# 6A-38 Jumper Wire (IJP)

# (Rank A)


Established in January 1956
Approved on June 21, 2007 (Rev. 04)
Enforced on July 23, 2007

Distribution Department

Tokyo Electric Power Company, Incorporated

# 1. Scope of Application

This product mainly used for jumper wire in high-voltage overhead electric lines and lead wire in high-voltage sealing ends.

# 2. Related Standards

## 2.1 Japanese Industrial Standards

JIS C 3152 (1984) Tin coated annealed copper wires

JIS C 3151 (1994) Tin coated hard-drawn copper wires

JIS C 3005 (2000) Test methods for rubber or plastic insulated wires and cables

JIS K 6251 (2004) Rubber, vulcanized or thermoplastics - Determination of tensile stress-strain properties

# 3. Types and Symbol

The types are classified in accordance with the nominal cross-section and the material of the conductor, as shown in Table 1. The symbol is IJP.

Note: IJP is an abbreviation of "Insulated Jumper Ethylene Propylene Rubber."

Table 1

| Symbol | Nominal cross-section | Material of the conductor |
|---|---|---|
| IJP | 14 $mm^2$, 22 $mm^2$, 50 $mm^2$, 60 $mm^2$, 100 $mm^2$, 150 $mm^2$, 200 $mm^2$, and 250 $mm^2$ | Annealed copper |
| | 22 $mm^2$ | Hard-drawn copper |

# 4. Structure and Material

## 4.1 General Matters

This product must be well-finished, easy-to-handle, and durable to long-time use.

## 4.2 Requirements for the Primary Structure

### 4.2.1 Conductor

The material used must be a circular stranded wire, having sufficient flexibility, composed of elemental wires that are either annealed copper wires or hard-drawn copper wires both stipulated in JIS and satisfying the product functions, or those in accordance with such wires, whose direction of twist at the outermost layer is S twist.

[Explanation]

According to present expertise, "annealed copper wires or hard-drawn copper wires both stipulated in JIS and satisfying the product functions" means those stipulated in JIS C 3152 (Tin coated annealed copper wires) or JIS C 3151 (Tin coated hard-drawn copper wires).

According to present expertise, wires "having sufficient flexiblity" means those the conductor pitch of which at the outmost layer is 20 times the external diameter or less, or those on a par with such wires.

### 4.2.2 Insulator

The conductor must be uniformly coated with EP rubber having a thickness shown in Attached Table 1

and free from flaws and air bubbles harmful to use. Note that the conductor must have an appropriate separator or semiconductive layer. The tolerance of the thickness of the insulator (in the case of semiconductive layer, its thickness is included in the thickness of the insulator) is ±10%. The thickness is defined as the average of measured values at several points on the same section. The minimum measured value, however, must be 80% or greater of the thickness shown in Attached Table 1.

### 4.2.3 Color

The color of the insulator must be black.

### 4.2.4 Dimensions

The standard dimensions are shown in Attached Table 1.

## 5. Performance

Table 2 shows the performance of this product for the tests in Section 7.

Table 2

| Item | | Performance | Test method |
|---|---|---|---|
| Appearance inspection | | There must be no points inappropriate for practical use. | 7.1 |
| Structure inspection | | The items in Section 6 must be satisfied. | 7.2 |
| Conductor resistance test | | The value must be smaller than or equal to that in Attached Table 1. | 7.3 |
| Withstand voltage test | | The product must withstand the test voltage in Attached Table 1 for 10 minutes. | 7.4 |
| Insulation resistance test | | The value must be greater than or equal to that in Attached Table 1. | 7.5 |
| Tensile test | Room temperature | Tensile strength: 4 MPa or greater, elongation: 300% or greater | 7.6 |
| | Heated | In comparison to the values before being heated, tensile strength: 80% or greater, elongation: 80% or greater | |
| Tracking resistance test | | The product must not burst into flame at a leak current of 0.5 A or less. | 7.7 |

## 6. Display on Electric Wires

The following items must be displayed consecutively on the surface of electric wires in an appropriate manner that can ensure that the display will not disappear for a long time.

(1) Nominal voltage 6,600 V

(2) Cable code IJP

(3) Nominal cross-section e.g., 100 $mm^2$

(4) Manufacturer name, or its symbol or registered trademark

(5) Manufacture year e.g., 2007

[Explanation]

"Displayed consecutively" means displays at intervals of approximately 60 cm, or those on a par with such displays.

