

**TOCOS®**

**納入仕様書**  
Specifications

種別

Model

Long-Life potentiometers

御社仕様番号

Customer Specification Number

御社機種名

Customer Part Name

御社部品番号

Customer Part Number

弊社形名

TOCOS Part Name

RVQ24YS08-03 トク50.8S B502

弊社仕様番号

TOCOS Specification Number

Y-40601

【RoHS compliant】

## Precautions for using TOCOS products




The products described in the specification are primarily designed and manufactured for such general electronic devices as audio-video equipment, home electric appliances, and business equipment unless otherwise specified in writing for particular applications

Even though, we take all possible measures to ensure the product quality, the least-likely of occurrence of electrical short or open can not be completely denied.

TOCOS does not recommend the use of any of its products in applications that require high safety and reliability. In case of the use in such applications, please do enough to check the appropriateness of aforementioned products at customers to avoid accident resulting in injury or death, fire accidents, electric shock, drop accidents and social damage.

The following extra attention is to be paid in designing:  
medical equipment · vehicles · aerospace instruments · security devices  
· public transportation · nuclear applications · social infrastructures  
(Electric power distribution, lifeline utilities etc.), prior examinations are necessary, securing that possible failures seen on our products remain confined to the product alone and will not impact on other regions of customer's finished products.

In order to ensure safety of your product, use of fail safe design, prevention of spread of fire design, and redundant design are recommended.

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 T. YOSHIDA	 H. KOIKE	 K. KAWAI	Y-40601	

# 1. General specification

(1) Scope of the specification : This specification applies to

RVQ24YS08-03 トク50.8S B502.

(2) Compliance with standard : JIS C 6444(Potentiometers). JIS C 5261(Test Method)

(3) Information : RoHS compliant

(4) Part number composition : Ex.) RV Q 24 Y S 08-03 トク 50.8 S B 502

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

① Carbon composition

② Long life rotation

③ Body size 24 : Approx. 24mmφ

④ Characteristic

⑨ Shaft type S : Slot

⑩ Resistance taper B : Linear

⑪ Nominal total resistance value code

3 digits. Unit : Ω

Y : Operating Temperature Range -10 to +85°C

Rated Ambient Temperature 40°C

First 2 digits are

Last digit represents

⑤ Style S : Single unit with lug-terminals, shaft sealing, cover sealing

significant that

the number of trailing

represent total

zeros.

⑥ Order of design

resistance value.

⑦ Special shaft style

502→50 00(Ω)→5kΩ

⑧ Shaft length 50.8 : 50.8mm

(5) Marking : Following markings are indicated on the products.

① Trademark

② Product name : RVQ24YS08-03

③ Shaft length : Ex.) トク50.8 (50.8mm, special shaft style)

④ Shaft style : Ex.) S (Slot)

⑤ Resistance taper : Ex.) B (Linear)

⑥ Nominal total resistance value : 3 digits. Ex.) 502 (5kΩ)

⑦ Date of manufacturing : 09 8 (Aug. 2009)

Last 2 digits of year. ↑ ↑ Month of 1 to 9, 0=Oct, N=Nov, D=Dec.

⑧ Terminal number : In case for showing on Case : Terminal 1 & 3.

In case for showing on Cover : Terminal 1, 2 & 3.

(6) Hardware : Nut 1pc. , Spring lock washer 1pc. , Plain washer 1pc.

(7) Packaging specifications :

100 pcs. of products and 10 pcs. of "silica-gel" are packaged in a packaging box, then put the lid on the box.

As an additional plus, the box shall be wrapped in a poly bag.

Another poly bag that contains washers(200 pcs.) and nuts(100 pcs.) is placed on or alongside the box, then the box shall be sealed.

(8) Addition

In case, there will be any change to contents of description in the specification or there will be left any doubt on item and article that are not described in this specification, with prior notification, both parties will decide quickly after due consultation.

Any part of this specification may be modified for improvements without prior notice.

When the part is used in a different way from common use state, please feel free to consult us at TOCOS sales dept.

