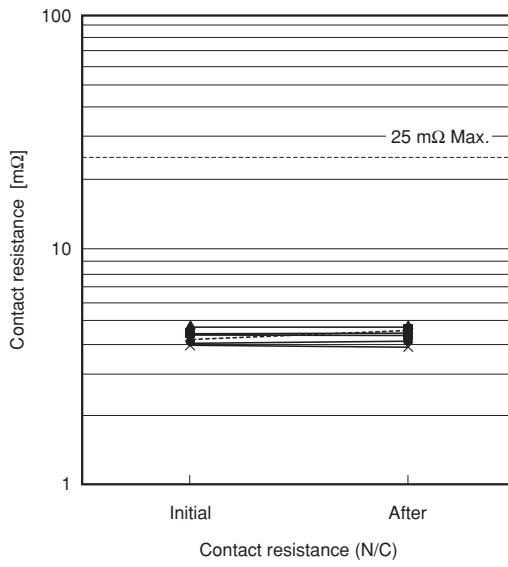
3. ENVIRONMENTAL CHARACTERISTICS

Terminal Bending Test

| Test items | Test conditions | Samples |
|-----------------------|-----------------------------------|--------------------|
| 1. Operate voltage | MIL-STD-202F-211A(B) | ET2-B3M1S 5 pcs |
| 2. Release voltage | All terminals | |
| 3. Contact resistance | Terminal bending cycle : 3 cycles | |
| 4. Coil resistance | Bending angle : 45° | |



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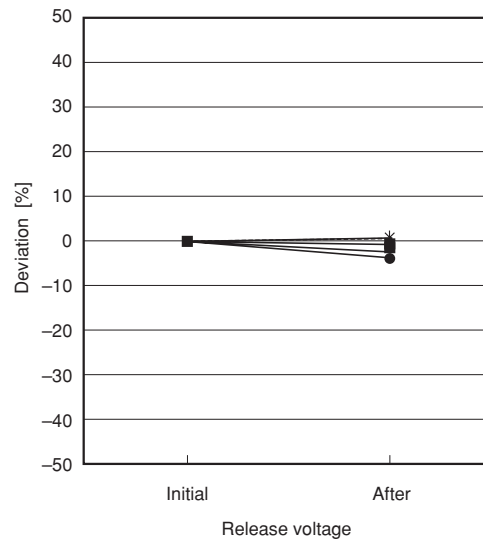
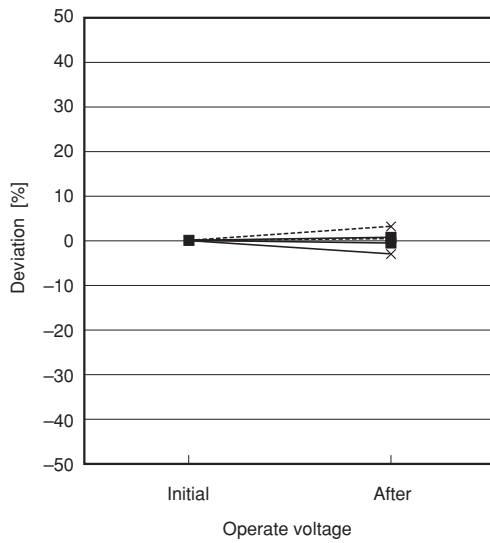
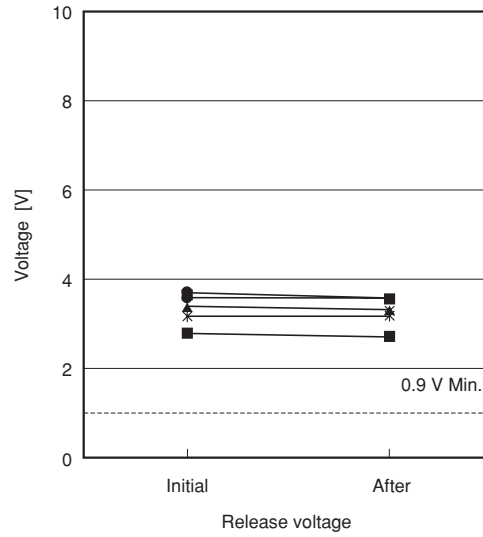
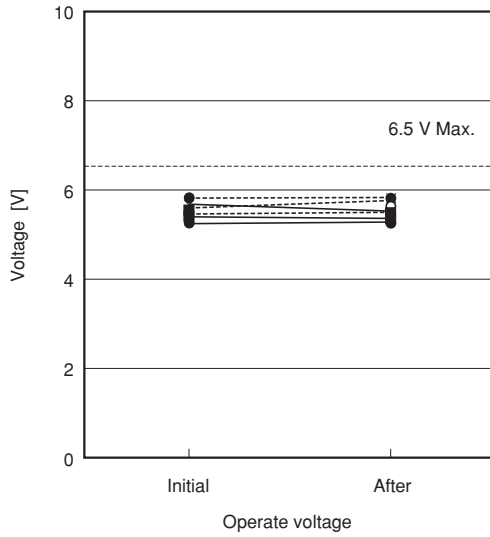


