

JIS

JAPANESE INDUSTRIAL STANDARD

Sensitive switches

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1. Scope

This Japanese Industrial Standard specifies sensitive switches of not more than 25 A rated current (thermal) for use in circuits of not more than 500 V a.c. at a frequency of 50 Hz or 60 Hz or of not more than 250 V d.c. (hereafter referred to as the "switch").

Remarks 1. Applicable Standards for this Standard are shown in Attached Table 1.

2. Corresponding International Standard for this Standard is shown below.

IEC 163-1 Sensitive Switches. Part 1: General requirements and rules for the preparation of detail specifications

2. Definitions

For the purpose of this Standard, the following definitions apply (see Fig. 1 and Fig. 2).

- (1) sensitive switch A small-sized switch having a snap action, microgap mechanism which is operated directly by a defined force through a defined travel, being enclosed in a case and externally provided with an actuator.
- (2) actuator The integral part of the sensitive switch to which an external mechanical force is to be applied. Movement of the actuator causes the snap-action mechanism to function, and let the moving contact(s) to close or open the switch.
- (3) actuator stopper The part of the switch provided to limit the movement of the actuator in the operating direction of the switch.
- (4) free position (symbol: FP) The position of the actuator, when no external mechanical force is applied to it.
- (5) operating position (symbol: OP) The position of the actuator, at the instant when an increasing applied force has just caused the snap-action mechanism to operate, to reverse the moving contact at the free position.
- (6) total travel position (symbol: TTP) The position of the actuator, when the actuator reaches to the actuator stop.
- (7) release position (symbol: RP) The position of the actuator, at the instant when a decreasing applied force causes the snap-action mechanism to revert to its initial state, to bring the moving contact at the operating position to the free position.
- (8) pre-travel (symbol: PT) The distance or angle between the free position and the operating position.
- (9) over-travel (symbol: OT) The distance or angle between the operating position and the total travel position.
- (10) movement differential (symbol: MD) The distance or angle between the operating position and the release position.
- (11) total travel (symbol: TT) The distance or angle between the free position and the total travel position, which is the sum of pre-travel and over-travel.
- (12) operating force (symbol: OF) The force which must be applied to the actuator to cause it to move from the free position to the operating position.
- (13) release force (symbol: RF) The value to which the actuating force must be reduced in order to permit the actuator at the total travel position to return to its release position.
- (14) repeatability of operating position The difference of the maximum value and the minimum value of the operating position of a switch, when the switch is repeatedly operated.

- (15) rated voltage The voltage that is determined in combination with the current and taken as the basis for the design and use of the switch.
- (16) rated current (thermal) The current that the switch can continuously carry within the specified temperature-rise limit, under no on/off operation.
- (17) making/breaking current The current that can be made or broken at the rated voltage under the specified category load conditions.

Fig. 1. Positions of the Actuator and Symbols

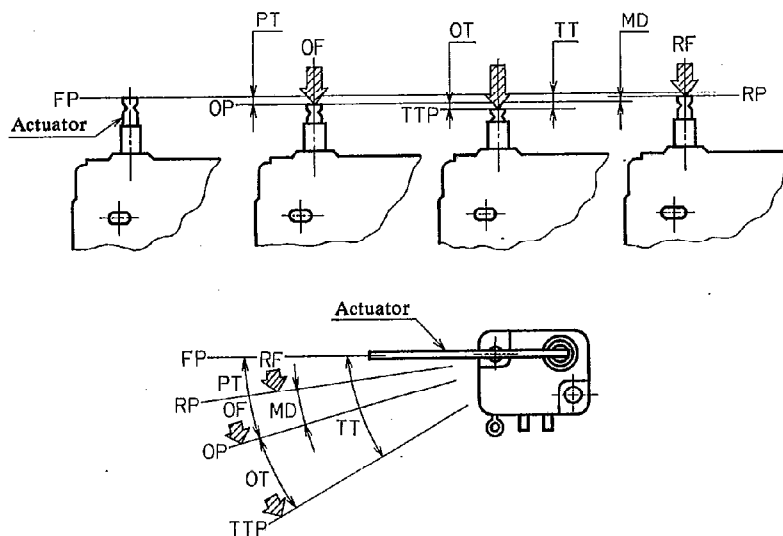
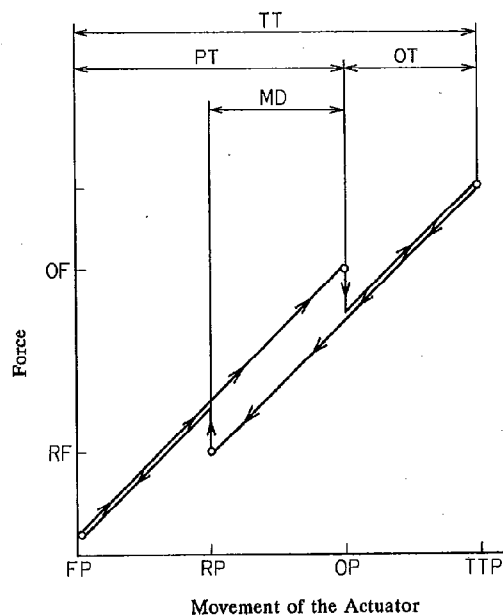


