

JAPANESE INDUSTRIAL STANDARD
JIS C 8306-1996
Testing methods for wiring devices

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ERRATA

Page 32

Clause 18

Through out in the first line, replace "ammoniac" by "ammonia".

Remarks: This errata is for correcting the first edition of this Standard.

Japanese Standards Association

JIS

JAPANESE INDUSTRIAL STANDARD

**Testing methods
for wiring devices**

JIS C 8306—1996

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**In the event of any doubt arising,
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**Business Department,
Japanese Standards Association**
4-1-24, Akasaka, Minato-ku,
Tokyo, JAPAN 107
TEL. 03-3583-8002
FAX. 03-3583-0462

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JAPANESE INDUSTRIAL STANDARD

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Testing methods for wiring devices

C 8306-1996

1. Scope This Japanese Industrial Standard specifies the general testing methods for following wiring devices used for connection to wiring of electric circuit at a.c. voltage not exceeding 600 V and a frequency of 50 Hz or 60 Hz (hereafter referred to as "devices").

- (1) Switches (cut-out switch, knife switch with cover, low voltage box type switch and similar switches)
- (2) Switches (small switch for indoor use, photoelectric automatic lighting switch and similar switches)
- (3) Connectors (screw socket, plug connector for wiring, ceiling rosette, plug connector for appliance, joint box and similar connectors)
- (4) Mounting frame and flush plate for multiple type wiring device
- (5) Panel board for dwelling

Remarks 1. In this standard, devices for special use such as those having overcurrent tripping mechanism, exclusively used for apparatus, of explosion-proof type and of oil immersed type are not intended for.

2. The following standards are cited in this Standard:

JIS B 1501	Steel balls for ball bearings
JIS B 7411	Etched-stem liquid-in-glass thermometers, total immersion type
JIS B 7502	Micrometer callipers
JIS B 7507	Vernier, dial and digital callipers
JIS C 0920	Tests to prove protection against ingress of water and degrees of protection against ingress of solid objects for electrical equipment
JIS C 1102	Electrical indicating instruments
JIS C 1302	Insulation resistance testers
JIS C 1601	Indicating thermoelectric thermometers
JIS C 1602	Thermocouples
JIS C 2805	Crimp-type terminal lugs for copper conductors
JIS C 3301	Rubber insulated flexible cords
JIS C 3306	Polyvinyl chloride insulated flexible cords
JIS C 3307	600 V Polyvinyl chloride insulated wires
JIS C 3312	600 V Grade polyvinyl chloride insulated and sheathed portable power cables

JIS C 3327	600 V Rubber insulated flexible cables
JIS C 7501	Incandescent lamps for general lighting purpose
JIS C 7709	Lamp caps and holders
JIS C 8313	Particular requirements for link-fuses
JIS C 8316	Flush plates
JIS C 8336	Boxes for rigid metal conduits
JIS C 8352	General requirements for fuses for the protection of low-voltage cables and lines
JIS K 6301	Physical testing methods for vulcanized rubber
JIS K 8116	Ammonium chloride
JIS K 8576	Sodium hydroxide
JIS Z 2371	Methods of neutral salt spray testing
JIS Z 8703	Standard atmospheric conditions for testing
JIS Z 8704	Temperature measurement - Electrical methods

2. General matters

2.1 Test items The test items shall be as follows:

- (1) Construction
- (2) Temperature rise
- (3) Contact resistance
- (4) Retention force
- (5) Insulation resistance
- (6) Dielectric withstand voltage
- (7) Water-proof
- (8) Make-and-break (at overload and rated load)
- (9) Short-circuit
- (10) Overcurrent withstand
- (11) Mechanical strength [Strength of terminal part (strength of screw terminal, strength of screwless terminal), strength of cord anchorage and cord outlet, strength of mounting part of base and brace, strength of switch operating part (string operated, others), strength of enclosure against (steel ball drop, pressurizing, free fall, and shock)]
- (12) Heat resistance

- (13) Moisture resistance
- (14) Heat cycle
- (15) Corrosion resistance (salt-mist and ammonium chloride)
- (16) Endurance in ammoniac gas

2.2 Application of test items The appropriate test items for each wiring device shall be selected from the test items specified in 2.1 and specified in the standard of each wiring device (hereafter referred to as "detail specification"). The test items and test conditions may, however, be added or revised in the detail specification when especially needed.