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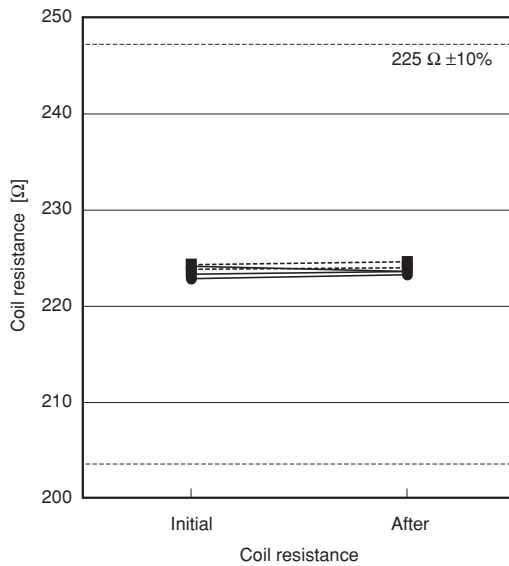
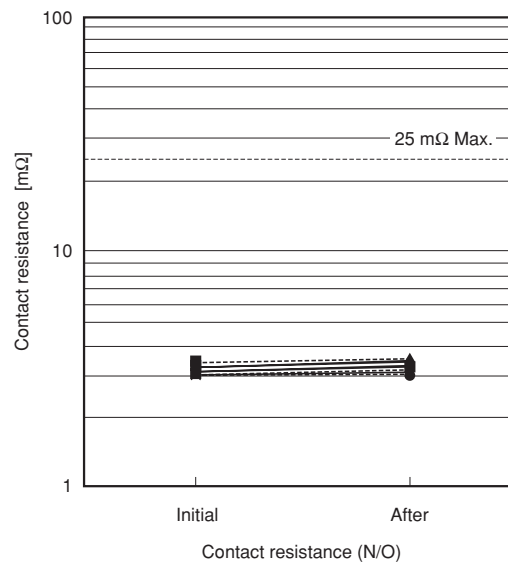
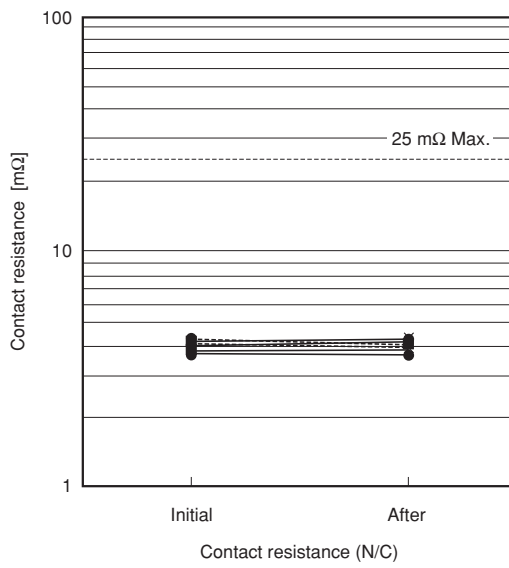
3. ENVIRONMENTAL CHARACTERISTICS

Resistance To Solder Heat Test

| Test items | Test conditions | Samples |
|---|--|--------------------|
| 1. Operate voltage 2. Release voltage 3. Contact resistance 4. Coil resistance | Solder temperature : 260°C ±10°C Dipping time : 10 sec. | ET2-B3M1S 5 pcs |



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3. ENVIRONMENTAL CHARACTERISTICS

Seal Test

| Test items | Test conditions | Samples |
|------------|-----------------|------------------------------------|
| | As per below | ET2-B3M1S 1. 10 pcs 2. 5 pcs |

1. Air tightness

Test Method

Samples soaked in Liquid (SC-75) for 20 min at 125°C.
Show in Fig.1

Test Result

No bubble occurred under the above condition

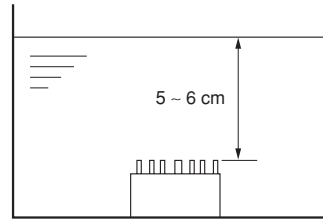


Fig.1 Sealing test method

2. Sealing

Test Method

- 1) 10 cycles of thermal shock between -40°C for 30 min and $+85^{\circ}\text{C}$ for 30 min.
- 2) Dipping relays into solder bath for 10 sec. at 260°C
- 3) Dipping relays into special ink bath for 60 sec. at 25°C
- 4) Check invasion of ink inside relay

Test Result

No invasion of ink was found in the samples.

