

AUTOMOTIVE RELAY

ET2 SERIES TECHNICAL DATA

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The information in this document is based on documents issued in April 2019.

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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The possibility of defects cannot be estimated entirely even though EM Devices Corporation has been making continuous effort to enhance the reliability of miniature power relay. To minimize risks of damage or injury to persons or property arising from a defect in an EM Devices electronic component, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features. EM Devices products are classified into the following three quality grades:

EM Devices products are classified into three quality grade: Standard, Special and Specific. The Specific quality grade applies only to devices that is 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 EM Devices products are considered at standard, unless otherwise it is specified in EM Devices Datasheet or Data book. If customers intend to use EM Devices products for applications other than those specified for Standard quality grade, they should contact an EM Devices sales representative in advance.

(Note)

(1) "EM Devices" that is used in this statement means EM Devices Corporation and also includes its majority-owned subsidiaries.

(2) "EM Devices electronic component products" means any electronic component product developed or manufactured by or for EM Devices (as defined above).

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1. PREFACE

NEXEM Miniature Power relays are mainly used in automotive electronics applications. This document gives the basic characteristics and test data of NEXEM'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.

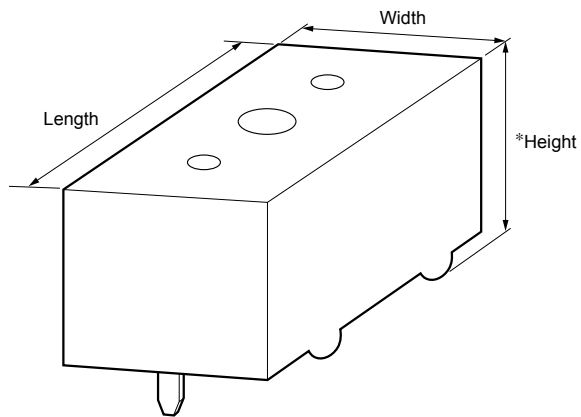
Read the cautions described in EM Devices' "Miniature Relays" when you choose relays for your application.



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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

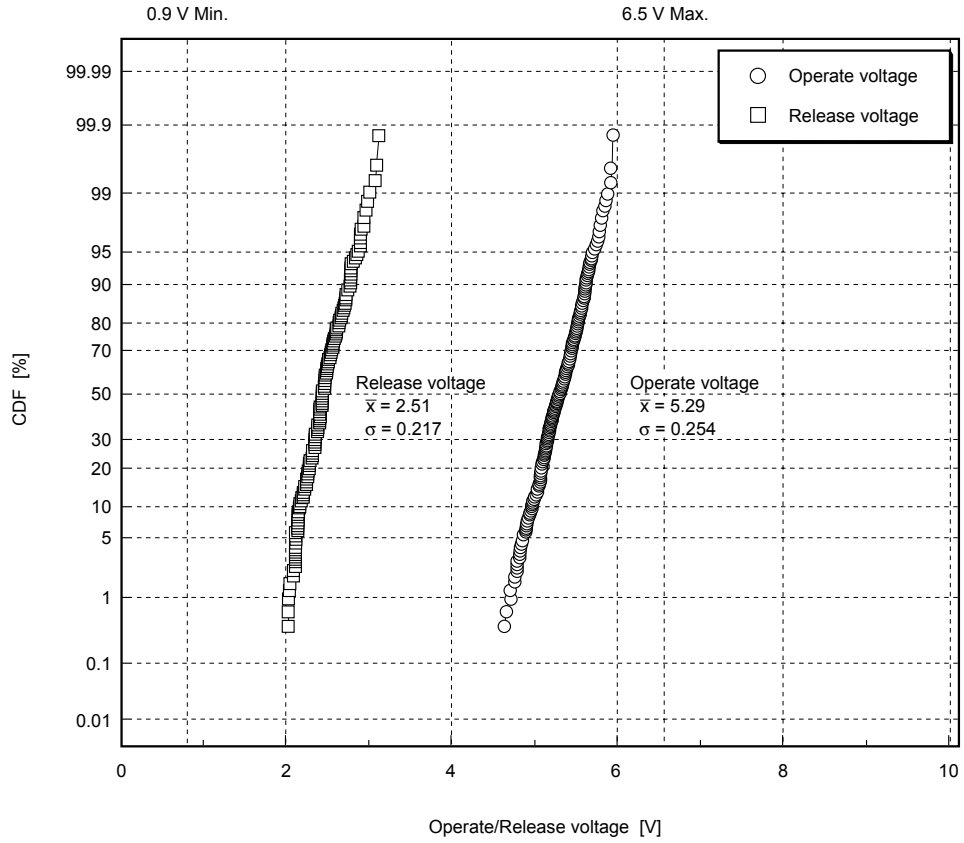


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2. INITIAL CHARACTERISTICS

Operate / Release Voltage

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

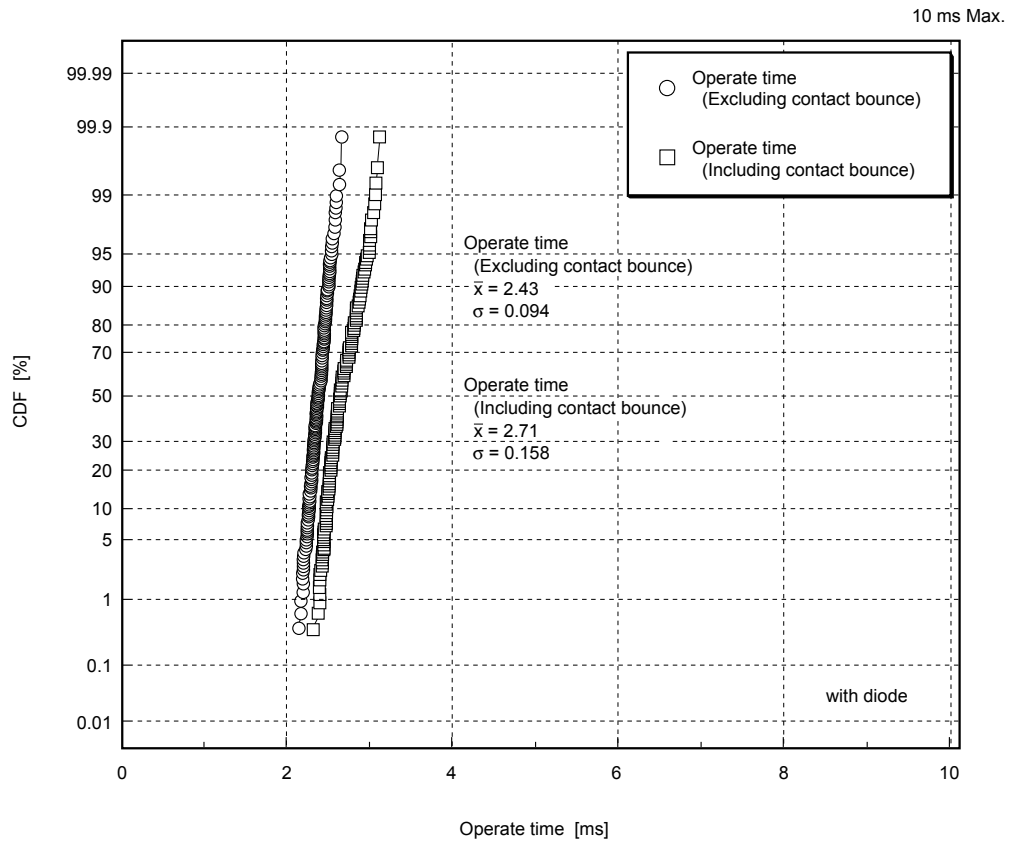


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2. INITIAL CHARACTERISTICS

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)		

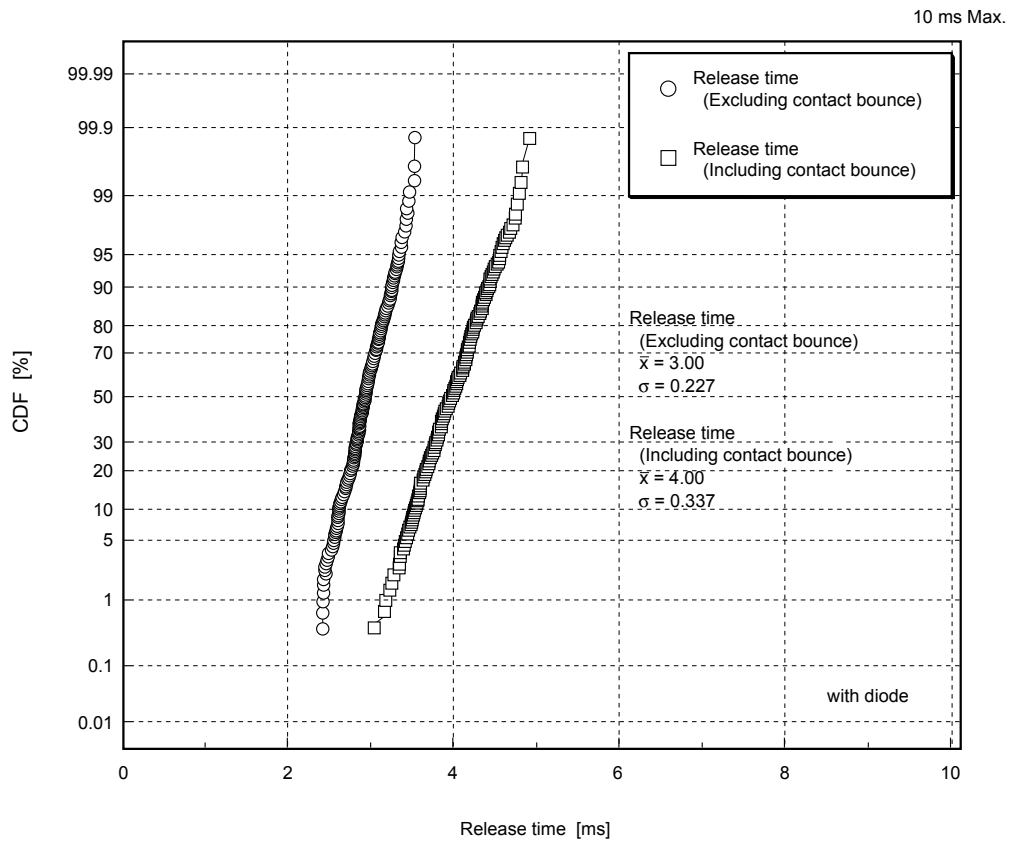


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2. INITIAL CHARACTERISTICS

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)		

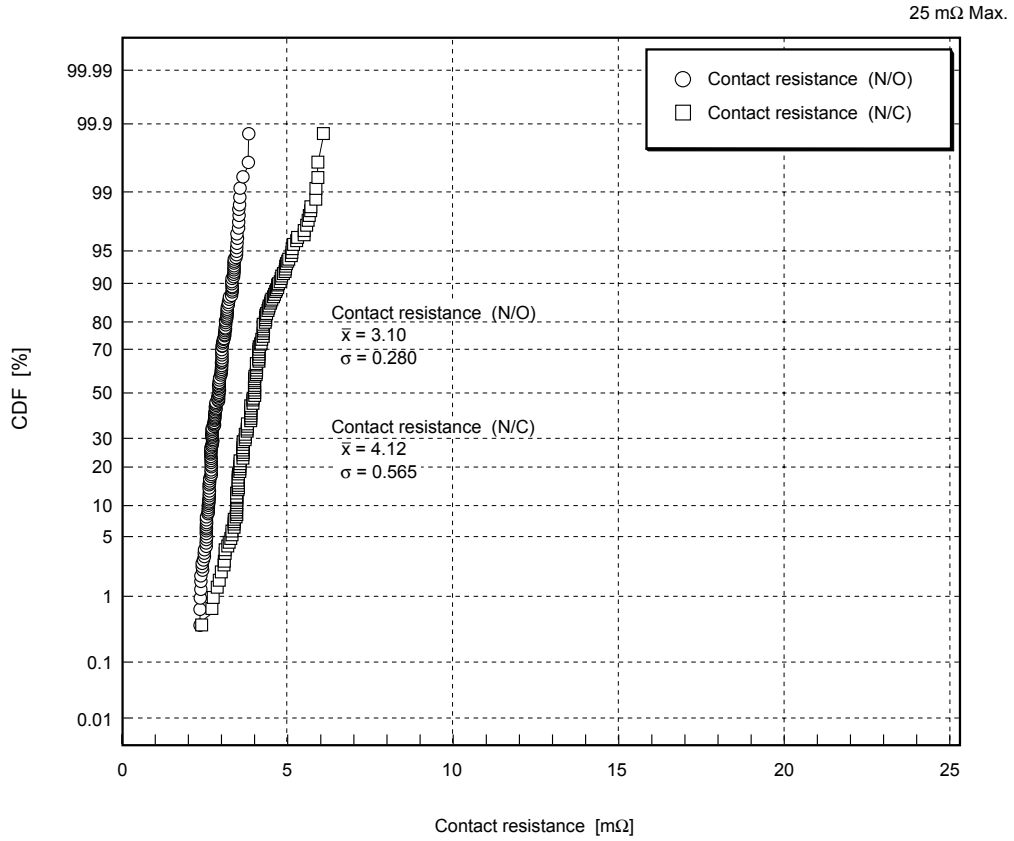


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2. INITIAL CHARACTERISTICS

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

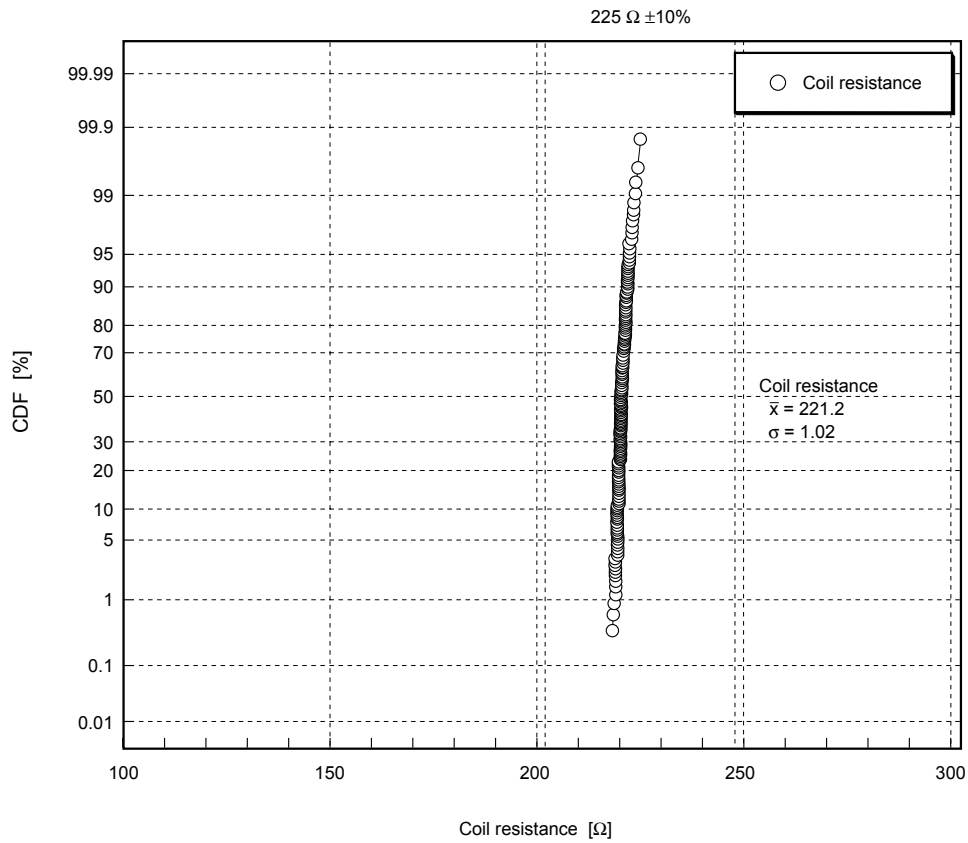


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2. INITIAL CHARACTERISTICS

Coil Resistance

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

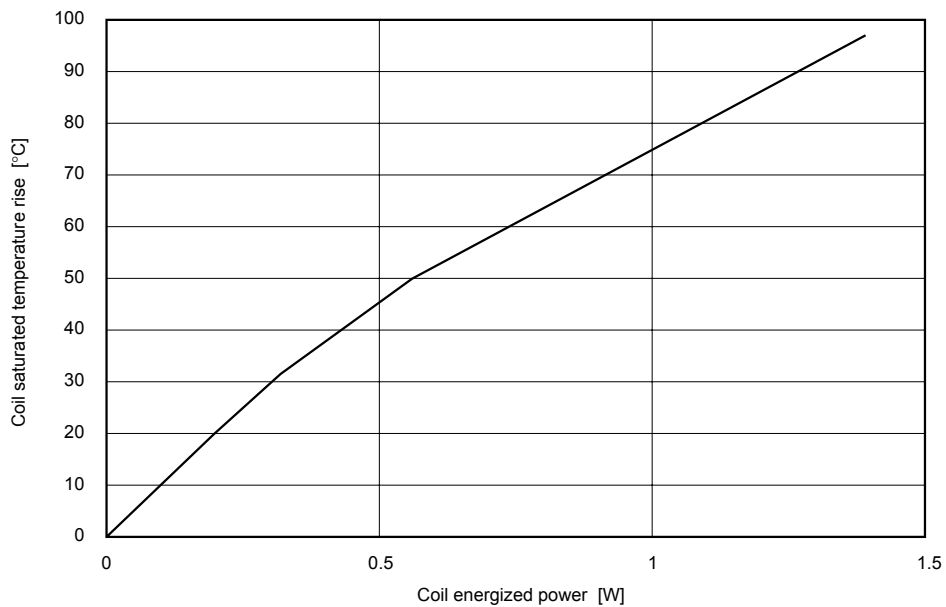
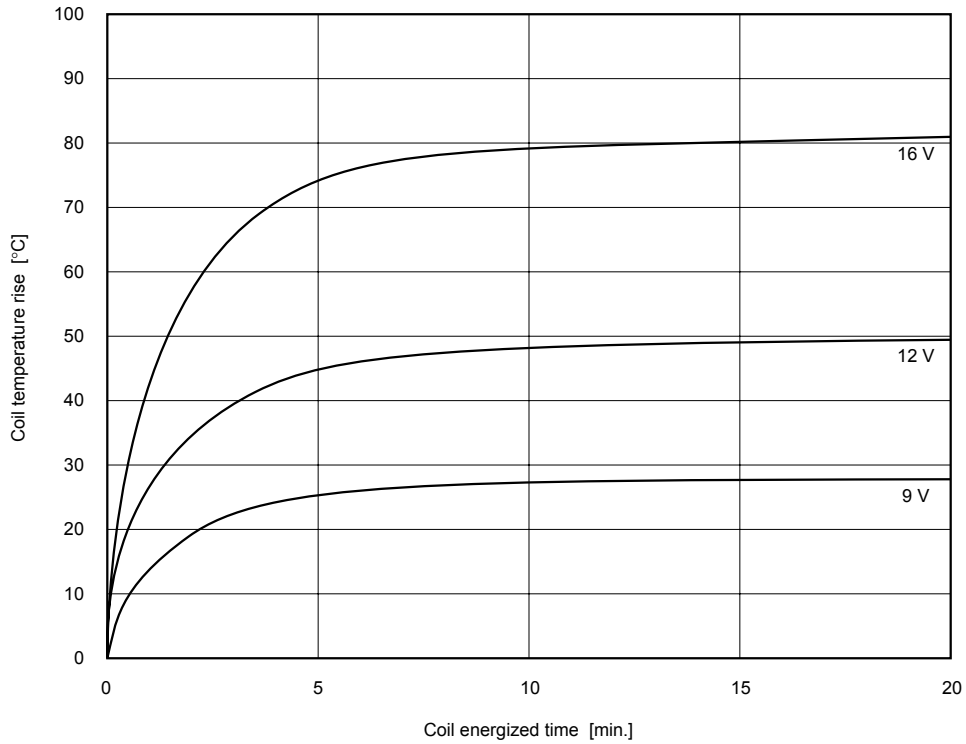


