

JIS

JAPANESE INDUSTRIAL STANDARD

**General rules on separable
type wire connectors for
interior wiring**

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In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

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General rules on separable type wire
connectors for interior wiring

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Forward for Japanese Industrial Standard

This Japanese Industrial Standard is prepared based on IEC 998-1 (Connecting devices for low voltage circuits for house hold and similar purposes Part 1: General requirements) and IEC 998-2 (Part 2: Particular requirements) issued in 1990 as the first edition, in original form of the international standards, but some parts are modified to meet present situation of this country and named as "General rules on separable type wire connectors for interior wiring".

In this Standard, the part with underlines or sidelines (dotted) states the matters which are modified or not contained in the original international standard.

1. Scope This Japanese Industrial Standard specifies separable type wire connectors (hereafter referred to as "connecting devices") for connection of copper wires with a rated voltage not exceeding 750 V under a.c. at a frequency not exceeding 1000 Hz or d.c. which serve in the general interior or outside wall wiring of 600 V or less. The range of wires applicable to these connecting devices is 0.8 mm to 3.2 mm in diameter for solid wires or 0.5 mm² to 38 mm² in cross sectional area for stranded wires and flexible stranded wires.

Connecting devices complying with this Standard shall not require the use of special tools, other than for twist-on wire connectors.

2. Cited standards The following standards are cited in this Standard.

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|------------|--|
| JIS C 0060 | Fire hazard testing Part 2: Test methods Section 1: Glow-wire test and guidance (IEC 695-2-1) |
| JIS C 0920 | Tests to prove protection against ingress of water and degrees of protection against ingress of solid objects for electrical equipment |
| JIS H 8610 | Electroplated coatings of zinc on iron or steel |
| JIS H 8617 | Electroplated coatings of nickel and chromium |
| JIS H 8619 | Electroplated coatings of tin |
| JIS K 7202 | Method of Rockwell hardness test for plastics |
| IEC 112 | Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions |

3. Definitions For the purpose of this Standard the following principal definitions apply:

3.1 separable type wire connector This means the separate entities used for linear connection, branch connection or end connection of wires or such entities as terminal lugs to be connected to the end of wire which allow separation of wires after connection without breaking the wire connector body.

3.2 rated connecting capacity The cross-sectional area of the largest rigid conductor(s) to be connected as stated by the manufacturer of the connecting device.

3.3 rated insulation voltage The voltage of a component, device or piece of equipment to which dielectric voltage tests and creepage distances are referred.

3.4 rated currents Current assigned to the device by the manufacturer.

3.5 clearance The shortest distance in air between two conductive parts.

3.6 creepage distance The shortest distance along the surface of an insulating material between two conductive parts.

3.7 ambient temperature The temperature of the air surrounding the connecting device together with its enclosure, if any.

3.8 temperature rise The difference between the temperature of the part under test, together with its enclosure if any, measured under load according to the test specification and the ambient temperature.

4. General Connecting devices shall be so designed and constructed that in normal use their performance is reliable and without danger to the user or surroundings.

Compliance is checked by carrying out all tests specified.

5. General notes on tests

5.1 Tests according to this Standard are type tests.

5.2 Unless otherwise specified, the samples are tested as delivered and installed as in normal use, at an ambient temperature of $20 \pm 5^{\circ}\text{C}$.

5.3 The tests are carried out in the order of the clauses.

5.4 Unless otherwise stated, three samples are submitted to all the tests, and this standard is met if all tests are satisfied.

5.5 If only one of the samples does not satisfy a test due to an assembly or manufacturing fault, which is not representative of the design, that test and any preceding ones which may have influenced the results of the test shall be repeated on another full set of samples all of which shall comply with the repeated test requirements. The standard is then met.

5.6 A supplementary set of three samples, which may be necessary for the repetition of a test, may be supplied at the same time as the first set. If the supplementary set is not supplied at the same time as the first one, all the tests must be repeated.

6. Main characteristics

6.1 The preferred values of the rated insulation voltage of the connecting device are 250 V, 450 V, 750 V.

6.2 The standard rated connecting capacities are 0.8 mm, 1.0 mm, 1.2 mm, 1.6 mm, 2.0 mm, 2.6 mm, and 3.2 mm for solid wires and 0.5 mm², 0.75 mm², 0.9 mm², 1.25 mm², 2.0 mm², 3.5 mm², 5.5 mm², 8 mm², 14 mm², 22 mm², and 38 mm² for stranded wires and flexible stranded wires.

6.3 Ambient temperatures above 40°C require *T* marking.

The preferred values are 55°C, 85°C, 110°C, 140°C and 200°C. If other values are used they shall be multiples of 5.

7. Classification Connecting devices as separate entities are classified as follows:

7.1 Classification according to the number of terminals

- (1) Single terminal (pole) devices
- (2) Multiway terminal (pole) devices.