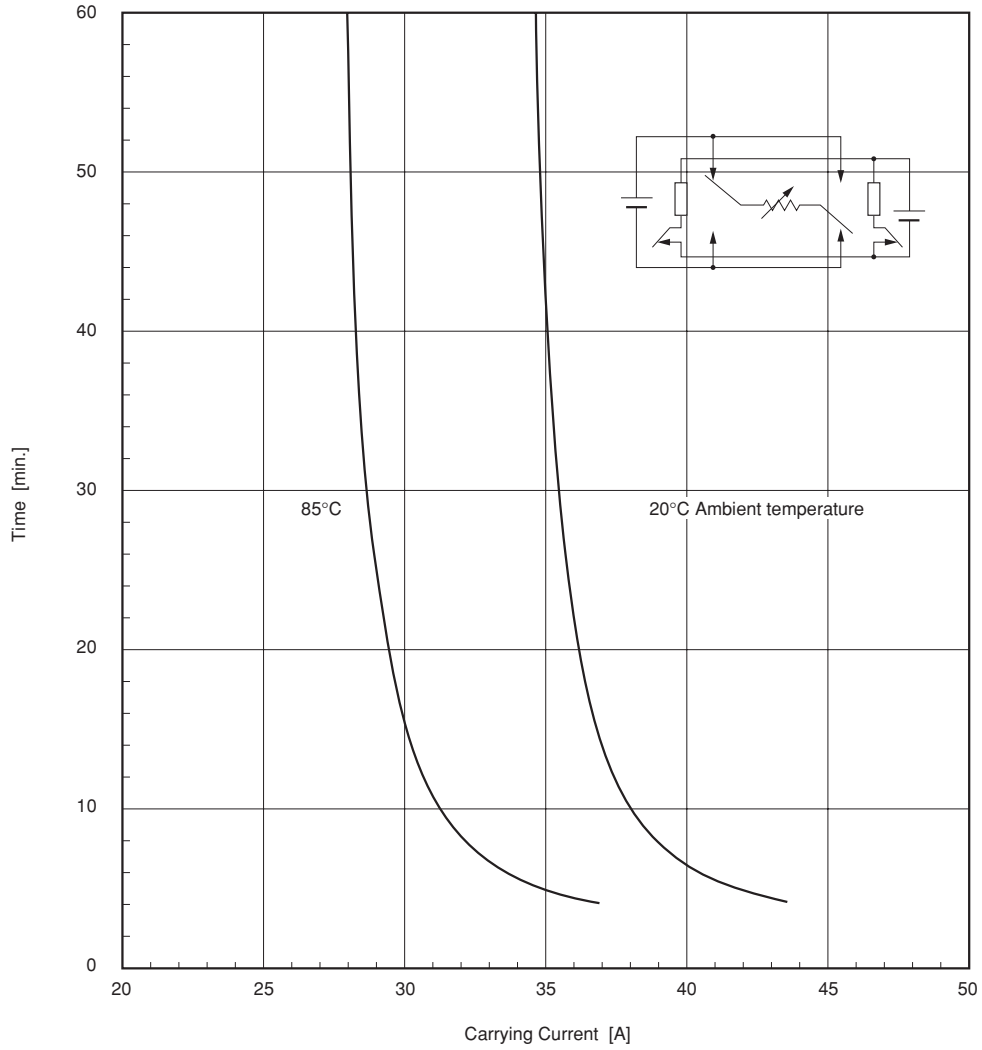


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3. ENVIRONMENTAL CHARACTERISTICS

Current Carrying Test

| Test Items | Test Conditions | Samples |
|---------------------|---|---------------------|
| 1. Carrying current | <ul style="list-style-type: none"> • Sealed type • Coil wattage: 0.87 W (225 Ω, 14 VDC) • H-Bridge type: <ul style="list-style-type: none"> Coil (side A) ON Coil (side B) OFF • Relay is connected directly to wire (10 AWG) with solder, not mounted on PC board • Temperature: 20°C, 85°C • Failure mode: Spool (Coil bobbin) melting | ET2-B3M1S 10 pcs |

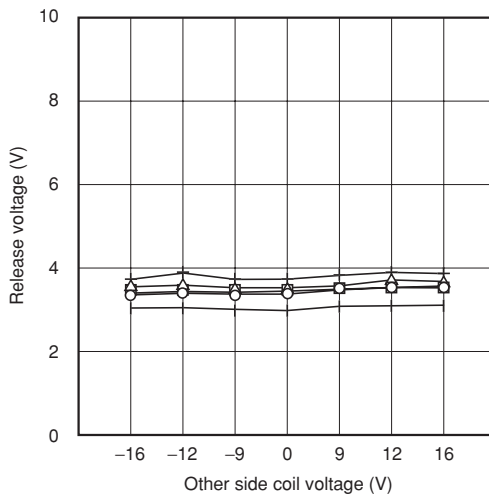
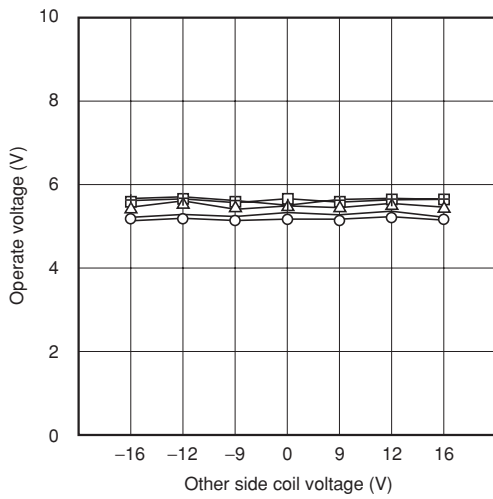
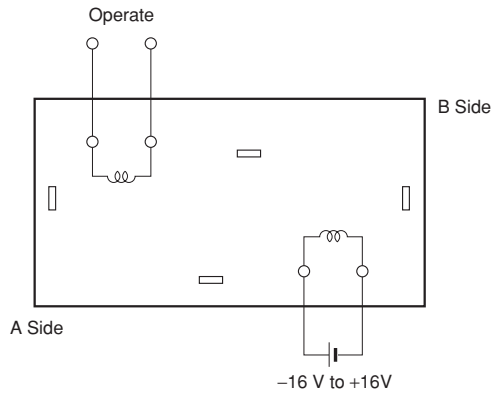