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2. INITIAL CHARACTERISTICS

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

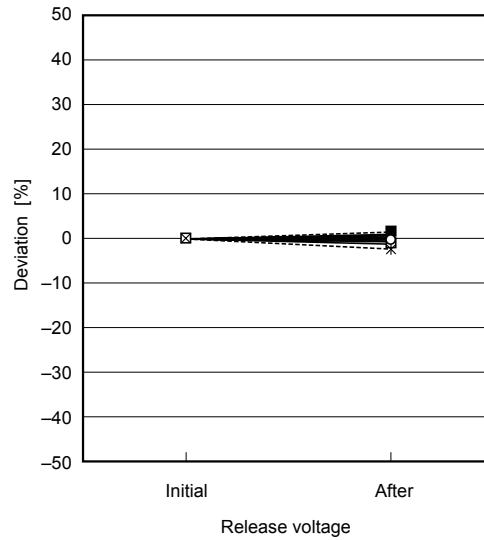
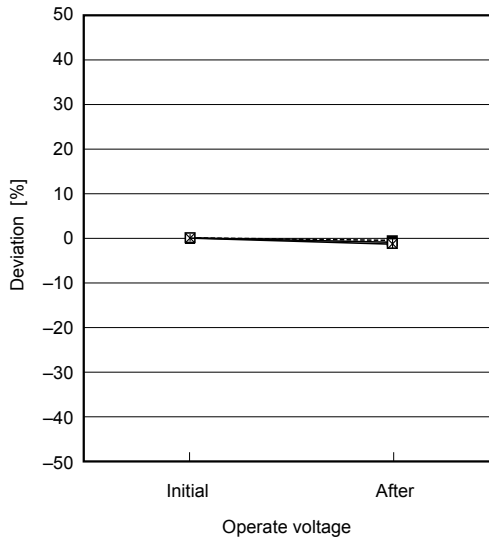
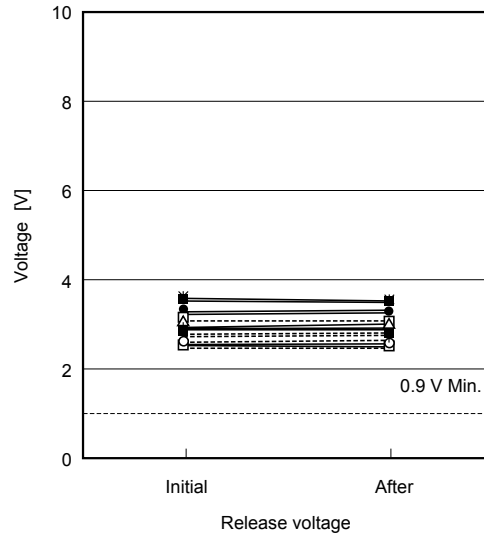
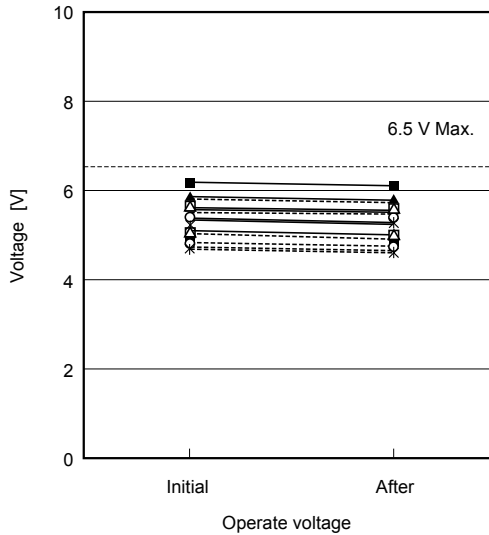


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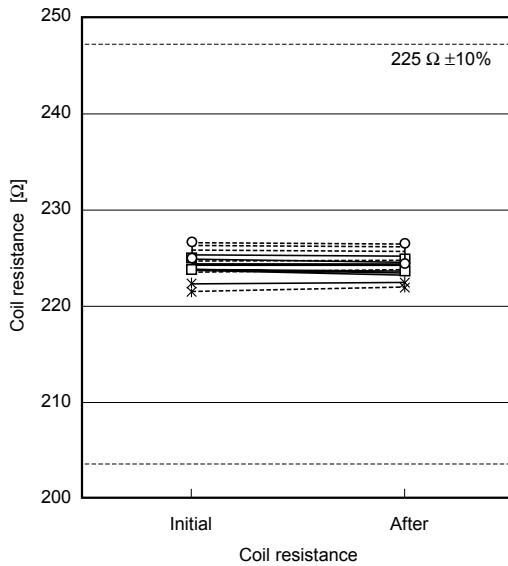
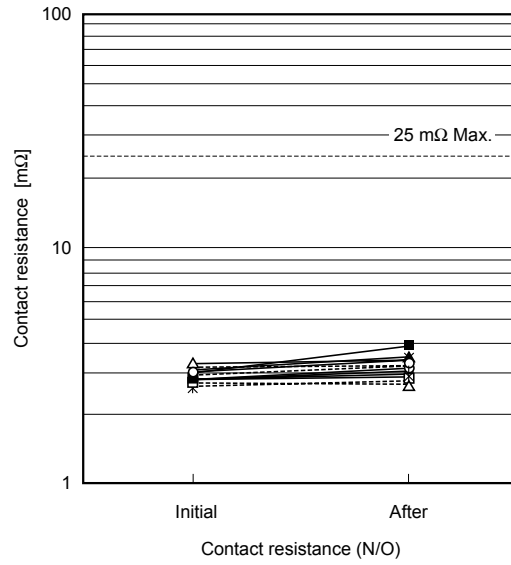
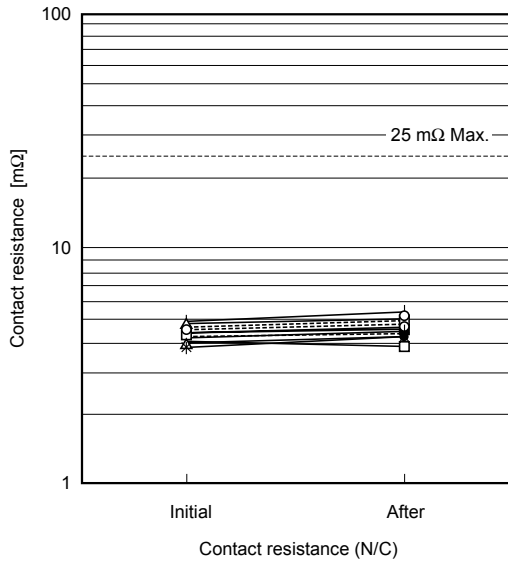
3. ENVIRONMENTAL CHARACTERISTICS

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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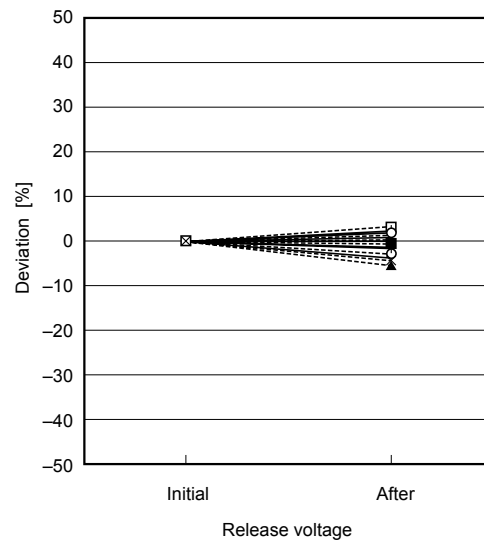
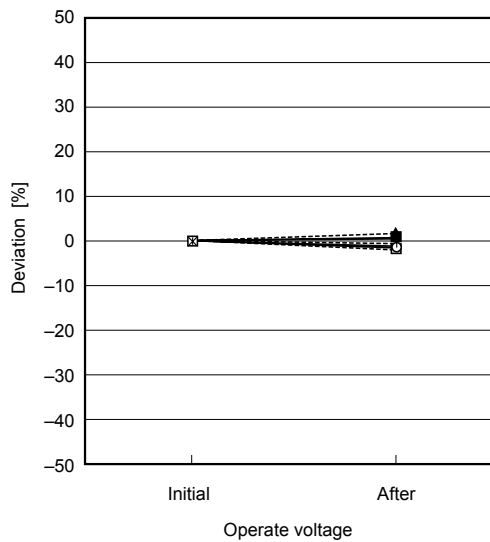
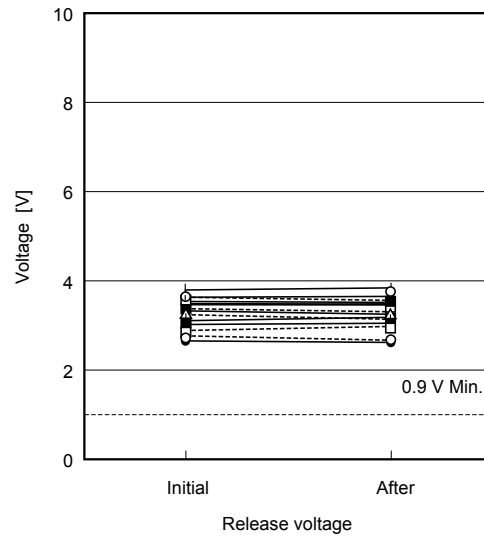
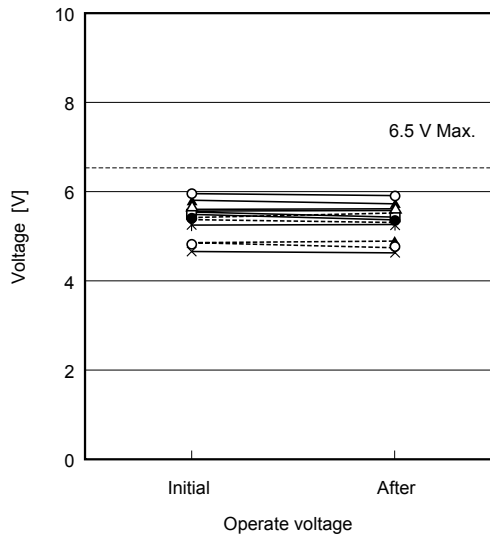


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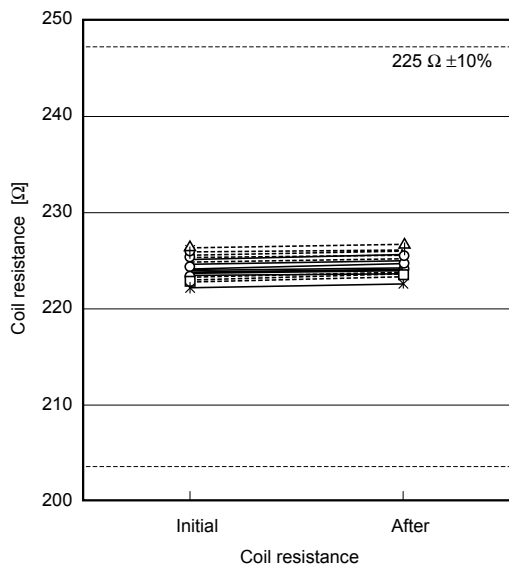
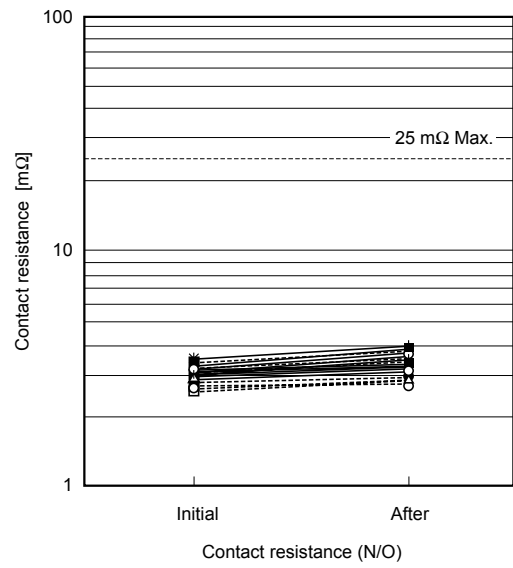
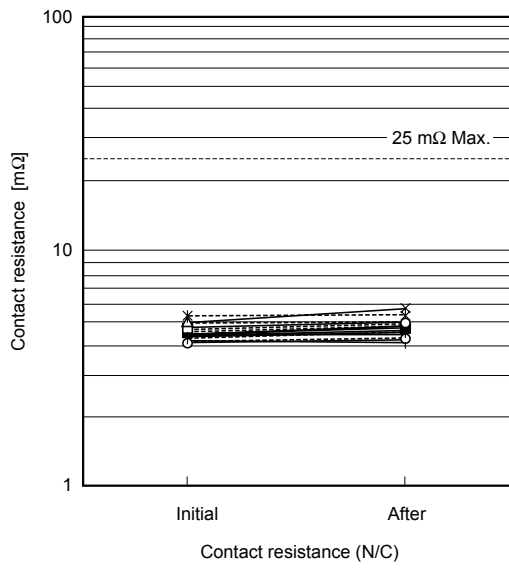
3. ENVIRONMENTAL CHARACTERISTICS

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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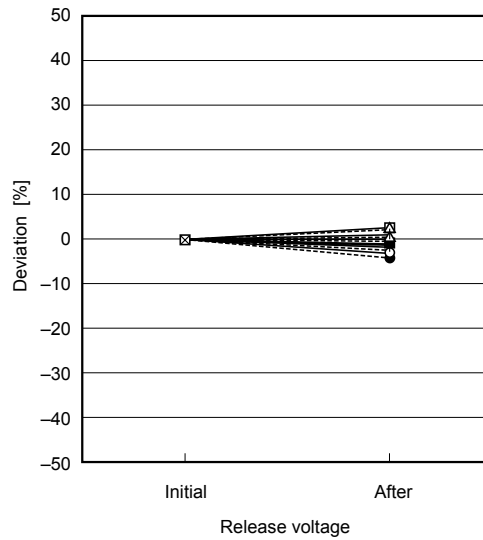
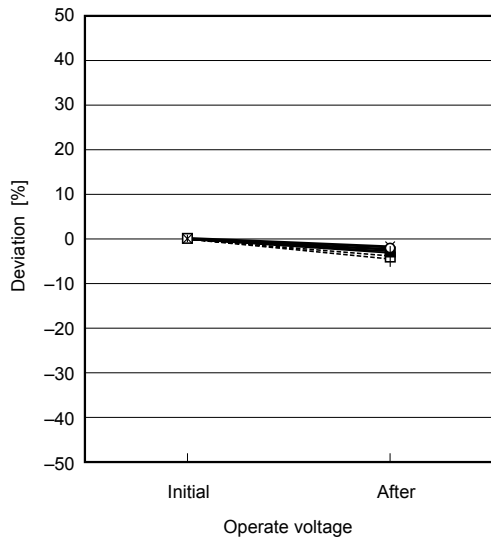
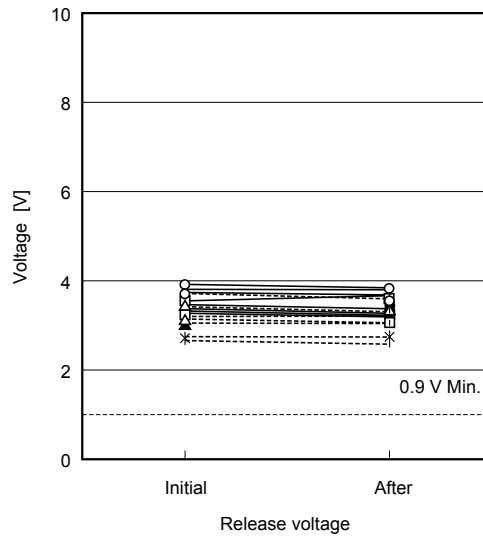
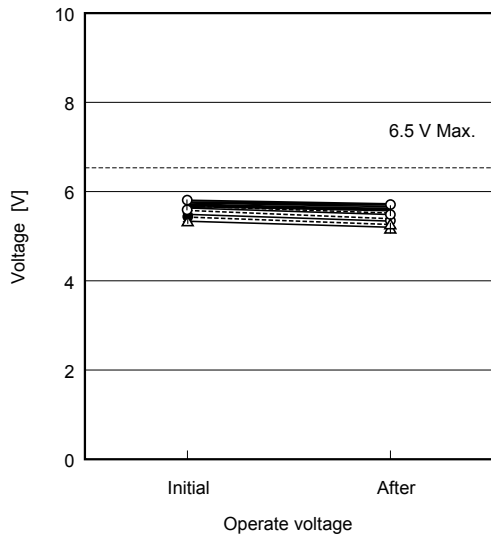