Fig. 2. Typical Relation between the Force and the Movement



3. Standard Operating Conditions

Standard operating conditions shall be as follows, but shall not be freezed or dewed.

- (1) Ambient temperature - 10 to +55°C
- (2) Relative humidity 45 to 85 %
- (3) Altitude not more than 2000 m

4. Classification

The switches shall be classified into the categories given in Tables 1 to 6 and Attached Figs. 1-1 to 12, by the basic mechanism, rated current (thermal), contact clearance, contact type, actuator and terminal.

The code for a category is formulated with the arrangement and combination of characters and numerals as follows:

Example:	Z	4	H	1	P01	A
	Basic mechanism	Rated current (thermal)	Contact clearance	Contact type	Actuator	Terminal
	(Character)	(Numeral)	(Character)	(Numeral)	(Character and numeral)	(Character)

- (1) Basic Mechanism The basic mechanism shall be represented by a character given in Table 1.

Table 1. Basic Mechanisms

Code	Basic mechanism	Attached Fig.	Code	Basic mechanism	Attached Fig.
Z	General type	1-1	W	Double-break type	1-7
R	Manual set general type	1-2	T	Double-break type for enclosed sensitive switch	1-8
Y	Separate-contact type	1-3	S	Very small type	1-9
D	Bipolar type	1-4	J	Ultra-small type	1-10
A	High capacity general type	1-5	C	Light-torque operation type (right-side pin)	1-11
V	Small type	1-6	K	Light-torque operation type (left-side pin)	1-12

- (2) Rated Current (Thermal) The rated current (thermal) shall be represented by a numeral given in Table 2.

Table 2. Rated Currents (thermal)

Unit: A

Code	Rated current (thermal)
0	0.1
1	1
2	5
3	10
4	15
5	20
6	25

- (3) Contact Clearance The contact clearance shall be represented by a character given in Table 3.

Table 3. Contact Clearances

Unit: mm	
Code	Contact Clearance
H	0.25
G	0.50
F	1.00
E	1.80

- (4) Type of Contact The type of contact shall be represented by a numeral given in Table 4. In the R-type switch, the terms "normally open" and "normally closed" mean the contact states after completion of resetting operation by means of the reset button shown in Attached Figures.

Table 4. Types of Contact

Code	Type of contact
1	Double-throw type (including double-break type)
2	Normally-closed type
3	Normally-open type

- (5) Actuator The actuator shall be represented by a character and numerals given in Table 5.