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3. ENVIRONMENTAL CHARACTERISTICS

Magnetic Interference (1)

| Test items | Test conditions | Samples |
|--|--|--------------------|
| 1. Operate voltage 2. Release voltage | Characteristics of A side on B side operated Vcoil = -16 V to +16 V | ET2-B3M1S 5 pcs |

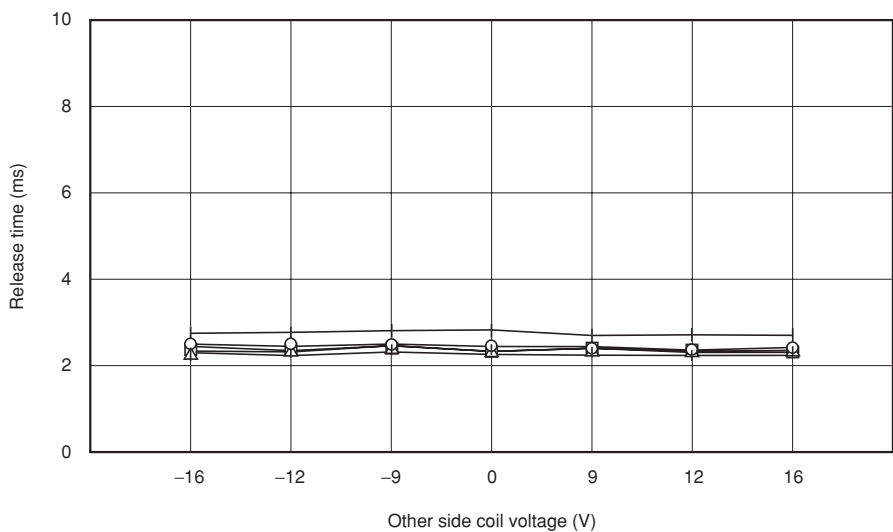
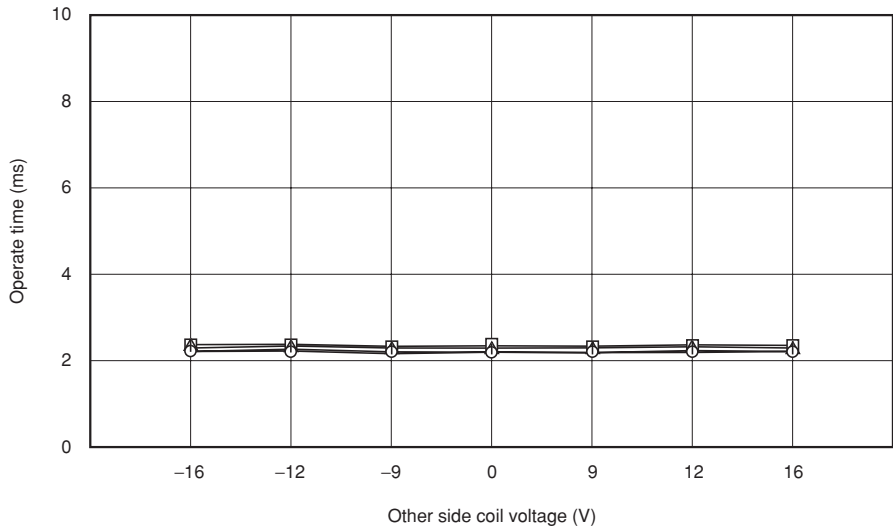


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3. ENVIRONMENTAL CHARACTERISTICS

Magnetic Interference (2)

| Test items | Test conditions | Samples |
|------------------------------------|--|--------------------|
| 1. Operate time 2. Release time | Characteristics of A side on B side operated Vcoil = -16 V to +16 V (with diode) | ET2-B3M1S 5 pcs |