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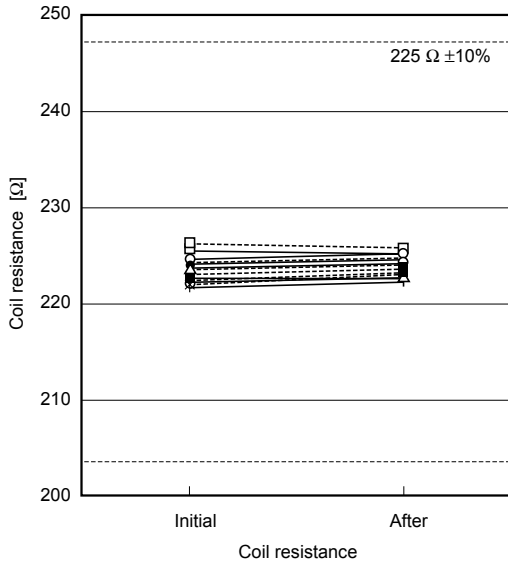
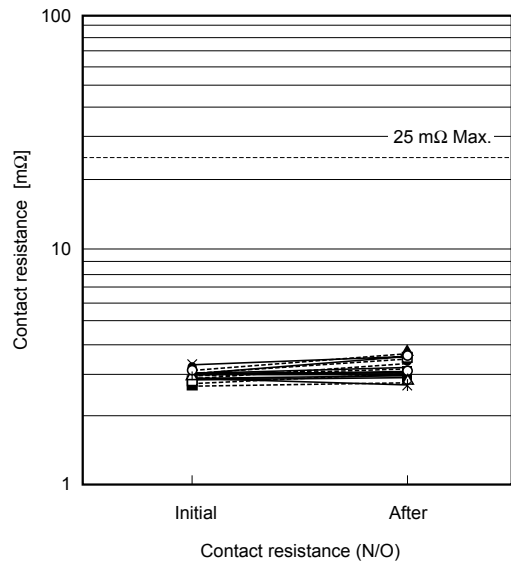
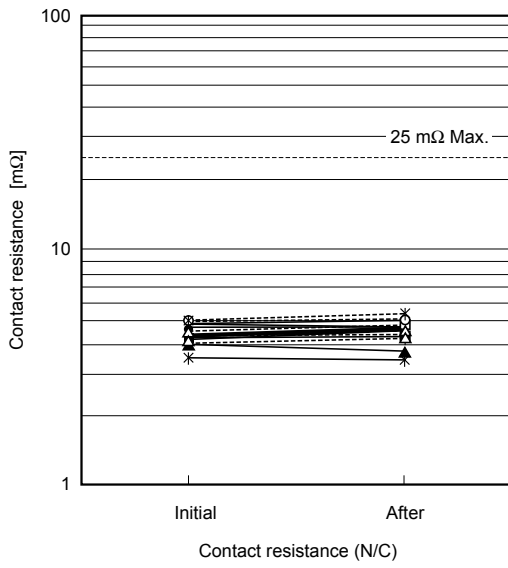
3. ENVIRONMENTAL CHARACTERISTICS

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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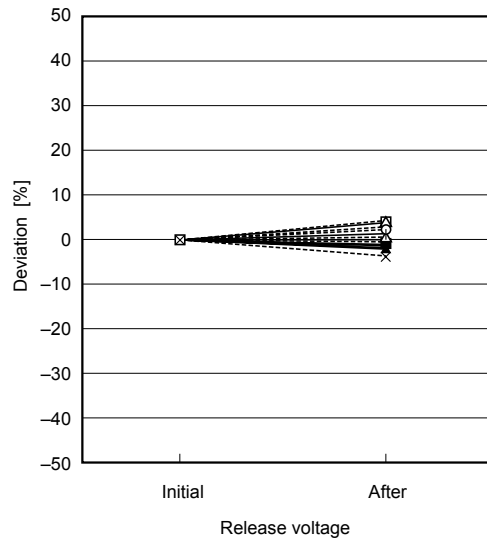
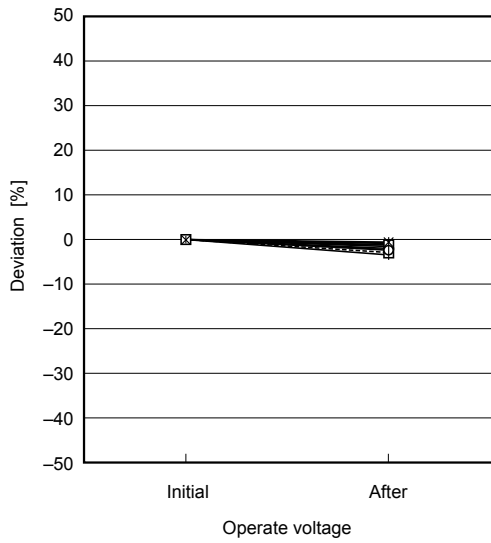
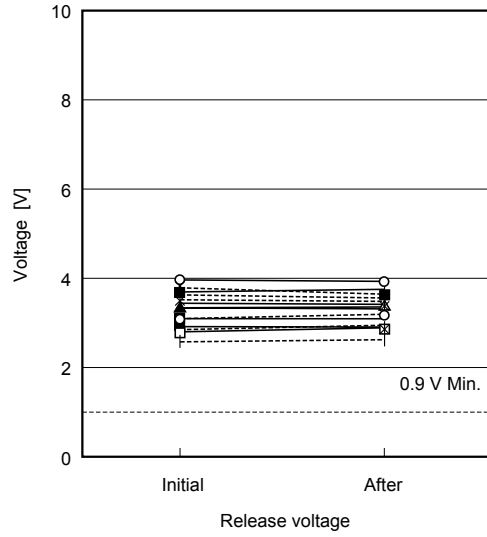
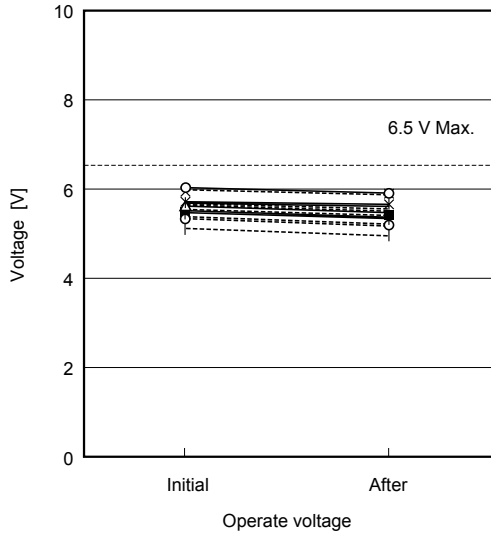


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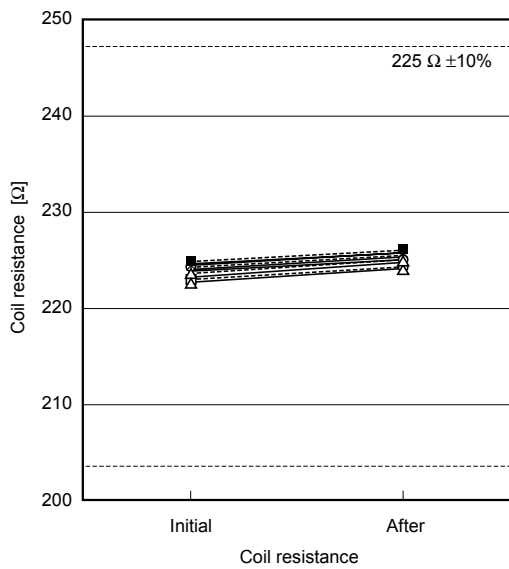
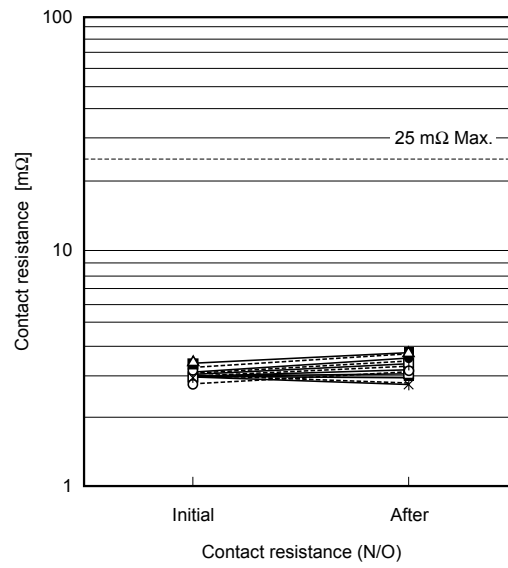
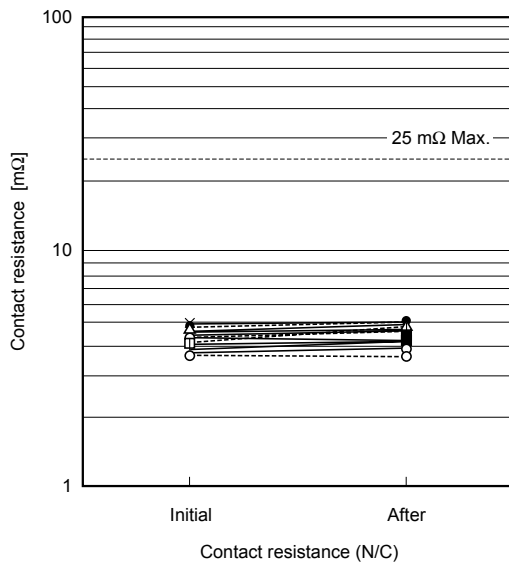
3. ENVIRONMENTAL CHARACTERISTICS

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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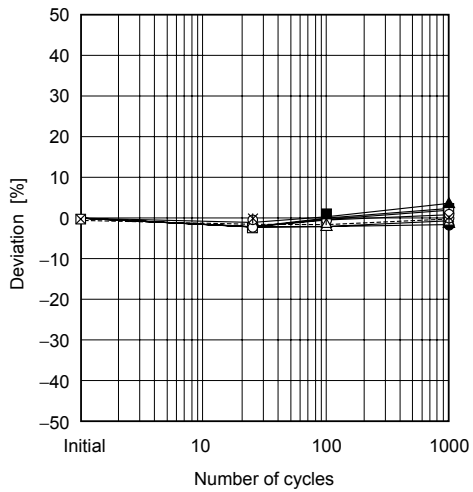
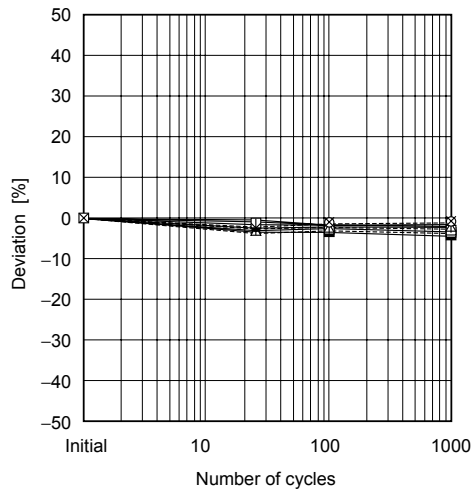
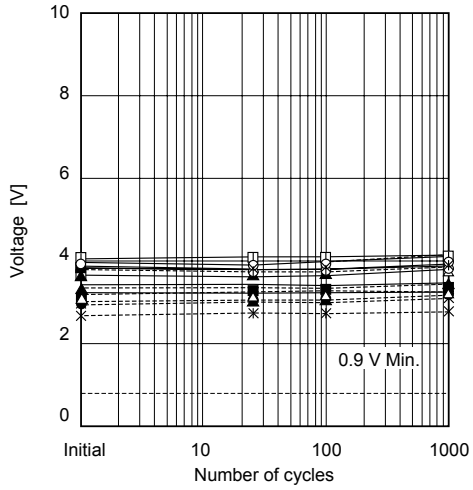
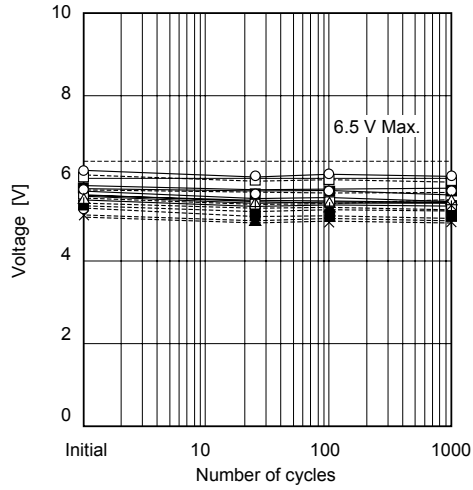


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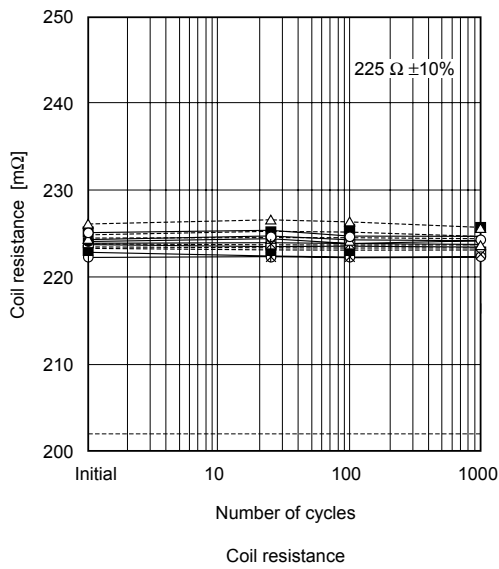
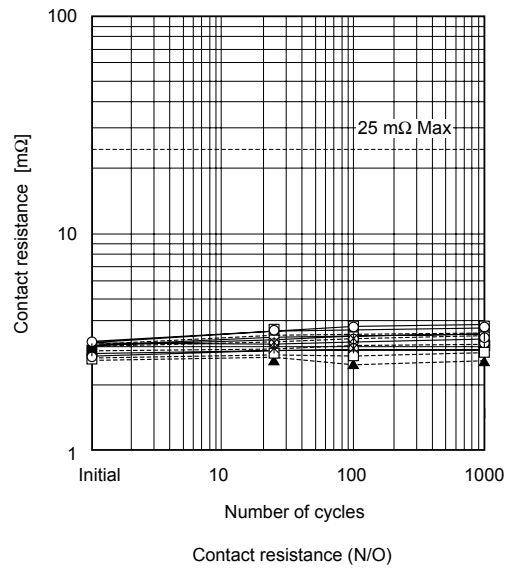
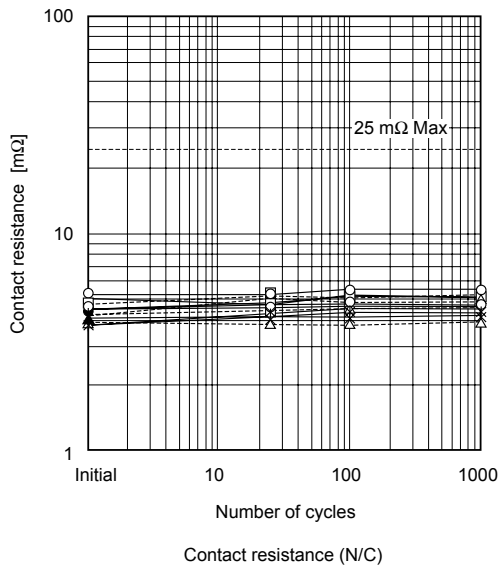
3. ENVIRONMENTAL CHARACTERISTICS

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



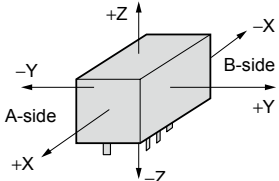
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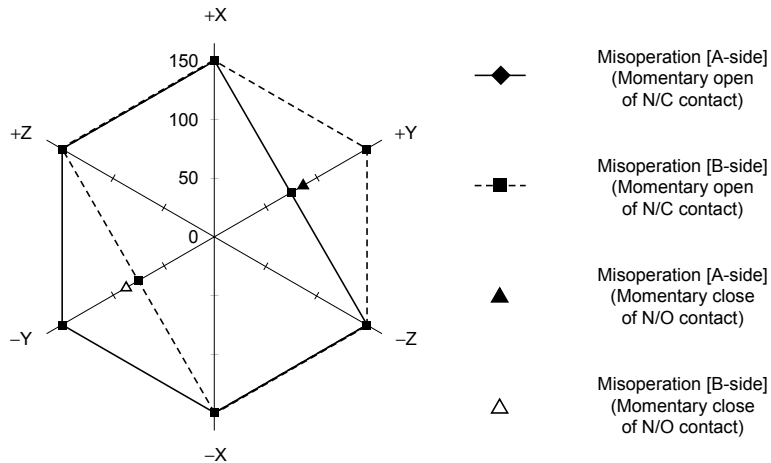
3. ENVIRONMENTAL CHARACTERISTICS