Table 5. Actuators

Code	Actuator	Number of Attached Fig.											
		Z	R	Y	D	A	V	W	T	S	J	C	K
P01	Push-pin type	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8	1-9	1-10	—	—
P03	Springed thin push-pin type	2	2	2	—	—	—	—	—	—	—	—	—
P05	Panel-mount type	3-1	—	3-1	—	3-2	—	—	—	—	—	—	—
P07	Roller-head panel-mount type	4	—	4	—	—	—	—	—	—	—	—	—
R01	Leaf-spring type	5-1	5-1	5-1	—	5-2	—	—	—	—	—	—	—
R03	Roller-head leaf-spring type	6-1	6-1	6-1	—	6-2	—	—	—	—	—	—	—
L01	Hinge-lever type	7-1	7-1	7-1	7-2	7-3	7-4	—	—	7-5	—	—	—
L03	Roller-head hinge-lever type	8-1	—	8-1	8-2	8-3	8-4	—	—	8-5	—	—	—
L05	Short hinge-lever type	9-1	—	—	—	—	9-2	—	—	—	—	—	—
L07	Roller-head short hinge-lever type	10-1	—	10-1	10-2	10-3	10-4	—	—	—	—	—	—
P09	Springed short push-button type	11	11	11	—	—	—	—	—	—	—	—	—
P11	Springed push-button type	—	—	—	—	12	—	—	—	—	—	—	—
W01	Rotary pin type	—	—	—	—	—	—	—	—	—	—	1-11	1-12

(6) Terminal The terminal shall be represented by a character given in Table 6.

Table 6. Terminals

Code	Terminal
A	Soldering terminal
B	Screwing terminal
C	Tab terminal

5. Ratings

5.1 Rated Voltages The rated voltages shall be as shown in Table 7.

Table 7. Rated Voltages
Unit: V

a.c. or d.c.	Rated Voltage				
a.c.	125	250	500		
d.c.	8	14	30	125	250

5.2 Rated Currents (thermal) The rated currents (thermal) shall be as shown in Table 8.

Table 8. Rated Currents (thermal)
Unit: A

Rated current (thermal)						
0.1	1	5	10	15	20	25

6. Performance

6.1 Repeatability of Operating Position The repeatability of operating position shall be not more than the values shown in Table 9, when the test specified in 8.2.2 is applied.

Table 9. Repeatability of Operating Position

Category of switch (Number of Attached Figs.)	Repeatability of operating position
1-1, 1-2, 1-3, 1-5, 1-6 (provided, OF ≥ 1.96 N), 1-9, 1-10, 9-2 (provided, OF ≥ 2.45 N), 10-4 (provided, OF ≥ 2.45 N)	0.05 mm
1-4, 1-6 (provided, OF ≤ 0.74 N), 1-7, 1-8, 2, 3-1, 3-2, 4, 5-1, 5-2, 6-1, 6-2, 9-2 (provided, OF = 0.74 N), 10-4 (provided, OF = 0.74 N), 11, 12	0.1 mm
9-1, 10-3	0.15 mm
7-1, 7-2, 7-3, 7-4 (provided, OF ≥ 1.47 N), 7-5, 8-1, 8-2, 8-3, 8-4 (provided, OF ≥ 1.47 N), 8-5, 10-1, 10-2	0.2 mm
7-4 (provided, OF = 0.34 N), 8-4 (provided, OF = 0.34 N)	0.3 mm
1-11, 1-12	2.0 degrees

6.2 Insulation Resistance The insulation resistance shall be not less than 100 M Ω , when the test specified in 8.2.3 is applied.

6.3 Withstanding Voltage When the test specified in 8.2.4 is applied, the test voltages shall be withstood.

6.4 Contact Resistance The contact resistance shall be not more than 50 mΩ, when the test specified in 8.2.5 is applied. For W, T, Y, C, K and V of OF = 0.25 N and those of 0.1 A rated current (thermal) the contact resistance shall be not more than 100 mΩ.

6.5 Strength The strength shall conform to the following items, when the test specified in 8.2.6 is applied.

- (1) Not to exceed 20 % of the operating characteristic value in Attached Figs. 1 to 12.
- (2) Insulation resistance to be not less than 100 MΩ.
- (3) Not to show mechanical damage detrimental to service.

6.6 Temperature Rise The temperature rise shall be not more than 50°C, when the test specified in 8.2.7 is applied.

6.7 Make and Break Operation The make and break operation shall conform to the following items, when the test specified in 8.2.8 is applied.