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## 2. Electrical characteristics

No.	Item	Spec.	Conditions
1	Total resistance value	5k (Unit: $\Omega$ )	
2	Total resistance tolerance	$\pm 10\%$	
3	End resistance	Less than 0.5% of total resistance value (Initial)	Between terminal #1-2 at C.C.W. position. Between terminal #2-3 at C.W. position.
4	Resistance taper	B (Linear)	Resistance percentage at 50% of effective rotational angle. Measure the resistance between terminals #1-2.
5	Absolute linearity	$\pm 3\%$ of total resistance value	Datum line (100% = 90% of effective electrical rotational angle)
6	Maximum input voltage	200V DC or power rating.	Whichever is smaller.
7	Power rating	Room temp. 40°C 0.15W Room temp. 85°C 0W	40 to 85°C is derived from power derating curve. <div data-bbox="904 766 1375 900" data-label="Figure"> <p>POWER DERATING CURVE</p> </div> <p>For potentiometers operated in ambient temperatures above 40°C Power rating shall be derated in accordance with the figure. taper: 0B <math>E^2=PR</math> but <math>E \leq 200V</math> <math>E</math>=Voltage rating (V) <math>P</math>=Power rating (W) <math>R</math>=Nominal total resistance (<math>\Omega</math>)</p>
8	Contact resistance variation	Less than 3% of resistance value (Initial)	Except the positions of both ends of effective rotational angle. (at JIS C 5261 5.8.2 method C)
9	Insulation resistance	More than 100M $\Omega$	Apply DC 1,000 $\pm$ 100V for 60 $\pm$ 5 sec. in between shaft/cover and resistance terminals.
10	Dielectric strength	No such abnormal as short, insulation breakage should be seen.	Apply AC1,000(+50,-0V) for 60(+10,-0) sec. in between shaft/cover and resistance terminals.
11	Electrical rotational angle	40 $\pm$ 5°	Electrically effective rotational angle.

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### 3. Mechanical characteristics

No.	Item	Spec.	Conditions
1.	Dimensions	Attached drawing No. A- 32837.	
2.	Shaft	トク50.8S (50.8mm, slot, special shaft style)	
3.	Rotational angle	300 ±5°	Mechanical rotational angle
4.	Torque	Less than 9.8mN·m(100gf·cm)	Rotates at normal temperatures(5 to 35°C). Rotation is possible at -10°C.
5.	Shaft strength	(Push)125N {12.75kgf} (Pull)125N {12.75kgf} No damage should be seen.	Immediately after applying pushing force for 10 sec. to the direction of shaft tip end. Apply pulling force for 20 sec. (Push nut method)
6.	Shaft stop strength	900mN·m(9.18kgf·cm) No damage or deformation should be seen.	Apply rotational force to terminal#1 and 3 side for 10±1 sec.
7.	Shaft wobble	Less than ±0.4×(L/30)mm L: Distance between fiducial surface to measuring point. Not applied to shaft length of below 20mm.	Apply bend moment of 0.1N·m{1.02kgf·cm} from 180° directions near the measuring point(within 3mm from tip end of shaft) in direction at right angle to shaft.
8.	Terminal strength	Pull : 20N(2.04kgf) Bend : 2 times No occurrence of breakage or looseness in terminals.	(Pull) To the direction of terminal tip end, apply pulling force for 10±1 sec. (Bend) Go and return of a 45° angle bend is counted as one time bend.
9.	Bushing nut Tightening strength	1,470mN·m(15kgf·cm)	Standard mounting hole
10.	Sealability	Degree of protection : IP64 (Shaft sealing, cover sealing)	JIS C 0920 : Degrees of protection provided by enclosures.

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4. Environmental characteristics (Please refer to Fig-1 for circuit evaluation purposes.)