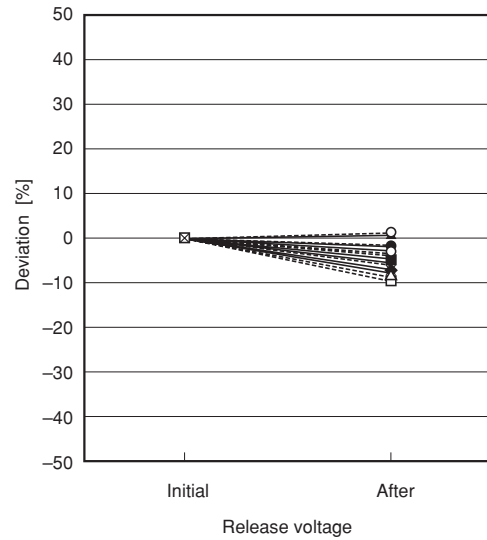
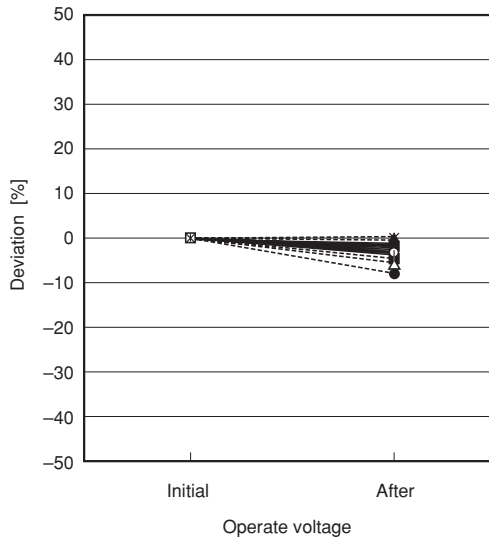
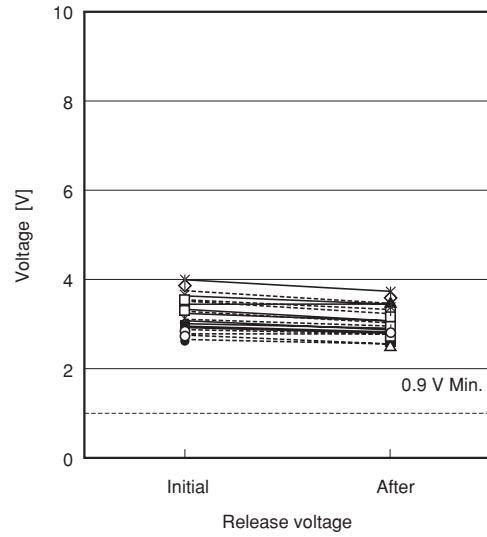
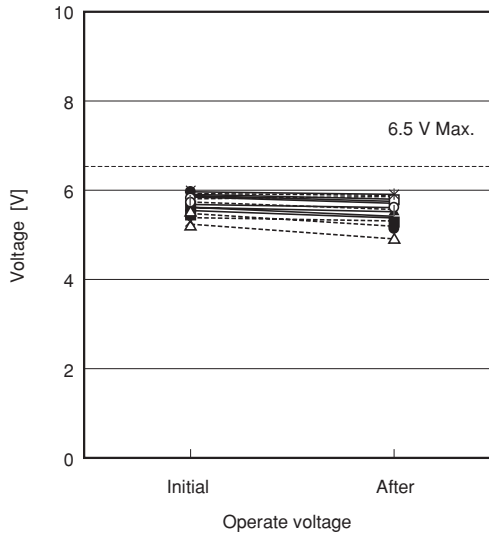


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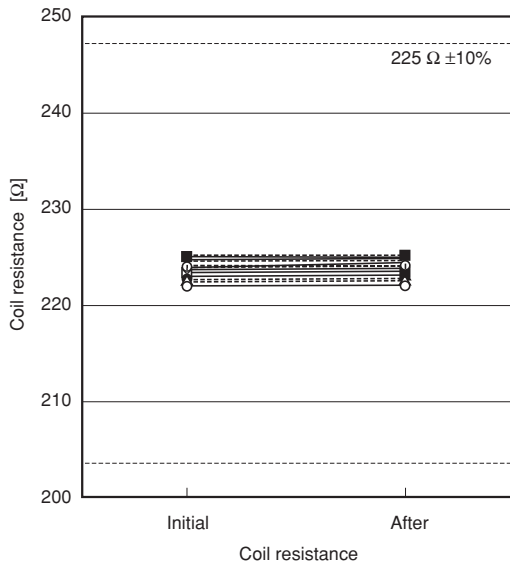
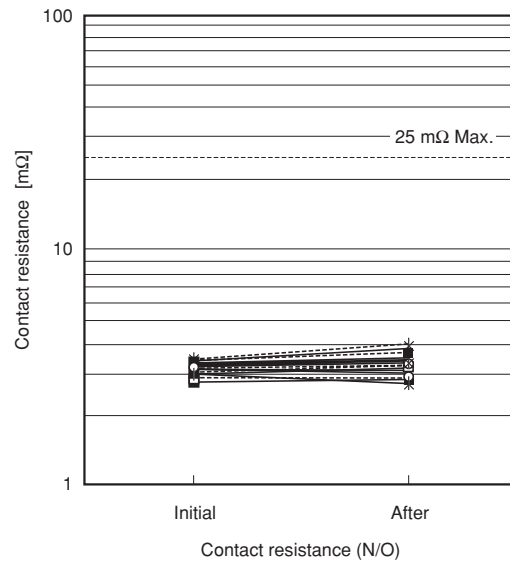
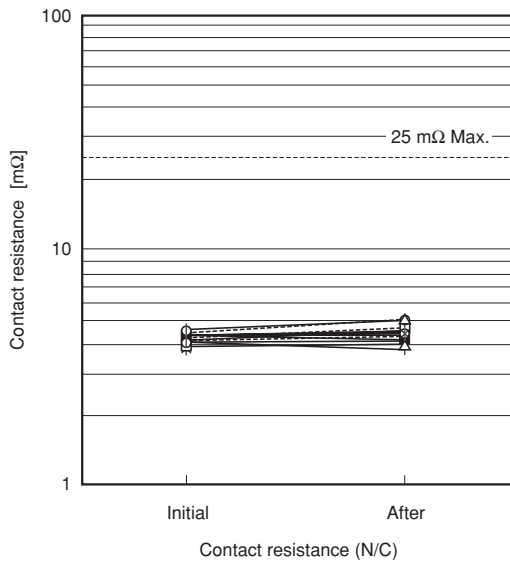
4. DURABILITY