# 7. Test Methods

## 7.1 Appearance Inspection

It must be conducted in accordance with Section 4.1 of JIS C 3005 (Test methods for rubber or plastic insulated wires and cables).

## 7.2 Structure Inspection

It must be conducted in accordance with Section 4.3 of JIS C 3005 (Test methods for rubber or plastic insulated wires and cables).

## 7.3 Conductor Resistance Test

It must be conducted in accordance with Section 4.4 of JIS C 3005 (Test methods for rubber or plastic insulated wires and cables).

## 7.4 Withstand Voltage Test

It must be conducted in accordance with Section 4.6 b) of JIS C 3005 (Test methods for rubber or plastic insulated wires and cables).

## 7.5 Insulation Resistance Test

It must be conducted in accordance with Section 4.7 of JIS C 3005 (Test methods for rubber or plastic insulated wires and cables).

To convert an insulation resistance measured at a temperature other than 20°C to a value at 20°C, multiply the relevant coefficient shown in Table 3 to the measured value.

Table 3

| Temperature [°C] | Coefficient | Temperature [°C] | Coefficient | Temperature [°C] | Coefficient |
|---|---|---|---|---|---|
| 0 | 0.42 | 12 | 0.70 | 24 | 1.20 |
| 1 | 0.43 | 13 | 0.74 | 25 | 1.25 |
| 2 | 0.45 | 14 | 0.77 | 26 | 1.30 |
| 3 | 0.48 | 15 | 0.80 | 27 | 1.35 |
| 4 | 0.50 | 16 | 0.84 | 28 | 1.42 |
| 5 | 0.52 | 17 | 0.86 | 29 | 1.48 |
| 6 | 0.54 | 18 | 0.91 | 30 | 1.55 |
| 7 | 0.56 | 19 | 0.95 | 31 | 1.62 |
| 8 | 0.59 | 20 | 1.00 | 32 | 1.70 |
| 9 | 0.62 | 21 | 1.05 | 33 | 1.78 |
| 10 | 0.65 | 22 | 1.10 | 34 | 1.84 |
| 11 | 0.68 | 23 | 1.15 | 35 | 1.90 |

## 7.6 Tensile Test

(1) Room temperature test

Apply a 20-mm long gauge marks at the center of a test specimen punched out from a finished product with a Type 3 dumbbell-shaped die (refer to Figure 1) stipulated in JIS K 6251 (Rubber, vulcanized or thermoplastics - Determination of tensile stress-strain properties) and then measure the length at a

temperature between 18 and 28°C.

The test specimen must stay in a tubular shape when the conductor cross-section is 14 $mm^2$ or less, whereas it must be formed into a dumbbell shape otherwise. The test must be conducted at a rate of approximately 500 mm/min.

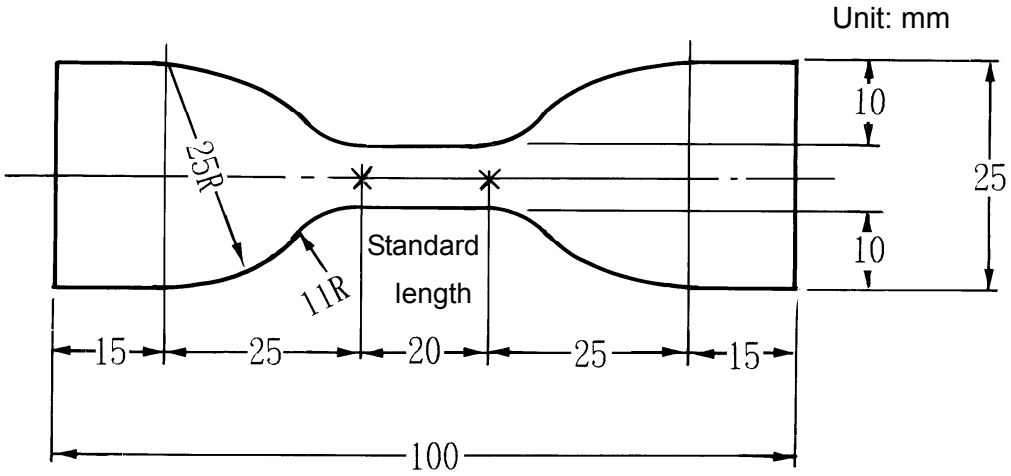



Figure 1: Type 3 dumbbell-shaped test specimen

(2) Heated test

Punch out the same sort of test specimen as that for (1) room temperature test from a finished product. After keeping the test specimen in a circulating air at a temperature of 100±2°C for 96 hours, take it out and leave it in a room temperature (20±15°C) for another 4 hours or longer. Conduct the test in Item (1) within 96 hours.