- (1) Not to exceed 20 % of the operating characteristic value in Attached Figs. 1 to 12.
- (2) Insulation resistance to be not less than 10 MΩ.
- (3) To withstand the test voltage, except for the part between terminals of the same pole.
- (4) Contact resistance to be not more than 2 Ω for the one with 1 A rated current (thermal) or more, or not more than 5 Ω for 0.1 A.

6.8 Shock Resistance The shock resistance shall conform to the following items, when the test specified in 8.2.9 is applied.

- (1) Any closed contact not to open exceeding a period of 1 ms.
- (2) Any open contact not to close exceeding a period of 1 ms.

6.9 Vibration Resistance The vibration resistance shall conform to the following items, when the test specified in 8.2.10 is applied.

- (1) Any closed contact not to open exceeding a period of 1 ms.
- (2) Any open contact not to close exceeding a period of 1 ms.

6.10 Salt Spray The salt spray shall conform to the following items, when the test specified in 8.2.11 is applied.

- (1) Not to exceed 20 % of the operating characteristic value in Attached Figs. 1 to 12.
- (2) Insulation resistance to be not less than 5 MΩ.
- (3) To withstand the test voltage, except for the part between terminals of the same pole.
- (4) Rust detrimental to service not to appear.

6.11 Humidity Resistance The humidity resistance shall conform to the following items, when the test specified in 8.2.12 is applied.

- (1) Not to exceed 20 % of the operating characteristic value in Attached Figs. 1 to 12.
- (2) Insulation resistance to be not less than 10 MΩ.
- (3) To withstand the test voltage, except for the part between terminals of the same pole.
- (4) Not to show damage and rust detrimental to service.

6.12 Cold Resistance and Heat Resistance The cold resistance and the heat resistance shall conform to the following items, when the test specified in 8.2.13 is applied.

- (1) Not to exceed 20 % of the operating characteristic value in Attached Figs. 1 to 12.
- (2) Insulation resistance to be not less than 10 MΩ.
- (3) To withstand the test voltage, except for the part between terminals of the same pole.
- (4) Not to show damage and rust detrimental to service.

6.13 Resistance to Soldering Heat The resistance to soldering heat shall conform to the following items, when the test specified in 8.2.14 is applied.

- (1) Not to exceed 20 % of the operating characteristic value in Attached Figs. 1 to 12.
- (2) Not to show visually remarkable deterioration.

6.14 Solderability When the test specified in 8.2.15 is applied, not less than 75 % of the surface area of the soldered terminal shall be covered with new solder.

7. Construction, Dimensions, Marks and Materials

7.1 Construction General The switch shall be made in the correct form, shall be strong and shall conform to the following items.

- (1) The construction shall be such that the on/off operation is smooth, electrical contact is perfect and the connection with wire is easy.
- (2) The switch shall be made in a small size and constructed sufficiently strong and to withstand mechanical shock, vibration and stress.
- (3) Contacts shall be tightly enclosed. However, airtightness is not required.
- (4) The insulation clearance between live parts of different polarity and that between live and dead metal parts (excluding that between a terminal and the base) shall be not less than 1.5 mm, where the rated voltage is not more than 250 V, or not less than 3.2 mm, where the voltage exceeds 250 V.
- (5) Terminal screws shall be easily replaceable and screwing terminals shall be provided with spring washers or tooth washers.
- (6) The nominal diameters of terminal screws and nominal sizes of tabs shall be not less than those given in Table 10.

Table 10. Nominal Diameters of Terminal Screws and Nominal Sizes of Tabs

Rated current (thermal)	A	5 max.	10	15	20	25
Nominal dia. of terminal screw	mm	3 (2.5)	3.5 (2.5)	3.5 (2.5)	3.5	4
Nominal size of tab	mm	2.8	4.8		6.3	

Remarks: The values in the parentheses for the nominal sizes of terminal screws are applicable to V- and W-types.

7.2 Dimensions and Operating Characteristics The dimensions and the operating characteristics shall follow Attached Figs. 1 to 12.