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	

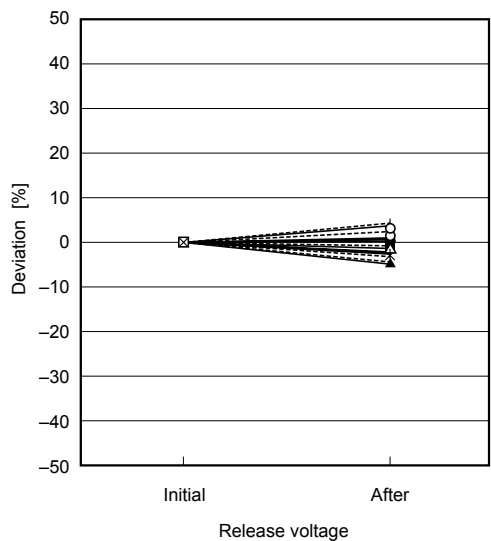
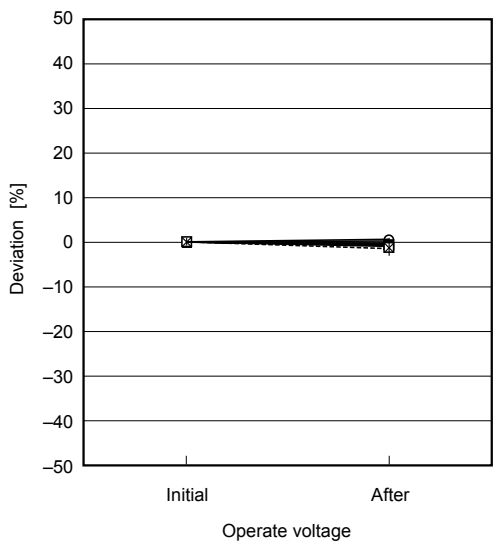
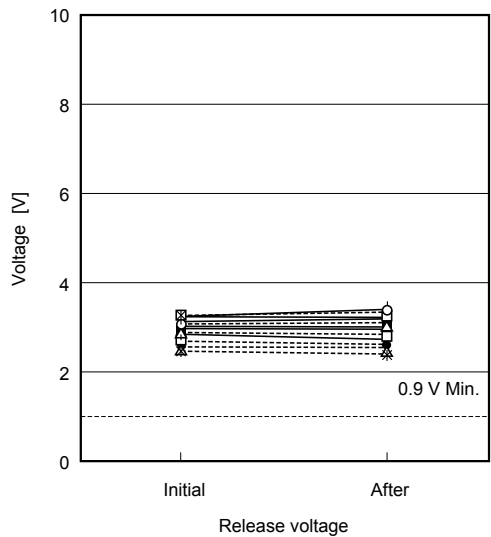
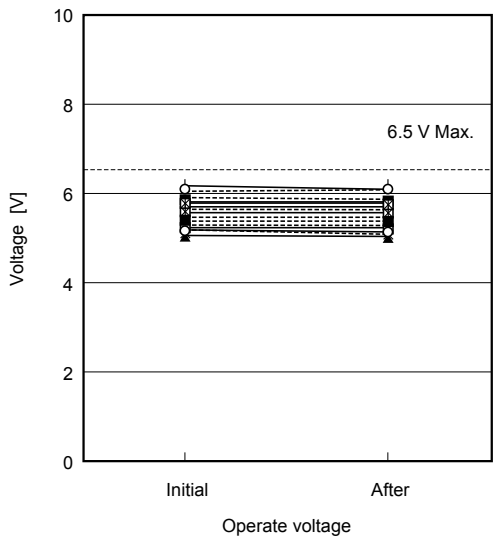


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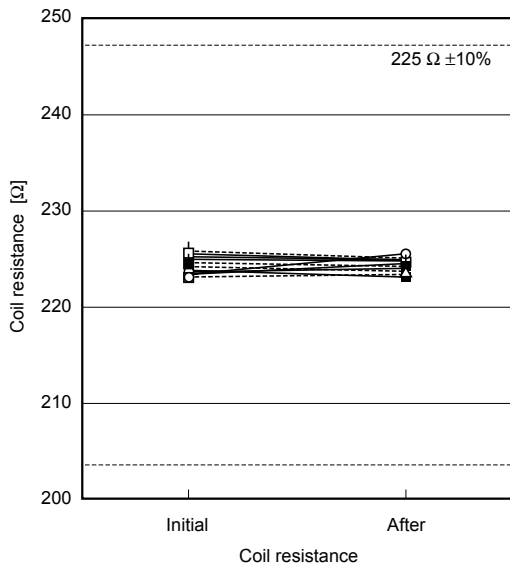
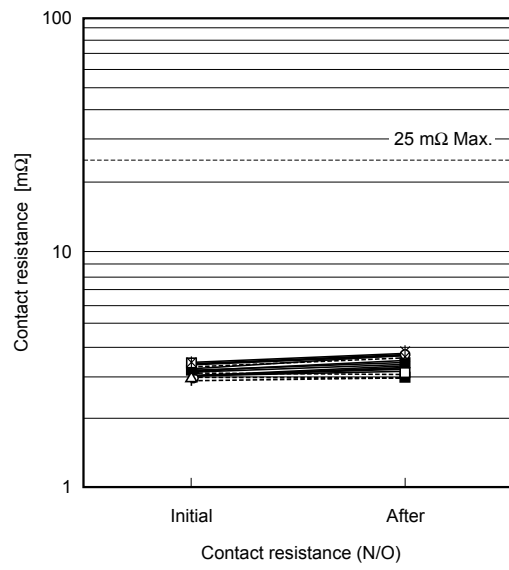
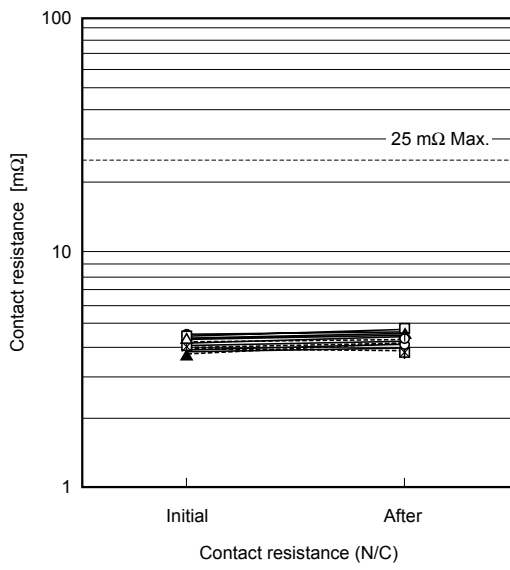
3. ENVIRONMENTAL CHARACTERISTICS

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	



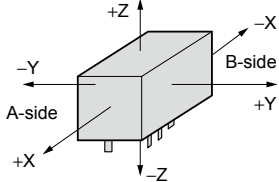
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3. ENVIRONMENTAL CHARACTERISTICS

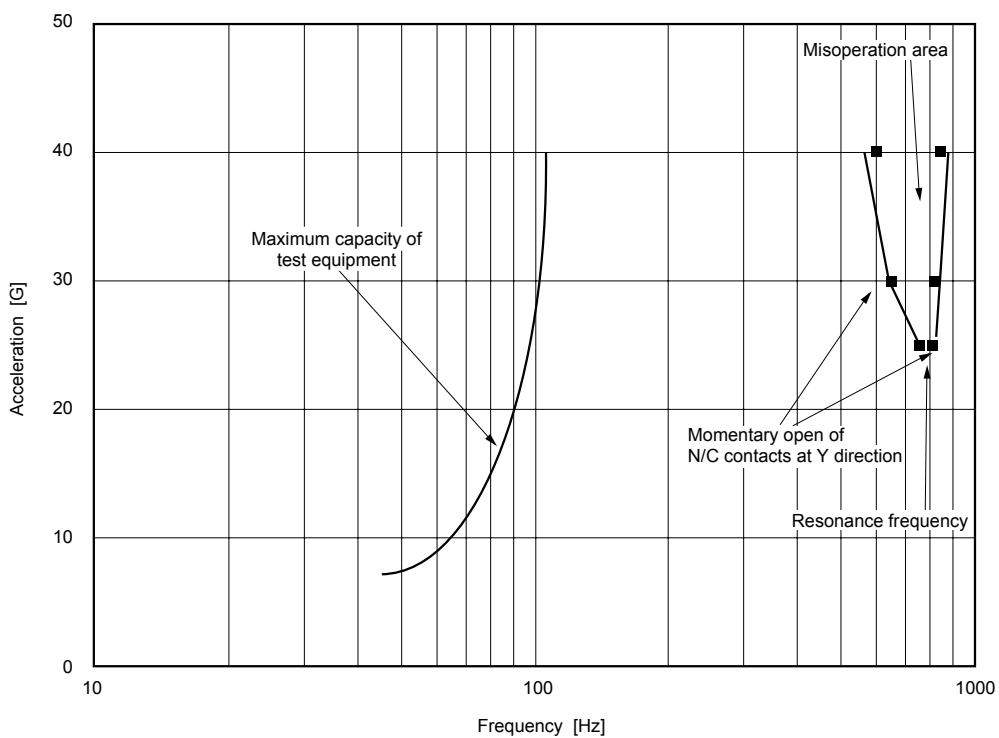
Vibration Test (misoperation)

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.

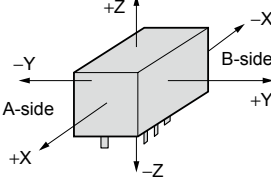
*Misoperation area of Non-energized samples at Y direction as follows.

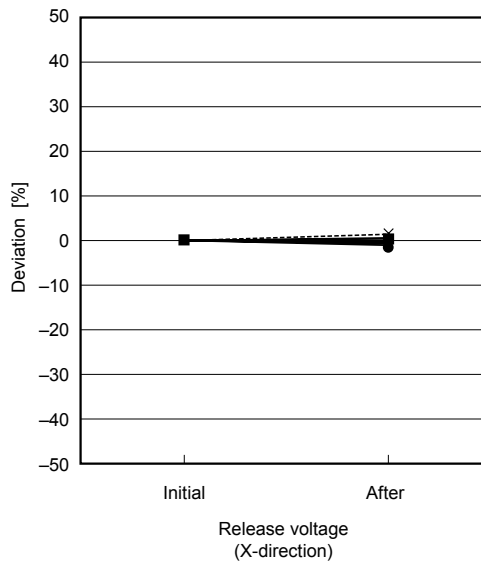
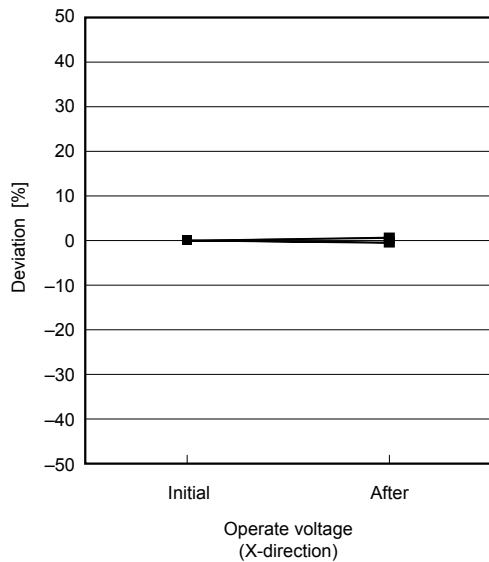
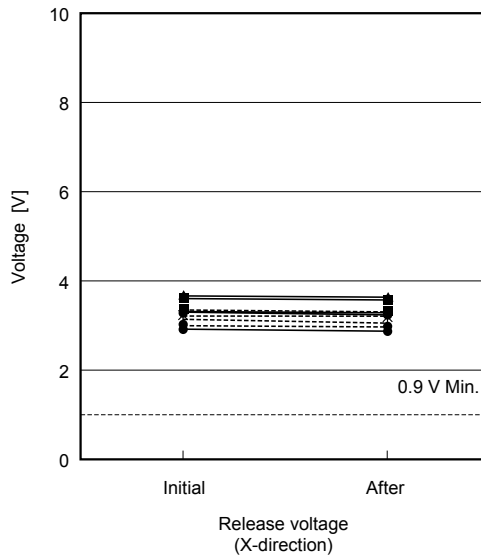
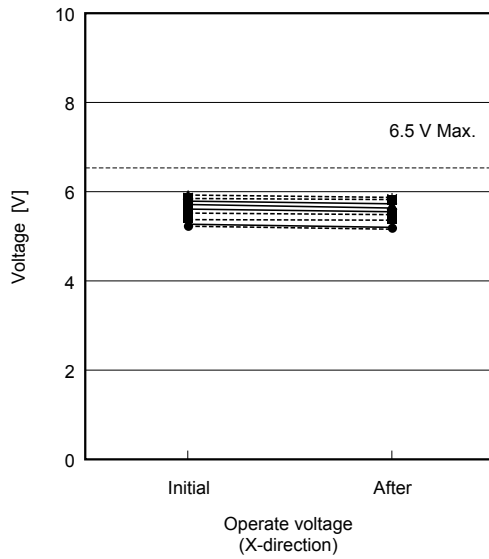


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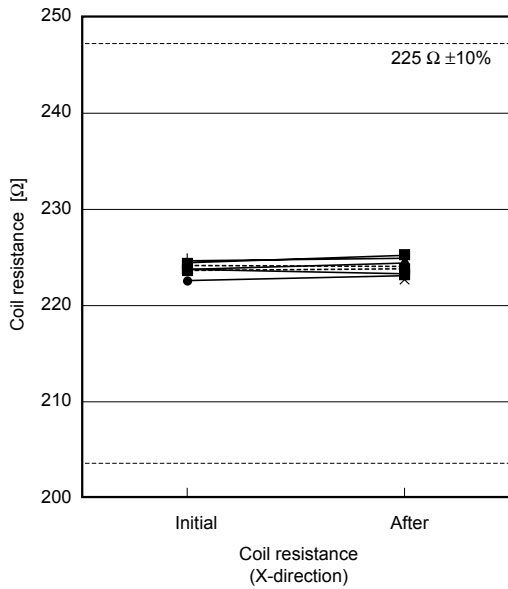
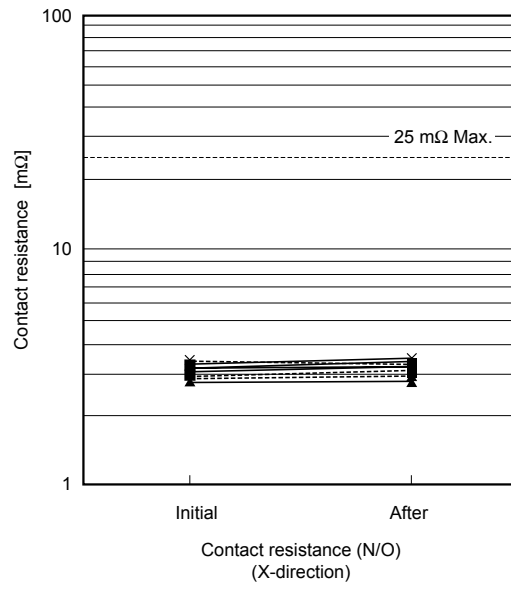
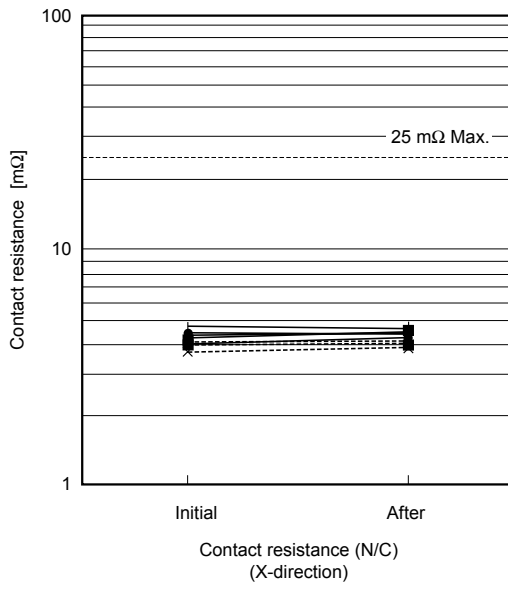
3. ENVIRONMENTAL CHARACTERISTICS