## 7.7 Tracking Resistance Test

It must be conducted in accordance with Section 4.13 of JIS C 3005 (Test methods for rubber or plastic insulated wires and cables).

# 8. Test and Inspection

## 8.1 General Items

This product must go through the type approval test in Section 8.2, manufacturing process inspection in Section 8.3, and the acceptance test in Section 8.4 based on the test method stipulated in Section 7 and comply with the entire provisions.

## 8.2 Type Approval Test

To check the quality standards of the manufacturer, a type approval test must be conducted for the following test items and all of them must be satisfied.

(1) Appearance inspection

(2) Structure inspection

(3) Conductor resistance test

(4) Withstand voltage test

(5) Insulation resistance test

(6) Tensile test

(7) Tracking resistance test

## 8.3 Manufacturing Process Inspection

Before conducting a type approval test, a series of inspections including the materials used, the quality control items in the manufacturing processes, the quality control method, fault-prevention measures, and the quality control system must be conducted as a general rule to confirm that the exactly same products as the one used for the type approval test can be produced in the production process.

## 8.4 Acceptance Test

The acceptance test must be conducted in the presence of the supplier at a location designated by the buyer based on a method stipulated in the type approval test in Section 8.2. Its concrete test items and sampling rate must be defined in consultation with the buyer. When no acceptance test will be conducted in the presence of the supplier, the manufacturer must conduct internal tests predefined in consultation with TEPCO and submit the results as a test report to the buyer.

# 9. Miscellaneous

## 9.1 General Matters

(1) Items necessary for satisfying the performance and functions of the product other than those stipulated in this specification document should be determined in consultation with TEPCO.

(2) When modifications to part of this specification document will yield a substantial benefit to the use or manufacturing, the manufacturer can change this specification document after having obtained approval from TEPCO.

(3) On-the-spot process inspection and material inspection can be conducted when TEPCO recognizes the necessity to do so.

## 9.2 Packing Method

(1) With stocks, wires must be wound on a one-by-one basis over a plastic drum shown in Attached Table 1 and packed in a package that can avoid damage during transportation. Note that when a plastic drum is used, it must be a drum designated by TEPCO.

(2) Labels pursuant to Attached Diagram 1 must be affixed to plastic drums.

## 9.3 Cost for Test Items

The supplier or the applicant of inspection will bear the product and test specimens used for tests as well as the costs involved in conducting them.

## 9.4 Documents to Be Submitted

### 9.4.1 Manufacturing Specifications

Specify the following items (1) to (5) and other necessary items in a manufacturing specifications and attach a drawing on which the tolerances of the dimensions and the materials are described in order that TEPCO can assess the conformance to this specification document.

Technical documents modeled after the manufacturing specifications must be also attached when necessary.

| | |
|---|---|
| (1) Conductor: | Material, structure, external diameter, performance, and pitch |
| (2) Insulator: | Material, performance, and the warranty limits to flaws and bubbles on the surface of the coating |
| (3) Display: | Display method |
| (4) Finished external diameter: | Diameter of core |
| (5) Packing type: | Method, dimensions, and display |

## 9.4.2 Test Report

Conduct the type approval test in Section 8.2 and describe the results and test conditions in a test report.

## 9.4.3 Quality Control Report

Specify the information about the materials used, the quality control items in the manufacturing processes, the quality control method, fault-prevention measures, and the quality control system in a "quality control flowchart" and "management of subcontract suppliers," and the like. Note that an outsourced process control document (a document described according to the format of a quality control flowchart, showing the process control status of the subcontractors) must be submitted when major manufacturing processes are outsourced. The concrete scope of description will be determined in consultation with TEPCO.