7.3 Terminal Marking For the purpose of ensuring correct connection with wires, the switch shall be marked with the following marks placed beside the corresponding terminals.

Common terminal: C, COM or COMMON

Normally-closed terminal: NC or NORMALLY CLOSED, however, W- and T-types may be marked 1 and 2.

Normally-open terminal: NO or NORMALLY OPEN, however, W- and T-types may be marked 3 and 4.

7.4 Materials of Principal Parts The materials of principal parts of the switch shall conform to the following requirements:

- (1) Metals used shall be of anticorrosive nature or be surface-treated against corrosion.

In the case where different materials that can cause electrolytic corrosion are used in contact with one another, they shall be metal-plated or treated equivalently.

- (2) The synthetic resin used for the actuator shall be of wear-resistant nature.

- (3) The insulator shall be a phenol-resin moulding in accordance with JIS K 6915 or an equivalent, being strong, less hygroscopic and good in electrical characteristics.
- (4) For the contacts shall be used the silver (Class 4 material specified in JIS C 2509) or a silver alloy or a material at least equivalent thereto. However, they may be supported by copper or a copper alloy.
- (5) Conductive parts shall be made of copper, a copper alloy or any material having good electrical and mechanical characteristics at least equivalent thereto.
- (6) The spring in conductive parts shall be made of a material conforming to JIS H 3130 or the like having good electrical and mechanical properties.
- (7) Terminals shall be made of copper or a copper alloy, and those to be soldered shall be pretreated for easy application of soldering.
- (8) Terminal screws shall be the machine screws of brass or bronze. However, the terminal screws not intended for direct conducting may be of steel plated to a grade not inferior to Class 2, Category 2 specified in JIS H 8610.

8. Tests

8.1 Standard Conditions for Testing Unless especially specified, the switches shall be tested under the conditions below.

- | | |
|-------------------------|----------------------------|
| (1) Ambient temperature | $20 \pm 2^{\circ}\text{C}$ |
| (2) Relative humidity | $65 \pm 5 \%$ |
| (3) Barometric pressure | 101.3 kPa |

However, if there is foreseen no ambiguity in the results of tests or judgment, the tests may be carried out within the limits of 5 to 35°C ambient temperature, 45 to 85 % relative humidity and 86 to 106 kPa barometric pressure.

8.2 Test Methods

8.2.1 Construction Test In the construction test, the switches are examined for conformance to 7. and 11.

8.2.2 Test for Repeating Accuracy of Operating Positions In the test for repeating accuracy of operating positions, the switch is set on a suitable test bed, the operating positions are measured 20 times under the conditions below, and the difference between the maximum and minimum of the values is calculated.

- | | |
|--|-------------------|
| (1) Load | No load |
| (2) Operating speed | 0.1 to 1 mm/s |
| (3) Displacement of actuator from the operating position | 70 to 100 % of OT |

8.2.3 Insulation Resistance Test In the insulation resistance test, the insulation resistance between two discontinuous terminals of the switch and that between each terminal and dead metal frame are measured with a 500 V d.c. insulation resistance tester.

8.2.4 Withstand Voltage Test For the withstand voltage test, the parts of the switch to be measured shown in Table 11 are applied for 1 min with a test voltage with a nearly sinusoidal waveform of 50 Hz or 60 Hz. For applying the voltage, not more than $\frac{1}{2}$ the prescribed test voltage is applied first, then the voltage is raised up to the prescribed test voltage gradually and as rapidly as practicable within such limit that the voltage at every step can be read. However, in the case where a number of specimens are tested and no ambiguity is foreseen in judgement, the direct application of a test voltage equal to 110 % of that given in Table 11 for 1 s is acceptable as an alternative method.

Table 11. Parts to be Measured and Test Voltages

Unit: V

Part to be measured	Test voltage
Between terminals of the same pole (contact clearance, H)	600
Between terminals of the same pole (contact clearance, G, F and E)	1000
Between terminals of different pole ⁽¹⁾ Between each terminal and dead metal part Between each terminal and earth ⁽²⁾	$2E + 1000$ (E is the highest rated voltage for the switch)

Notes ⁽¹⁾ To each part between terminals of W-, T- and Y-type switches the test voltage for the part between terminals of the same-pole is applied.