Vibration Durability Test

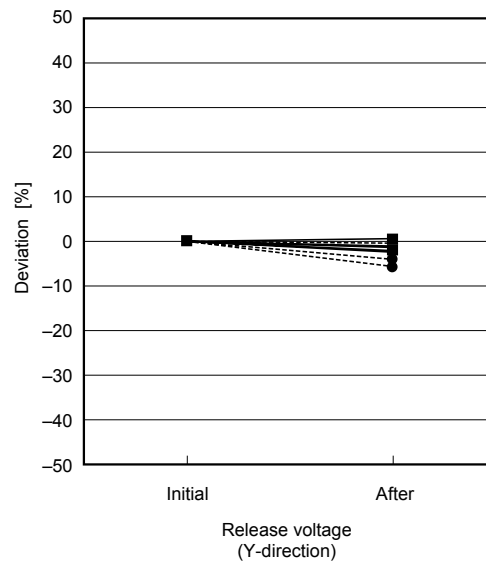
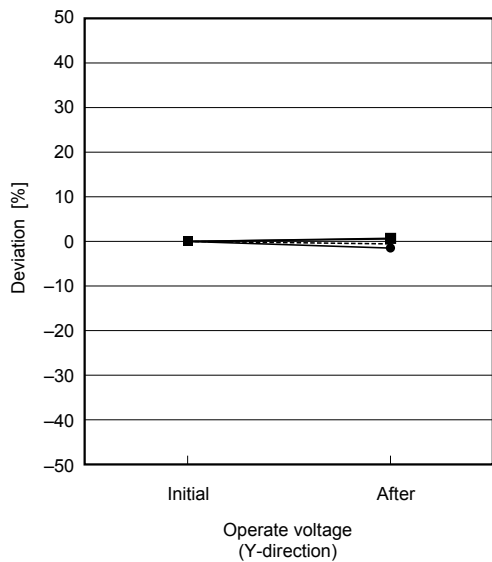
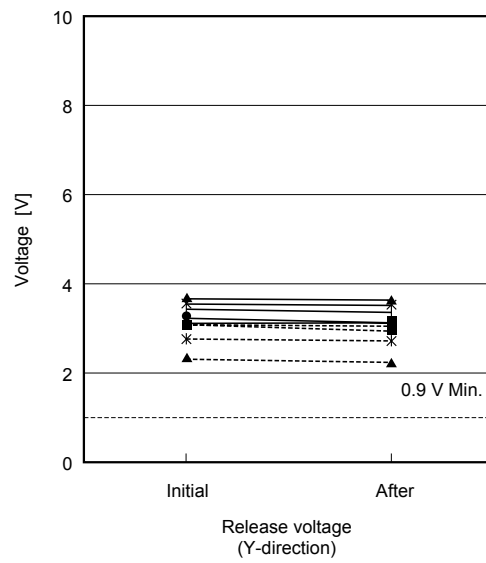
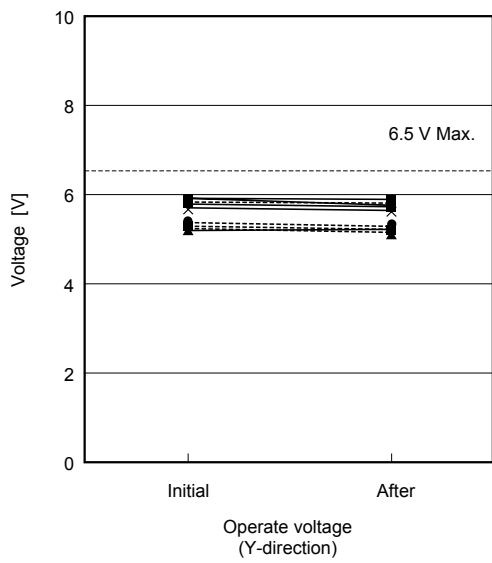
Test items	Test conditions	Samples
1. Operate voltage 2. Release voltage 3. Contact resistance 4. Coil resistance	Vibration frequency : 10 to 500Hz, 4.4G, 200 Hours The vibration added to 3 directions as follows. 	ET2-B3M1S 15 pcs (Each directions : 5 pcs)



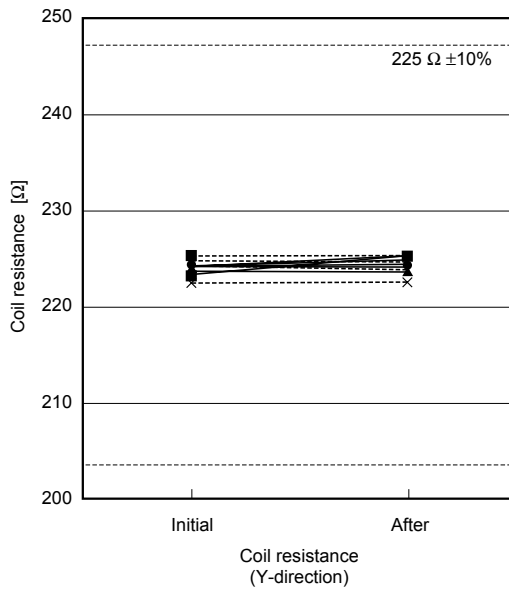
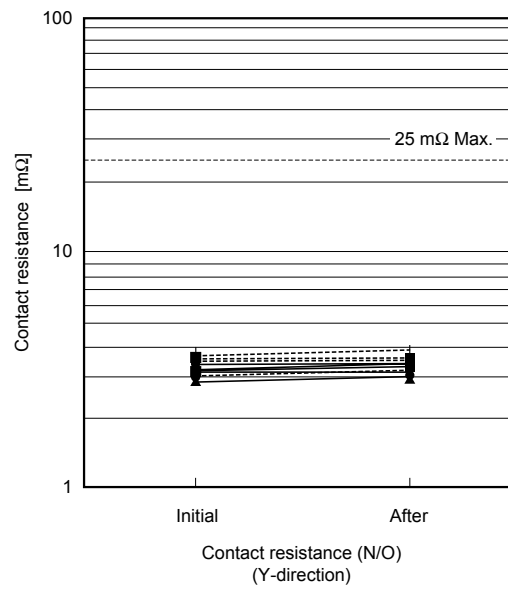
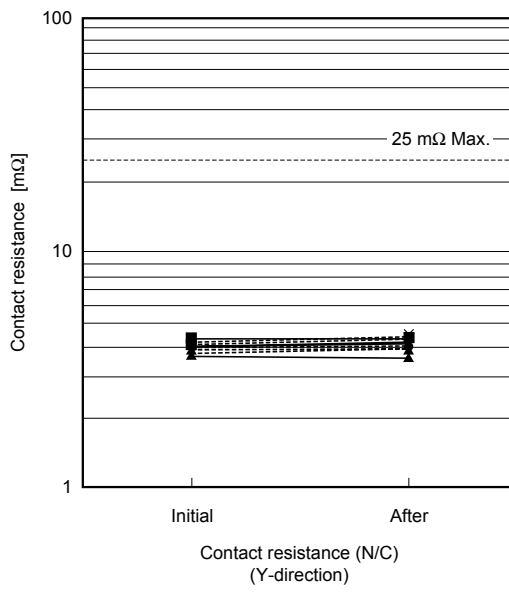
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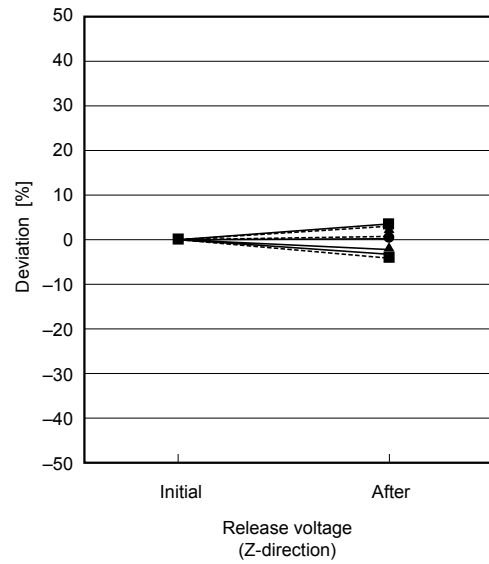
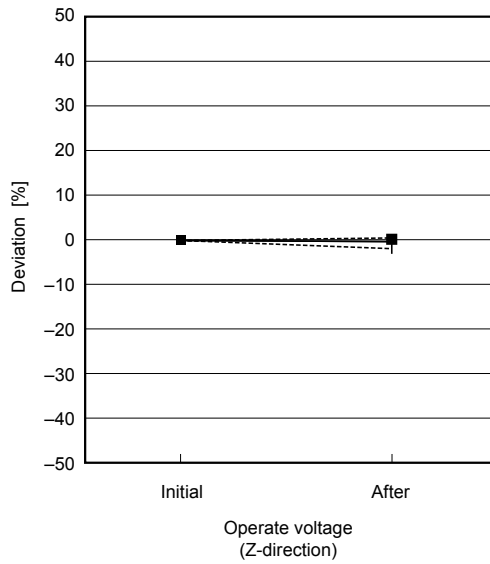
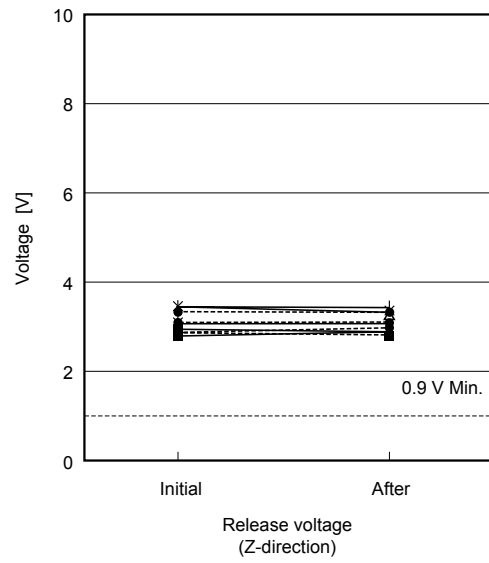
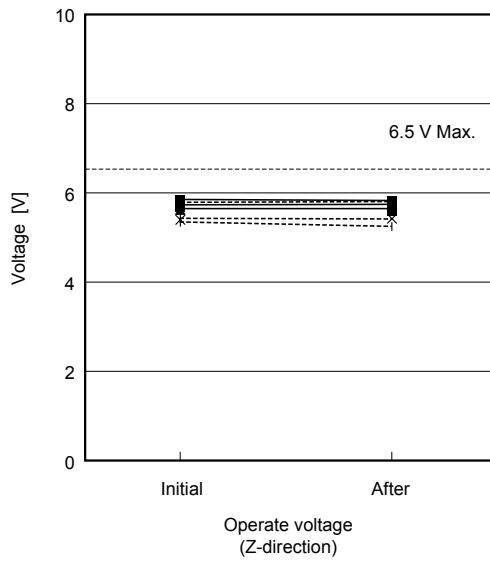
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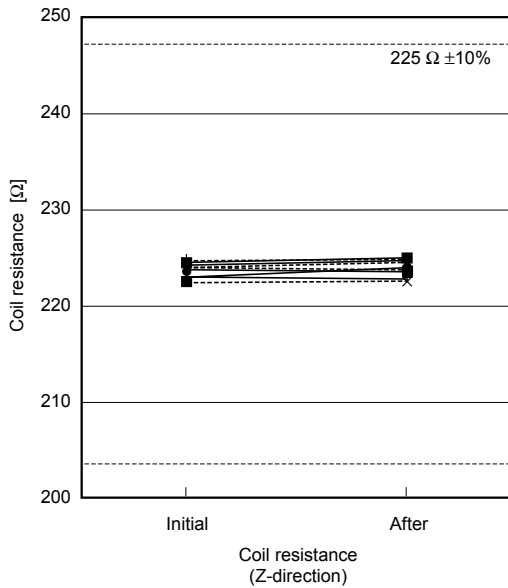
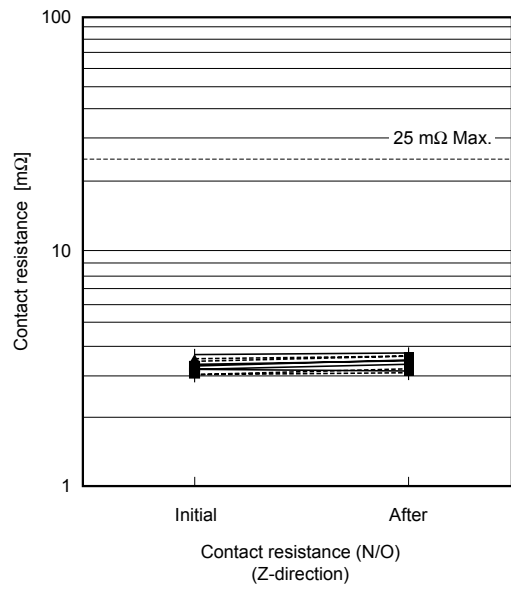
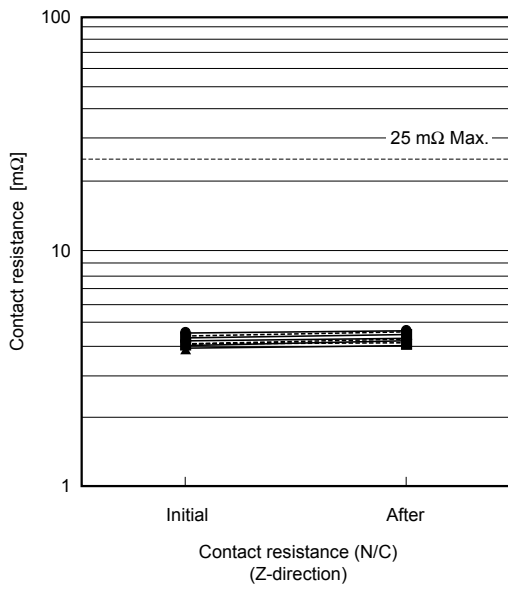
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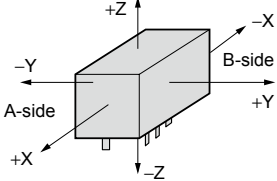
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3. ENVIRONMENTAL CHARACTERISTICS

Drop Test (1)

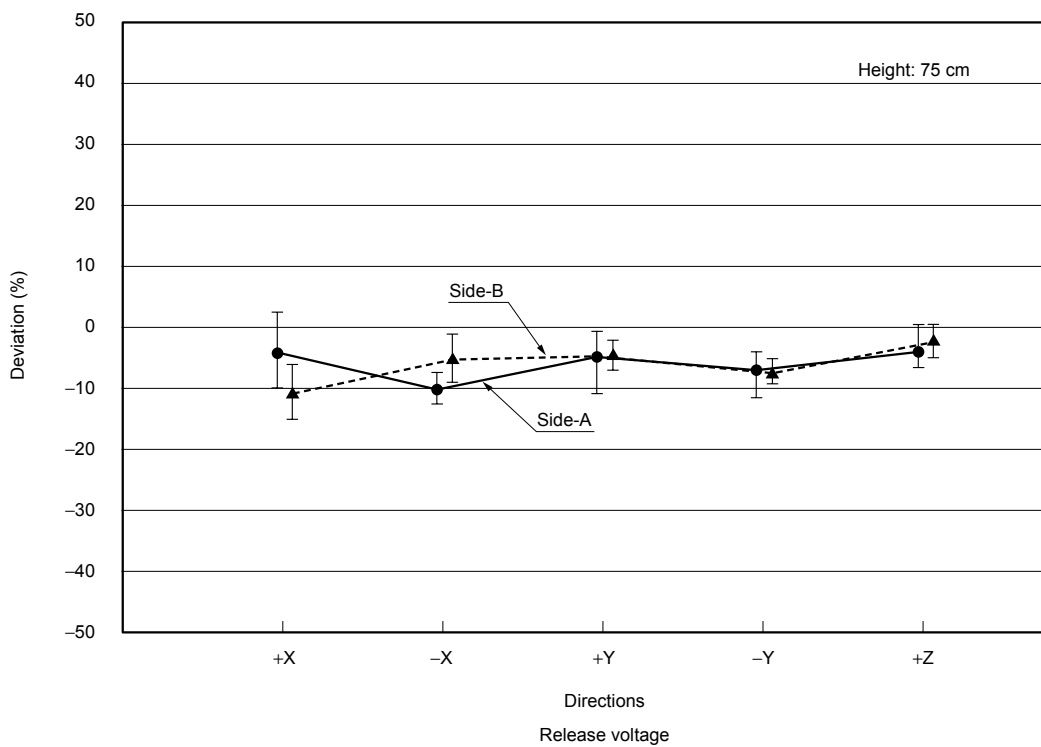
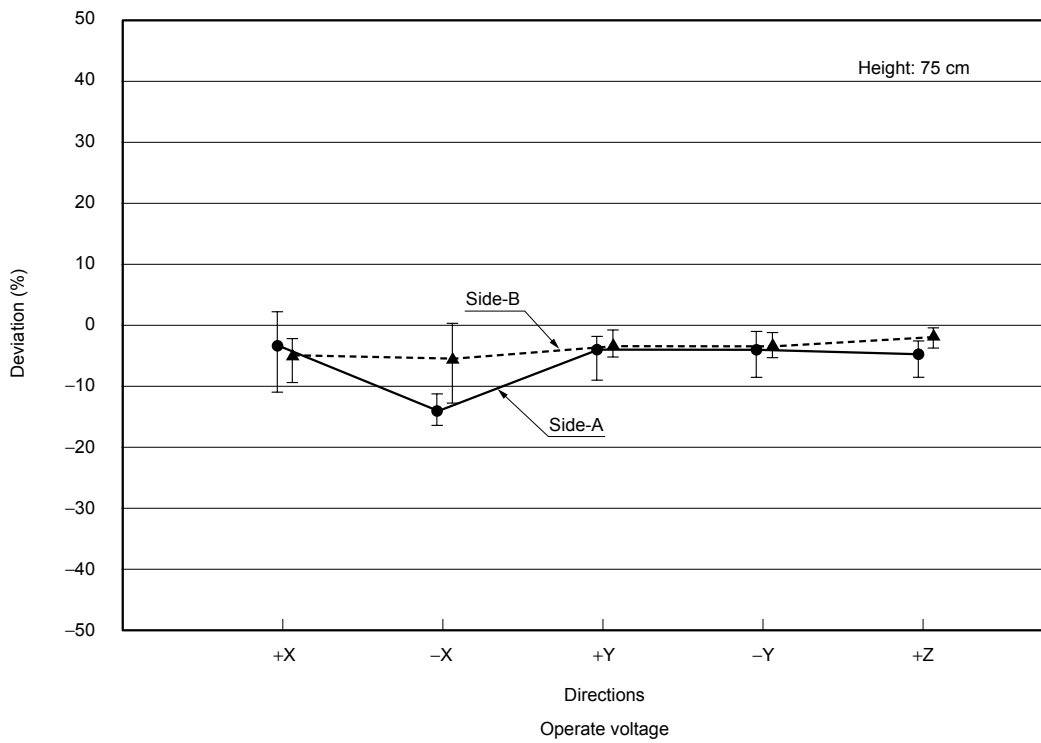
Test items	Test conditions	Samples
1. Operate voltage 2. Release voltage	Dropping number : 1 times Direction : 5 directions as follows Height : 75 cm 	ET2-B3M1S 15 pcs (Each directions : 3 pcs)

< 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)