2.3 Testing place The testing place shall be as follows:

- (1) Unless otherwise specified, the test shall be carried out in a place at ordinary temperature 5 °C to 35 °C and ordinary humidity (relative humidity 45 % to 85 %) as specified in JIS Z 8703, where draft, temperature variation and other conditions which will give remarkable influence on the test results are not anticipated.
- (2) Temperature of the testing place shall be measured using a stem thermometer (one specified in JIS B 7411 and so on) or a thermoelectric thermometer (one specified in JIS C 1601 and so on) at a place 1 m to 2 m apart from the test specimen in the height nearly equal to the height of the test specimen from floor, while the thermometer is so located that the influence of draft or the like from others is avoided.
- (3) The humidity of the testing place shall be measured by psychrometer method at the temperature measuring point of (2), in relative humidity.

3. Construction test Whether the construction, dimensions, materials, finishing and the like specified in the detail specification are satisfied or not is examined on finished products in the following manner:

- (1) Construction, materials, finishing, marking, lack of components shall be examined by naked eye or by touching.
Moreover, base materials of plated components or the like shall be examined after a part of the plating has been removed with a suitable way.
- (2) The measurement of dimensions shall be carried out using the vernier calliper specified in JIS B 7507, the micrometer specified in JIS B 7502 or measuring instrument at least equivalent in accuracy. However, measurement of devices for which use of gauges is specified shall be carried out with such gauges.
- (3) The measurement of insulation distance shall be carried out as follows:
 - (a) The minimum distance between the parts specified in the detail specification shall be measured to serve as the clearance (refer to Attached Fig. 2).

The clearance shall be the distance measured while a force of 30 N for the outside parts of the device or 2 N for the inside parts is so applied that the distance becomes the minimum. However, for the distance between the parts of the same polarity which do not cause danger when short-circuited, the above requirement does not apply.

- (b) The minimum distance between the parts specified in the detail specification along the surface of insulating material shall be measured to serve as the creepage distance. In this case, if there are grooves of less than 1 mm wide on the surface of insulating material of measuring portion, the creepage distance shall be measured by neglecting the depth of each groove.
 - (c) As for (a) and (b) above-mentioned, if there is non-grounded dead metallic body or dead metallic body not liable to be touched by man on the midway of measuring portion, then the sum of the minimum distances between that metallic body and the metal parts located on both sides of the metallic body shall be obtained. In this procedure, such dead metallic body and the metal part under measurement are regarded as in close contact if the distance between them is less than 1 mm [refer to Attached Fig. 2 (4) and (5)].
- (4) The inspection of preventive measure that protects a man from access to the live metallic part at an opening or the like of device shall be made in such a way that the test specimen is located as in normal service, the surface of the device is touched with the test finger shown in Attached Fig. 1 as a man usually touches the device and no lighting of the pilot lamp is verified. The circuit voltage of pilot lamp shall be under 40 V.

When the surface of live metallic part is covered with thin film of insulating material such as varnish, the test shall be carried out after the surface has been covered with metallic foil, and electrically connected with the live metallic part.

4. Temperature rise test The temperature rise of conductive part shall be measured on a finished product under normal working state by passing the rated current or test current in the detail specification and following the methods prescribed below. For the monobloc moulding with lead wires or provided with only wire connecting terminals on the outside as well as the ones which will change the characteristics by overhauling, however, temperature rise of conductors of connecting wires, connecting cords or terminal metal fitting shall be measured.

- (1) The power source used for the test shall be of single phase a.c. at 50 Hz or 60 Hz, which can maintain the test current within the range of $\pm 2\%$ of the prescribed value.