⁽²⁾ The switch shall be tested being fixed on a metal plate at its mounting holes. In the above, the insulation clearance between any terminal and the metal plate shall be maintained at not less than 1.5 mm, for the switch with not more than 250 V rated voltage, or at not less than 3.2 mm, for the one with a rated voltage of over 250 V, by using an insulator.

8.2.5 Contact Resistance Test In the test, the contact resistances between the common terminal and the normally-closed terminal (for W and T type switches, between the two normally-closed terminals, for Y type one, between the common terminal and the two normally-closed terminals connected together and between the two normally-closed terminals) with the actuator in the free position, and between the common terminal and the normally-open terminal (for W and T type switches, between the two normally-open terminal, for Y type one, between the common terminal and the two normally-open terminals connected together and between the two normally-open terminals) with the actuator in the total travelled position shall be measured successively 3 times respectively by the voltage drop method, under a current of 1 A at 6 to 8 V d.c. and under the pole (direction of the current) of higher contact resistance, after finding out the pole (direction of the current) showing higher contact resistance by changing the pole (direction of the current). However, switches with a rated current (thermal) of less than 1 A shall be tested with the test current equal to the rated current (thermal).

8.2.6 Strength Test In the strength test, the operating characteristics specified in 8.2.3 and Attached Figs. 1 to 12 shall be measured after carrying out the test on the items below.

- (1) **Actuator and Actuator Stopper** In the test, a load of 10 times of the necessary force specified in the operating characteristics of Attached Figs. 1 to 12 is applied to the actuator for 1 min in the operating direction of the actuator. However, this test shall be carried out only for the actuators in the categories P01 and W01.
- (2) **Terminal Part**
 - (a) **Strength Test of Soldering Terminals** A lead wire of suitable length is attached to the terminal and the tensile load shown in Table 12 is applied for 1 min in the direction towards which the terminal is thought to be the weakest. One terminal is tested in one direction.

Table 12. Strength Test of Soldering Terminals

Rated current (thermal) A	0.1 and 1	5	10	15	20	25
Tensile load N	6	12	17	23	23	30

- (b) **Strength Tests of Screwing Terminals** The switch to be tested is set on a suitable test bed and the torque shown in Table 13 is applied to the terminal screw under test by gradual screwing with a torque-driver.

Table 13. Nominal Diameter of Terminal Screw and Screwing Torque

Nominal dia. of terminal screw mm	2.5	3	3.5	4
Screwing torque N · m	0.3	0.6	1.0	1.5

- (c) **Strength Test of Tab Terminals** The loads (pull or push) shown in Table 14 are gradually applied to the tab in the direction parallel to the longitudinal axis of the tab and maintained for 1 min once respectively.

Table 14. Nominal Size of Tab and Load

Nominal size of tab mm	2.8	4.8	6.3
Load (pull or push) N	60	80	150

8.2.7 Temperature Test In the temperature test, wires shown in Table 15 are connected to the switch and rated currents (thermal) given in Attached Table 2 are passed (for a switch of double-throw type contacts, on the normally-closed contacts and the normally-open contacts separately), and when the temperature rise of the terminal parts has become stationary, the temperature shall be measured in accordance with the following methods.

Table 15. Wires to be Connected

Rated current (thermal) A		5 max.	10	15	20	25
Dia. of wire to be connected	Dia. of conductor mm	1	1.2	1.6	2	2.6
	Nominal cross-sectional area of conductor mm ²	0.75	1.25	2	3.5	5.5
Length of wire to be connected mm		300 min.				
Type of wire to be connected		JIS C 3307 JIS C 3316				

- (1) Temperature rises shall be measured by the thermoelectric thermometer method (following Grade C measuring method specified in JIS Z 8704). In the above, an alloy thermocouple mainly composed of copper-nickel with a wire diameter of not more than 0.32 mm (Grade 0.75) shall be used.
- (2) The thermocouple shall be soldered to the part of the terminal exposed outside the switch case at the point nearest to the case.
- (3) When the temperature rises (difference of the temperature of the part to be measured and the ambient temperature) measured 3 times in succession at an interval of 10 min have become to show an increment of less than 0.5°C, the temperature shall be considered to have become stationary, and the maximum value of which shall be specified as the temperature rise.