No.	Item	Spec.	Conditions
1.	Resistance temperature characteristic	Change ratio in total resistance $\Delta R/R \pm 5\%$	$85 \pm 3^\circ\text{C}$ 5 hrs. Non-load.
2.	Vibration	① No occurrence of electrical discontinuity with over 0.5ms between terminal # 1-2 during test ② Change ratio in total resistance $\Delta R/R \pm 5\%$	10 to 55Hz. 1.5mm or $196\text{m/s}^2$ X Y Z directions each 2 hrs. Total 6 hrs.
3.	Soldering heat	① Change ratio in total resistance $\Delta R/R \pm 2\%$ ② There shall not be looseness in terminals.	$350 \pm 10^\circ\text{C}$ for $3.5 \pm 0.5$ sec. Leave for $4 \pm 0.5$ hrs. at normal temperatures.
4.	Solderability	More than 75% of solder dipped surface	$235 \pm 5^\circ\text{C}$ for $5 \pm 0.5$ sec.
5.	Temperature cycle	① Change ratio in total resistance $\Delta R/R \pm 10\%$ ② No abnormal seen in outward appearance	$-10 \pm 3^\circ\text{C}$ , $+85 \pm 2^\circ\text{C}$ 5 cycles for each 30 minutes. Leave at normal temperatures for more than 1 hr. within 2 hrs.
6.	Durability (Moisture and load life)	① Change ratio in total resistance $\Delta R/R \pm 20\%$ ② Insulation resistance more than $10\text{M}\Omega$	$40 \pm 2^\circ\text{C}$ 90 to 95%RH DC rated voltage. Cycle of 1.5 hrs. ON 0.5 hr. OFF for $500 \pm 12$ hrs. Leave for 5 hrs. at normal temperatures. Insulation resistance DC $500 \pm 50\text{V}$ for $60 \pm 5$ sec.
7.	Rotational life	Change ratio in total resistance $\Delta R/R \pm 15\%$	2 million $\pm 200$ cycles. Non-load at normal temperatures. (90% sliding of electrically effective angle)
8.	Load life	Change ratio in total resistance $\Delta R/R \pm 10\%$	$40^\circ\text{C}$ 0.5W for 1,000 hrs.
9.	Load characteristics	Change ratio in total resistance $\Delta R/R \pm 5\%$	Apply rated load for 3 hrs. in between terminal # 1-3
10.	Operating temperature range	$-10$ to $+85^\circ\text{C}$	

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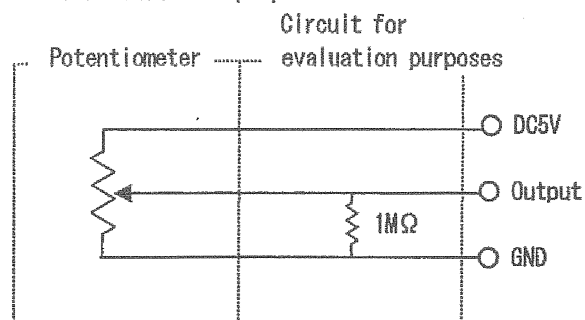
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Fig-1 : Circuit for evaluation purposes



## 5 Application notes

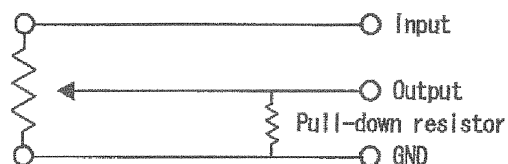
### (1) Regarding for circuit

※ Please use the potentiometers in a circuit as a potentiometer.

(Three-terminal voltage divider. Please refer to Fig-1 for voltage divider circuit).

※ Pull-down resistor installed onto a circuit can reduce the effects against linearity and noise caused by contact resistance.

Therefore, we recommend to install an additional pull-down resistor which is over 200 times higher in value than total resistance.



### (2) Stress for shaft

※ Using the potentiometers in a state when stress is applied to shaft may cause to increase shaft locking and looseness.

In such cases, please note there may exert an influence upon its characteristics.

Therefore, an adequate verification shall be given prior to use.

Also, please do not apply stress over 0.98N(100gf) to shaft either in thrust or radial directions.

### (3) Vibration for shaft

※ The method of connection by which vibrations are applied to VR(Variable Resistor) shaft, depending on setting positions, would rotate the shaft by the vibrations, which in turn cause feeble vibrations at slider contact area.

Due to this, there is a possibility that irregular abrasion would occur resistive element surface to cause a characteristics failure.

Please use a connection method by which vibrations are not applied to the shaft.

In case of having no choice but to adopt a connection method of applying vibrations to the shaft, there is a method to install return springs for VR to prevent the vibrations.

Please consult with us on this method.

### (4) Application notes (Potentiometers)

※ Please refer to "Pull-down resistor" and "Application notes (Potentiometers)".

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## Pull-down resistor

### 1. Recommendable conditions

We recommend to install an additional pull-down resistor which is over 200 times higher in value than total resistance, taking into account of output voltage variations influenced by contact resistance and loading error (influence on linearity).

For instance, even when resistance value  $5k\Omega$  creates  $5k\Omega$  contact resistance, pull-down resistance with additional  $1M\Omega$  can reduce output voltage variations to approx.  $25mV$  and moderates the influence on linearity at approx.  $-0.99\%$ .

(Please refer to Fig. 2 shown below for the details.)

Remarks : At the time of use, please confirm the evaluation while the potentiometers are mounted on customers' products.

### 2. Explanation

Potentiometer is designed to function that movable wiper contact slides over the resistive element, thus allowing the electrical contacts to be kept.