## 9.4.4 Technical Documents

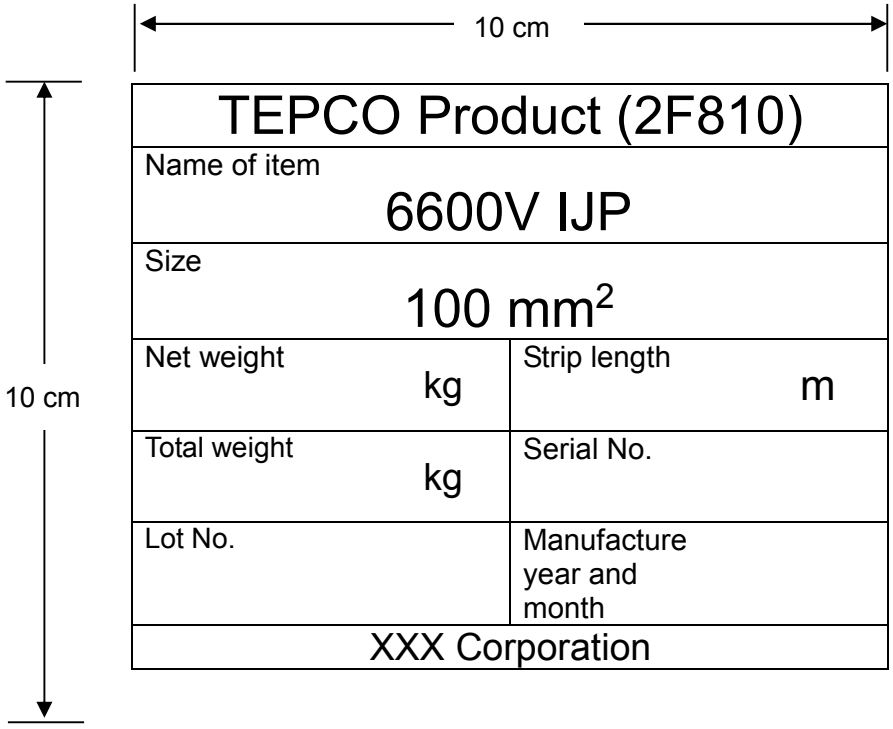
Before type approval assessment is carried out, submit the following technical documents in order that the performance and quality of the product can be assessed sufficiently and appropriately. Note that technical documents other than the following may also be requested.

(1) Technical back data about the long-term weather resistance of the insulator

Attached Table 1

| Nominal cross-section | | 14mm$^2$ | 22mm$^2$ | 50mm$^2$ | 60mm$^2$ | 100mm$^2$ | 150mm$^2$ | 200mm$^2$ | 250mm$^2$ |
|---|---|---|---|---|---|---|---|---|---|
| Conductor | Number of elemental wires / diameter of elemental wires (mm) | 7/1.6 | 7/2.0 | 19/1.8 | 19/2.0 | 19/2.6 | 37/2.3 | 19/14/1.0 | 19/17/1.0 |
| | External diameter (mm) | 4.8 | 6.0 | 9.0 | 10.0 | 13.0 | 16.1 | 22.1 | 25.0 |
| Thickness of the insulator (mm) | | 3.0 | 3.0 | 3.0 | 3.5 | 3.5 | 3.5 | 4.0 | 4.0 |
| Finished external diameter (standard) (mm) | | 11 | 12 | 15 | 17 | 20 | 24 | 30 | 33 |
| Estimated mass (kg/km) | | 230 | 310 | 590 | 740 | 1150 | 1720 | 2350 | 2810 |
| Maximum conductor resistance | 20°C (Ω/km) | 1.35 | 0.849 *0.858 | 0.394 | 0.313 | 0.185 | 0.121 | 0.0930 | 0.0766 |
| Test voltage (V) | | 15000 | | | | | | | |
| Insulation resistance 20°C (MΩ・km) | | 100 | 100 | 100 | 100 | 70 | 70 | 50 | 50 |
| Standard strip length (m) | | 200 | 200 | 100 | 100 | 50 | 50 | 50 | 50 |
| Packing | | Drum | Drum | Drum | Drum | RP4-6 | RP4-6 | RP4-6 | Drum |

* applies to tin coated hard-drawn copper wires.




| TEPCO Product (2F810) | |
|---|---|
| Name of item<br>6600V IJP | |
| Size<br>100 $mm^2$ | |
| Net weight<br>kg | Strip length<br>m |
| Total weight<br>kg | Serial No. |
| Lot No. | Manufacture year and month |
| XXX Corporation | |

Attached Diagram 1

Note 1. Labels must be affixed on the both sides of the drum.

Note 2. The color of labels must be yellow.

Note 3. Use labels whose color and display are identifiable and that stay put even when the drum has been left outdoors for three months after the delivery.