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**Testing method for insulators—
Part 3 : Hollow insulators**

ICS 29.080.10

Descriptors : electric insulators, electrical porcelain, electrically-insulated bushings,
electrical installations, testing

Reference number : JIS C 3801-3 : 1999 (E)

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of International Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law. Consequently **JIS C 3801 : 1993** is replaced with **JIS C 3801-1 to -3 : 1999**.

In this revision, the contents of **JIS C 3801 : 1993** and **JIS C 3804 : 1982** are divided into three parts according to aimed products and the International Standard corresponding to this part is stated in Annex (normative) for being in conformity with International Standards.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

JIS C 3801 consists of the following parts with the general title *Testing method for insulators*.

Part 1 : Insulators for overhead line

Part 2 : Post insulators for station

Part 3 : Hollow insulators

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In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

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Testing method for insulators— Part 3 : Hollow insulators

Introduction This Japanese Industrial Standard has been prepared based on **IEC 60233** *Tests on hollow insulators for use in electrical equipment* published in 1974 as the second edition and its Amendment 1 (1988) in such a manner that the testing method for insulators specified in old **JIS** is adopted as the text and the International Standard corresponding to this Standard is stated in Annex without modification in technical contents. However, the testing solution for porosity test is specified by changing the contents of the International Standard to precede the safety. The amendments are included in this preparation.

The **IEC** Standard number is based on the new numbering system of **IEC** Standards put in force on January 1st 1997, and the Standard published before the said date is numbered by adding 60000 to the former number. This is only the change in the numbering system and the contents remain unchanged.

1 Scope This Standard specifies testing methods for porcelain hollow insulators to be used for electric machinery and equipment with a nominal voltage not less than 3 300 V (hereafter referred to as “hollow insulators”).

Either of the specifications stated in this text or those stated in the Annex (normative) shall be applied throughout to a product, and it is not allowed to apply the items and contents from the text and Annex confusedly.

Remarks : The International Standard corresponding to this Standard is given below.

IEC 60233 : 1974 *Tests on hollow insulators for use in electrical equipment*

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards indicated below shall be applied.

JIS B 7503 *Dial gauges*

JIS B 7507 *Vernier, dial and digital callipers*

JIS B 7512 *Steel tape measures*

JIS B 7516 *Metal rules*

JIS C 3802 *Permissible limits of visual defects for insulating porcelains*

JIS C 3803 *Glossary of terms for insulator and bushing*

JIS K 8891 *Methanol*

3 Definitions For the purposes of this Standard, in addition to the definitions stated in **JIS C 3803**, the following principal definitions apply:

- a) **camber** The maximum value of difference between the straight line connecting centres of outer profiles at both ends of a hollow insulator and the line passing through centres of the hollow insulator.
- b) **partial thickness** The difference between the maximum wall thickness and the minimum wall thickness in the same plane perpendicular to the axis of a hollow insulator.
- c) **shed angle** The difference between the maximum dimension and the minimum dimension from the end shed to the end face of a hollow insulator.
- d) **parallelism of the end faces** The difference between the maximum height and the minimum height of an end face from the end face to be attached to the equipment being adapted as the reference face.
- e) **eccentricity** The difference between the normal passing through the centre of outer profile of the face to be attached to the equipment being adopted as the reference face, and the centre of outer profile of the other end face.

4 **Classification of tests** The tests are classified as given in Table 1.

Table 1 Classification of tests

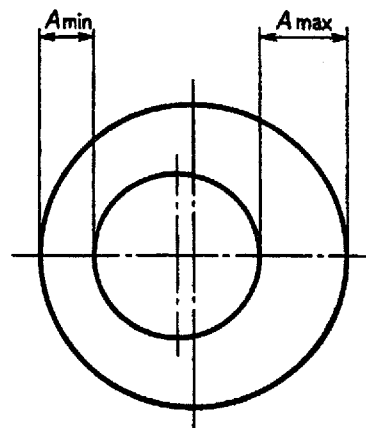
Classification of test	Applicable clause for test method
a) Dimensional test	5
b) Visual test	6
c) Temperature cycle test	7
d) Porosity test	8
e) Power frequency withstand voltage test	9
f) Mechanical failing load test by bending	10
g) Mechanical failing load test by internal pressure	11

Remarks : The tests of f) and g) are carried out for reference when the necessity is agreed upon between the parties concerned.

5 Dimensional test

5.1 Dimensions The dimensions shall be measured, based on the drawing, using necessary measuring apparatus such as the vernier callipers specified in **JIS B 7507**, the metal rules specified in **JIS B 7516**, the steel tape measures specified in **JIS B 7512**, the dial gauges specified in **JIS B 7503**.