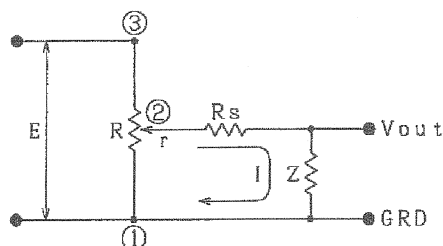
Because of this wiper contacts, generation of abrasion particles at both the element side and wiper contact side are inevitable.

Abrasion particles are electrically insulated. When wiper comes on over the abrasion particles, contact resistance will rise accordingly.

On the assumption that contact resistance would be approx.  $5k\Omega$ , it is required to choose particular pull-down resistor by that there will be no influence on output voltage through the contact resistance.

Ex.) Calculation: On the assumption that  $5k\Omega$  of contact resistance would occur against  $5k\Omega$  in total resistance.

#### 1) Model circuit



Z: Pull-down resistor ( $\Omega$ )  
E: Applied voltage (V)  
r: Voltage divided resistance ( $\Omega$ )  
Rs: Contact resistance ( $\Omega$ )  
R: Total resistance value ( $\Omega$ )  
I: Load current (A)

#### 2) Model conditions

Z:  $1M\Omega$  ( $5k\Omega \times 200$ )  
E: 5V  
r:  $5k\Omega$   
Rs:  $5k\Omega$  ( $5k\Omega \times 100\%$ )  
R:  $5k\Omega$

#### 3) Load current by pull-down resistor (Z)

① Calculation formula 
$$I = \frac{r \cdot E}{R(r+Rs+Z) - r^2} \quad [A]$$

② Results 
$$I = 0.00000498 \text{ A} = 4.98 \mu A$$

#### 4) Output voltage by pull-down resistor (Z)

① Calculation formula 
$$V_{out} = \frac{r \cdot E \cdot Z}{R(r+Rs+Z) - r^2} \quad [V]$$

② Results 
$$V_{OUT} = 4.97512438 \text{ V} = 4.975 \text{ V}$$

Amount of variations in output voltage: Approx.  $25mV$

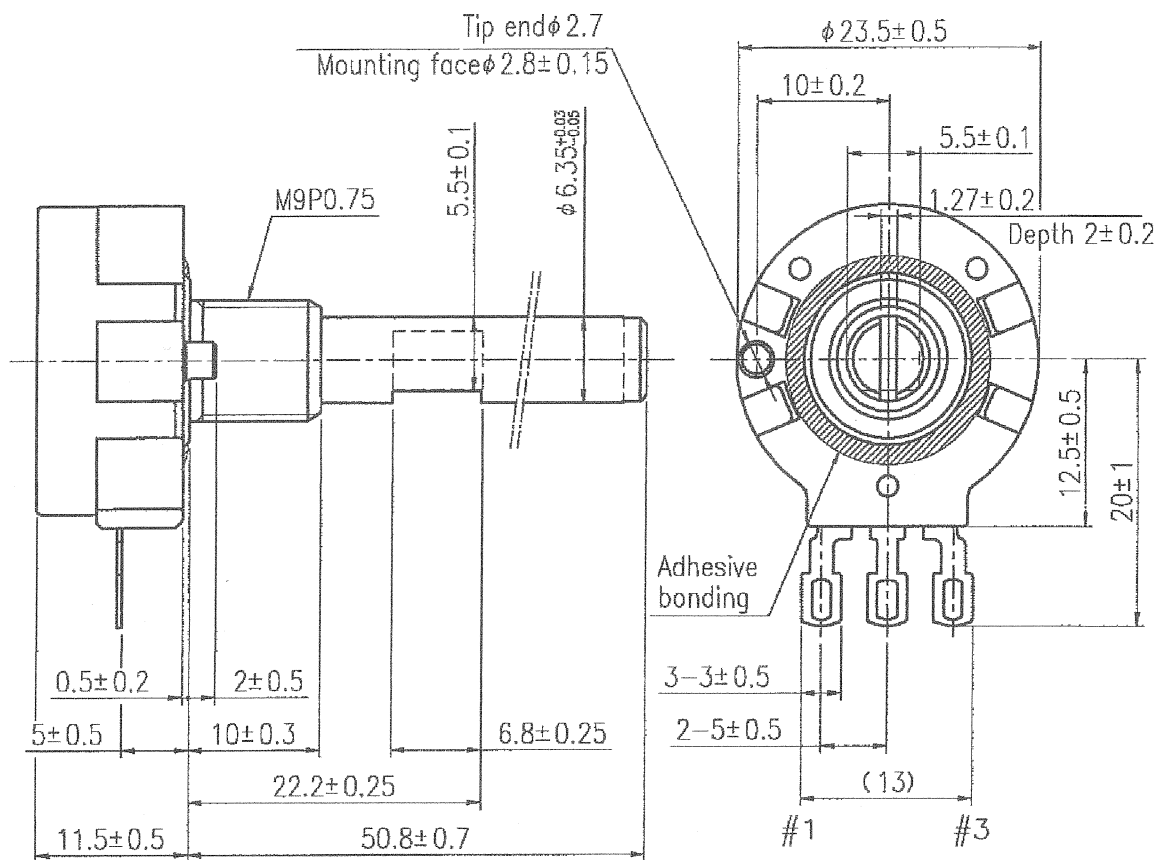
#### 5) Max. variation rate of linearity (%) by pull-down resistor (Z) and contact resistance (Rs)