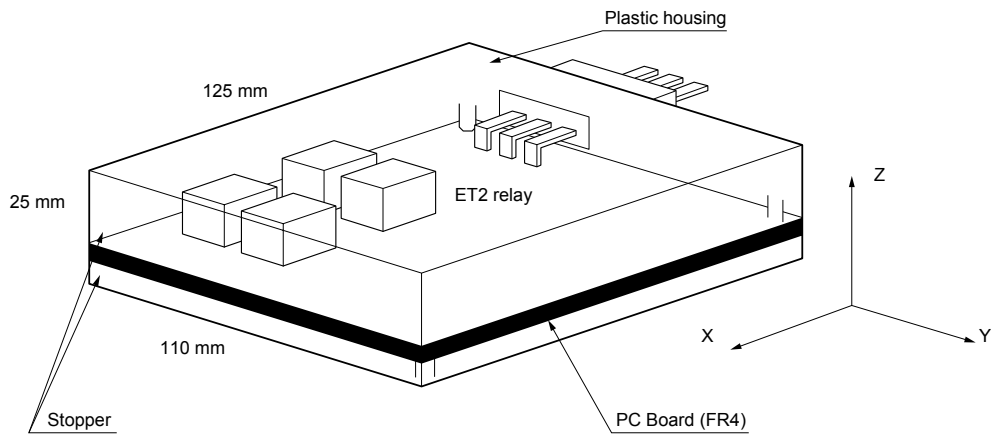
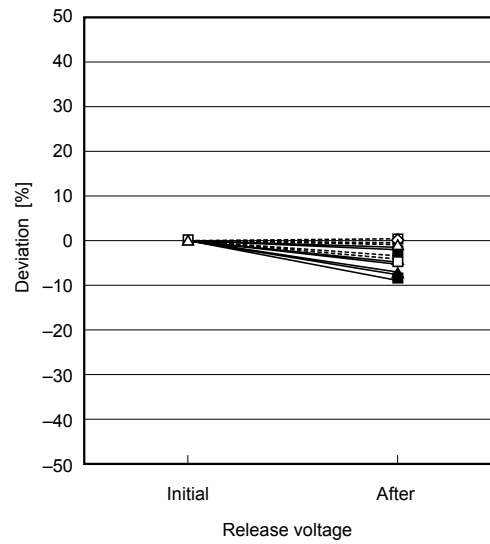
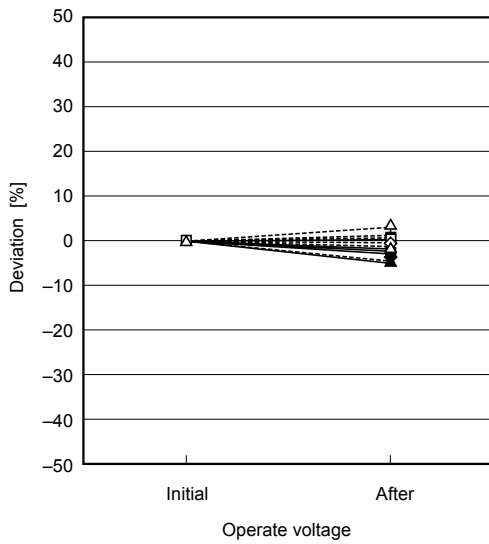
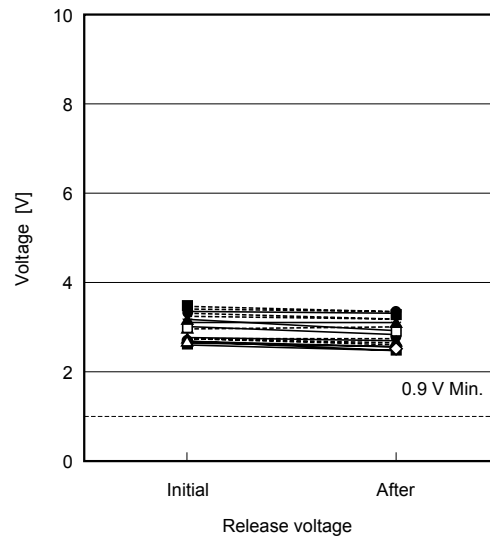
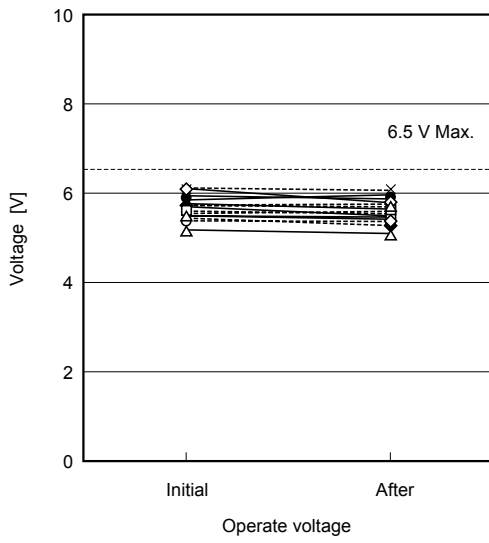


Fig.1 Module for drop test



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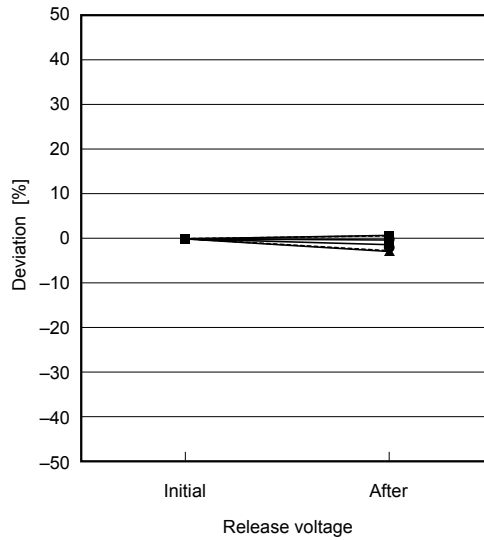
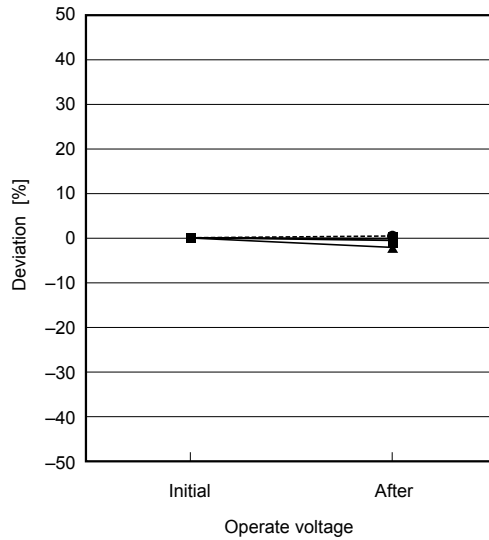
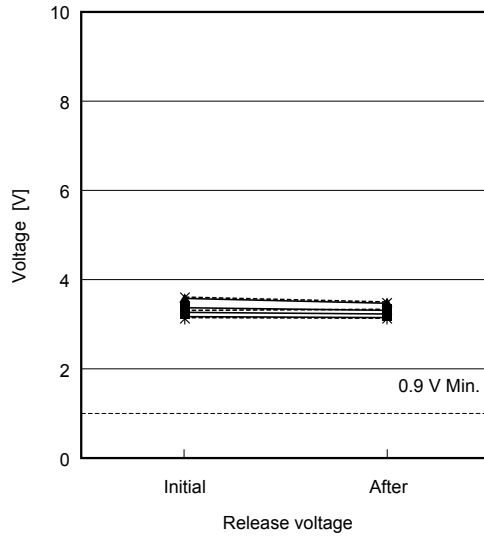
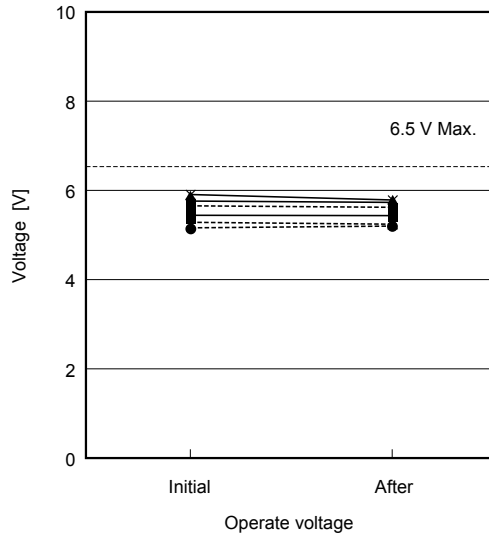


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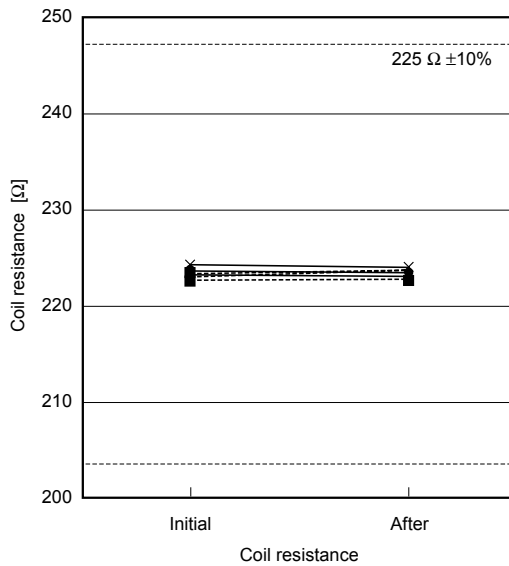
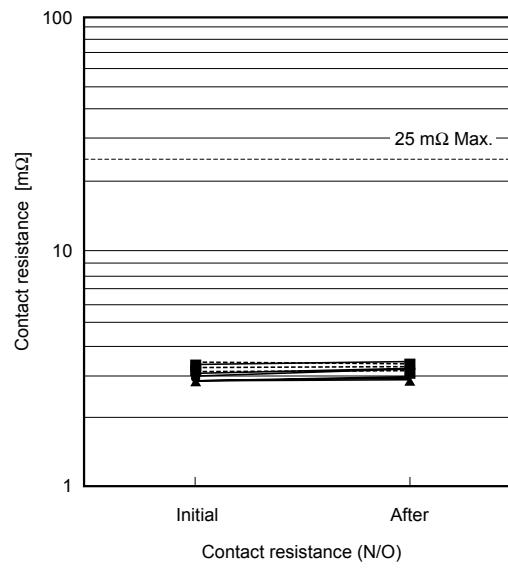
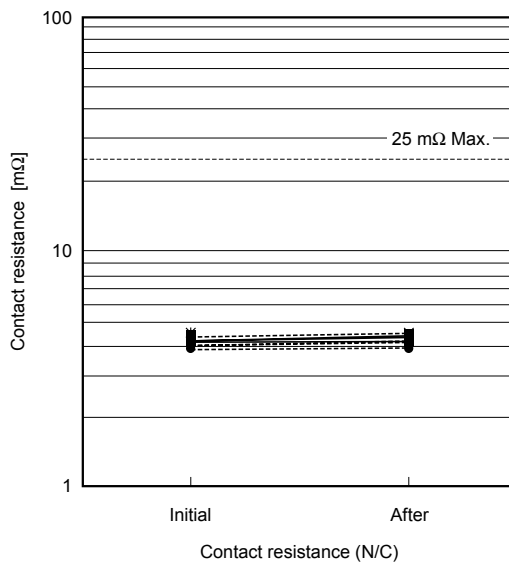
3. ENVIRONMENTAL CHARACTERISTICS

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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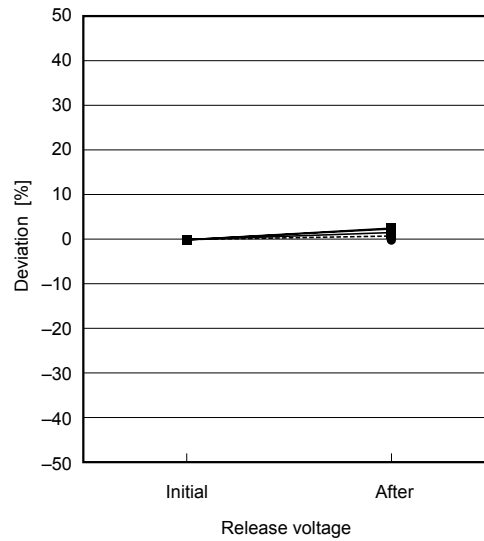
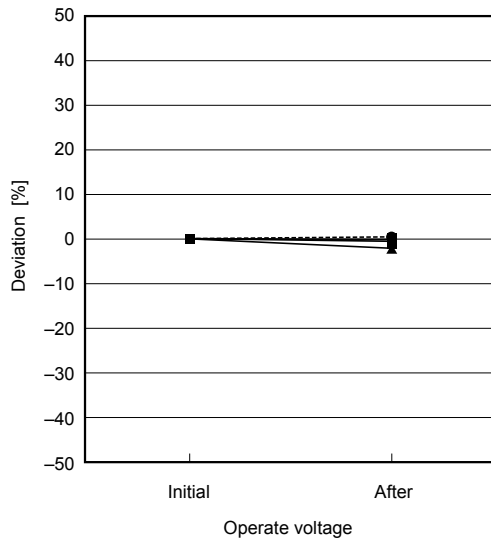
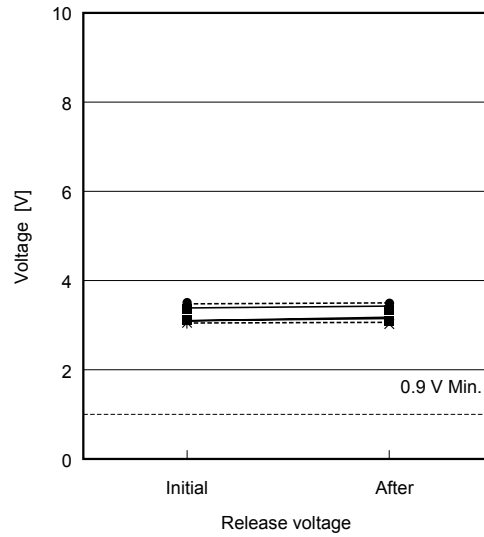
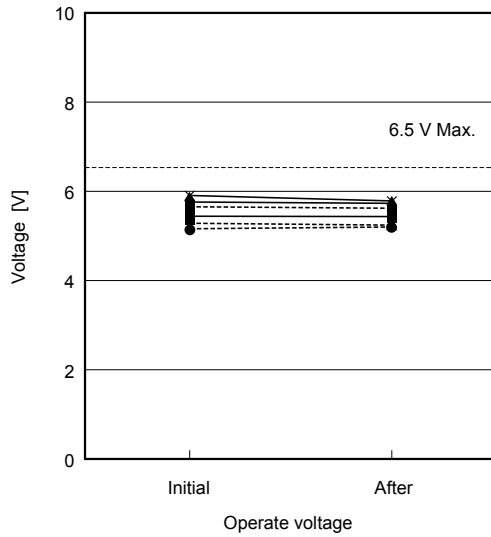


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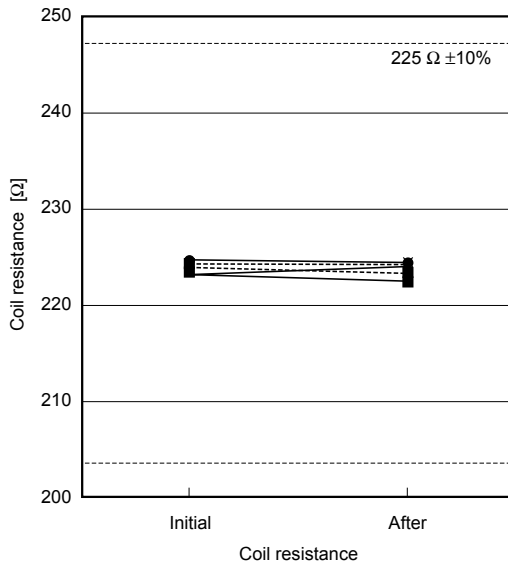
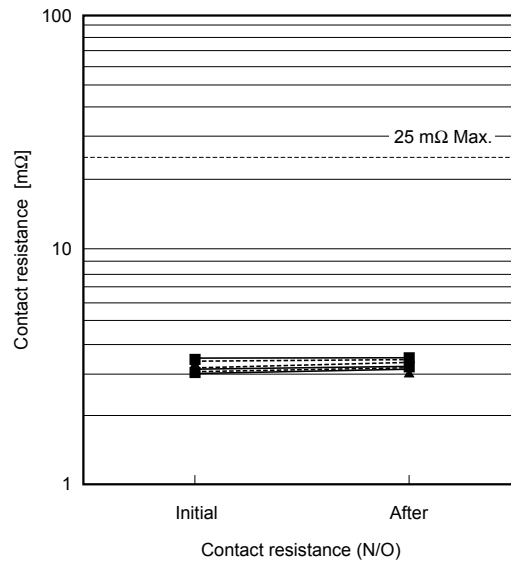
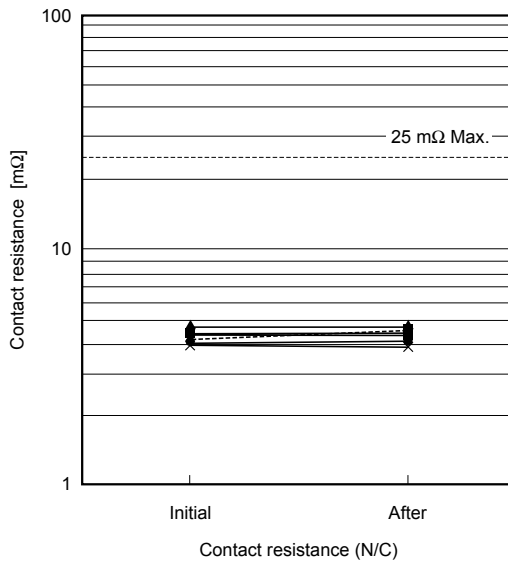
3. ENVIRONMENTAL CHARACTERISTICS