8.2.8 Operation Tests The operation tests include the resistance load test, inductance load test and motor load test, and no-load test, and each test shall be made on a different test specimen (the load test on the switch of double-throw type contacts shall be made for the normally-closed contacts and normally-open contacts individually), and afterwards the operating characteristic values in Attached Figs. 1 to 12, and the requirements of 8.2.3, 8.2.4 and 8.2.5 shall be examined. However, on the switches of not less than 1 A rated current (thermal), (1) Breaking and Making Current Capacity Test, (2) Rated Load Test and (3) No-load Test shall be carried out, and on those of 0.1 A rated current (thermal), (4) Microload Test only.

In the above, the test current that corresponds to any one of the rated voltages in Attached Table 2 shall be chosen, and the displacement of the actuator from its operating position shall be 7.0 to 100 % of OT.

- (1) **Breaking and Making Current Capacity Tests** The operation for opening and closing the switch shall be repeated continuously under the conditions in Table 16.

Table 16. Breaking and Making Current Capacity Test

Load	Test voltage	Test current		Power factor	Test condition		
		Make	Break		On-current period s	Rest period s	Number of operations time
Resistance load	1.0 <i>E</i>	1.5 <i>I</i>	1.5 <i>I</i>	0.9 to 1	Approx. 1	Approx. 10	50
Inductance load	1.0 <i>E</i>	2.2 <i>I</i>	2.2 <i>I</i>	0.6 to 0.7	Approx. 1	Approx. 10	50
Motor load	1.0 <i>E</i>	8 <i>I</i>	10 <i>I</i>	0.3 to 0.4	Approx. 0.05	Approx. 10	5

Remark: *E* : Rated voltage

I : Making/breaking current (Follow Attached Table 2.)

- (2) **Rated Load Test** An operation consists of making the current specified in Table 17 by the switch, passing the current for approximately 1 s for a.c., or for approximately 2 s for d.c., and then breaking it, shall be repeated the number of times specified in Table 18, at a rate of 20 times/min for a.c., or 10 times/min for d.c.

In the case of the motor load, the making current shall be passed for approximately 50 ms, then reduced to the breaking current. In the case of a Z-type switch, the unstable state of make/break operation, when the actuator is operated vertically at a minute speed before the test, shall be not more than $\frac{1}{10}$ of the maximum of MD specified in Attached Fig. 1-1.

The term "minute speed" implies the speed of passing MD specified in Attached Fig. 1-1 in approximately 8 s.

Table 17. Rated Load Test

Test item	Test current	
Resistance load	Making/breaking current under resistance load specified in Attached Table 2	
Inductance load	Making/breaking current under inductance load specified in Attached Table 2 (power factor, 0.6 to 0.7; d.c. time constant, 7 ms)	
Motor load	Break	Making/breaking current under motor load (power factor, 0.6 to 0.7) in Attached Table 2
	Make	6 times the making/breaking current under motor load (power factor, 0.3 to 0.4) in Attached Table 2

Table 18. Number of Make/Break Operations

Fundamental mechanism	Contact clearance	Rated load test 10 ⁴ times	No-load test 10 ⁵ times	Microload test 10 ⁶ times
Z	H, G	15	150	120
	F	10	100	—
	E	5	50	—
A	H, G	10	100	—
	F	5	50	—
	E	5	50	—
R	All types	2.5	25	—
D, Y		5	50	—
C, K		2	100	80
T		10	100	—
V, W, S, J		2	10	8

- (3) No-load Test For the test, the on/off operation of the switch under no-load condition shall be repeated the number of times specified in Table 18 at a rate of 50 to 300 times/min.
- (4) Microload Test In the microload test, for a switch of 0.1 A rated current (thermal), make/break operation test shall be carried out under the following conditions.
- (a) Test voltage d.c. 5 V or 12 V
 - (b) Test current d.c. 10 mA
 - (c) Load Resistance load
 - (d) Operation rate 50 to 300 times/min
 - (e) Number of operation as shown in Table 18

8.2.9 Shock Resistance Test In the shock resistance test, a shock of the magnitude specified in Table 19 shall be given to the switch, under the two conditions in which the actuator is in free position and total travelled position respectively, by means of a testing machine of at least performance specified in JIS C 0041, successively 3 times in a direction in which the false operation of the switch is most probable. In the above, the waveform of the fundamental pulse shall be sinusoidal half wave pulse.