① Calculation formula 
$$\text{Lin.}\% = \frac{r \cdot Z}{R(r+Rs+Z) - r^2} - \frac{r}{R} \times 100[\%]$$

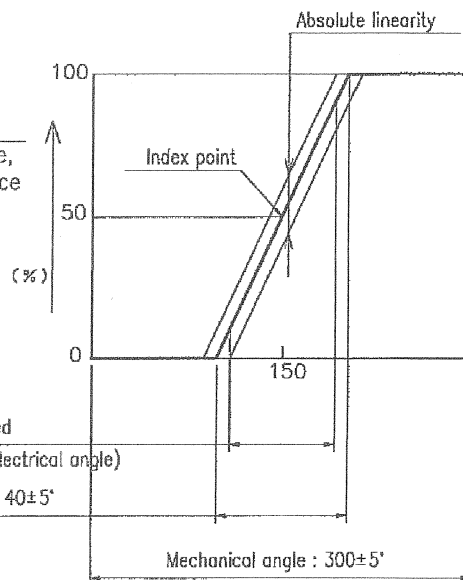
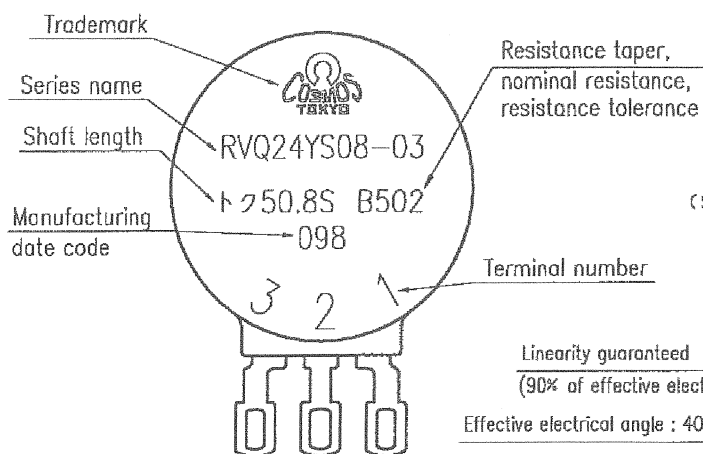
② Results 
$$\text{Lin.}\% = -0.99009901\% = -0.99\%$$



## Outline dimensions



### Marking on rear side



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Approved	Checked	Drawing	Scale : 2/1	Unit : mm
<i>T. Ishida</i>	<i>H. Kawai</i>	<i>H. Kawai</i>	Spec. No. A-32837	Rev.

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TOCOS' s potentiometers have been designed and manufactured with emphasis on dependability and profitability.

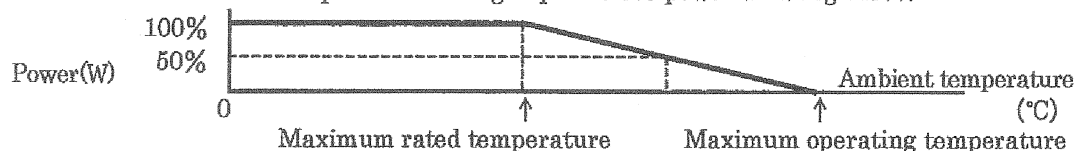
Described hereunder are precautions to be taken for your designing and use of circuitry and for the general safety and security.

#### 1. Rated performance (Power rating)

- ① Carefully check the rated power, maximum operating voltage, working temperature range and other rated performance.

Use the potentiometer always.

- ② Increase or decrease the rated power according to prescribed power derating curve.



