6C-001 High-Voltage Pin-Type Insulator

Established in November 1928
August 2014 (Rev. 05)

Distribution Department
Tokyo Electric Power Company, Incorporated

1. Scope of Application

This product is used as a suspension insulator for a transformer drop wire at a voltage of 6,900 V or lower on a transformer pole under a high-voltage distribution line.

2. Related Standards

2.1 Japanese Industrial Standards

(1) JIS B 0205 (2001) ISO general purpose metric screw threads

(2) JIS B 0209 (2001) ISO general purpose metric screw threads－Tolerances

(3) JIS C 3801-1 (1999) Testing method for insulators－Part 1 : Insulators for overhead line

(4) JIS C 3802 (1964) Permissible limits of visual defects for insulating porcelains

(5) JIS C 3821 (1992) 6600V Pin type insulators

(6) JIS G 3101 (2010) Rolled steels for general structure

(7) JIS H 8641 (2007) Hot dip galvanized coatings

(8) JIS R 5210 (2009) Portland cement

2.2 Japanese Electrotechnical Committee Standards

(1) JEC-0201 (1988) Alternating voltage insulation test

2.3 TEPCO Standards

(1) 6E-086 Side Pin Mounting Bracket

(2) 6E-145 High-Voltage Cutout Suspension Arm

3. Types

This product has one type, which is shown in the attached figure.

4. Structure and Material

4.1 General Matters

(1) The product must not have any scratches, cracks, rust, and other flaws inappropriate for practical use.

(2) The surface of the product must be smooth and free from protrusions and burrs.

4.2 Requirements for the Primary Structure

(1) Structure

The standard shape and dimensions are shown in the attached figure. The tolerances of dimensions are specified in the attached figure. For a point to which no tolerance is indicated, use the value on the figure as the standard and its dimension must be in a range where the product can be used without a hitch.

(2) Materials

(a) Main Body

The main body of this product must be made of porcelain. The porcelain must be produced without any flaws that may constitute an obstacle to the use of this product. Apply a white glaze uniformly over the surface.

(b) Pin and Nut

Use materials stipulated in JIS and satisfying the functional characteristics of the product.

[Explanation]

According to present expertise, "materials stipulated in JIS and satisfying the functional characteristics of the product" include SS400 stipulated in JIS G 3101.

(c) Adhesive Material

The porcelain and the pin must be rigidly adhered to each other with a cement-based adhesive so that the central axis of the former agrees with that of the latter.

[Explanation]

According to present expertise, portland cement stipulated in JIS R 5210 can be a criterion for a "cement-based adhesive."

(d) Bolt and Nut

Use materials stipulated in JIS and satisfying the functional characteristics of the product.

[Explanation]

According to present expertise, "materials stipulated in JIS and satisfying the functional characteristics of the product" include SS400 stipulated in JIS G 3101 (Rolled steels for general structure) and SWCH8R stipulated in JIS G 3507-2 (Carbon steels for cold heading-Part-2: Wires).

(3) Surface Treatment

Apply a hot dip galvanized coatings stipulated in JIS H 8641 (Hot dip galvanized coatings) uniformly over the entire surface of the pin and the nut. Note that this does not apply when steel having an anticorrosion property equal to or higher than zinc hot dip galvanizing is used.

From here down blank.

5. Performance

Table 1 shows the performance of this product for the tests in Section 7.

Table 1

Item	Performance	Test method Applicable section
Appearance inspection	There must be no points inappropriate for practical use.	7.1
Structure and dimensions	The major dimensions (tolerances) shown in the attached figure must be satisfied.	7.2
High-frequency voltage performance test	Any portion and performance must not constitute an obstacle to the use of the product.	7.3
Power-frequency voltage test	Any portion and performance must not constitute an obstacle to the use of the product.	7.4
Wet power-frequency withstand voltage test	The product must withstand the test.	7.5
Lightning impulse withstand voltage test	The number of flashovers must be two or less.	7.6
50% lightning impulse flashover voltage test	The standard value must be 80 kV.	7.7
Puncture voltage in oil test	The puncture voltage must be 90 kV or greater.	7.8
Bending fracture load test	The fracture load must be 3.43 kN or greater. The pin must not rupture.*	7.9
Porosity test	The liquid must not sink into the porcelain.	7.10
Thermal shock test	Any portion and performance must not constitute an obstacle to the use of the product.	7.11
Freezing test	There must be no abnormality in the appearance and the structure. High-frequency voltage performance, power-frequency voltage, and bending fracture load performance must be satisfied.	7.12
Autoclave expansion test	There must be no abnormality in the appearance and the structure. High-frequency voltage performance, power-frequency voltage, and bending fracture load performance must be satisfied.	7.13
Plating test	The mass of deposit per unit area must be 350g/m^2 or greater.	7.14
Equivalent fog test	The 5% flashover voltage must be 7.2 kV or greater.	7.15
Tensile fracture load test	The fracture load must be 4.9 kN or greater.*	7.16