Remarks: The pole referred here means the voltage phase, neutral pole, etc. and when there are two or more joints but they are connected to the same phase, in such a case number of poles is one.

7.2 Classification according to protection against electric shock

- (1) Devices without protection
- (2) Devices with protection

7.3 Classification according to means of fixing

- (1) Devices without means of fixing (location is only ensured by the stiffness of the conductors which are connected to them)
- (2) Devices with means of fixing (location is ensured by their own fixing means or by associated means, such as screws, rails supports or similar)

7.4 Classification according to the maximum ambient temperature of use of the connecting device (rated temperature)

- (1) Devices without *T* marking for ambient temperatures not higher than 40°C.
- (2) Devices with *T* marking for ambient temperatures higher than 40°C.

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7.5 Classification according to protection against harmful ingress of water and humidity and against foreign solid bodies For the description of the IP degrees see JIS C 0920.

Remarks: IP means the symbol denoting protection degree against ingress of water and foreign solid bodies.

7.6 Classification according to the type of terminals

- (1) Devices with screw-type terminals
- (2) Devices with screwless-type terminals
- (3) Devices with insulation piercing terminals
- (4) Devices with flat quick-connect terminations
- (5) Devices with twist-on terminals

8. Marking

8.1 The following markings shall be put on the main part:

- (1) Rated connecting capacity in millimeters or square millimeters (see 6.2)
- (2) Rated insulation voltage in volts
- (3) Maximum ambient temperature in degrees Celsius of use if greater than 40°C, expressed with a *T* marking (see 6.3)
- (4) Type reference (e.g. a catalogue number)
- (5) Manufacturer's or responsible vendor's name or trade mark or identification mark.

For very small devices with a surface insufficient for marking, only the markings stated in (4) and (5) need to be indicated on the device. In such cases, all the marks specified shall be visible on the smallest package unit.

8.2 For multiway terminal devices, the required marking shall be complete on at least any two adjacent devices.

8.3 When symbols are used, they shall be as follows:

V for volts.

mm or mm² for rated connecting capacity in millimeters or square millimeters.

T for maximum ambient temperature (rated temperature).
For example, *T* 55.

8.4 Marking on the product shall be durable and easily legible.

Compliance with 8.1 to 8.4 is checked by inspection with naked eye and by the following test on the device. The test is made by rubbing the marking by hand for 15 s with a piece of cloth soaked with water and again for 15 s with a piece of cloth soaked with petroleum spirit. After these tests the marking shall still be legible.

- Remarks 1. Markings made by moulding, carved stamping, pressing or engraving are not subjected to this test.
2. The petroleum spirit used should consist of a solvent hexane with a content of aromatics of maximum 0.1 % volume, a kauri-butanol value of 29, an initial boiling-point of approximately 65°C, a dry-point of approximately 69°C and a density of approximately 0.68 g/cm³.

9. Protection against electric shock Insulated connecting devices shall be so constructed that live parts are not accessible when correctly installed and fitted with an insulated cord of the smallest and/or largest cross-sections.

Generally, connecting devices without enclosures are not protected against electric shock. In case of protection against electric shock, the following applies:

Each clamping unit of the connecting device shall be connected with a conductor of the smallest and largest specified cross-section or the minimum and maximum combination accommodated by the clamping unit.

Compliance is checked, unless otherwise specified, by the following test carried out for connecting devices with ancillary parts intended for protection against electric shock.

In the case of *T*-marked products the connecting device is brought to a temperature of the *T* rating $\pm 2^\circ\text{C}$.

The standard test finger, according to Annex of JIS C 0920 is applied with a force of 10 N to any openings on the connecting device and, if it penetrates fully or partially, it is placed in every possible position.

An extra-low voltage supply (between 40 V and 50 V) in series with a suitable lamp is connected between the test finger and the live parts. Conducting parts covered only with varnish or paint, or protected by oxidation or by a similar process, shall be covered with a metal foil and electrically connected to those parts which are normally live in service.

Protection is satisfactory if the lamp does not light.

10. Connection of conductors Connecting devices shall allow the correct connection of conductors, which are specified in the relevant detail specification.

11. Construction

11.1 The constructional requirements are given in the relevant detail specification.

11.2 Clamping units shall be so designed and constructed that they clamp the conductors reliably and between metal surfaces, with the exception of specific cases subject to requirements of the relevant specification.

Compliance is checked by inspection with naked eye and by the relevant test specified in the relevant Part 2.

11.3 Connecting devices shall be so designed and constructed that conductors may be installed without the insulation of any one of them being in contact with live parts connected to another conductor of different polarity.

Compliance is checked by inspection with naked eye and if necessary, by mounting the connecting device with the least favourable conductors or combinations thereof.

11.4 Insulating linings, barriers and the like shall have adequate mechanical strength and shall be secured in a reliable manner.