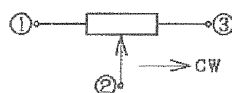
- ③ Give the rated power sufficient allowance for the potentiometer to maintain stable performance for a long time.

We recommend you to use the potentiometer with working power reduced to half the rated power at most.

#### 2. Terminal arrangement

Turning the shaft clockwise will increase the resistance between the terminals 1 and 2.

Draw your due attention to the arrangement of terminals, rotational direction of shaft and increase / decrease of the resistance when you use the potentiometer.



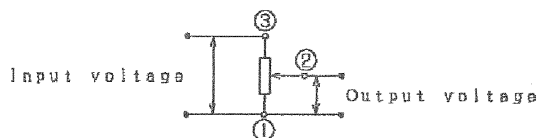
#### 3. Regarding for circuit

- ① The circuit to be used may roughly be divided into potentiometer type and rheostat type.

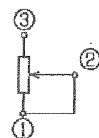
The potentiometer type circuit is preferred for stabler performance of trimmer-potentiometer.

- ② When use the rheostat type circuit, please check carefully the resistance-constriction and temperature characteristic (temperature coefficient) .

Since the rated power is partial load, increase or decrease it in proportion to the position of the slider (contact) .



Potentiometer type

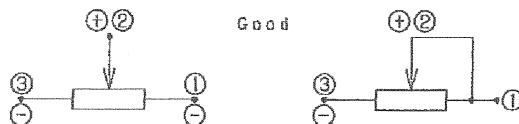


Rheostat type

#### 4. Application voltage

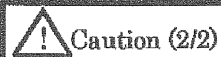
When DC voltage is applied, local resistance might be abnormally high depending on the connecting method.

Connect the slider (contact) to positive (+current) side



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#### 5. Prevention of ground noise

Multi-ganged potentiometers are provided with a ground noise preventive mechanism.

Push and / or pull type potentiometers and some of dual shaft types are not equipped with such a ground noise preventive mechanism.

When using potentiometers for high-gain equipment, please contact us.

#### 6. Precaution to be taken for adjustment and use

##### ① Adjustment at termination

- 1) Avoid setting the slider (contact) at both terminations since it is likely to cause electric instability.
- 2) Have some allowance for the overlap of adjustment range for span adjustment and the like.
- 3) Set the resistance in the range excluding 10% from the both ends of the electrical operation range as far as possible.

##### ② Refrain from conducting any inadvertent electrification test with such tester as causing Short-circuit current because it may give rise to fusion and / or burning by over-current.

##### ③ Adhesion of condensate and water drop

- 1) Never try to use the trimmer-potentiometer with water drop or condensate adhered.
- 2) The adhesion of condensate and / or water drop may cause silver migration thereby bring about short-circuit or burning.

Take care of the fact that the silver migration is likely to take place when high (DC) current is applied under high temperature / humidity conditions.

#### 7. Installation

- ① Use always recommended mounting holes best suited to the array and arrangement of the terminals.
- ② The mounting holes shall have prescribed diameters.
- ③ Mount the body in close contact with the circuit board (to be inserted into the prescribed position) .
- ④ Never try to apply any bending stress larger than the prescribed one after the insertion of the terminals.
- ⑤ Never try to bend or pull the load-wire unnecessarily.
- ⑥ The terminals shall be folded or bended, wherever required, so that any load is imposed on the body before soldering.

#### 8. Soldering

##### Soldering by iron

- 1) Notice that improper shape, heat capacity and size of soldering iron or incorrect soldering conditions may bring forth broken circuit board or abnormal connection between the terminals and resistors there by causing poor contact.
- 2) Any soldering of terminals when wiring shall be performed in as short as possible a time so that nor solder nor flux should adhere to the surface of resistor or calked portion of terminals.
- 3) No force larger than the prescribed one shall be applied to any terminals, which shall be bent or stretched within the prescribed force range.
- 4) Fold and bent the terminals before soldering so that no load is applied onto the body.
- 5) Take full care not to leave the soldering iron to contact with the body.

#### 9. Others

- ① When you use this potentiometers for any such purposes requiring, please contact us beforehand for discussions.
- ② Upon using our product, please do not hesitate to ask us when you need to confirm the evaluation test.
- ③ Any part of this catalog may be modified for improvements without prior notice. Please therefore read and confirm the contents of the catalog.
- ④ If you are desirous of having any product specifications other than in this catalog, please indicate your requirements as in detail as possible when consulting us.

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