The test shall be carried out while the rated voltage is applied to the control circuit, if provided.

- (2) The voltage and current shall be measured using the voltmeter and ammeter of Grade 0.5 specified in JIS C 1102 or those at least equivalent in accuracy.
- (3) Each test specimen shall be mounted individually on the test board by the following methods:

- (a) Flush type device shall be mounted correctly in the switch box or outlet box specified in JIS C 8336, and be so connected with wires in accordance with (4) below that the terminal and contact blade and the blade receiver form a current path similar to that in use, and be covered with the flush plate of synthetic resin specified in JIS C 8316. For a device with 2 or more current carrying poles, each pole shall be connected in series (refer to Attached Fig. 3). For a multiganged device, the test shall be carried out by mounting one device in the middle of the mounting metal fittings.
- (b) Surface type device (including device to connect cord) shall be placed (the ones to be fixed in use shall be mounted correctly) on a wooden board (10 mm or more thick), and be connected with wires (cord for the device to be connected cord only) in the same way as (a).
- (c) For a device provided with terminals to attach link fuse or wire fuse (hereafter referred to as "fuse terminal"), the appropriate copper wire or copper sheet for the rated current of the device shown in Table 1 shall be attached instead of the fuse. In this case, the fuse set screw shall be clamped with $\frac{2}{3}$ of clamping torque shown in Table 7 according to the size of screw.
- (d) For a device provided with holder of cartridge fuse or plug fuse (hereafter referred to as "fuse holder"), the copper wire or copper sheet similar to (c) shall be attached instead of the fuse element.
- (e) For a device provided with inlet receptacle, inlet screw socket, plug-in blade or screw cap, the current shall be passed using an applicable attachment plug, screw plug, receptacle or screw socket.

Table 1. Dimensions of copper wire and copper sheet instead of fuse

Rated current of device I A	$I \leq 7$	$7 < I \leq 15$	$15 < I \leq 30$	$30 < I \leq 60$	$60 < I \leq 100$	$100 < I \leq 200$
Copper wire (diameter) mm	1.6	1.6	2.6	—	—	—
Copper sheet (thickness × width) mm	—	0.3×10	0.5×12	1.4×16	1.8×20	3.2×25

Remarks 1. For the device whose rated current is above 200 A, the size of copper sheet shall be so determined that the current density is 1.8 A/mm² to 2.3 A/mm².

2. The dimensions of copper wire and copper sheet are the basic size.

3. For the cartridge fuse, plug fuse, etc., when it is impossible to make thickness and width of copper sheet as the dimensions given in Table, a copper sheet or copper wire having sectional area nearly equal to it may be used.

(4) The wire and cord used for connection with test specimen shall be as follows:

- (a) Class and size (nominal) of wire and cord shall be as given in Table 2.

Table 2. Class and size (nominal) of wire for connection

Rated current of device I A		$I \leq 7$	$7 < I \leq 10$	$10 < I \leq 15$	$15 < I \leq 20$	$20 < I \leq 30$	$30 < I \leq 40$	$40 < I \leq 60$	$60 < I \leq 75$	$75 < I \leq 100$
Size (nominal) of connecting wire and cord	Nominal diameter mm	1.6	1.6	1.6	2	2.6	—	—	—	—
	Nominal sectional area mm ²	0.75	1.25	2	3.5	5.5	8	14	22	38
Length of connecting wire and cord m		1 and over (per unit)								
Class of connecting wire and cord		JIS C 3301, JIS C 3306, JIS C 3307, JIS C 3312, JIS C 3327								

Remarks 1. For a device whose rated current is above 100 A, a wire of allowable current (in the case of 3 wires in a metal conduit) corresponding to that current shall be used. If there is no wire having the appropriate sectional area, a wire having nearest large sectional area shall be used.

2. For a device wherein the wire or cord to be connected is designated specially, such wire or cord shall be used.

3. For the cord whose nominal sectional area is 5.5 mm² or more, the Class 2 P.V.C. cabtyre cable specified in JIS C 3312 or Class 2 rubber cabtyre cable specified in JIS 3327 shall be used.