Table 19. Magnitude of Shock

Unit: m/s²

Fundamental mechanism	Actuator	Contact clearance			
		E	F	G	H
Z, Y, D, A, V ⁽³⁾ , W, T, S, J	P01	490	294	294	196
V with OF ≤ 0.74 N		—	49	49	—
R		294	—	—	—
C, K	W01	—	—	196	98
Z, R, Y, D, A, V, S	All except P01, W01	98	49	49	49

Note (3) Those with OF > 0.34 N.

8.2.10 Vibration Resistance Test In the vibration resistance test, the vibrations prescribed below shall be given to the switch in accordance with JIS C 0040, under the two conditions in which the actuator is in free position and total travelled position respectively, continuously for 2 h in each of the vertical, right-and-left, and back-and-forth directions. The vibrations to apply shall be of a simple harmonic motion with a half amplitude of 0.75 mm, and in which the frequency is continuously and nearly uniformly varied within the limits of 10 to 55 Hz. The period of one cycle of the frequency variation shall be 3 to 5 min.

The test in free position shall be carried out only on the actuators P01, P03, L01 and W01.

8.2.11 Salt Spray Test For the salt spray test, the switch shall be exposed to salt spray for 100 h in accordance with the method specified in JIS Z 2371, immediately removed of adhering salt in running water at room temperature, dried for 6 h in blowing air at 60°C, and then examined for the operating characteristics in Attached Figs. 1 to 12 and the requirements of 8.2.3 and 8.2.4.

8.2.12 Humidity Resistance Test In the humidity resistance test, in accordance with JIS C 0022, the switch shall be placed in a chamber of relative humidity of $93 \pm \frac{2}{3}\%$ under the ambient temperature of $40 \pm 2^\circ\text{C}$ for 96 h, and after returning to the standard test conditions, the tests of the operating characteristics shown in Attached Figs. 1 to 12 and the tests specified in 8.2.3 and 8.2.4 shall be carried out.

8.2.13 Cold Resistance and Heat Resistance Tests For the cold resistance and heat resistance tests, the switch shall be placed in the air at a temperature between -40 and -45°C for not less than 48 h, then immediately placed in the air at a temperature between 85 and 90°C for not less than 48 h, be returned into the air at room temperature, and then be examined for the operating characteristics in Attached Figs. 1 to 12 and the requirements of 8.2.3 and 8.2.4.

8.2.14 Test for Resistance to Soldering Heat In the test for resistance to soldering heat, the switch shall be tested by the test method Tb, method IB specified in JIS C 0050. In the above, the immersion depth for S- and J-type switches shall be up to the level 1 mm from the root of the terminal under test. Then the operating characteristics shown in Attached Figs. 1 to 12 shall be measured.

8.2.15 Solderability Test In the solderability test, the switch shall be tested by the test method Ta, method I specified in JIS C 0050. In the above, the immersion depth for S- and J-type switches shall be up to 1 mm from the root of the terminal under test.

9. Inspections

9.1 Type Inspection The type inspection shall be carried out in accordance with 8. for the following items, and shall conform to 6., 7. and 11.

- (1) Construction
- (2) Repeatability of operating position
- (3) Insulation resistance
- (4) Withstand voltage
- (5) Contact resistance
- (6) Strength
- (7) Temperature rise
- (8) Make/break operation
- (9) Shock resistance
- (10) Vibration resistance
- (11) Salt spray
- (12) Humidity resistance
- (13) Cold resistance and heat resistance