Mechanical Life Test

| Test items | Test conditions | Samples |
|-----------------------|---|--------------------|
| 1. Operate voltage | Temperature : 20° | ET2-B3M1S 5 pcs |
| 2. Release voltage | Frequency : 15 Hz (50% duty) | |
| 3. Contact resistance | Contact load : No load | |
| 4. Coil resistance | Number of operations : 10×10^3 | |



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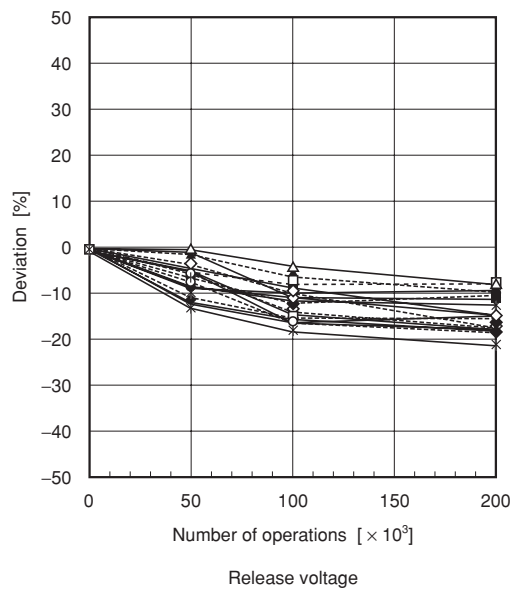
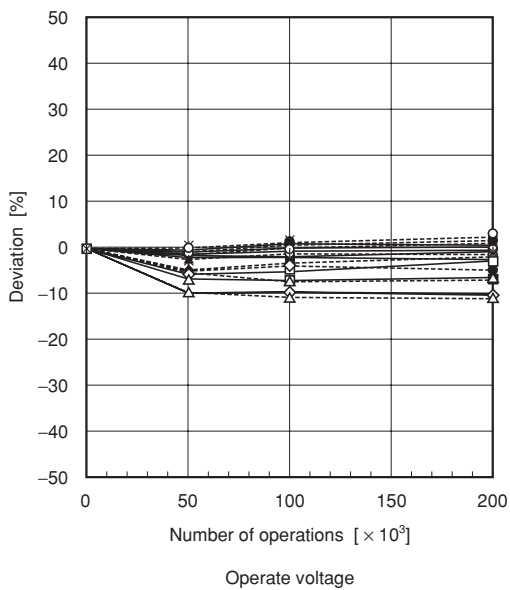
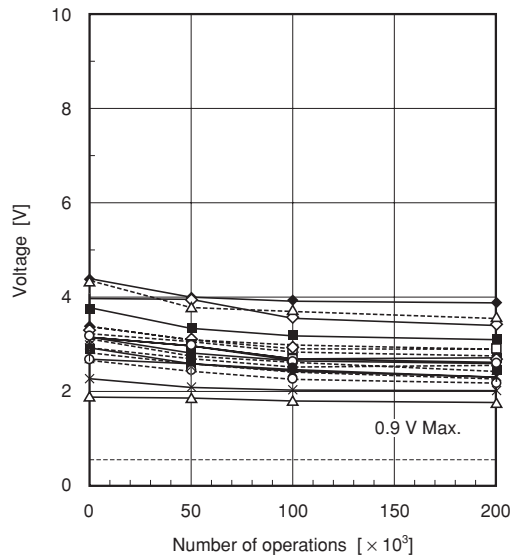
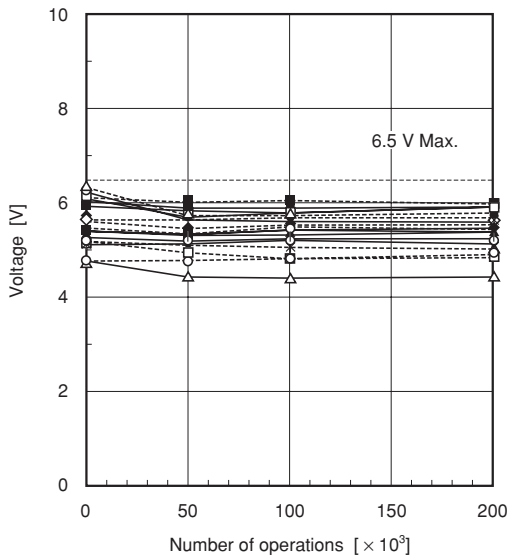