4. For a device with lead wires, Table 2 is not applicable to such lead wires.

- (b) The termination of wire (stranded wire) and cord for connection shall be so treated that it will not work loose when connected. For the terminal having no possibility of loosening the component wires at the time of connection, however, no special termination treatment is needed. In this case, if a terminal is used for the termination, the terminal shall be a crimp-style terminal specified in JIS C 2805 which is applicable for the terminal screw of the test specimen and the size of connecting wire.
- (c) The joint between the lead wire fixed on a device and connecting wire for test shall be soldered perfectly at the joint, or clamped with bolt and nut using crimp-style terminal as indicated in (b).
- (d) In the case of connecting the wire or cord to the terminal metal fittings of device, the clamping torque of terminal screw shall be $\frac{2}{3}$ of the value in Table 7.
- (5) The measurement of temperature rise shall be carried out in accordance with the thermoelectric thermometer method (the Class C measuring method specified in JIS Z 8704 shall be followed as practical).

Moreover, the following requirements shall apply.

- (a) The thermocouple of T (C.C) Grade 0.75, with element wire diameter 0.32 mm specified in JIS C 1602 employing ice point system or calibrated compensation system for the reference junction and Grade 0.5 meters, shall be used.
- (b) The measuring junction shall be fixed tightly to the measuring point so as not to give harmful influence on the test conditions.

When the body under measurement is metal, the junction shall be soldered and when the body is others, they shall be placed in close contact and fixed with adhesive or the like.
- (c) The temperature of measuring point and the ambient temperature shall be measured from the beginning of the test at suitable uniform intervals (not less than 10 min).

When there is no difference 0.5 °C or more between temperature rise values (temperature of measuring point — ambient temperature) obtained consecutively 3 times, it shall be regarded as the temperature rise has been stabilized.
- (d) The measurement of ambient temperature shall comply with 2.3 (2).
- (e) The maximum temperature rise of a measuring point shall be expressed by the difference between the maximum temperature of the measuring point in consecutive 3 measurements and the mean value of ambient temperatures at those 3 times when the temperature rise is stabilized.

(6) Other test conditions shall be as follows:

- (a) The test current, if specified in the detail specification, or the rated current (larger rated current when marked with 2 or more rated currents), if marked on the device, shall be passed continuously until the temperature rise at the point specified in detail specification becomes constant.
- (b) The device in which the motor rating is marked, the standard current (corresponding to larger one when marked with 2 or more ratings) for the rating given in Table 4 shall be passed continuously until the temperature rise at the point specified in detail specification becomes constant.
- (c) The device in which both of the rated current and motor rating are marked, the test shall be carried out at the current specified in (a) or (b) whichever is the larger.
- (d) For the device provided with switch mechanism or plug-entry, make-and-break operations without passing current shall be carried out for several times just before the start of the test.
In the device provided with plug-entry, the temperature rise test after make-and-break test shall be carried out on the blade not used for other tests.
- (e) For the device provided with branch outlets or the device having plural circuits, the test shall be carried out on each branch outlet or each circuit. For the device having the same pole arrangement or the same sized receptacle, however, the test may be carried out on an arbitrary entry only.
- (f) For the device provided with feed terminal, the test shall be carried out separately at the marked rating of feeding capacity, and for the device having no mark, at a current equal to the rating of device (minimum 15 A).

5. Contact resistance test The contact resistance at the joint of current carrying parts shall be measured on the finished product as specified below. For the device provided with plug-entry, the contact resistance after make-and-break test shall be measured on the blade not used for other tests.

5.1 Contact resistance test by d.c. method The contact resistance test by d.c. method shall be carried out as follows:

- (1) The power source used for the test shall be able to keep the test current stable at an arbitrary d.c. voltage not more than the rated voltage.
- (2) For the measurements of voltage and current, voltmeters and ammeters of Grade 0.5 specified in JIS C 1102 or those at least equivalent in accuracy shall be used.