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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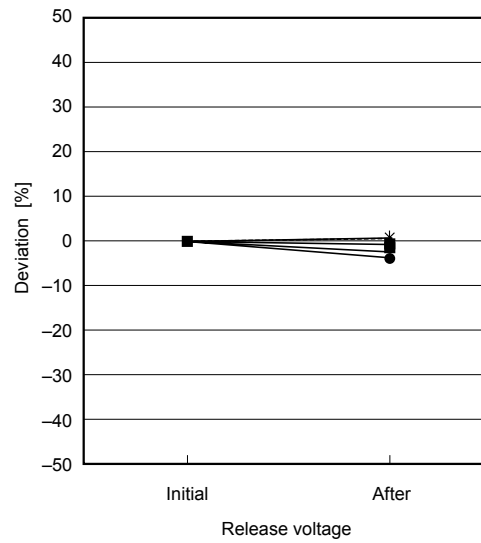
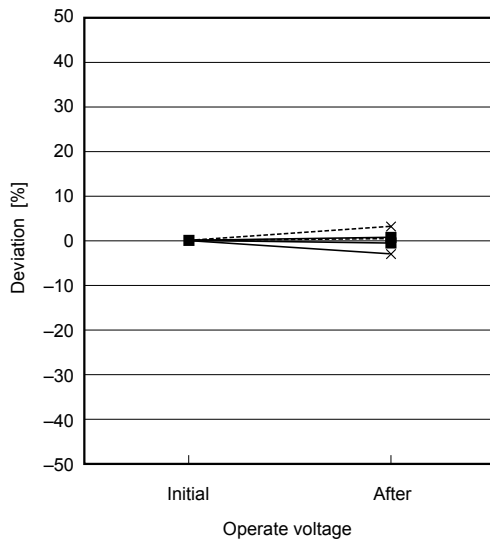
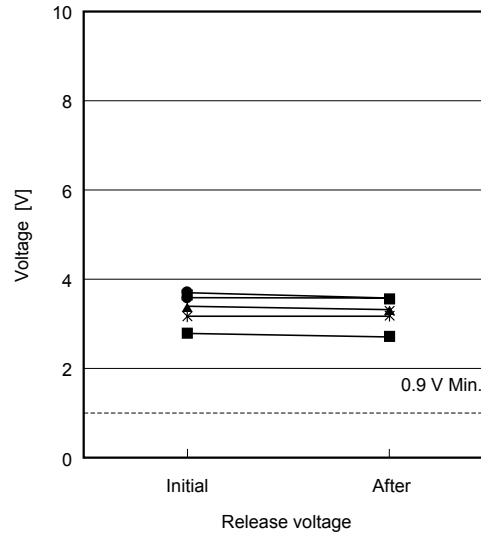
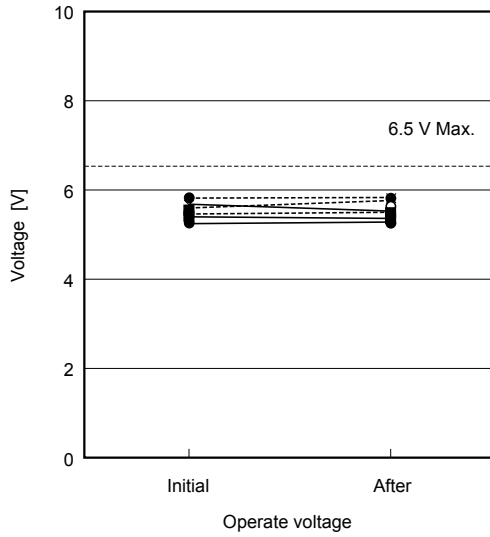


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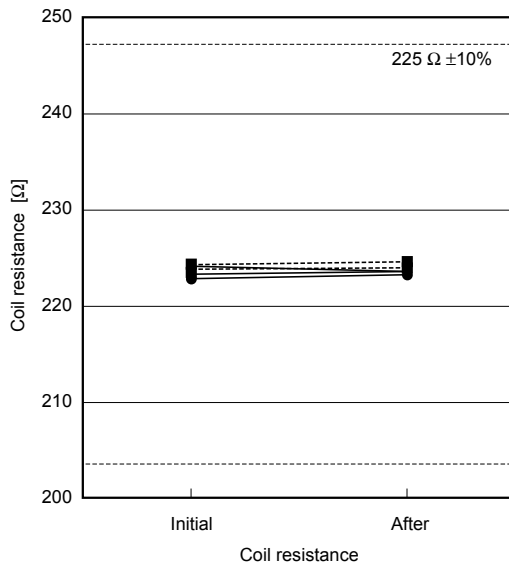
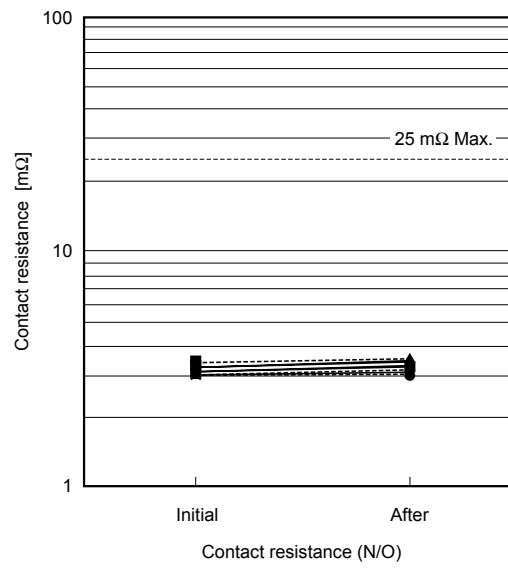
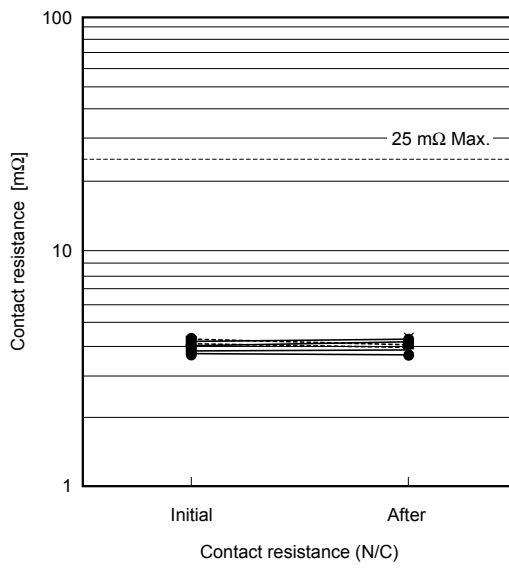
3. ENVIRONMENTAL CHARACTERISTICS

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 85°C
As shown in Fig.1

Test Result

No bubbles occurred under the above condition

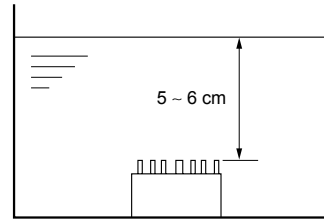


Fig.1 Sealing test method

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 the relays into solder bath for 10 sec. at 260°C
- 3) Dipping the relays into special ink bath for 60 sec. at 25°C
- 4) Check invasion of ink inside relay

Test Result

No invasion of ink found in the samples.

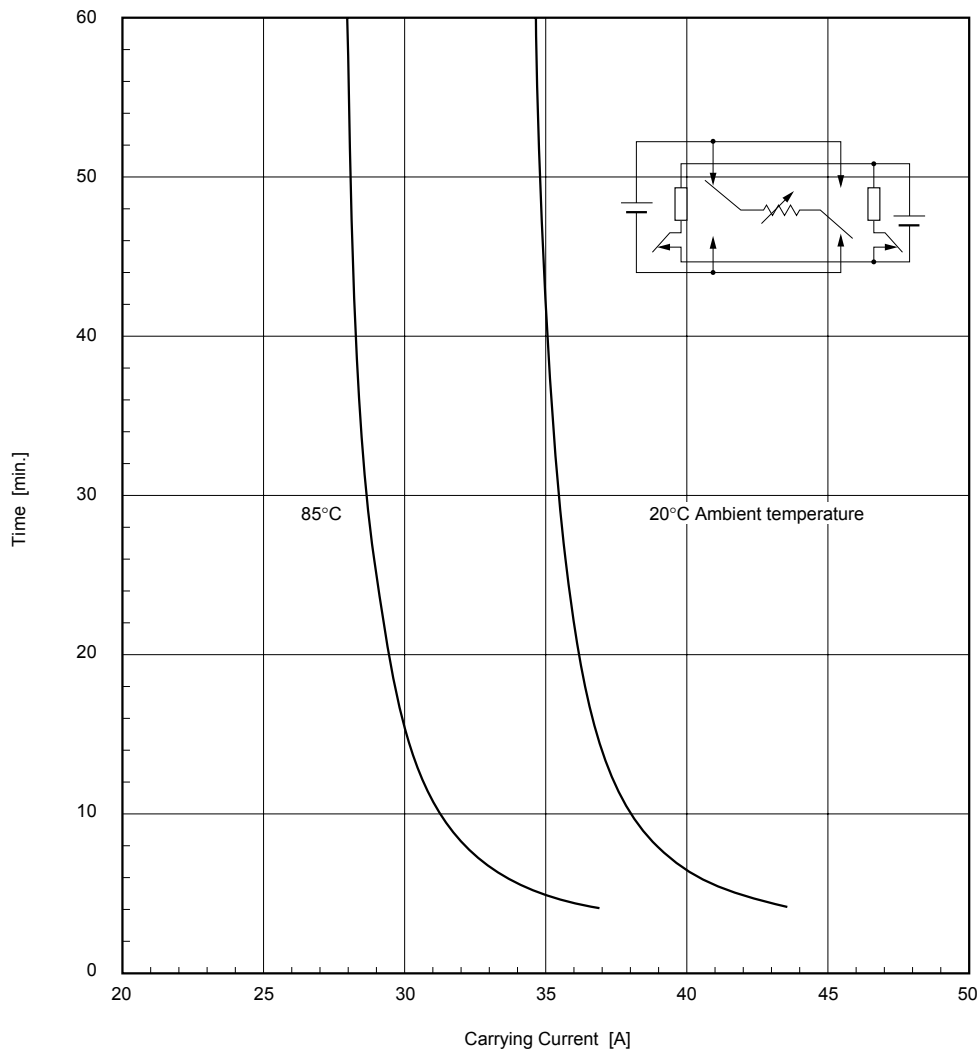


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3. ENVIRONMENTAL CHARACTERISTICS

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

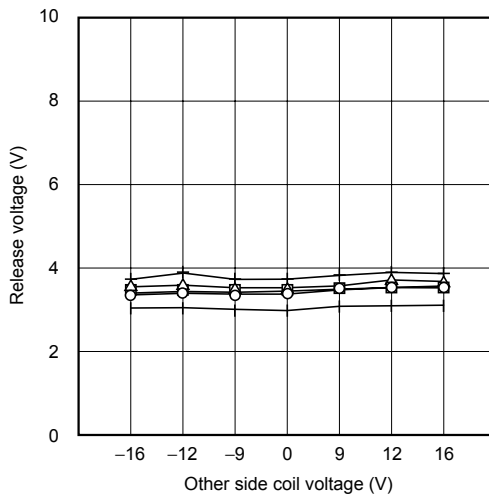
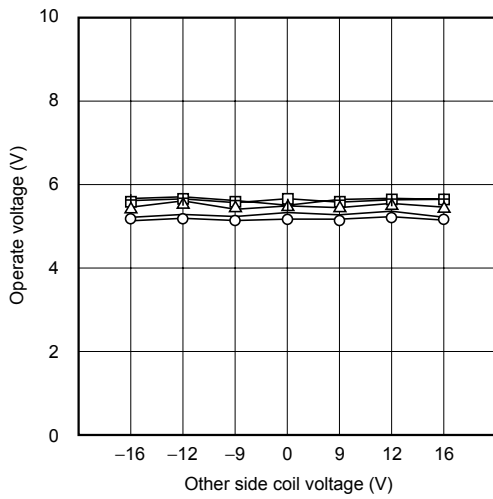
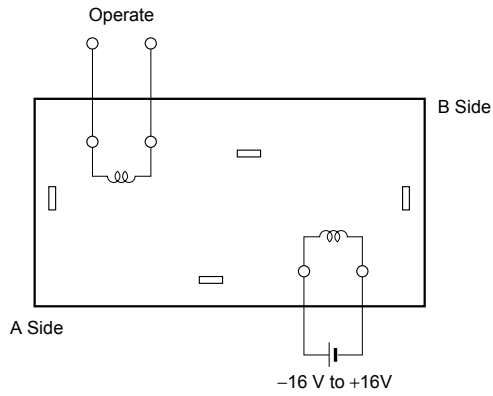


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3. ENVIRONMENTAL CHARACTERISTICS

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

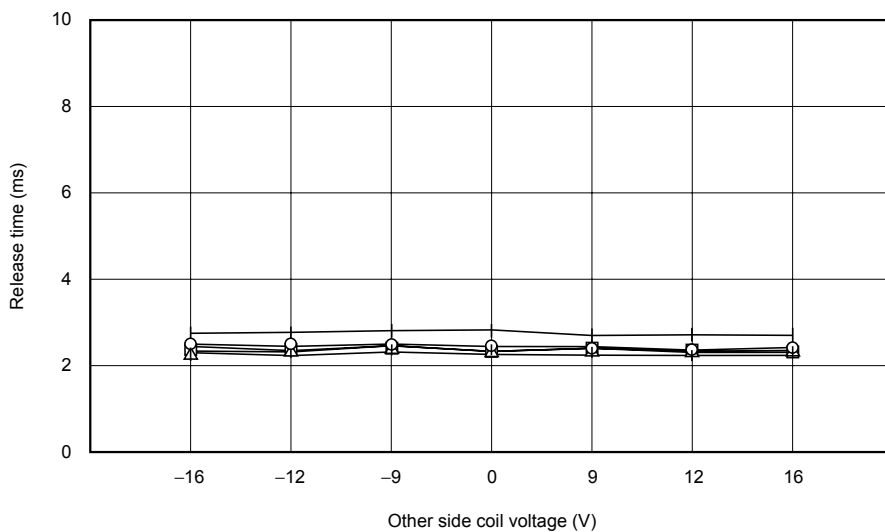
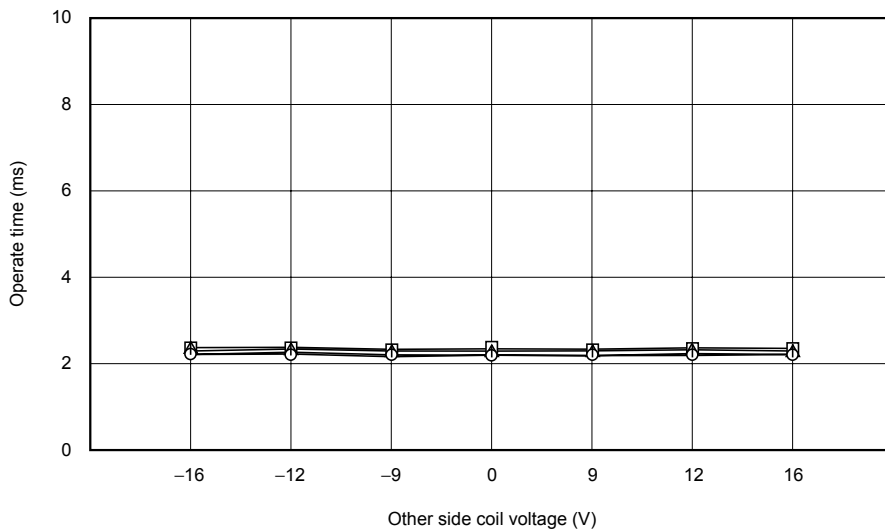


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3. ENVIRONMENTAL CHARACTERISTICS

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

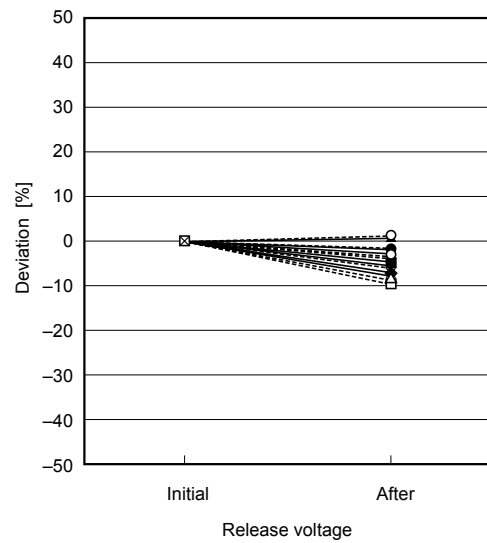
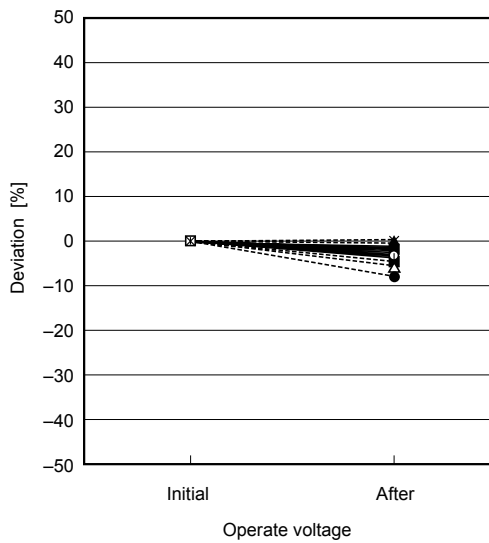
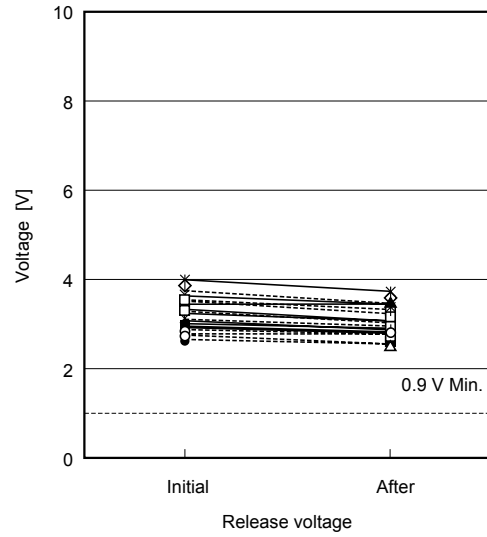
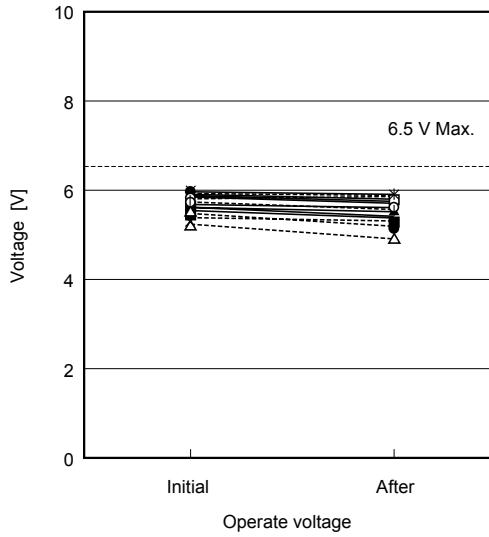