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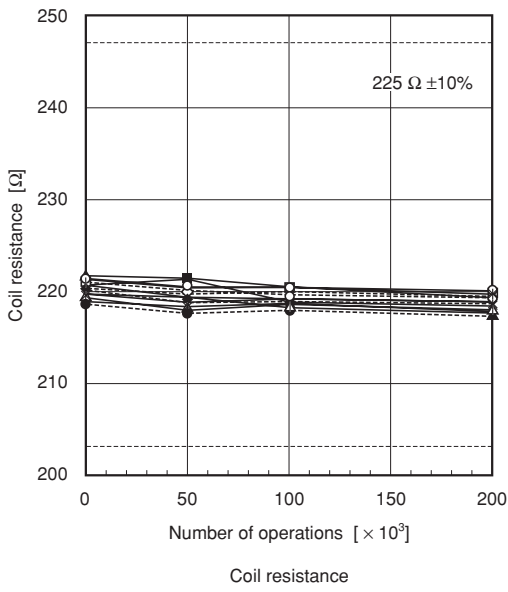
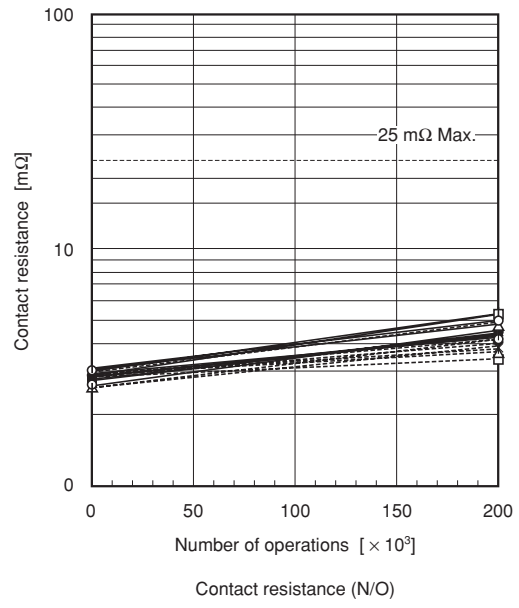
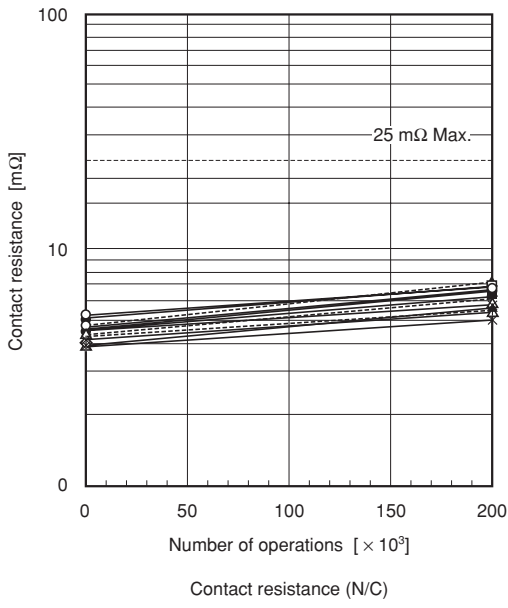
4. DURABILITY

Electrical Life Test (14 V, 20 A, P/W, Motor Load, Lock)

| Test items | Test conditions | Samples |
|-----------------------|--|---------------------|
| 1. Operate voltage | Temperature : 20°C | ET2-B3M1S 10 pcs |
| 2. Release voltage | Frequency : 0.2s ON/9.8s OFF, 0.1 Hz | |
| 3. Contact resistance | Contact load : 14 Vdc 20 A, P/W motor load | |
| 4. Coil resistance | Number of operations : 200 × 10 ³ | |



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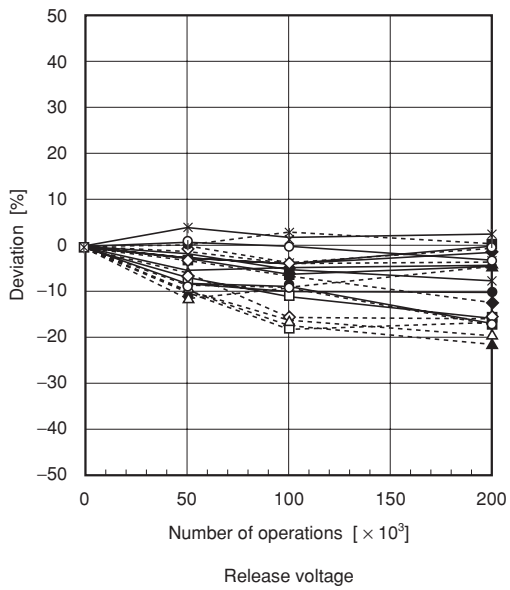
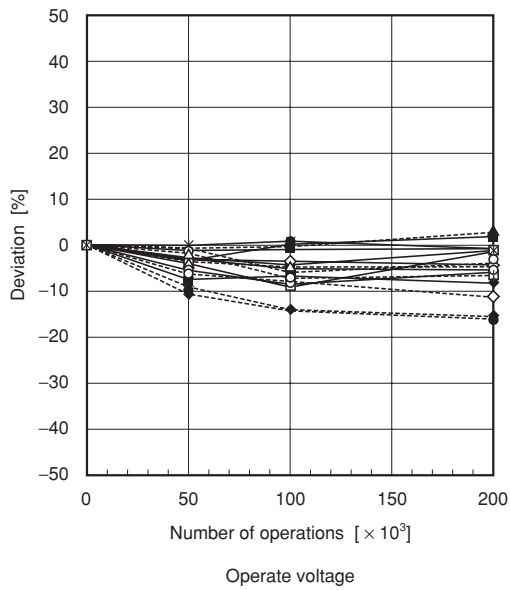
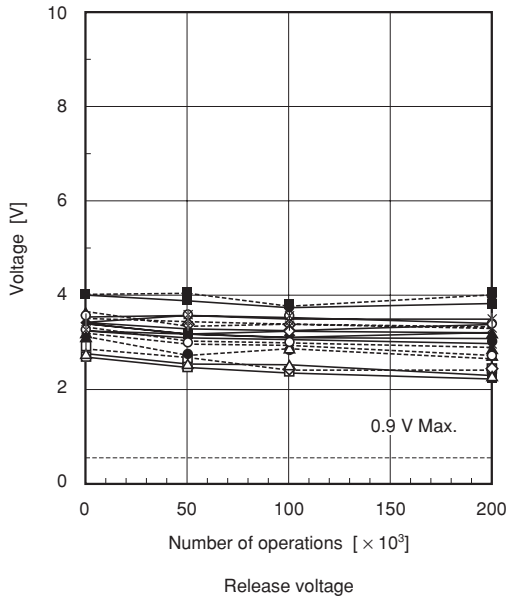
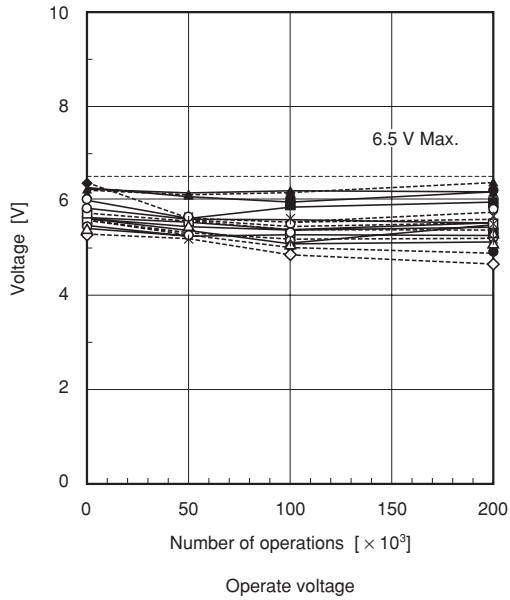