- (3) The test specimen is connected as in practical use, a current of 1 A (the specified current if the detail specification calls for) is passed, and the contact resistance of the part specified in the detail specification shall be measured by means of voltage drop method 3 times consecutively. The average of three measured values shall be taken as the contact resistance. For the device whose rating is under 1 A, however, the rated current may be taken as the test current.
- (4) The sequence in one measurement of contact resistance shall be as follows:
 - (a) Set the test specimen at closed circuit condition.
 - (b) Make the current to the specified value and measure the voltage drop.
 - (c) Reverse the direction of current and measure the voltage drop in the same way.
 - (d) Set the test specimen at open-circuit condition.
 - (e) Obtain a contact resistance by averaging the values of (b) and (c) above-mentioned. Repeat such measurement three times.
- (5) Generally, measurement of voltage drop shall be carried out between one set of terminals including the contact part.

5.2 Contact resistance test by a.c. method The contact resistance test by a.c. method shall be carried out as follows:

- (1) The power source used for the test shall be able to keep the test current stable at an a.c. voltage not exceeding 12 V at a frequency 50 Hz or 60 Hz.
- (2) For the measurement of voltage and current, voltmeters and ammeters of Grade 0.5 specified in JIS C 1102 or those at least equivalent in accuracy shall be used.
- (3) The test specimen is connected as in practical use, 1.5 times the rated current (min. 25 A) of the device is passed, and the contact resistance of the part specified in the detail specification shall be measured by means of voltage drop method 3 times consecutively. The average of three measured values shall be taken as the contact resistance.
- (4) The sequence in one measurement of contact resistance shall be as follows:
 - (a) Set the test specimen at closed circuit condition.
 - (b) Make the current to the specified value and measure the voltage drop.
 - (c) Set the test specimen at open-circuit condition.
- (5) Generally, measurement of voltage drop shall be carried out between one set of terminals including the contact part.

6. Retention force test The retention force test of plug connector shall be made on the finished product in accordance with the following items:

(1) The test specimen is mounted on a suitable testing device, the test plug is inserted correctly, the tensile load is gradually applied straight in the pull out direction, and the value when the plug is slipped out shall be measured. Before the test, insertion and withdrawal of 5 times shall be carried out.

(2) At every insertion and withdrawal, the blade of test plug shall be degreased and cleaned by benzine or the like.

The dimensions of blade shall be the standard dimensions specified in detail specification and the one which is not used for other tests shall be used.

(3) The load shall be applied at a uniform rate. In the case of using a spring balance for measuring the load, the scale interval shall not exceed 1 N or 100 gf.

(4) The measurement of retention force shall be carried out on the same specimen 3 times consecutively and the retention force shall be expressed by the mean value.

(5) For the device with an earthing pole, wherein attachment plug without earthing pole is able to be inserted, the retention forces shall be measured using each of the both attachment plugs with earthing pole and those without earthing pole.

(6) For the plug connector which permits insertion of plugs having different pole arrangements, the retention force shall be measured by using each of the applicable plugs.

7. Insulation resistance test The insulation resistance test shall be carried out on the finished product as follows:

(1) The test specimen shall be tested under the following conditions:

(a) Flush type device shall be mounted correctly in the metallic switch box or outlet box, connected with wires and covered with a metallic flush plate. If the usable plate is limited, such a plate shall be used.

(b) The surface type device which is used as mounted shall be mounted correctly on the metal plate and be connected with wires.

(c) The device to be used without mounting shall be fitted with wire or cord.

(d) If the parts liable to be touched by man during handling such as enclosure, knob, button, are of insulating material, aluminium foil or tin foil shall be adhered closely on the portion touched by fingers.

Also, a jig having equivalent effect may be used.