*1 A fracture means an occurrence of damage harmful to use, such as cracking and crazing.

*2 A fracture means a halt in the increase of load due to rupture or buckling. Deformation is not regarded as a fracture.

6. Display Method

The following items must be displayed on insulators at the position shown in the attached figure in a manner that can ensure that the display is easy to see and will not disappear easily.

(1) Manufacturer name or its symbol

(2) Manufacture year and month (the manufacture year must be in the Christian Era and can be the last two digits)

7. Test Methods

7.1 Appearance Inspection

Inspect the presence or absence of flaws inappropriate for practical use visually or by touching with the hands.

7.2 Structure and Dimensions Inspection

Measure the dimensions with a vernier or a ruler.

7.3 High-Frequency Voltage Performance Test

Apply a high-frequency voltage for 3 to 5 seconds according to Section 7.7 of JIS C 3801-1.

7.4 Power-Frequency Voltage Test

Apply a power-frequency voltage of 45 kV for 2 minutes according to Section 7.6 of JIS C 3801-1.

7.5 Wet Power-Frequency Withstand Voltage Test

Apply a power-frequency voltage of 22 kV for 1 minute according to Section 7.4 of JIS C 3801-1.

7.6 Lightning Impulse Withstand Voltage Test

Apply a standard lighting impulse voltage having a peak value of 65 kV according to Section 7.9 of JIS C 3801-1.

7.7 50% Lightning Impulse Flashover Voltage Test

Measure a 50% lightning impulse flashover voltage according to Section 7.8 of JIS C 3801-1.

7.8 Puncture Voltage in Oil Test

Apply a voltage according to Section 7.5 of JIS C 3801-1 to measure the voltage leading to a puncture.

7.9 Bending Fracture Load Test

Increase the load to approximately 75% of the predetermined fracture load value as appropriate using the method described in Section 8.2.2 of JIS C 3801-1. After that, gradually increase the load to cause a fracture.

7.10 Porosity Test

It must be conducted by using the method described in Section 11 of JIS C 3801-1.

7.11 Thermal Shock Test

It must be conducted by using the method described in Section 10 of JIS C 3801-1. The temperature difference must be 90°C or more (the temperature of cold water is 0 to 10°C), the soaking time 30 minutes each, and the number of soaking three times each.

7.12 Freezing Test

After allowing the product to stand in a freezing chamber (in the air) at a temperature of -20°C for 1 hour, soak it in hot water at a temperature of 60°C or higher for 10 minutes. Repeat this procedure five times before conducting the tests in Sections 7.3, 7.4, and 7.9.

7.13 Autoclave Expansion Test

Allow the product to stand in saturated water vapor at a temperature of 210°C and a pressure of 2.03×10^6 Pa for 4 hours. Gradually cool it to the room temperature before conducting the tests in Sections 7.1, 7.2, 7.3, 7.4, and 7.9.

7.14 Plating Test

With galvanized products, plating test must be conducted by using the method described in Section 12 of JIS C 3801-1.

7.15 Equivalent Fog Test

(1) Pretreatment to Test Samples

Wash the test specimen with a neutral detergent and rinse it sufficiently to remove the water repellency on the surface. Blow compressed air to dry the test specimen to prevent grease from adhering on it.

(2) Fouling Treatment to Test Samples

Use an emulsion consisting of salt and polishing powder as the fouling liquid for the purpose of equivalent mass of salt deposit shown in Table 2. Spray the emulsion on the test specimen with a spray gun until the surface leakage resistance becomes saturated. Note that the fouling treatment to the test specimen must be renewed for every application of a voltage.