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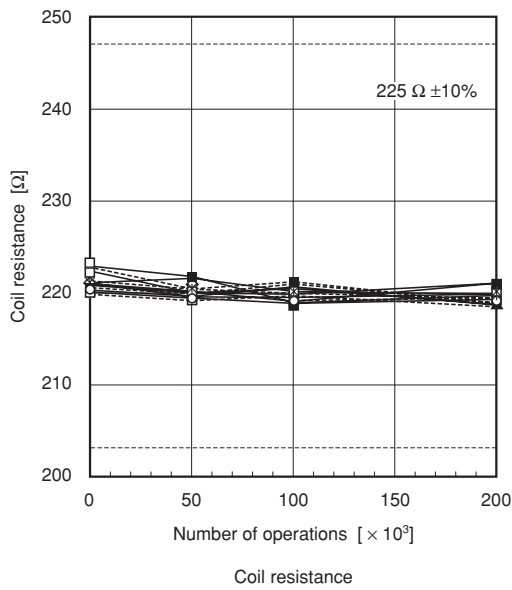
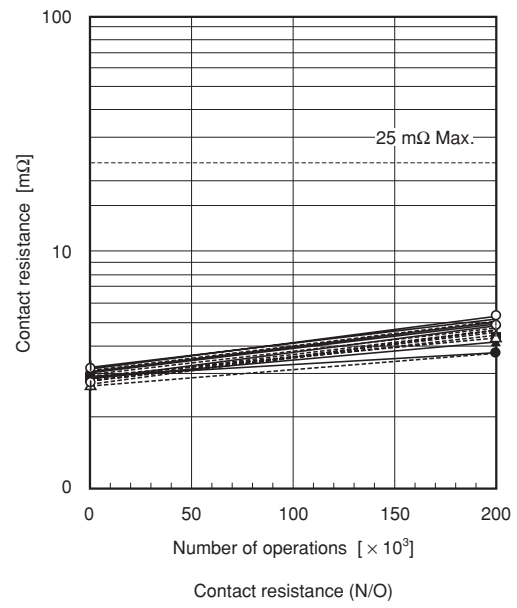
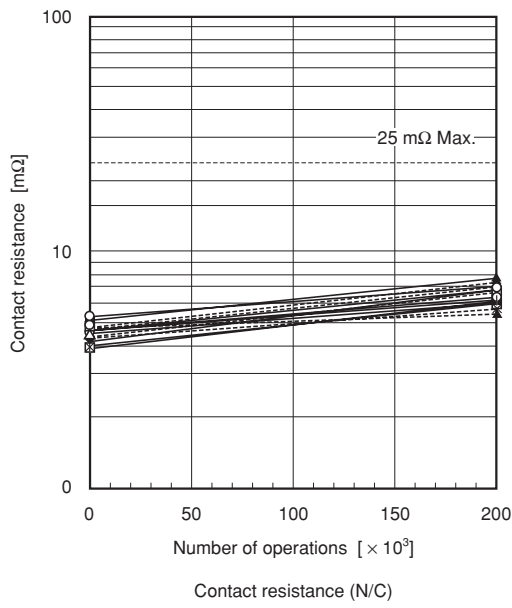
4. DURABILITY

Electrical Life Test (14 V, 18 A/2 A, P/W, Motor Load, Unlock)

| Test items | Test conditions | Samples |
|-----------------------|--|---------------------|
| 1. Operate voltage | Temperature : 20°C | ET2-B3M1S 10 pcs |
| 2. Release voltage | Frequency : 0.2s ON/9.8s OFF, 0.1 Hz | |
| 3. Contact resistance | Contact load : 14 Vdc 18 A/2 A, P/W motor load | |
| 4. Coil resistance | Number of operations : 200×10^3 | |



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