- (2) The insulation resistance of the following parts shall be measured with an insulation resistance tester of 500 V (1000 V for the test specimen whose rated voltage is over 300 V up to and including 600 V) specified in JIS C 1302 or an insulation resistance tester equivalent to it in performance:
- (a) Between live metallic parts of different polarity.
 - (b) Between terminals of the same polarity at open-circuit condition.
 - (c) Between live metallic part and dead metallic part liable to be earthed or dead metallic part accessible by man [including the metallic foil of (1) (d)]. In this case, the earthing pole shall be regarded as dead metallic part.

8. Dielectric withstand voltage test The dielectric withstand voltage test shall be carried out successively after the test of 7. as follows:

- (1) The test power source shall be a nearly sinusoidal a.c. power at a frequency of 50 Hz or 60 Hz, having a capacity not less than 500 VA, and the test voltage shall be able to rise uniformly from null to the specified value continuously, and the sensitivity current of the overcurrent relay shall be 10 mA or more.
- (2) The voltage shall be measured with a voltmeter of Grade 1.5 or better specified in JIS C 1102, and the time shall be measured with a watch graduated in second.
- (3) The test shall be carried out on the parts specified in 7. (2), in such a manner that the test voltage is raised at a uniform rate (at which the instantaneous voltage can be read by a voltmeter) from null to the value prescribed below, and kept at that value for 1 min, and then, whether the device withstands or not is examined. For the acceptance inspection or the like, however, it may be substituted by application, from the start, of a voltage equal to 120 % of the test voltage for 1 s.

The test voltage shall be $2E + 1000$ (V), where E is the rated voltage.

9. Waterproof test The device of waterproof type shall be tested on the finished product according to the degree of waterproof construction as follows:

The test specimen shall be mounted correctly as in practical use, connected with wire or cord, and sprayed with water or immersed in water in accordance with the method specified in JIS C 0920 for the specified duration. Immediately after the spray or the immersion, the tests of 7. and 8. shall be carried out, and successively, the presence of water ingress shall be inspected. In this case, immersion-proof type shall comply with 4.9 (1) specified in JIS C 0920.

10. Make-and-break test

10.1 The following 2 tests shall be carried out on the same test specimen in the make-and-break test.

- (1) Overload test
- (2) Rated load test

10.2 The power source used for test shall be as follows:

- (1) The power source shall be a nearly sinusoidal a.c. power at a frequency 50 Hz or 60 Hz, complying with the following (2) and (3).
- (2) The no-load voltage of the test circuit shall be capable of being kept within the range of test voltage $^{+5}_0$ V.
- (3) The voltage drop measured at the power source side terminals of the test specimen when the currents corresponding to 1.5 times and 8 times of the rated current of test specimen are passed through the test circuit shall be not more than 2.5 % and 15 % of the test voltage (no-load voltage) for the device marked with the motor rating and that marked with the rated current, respectively. In the case of testing 2 or more test specimens are tested simultaneously, however, the sum of the rated currents is considered as the rated current and the current shall be passed as stated above.

10.3 The voltage and current of test circuit shall be measured with meters of Grade 1.0 or better specified in JIS C 1102 or meters at least equivalent in accuracy.

10.4 The test specimen shall be mounted on a suitable testing device and be connected between the power source and load as follows:

- (1) The device used under fixed state shall be mounted as in practical use.
- (2) The device used under non-fixed state shall be mounted in a suitable way.
- (3) The power source is connected to the power supply terminals of the test specimen, and the load is connected to the load side terminals, as in practical use.

The device, in which the power source side and load side are not clearly indicated, shall be treated as follows:

- (a) In the device, provided with overcurrent protection such as fuse, the terminals of such protection side are considered as the load side terminals.
 - (b) In sockets, holding metal fitting is connected with the load side.
If there is no screw-in plug applicable to the holding metal fittings the test shall be carried out with the holding metal fitting short-circuited.
 - (c) In plug connectors, the ones provided with blade holder are considered as power source side (in the multitap provided with blades, the blades are considered as power source side).
 - (d) In change-over switches, the terminal for common line connection is considered as power source side.
- (4) For the device provided with fuse, the conductor of Table 1 shall be fitted instead of the fuse [refer to (c) and (d) of 4. (3)].