Table 2

Equivalent mass of salt deposit (mg/cm^2)		0.06
Fouling liquid (mg/cm^3)	Salt	24
	Polishing powder	40

(3) How to Apply a Voltage

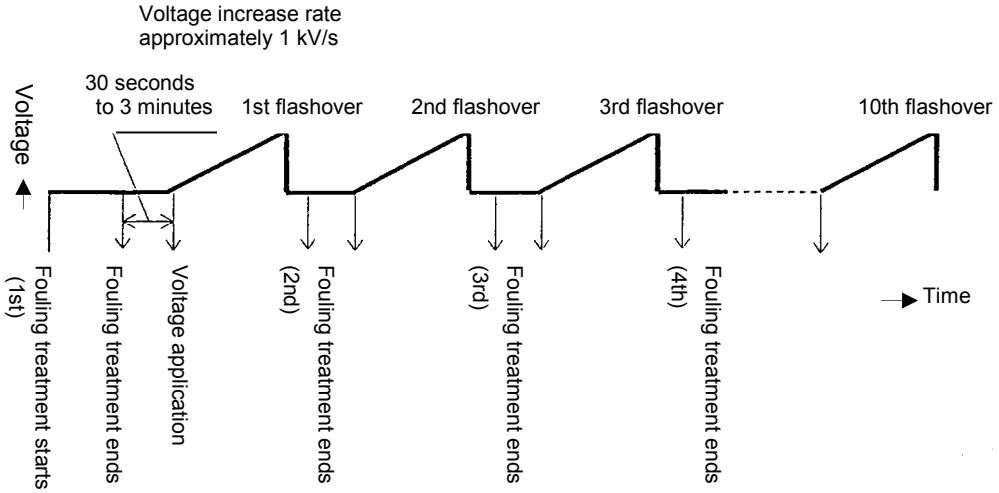
Apply a voltage after a lapse of between 30 seconds and 3 minutes from the completion of fouling, and increase the voltage at a rate of approximately 1 kV/s to cause a flashover.

(The time to a flashover must be between 10 and 60 seconds.)

(4) 5% Flashover Voltage

Determine the 5% flashover voltage by, for example, plotting the 10 flashover voltages measured by using the method above on a sheet of normal probability paper.

(5) Process of Equivalent Fog Test



(6) Capacity of Test Power Supply

The power supply must be able to supply a short-circuit current of 5 A or more at a voltage of 8 kV.

7.16 Tensile Fracture Load Test

Increase the load to approximately 75% of the predetermined fracture load value as appropriate using the method described in Section 8.2.1 of JIS C 3801-1. After that, gradually increase the load to cause a fracture.

8. Test

8.1 General Matters

This product must go through the “Type approval test” in Section 8.2, the “Acceptance test” in Section 8.3, and the “Manufacturing process inspection” in Section 8.4 based on the test method stipulated in Section 7 and comply with the entire provisions from Section 4 to Section 6.

8.2 Type Approval Test

Type approval test must be conducted on a product or a test specimen manufactured under the same conditions with products for the test items and the number of tests shown in Table 3.

Table 3: Test items and number of tests

	Test item	Number of tests
1	Appearance inspection	3
2	Structure and dimensions inspection	3
3	High-frequency voltage test	3
4	Power-frequency voltage test	3
5	Wet power-frequency withstand voltage test	3
6	Lightning impulse withstand voltage test	3
7	50% lightning impulse flashover voltage test	3
8	Power-frequency puncture voltage in oil test	3
9	Bending fracture load test	3
10	Porosity test	3
11	Thermal shock test	3
12	Freezing test	3
13	Autoclave expansion test	3
14	Galvanization test	3
15	Equivalent fog test	3
16	Tensile fracture load test	3

8.3 Acceptance Test

The acceptance test must be conducted in the presence of the supplier when 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.

8.4 Manufacturing Process Inspection

A series of inspections including the materials used, the quality control items in the manufacturing processes, and the quality control method must be conducted to confirm that the manufacturer has a system in which the exactly same products as the one used for the type approval test can be produced in the mass production process.

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 Cost for Test Items

The supplier will bear the test specimens.

9.3 Documents to be Submitted

The following documents must be submitted for type approval evaluation.

9.3.1 Manufacturing Specifications

Specify necessary items in a manufacturing specifications and attach a drawing on which the tolerances of the dimensions and the materials are described in detail 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.

9.3.2 Test Report

Conduct the “Type approval test” in Section 8.2 and describe the results and test conditions in a test report.