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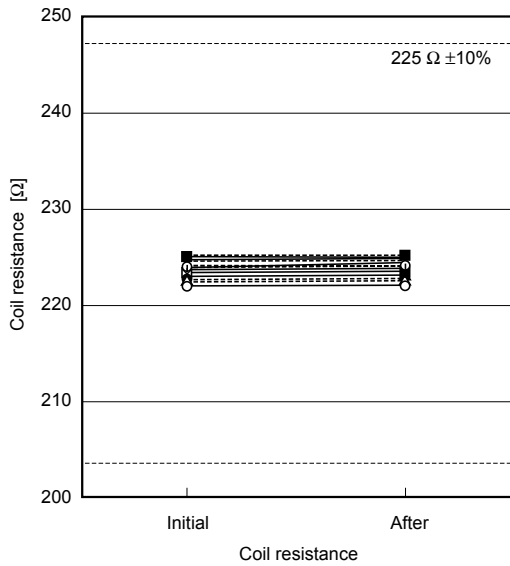
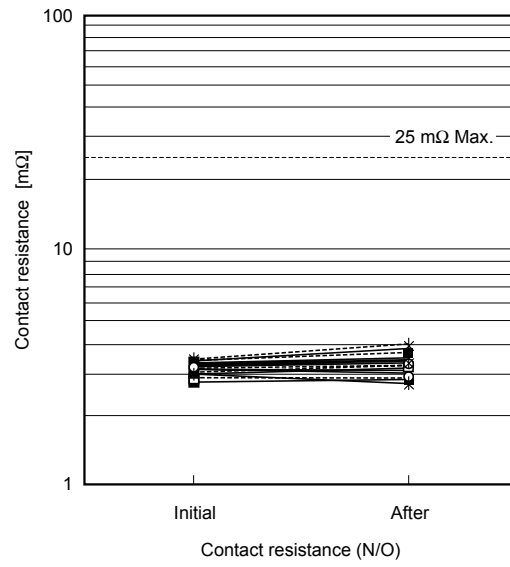
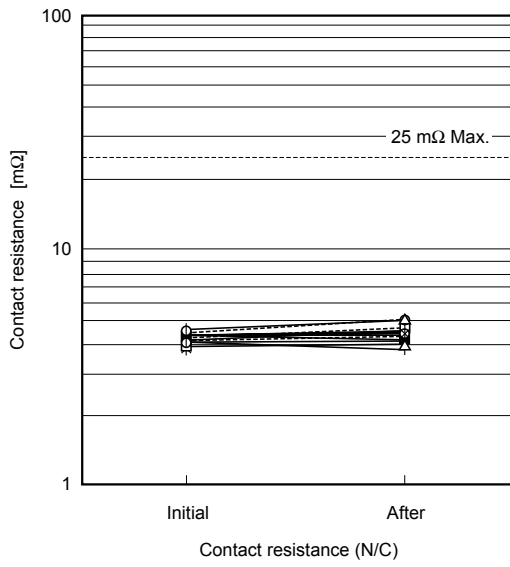
4. DURABILITY

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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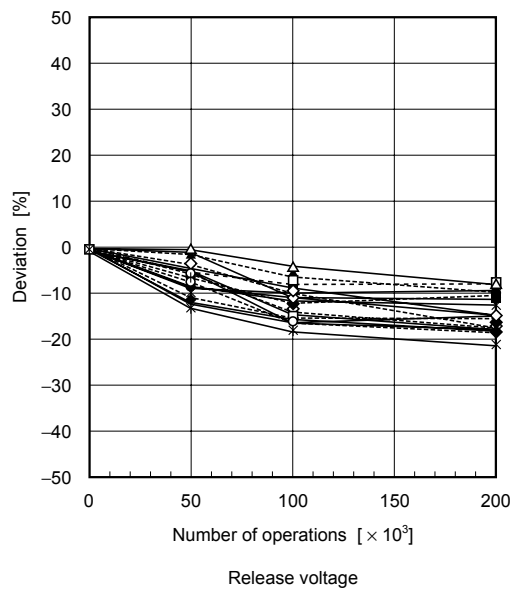
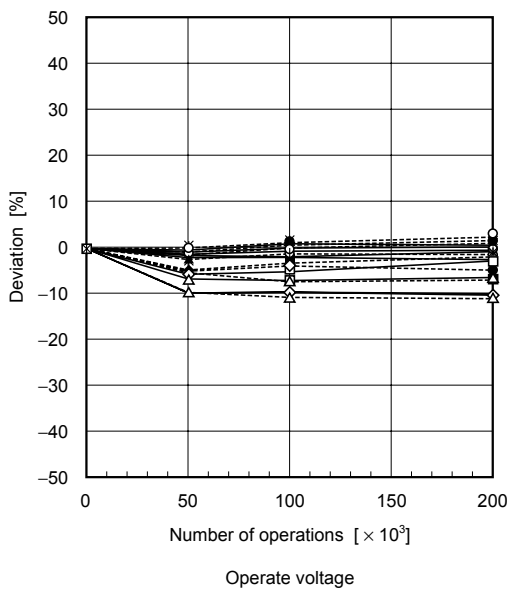
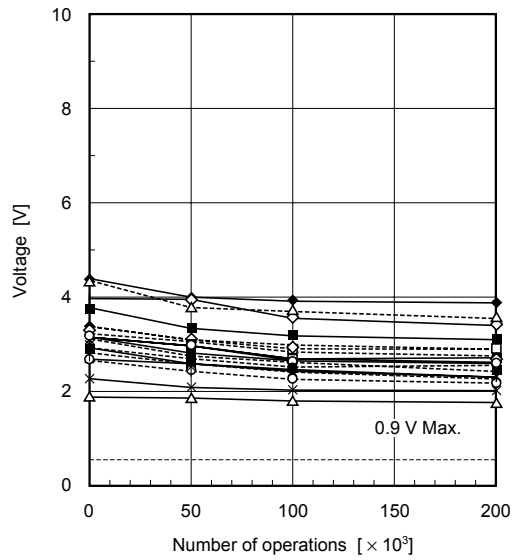
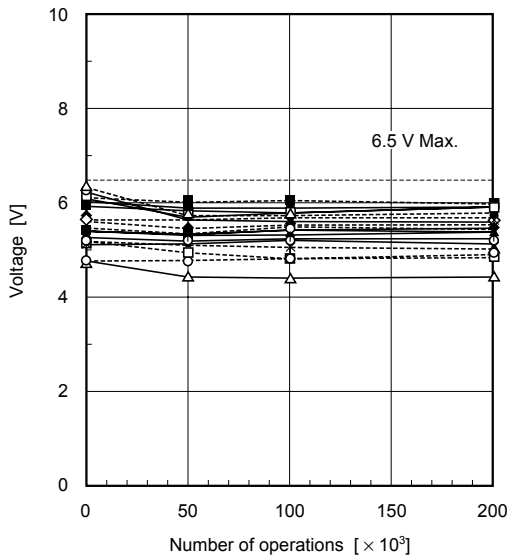


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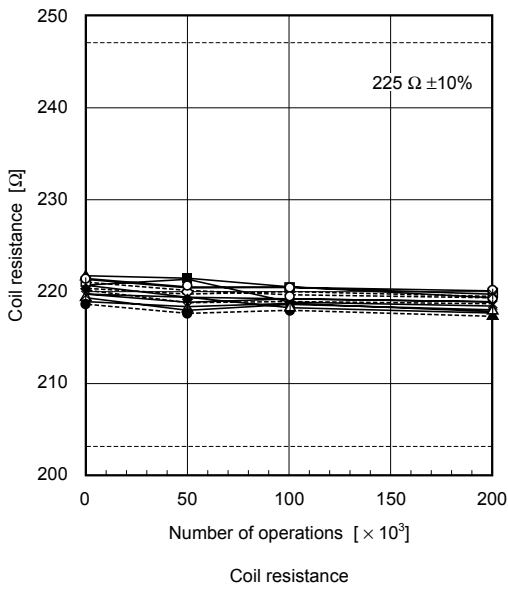
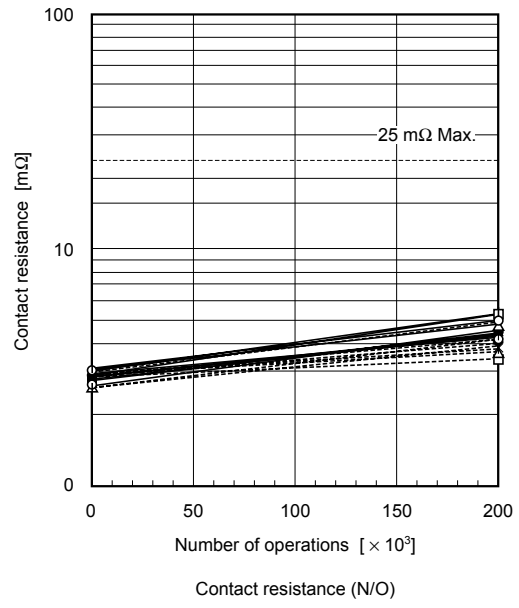
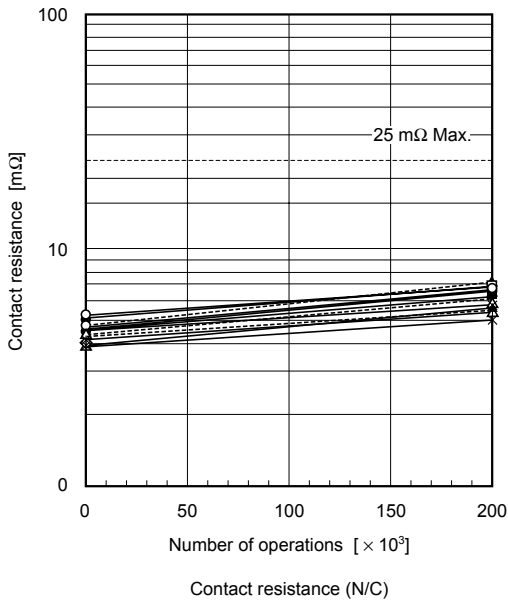
4. DURABILITY

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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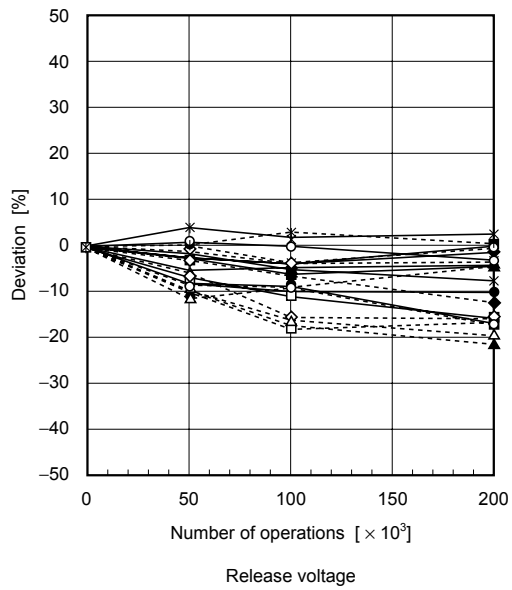
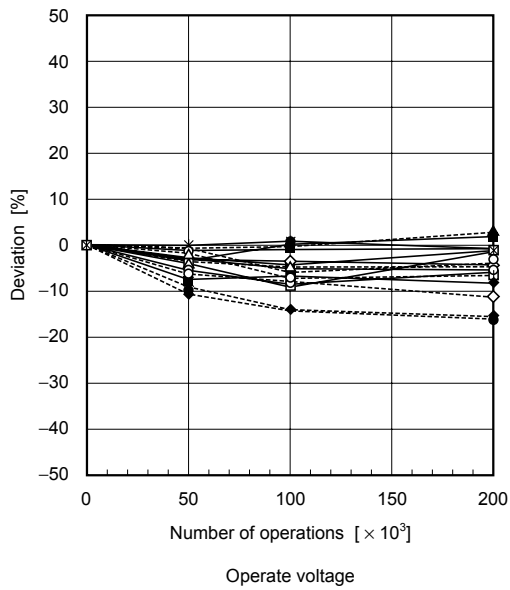
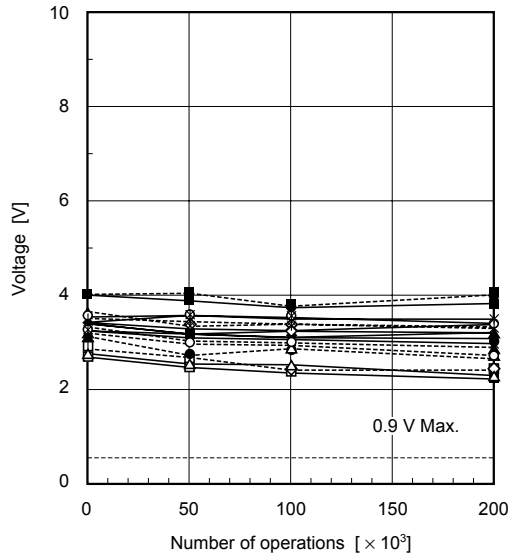
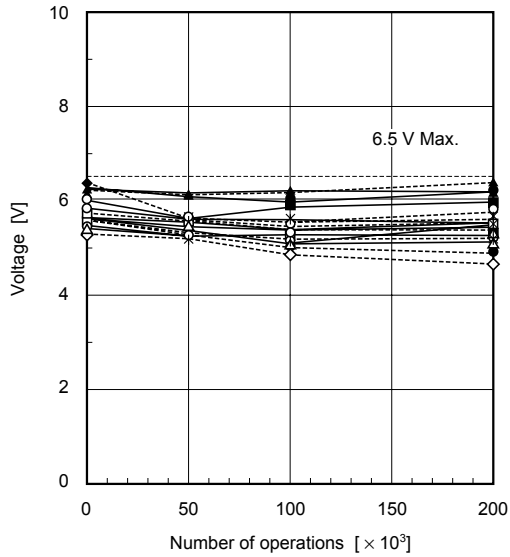


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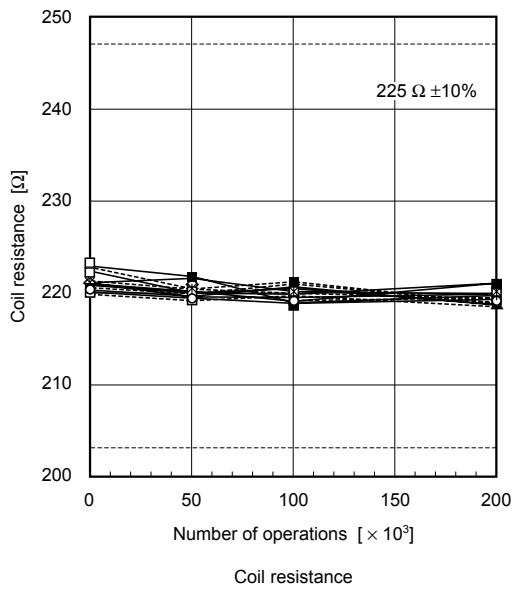
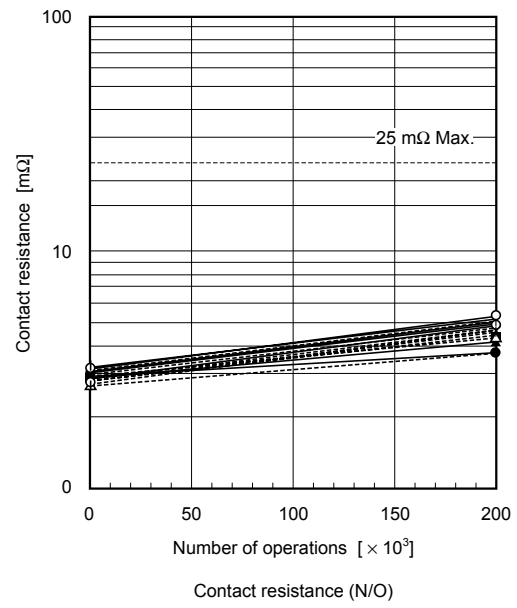
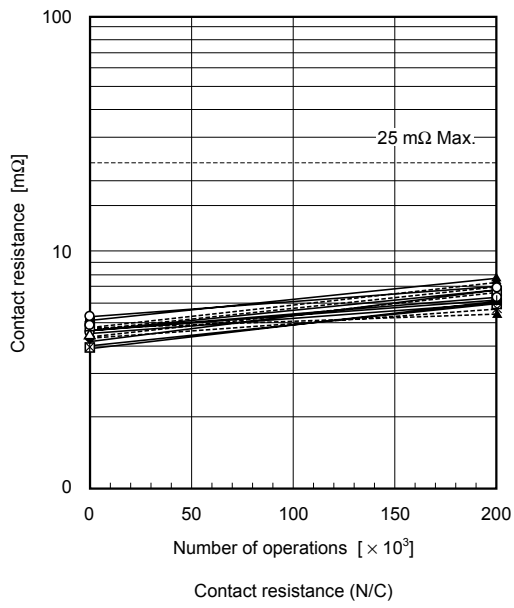
4. DURABILITY

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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