Compliance is checked by inspection with naked eye after the tests of clause 14.

11.5 Current-carrying parts, including all terminals, shall be of a metal having, under the conditions occurring in the equipment, mechanical strength, electrical conductivity and resistance to corrosion adequate for their intended use.

Compliance is checked by inspection and, if necessary, by chemical analysis.

Remarks 1. Typical examples of suitable metals, when used within the permissible temperature range and under normal conditions of chemical pollution, are:

- (1) copper
- (2) an alloy containing at least 58 % copper for parts made from rolled sheet (in cold condition) or at least 50 % copper for other parts.
- (3) stainless steel containing at least 13 % chromium and not more than 0.09 % carbon.
- (4) steel provided with an electroplated coating of zinc, according to JIS H 8610, with coating having a thickness of at least 5 μm .
- (5) steel provided with an electroplated coating of nickel and chromium according to JIS H 8617, the coating having a thickness of at least 20 μm .
- (6) steel provided with an electroplated coating of tin, according to JIS H 8619, the coating having a thickness of at least 12 μm .

Current-carrying parts, which may be subjected to mechanical wear, shall not be made of steel provided with an electroplated coating.

Under moist conditions, metals showing a large difference of electrochemical potential with respect to each other shall not be used in contact with each other.

Remarks 2. Springs, resilient parts, clamping units, clamping screws, and the like are not considered as parts mainly intended for carrying current.

The use of aluminium alloy for current carrying parts requires additional tests which are under consideration.

11.6 On terminals, according to their rated connecting capacity, it shall be possible to connect the number and the cross-sections of rigid (solid or stranded) or flexible conductors specified by the manufacturer.

Compliance is checked by connecting the appropriate conductors and by inspection with naked eye.

11.7 The fixing means of bases shall not serve any other purpose.

Compliance is checked by inspection.

12. Resistance to ageing, to humidity conditions, to ingress of solid objects and to harmful ingress of water

12.1 Connecting devices shall be resistant to ageing.

Unless otherwise specified, the following test is carried out:

Connecting devices with insulating material other than ceramic and thermo-setting material are subjected to a test in a heating cabinet with an atmosphere having the composition and pressure of the ambient air and which is ventilated.

Remarks 1. The ventilation may be provided by natural circulation through holes in the walls of the heating cabinet.

The samples are kept in the cabinet for 7 days (168 h) the temperature of which being $70 \pm 2^\circ\text{C}$ for not T marked connecting devices or $T + 30 \pm 2^\circ\text{C}$ for T marked devices (e.g. for $T = 85$ the cabinet temperature shall be $115 \pm 2^\circ\text{C}$).

Remarks 2. The use of an electrically heated cabinet is recommended.

After this treatment, the samples are removed from the cabinet and left at room temperature for at least 4 h.

The samples shall show no cracks visible to the naked eye with normal or corrected vision without additional magnification nor shall the material have become sticky or greasy, this being judged as follows:

The sample is placed on one of the pans of a balance and the other pan is loaded with a mass equal to the mass of the sample plus 500 g. Equilibrium is then restored by pressing the sample with the forefinger, wrapped in a dry piece of rough cloth.

After the test, the samples shall show no damage which would lead to non-compliance with this standard.

12.2 Connecting devices shall be designed to withstand humid conditions which may occur in normal use.

Unless otherwise specified, the following test is carried out.

The test is made using the humidity treatment described below immediately followed by the measurement of insulation resistance and the electrical strength test specified in clause 13. The humidity treatment is carried out in a humidity cabinet containing air with relative humidity maintained between 91 % and 95 %.

The temperature of the air, at all places where samples can be located, is maintained within 1°C of any convenient value of t between 20°C and 30°C. Before being placed in the humidity cabinet, the samples are brought to a temperature between t and $t + 4^\circ\text{C}$. The samples are kept in a cabinet for:

- (1) 168 h for connecting devices where protection against ingress of water as specified in the relevant Part 2 is higher than 1PX2.
- (2) 48 h for all other products.

Remarks 1. A relative humidity between 91 % and 95 % can be obtained by placing in the humidity cabinet a saturated solution of sodium sulphate (Na_2SO_4) or potassium nitrate (KNO_3) in water, the solution having a sufficiently large contact surface with the air.

2. In order to achieve the specified conditions within the cabinet, it is necessary to ensure constant circulation of the air within and, in general, to use a cabinet which is thermally insulated.

After this treatment, the samples shall show no damage within the meaning of this standard.

12.3 The connecting device shall provide an 1P degree of protection against harmful ingress of water in accordance with the classification of the devices.

Compliance is checked by the appropriate treatment according to JIS C 0920 which is made on connecting devices fitted with the cables for which they are designed. Immediately after this treatment, the samples shall withstand an electric strength test as specified in Sub-clause 13.4 and an inspection shall show that water has not entered the samples to any appreciable extent and not reached live parts.