9.3.3 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.

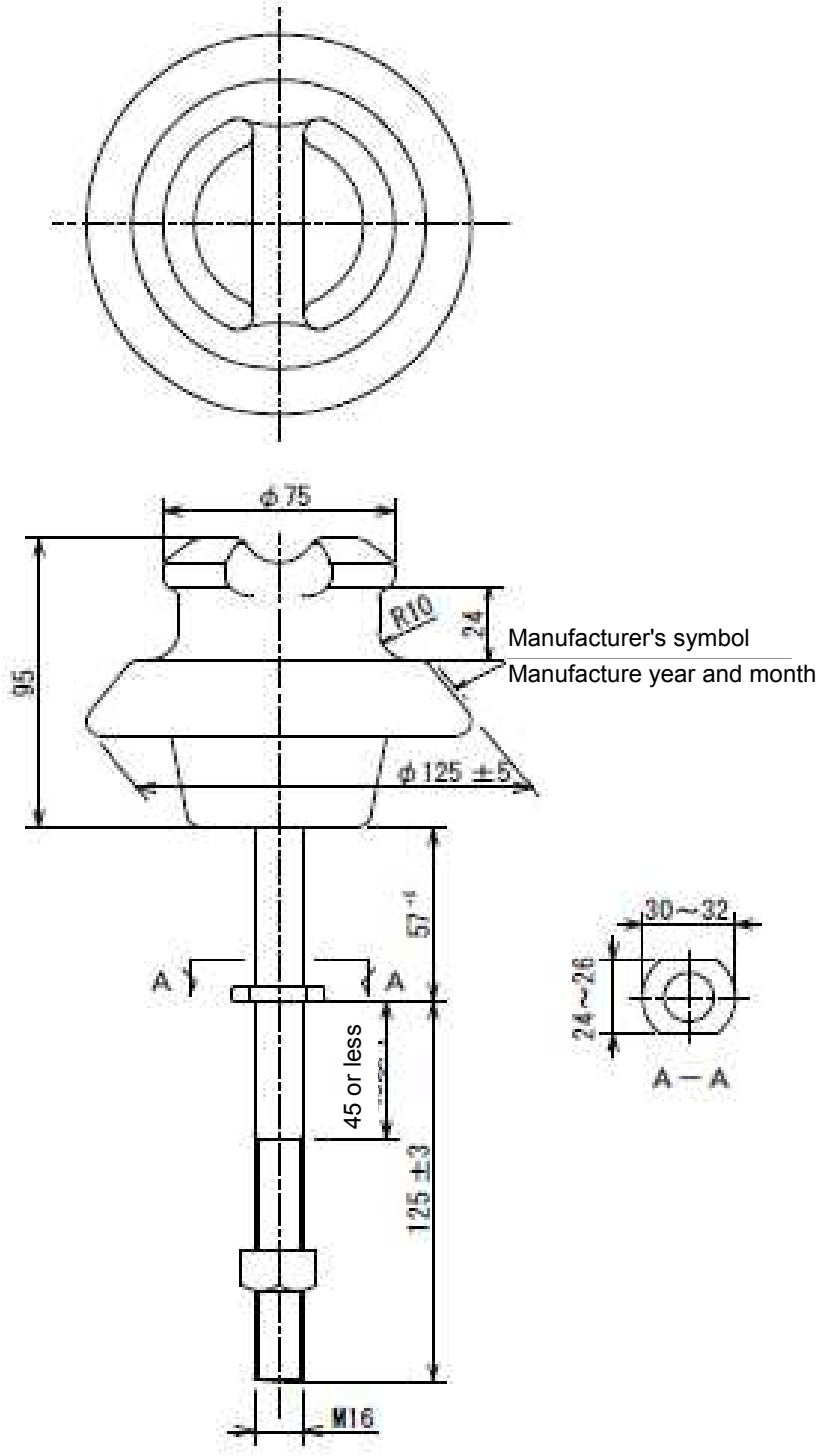
9.3.4 Technical Documents

Before type approval test is carried out, the submission of technical documents may be requested in order that the performance and quality of the product can be assessed sufficiently and appropriately.

9.4 Package and Packing

Use an appropriate method suitable for transportation and carrying, which can ensure that the products will not be easily broken.

From here down blank.



Attached figure 1: Example of an Assembled Product