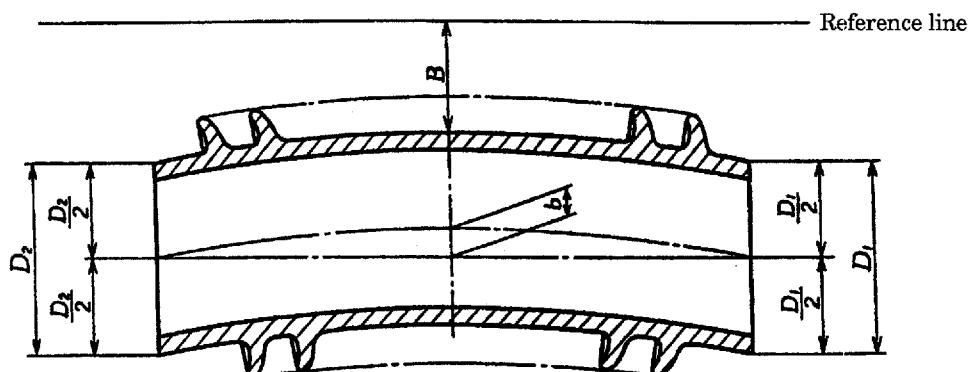
5.2 Partial thickness The difference between the maximum wall thickness and the minimum wall thickness on the circumference of core parts of hollow shall be measured, by following the procedure illustrated in Fig. 1 to obtain the thickness.



Partial thickness: $a = A_{\max} - A_{\min}$

Fig. 1 Measuring method for partial thickness

5.3 Camber The camber shall be obtained, by following the procedure illustrated in Fig. 2, as the maximum deflection of the axis of hollow (locus of the centres of transverse-sections) from the straight line which is taken as the reference and passes the centres of outer profiles (diameters) at both end faces of the hollow porcelain.



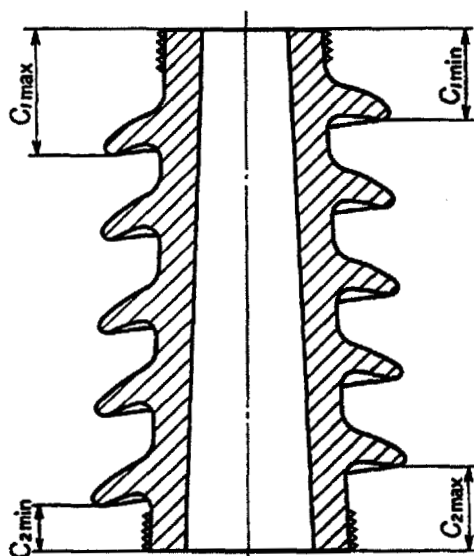
Camber: b

Remarks : The camber may be obtained in such a manner that the hollow insulator is rotated about the straight line which is taken as the axis and passes the centres of outer profiles (diameters) at both end faces of the hollow insulator, the maximum value $B_{\max}$ of the dimension from the reference line to the outer profile of core part B and such dimension at 180 degrees opposite position where $B_{\max}$ appeared $B_{\min}$ are measured, and the camber is calculated as follows:

$$\text{Camber: } b = \frac{B_{\max} - B_{\min}}{2}$$

Fig. 2 Measuring method for camber

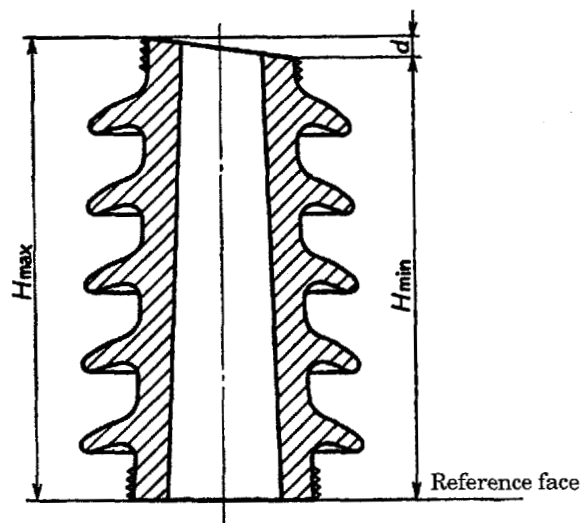
5.4 Shed angle The shed angle shall be measured on a hollow insulator the both end faces of which are ground, by following the procedure illustrated in Fig. 3.



$$\text{Shed angle: } c = C_{1\max} - C_{1\min} \\ \text{or } C_{2\max} - C_{2\min}$$

Fig. 3 Measuring method for shed angle

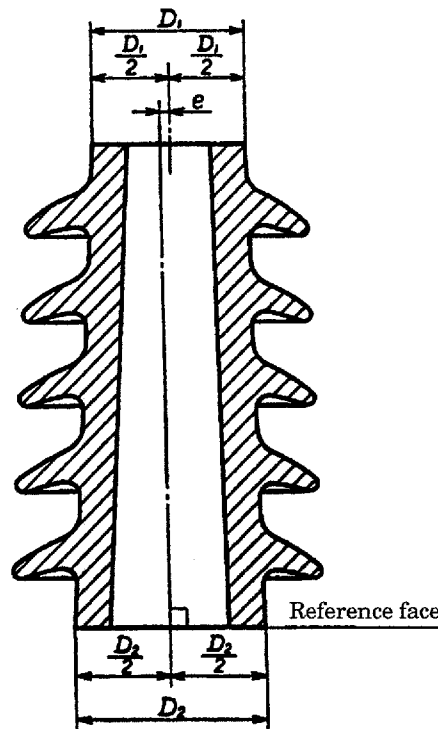
5.5 Parallelism of the end faces The parallelism of the end faces shall be obtained, by following the procedure illustrated in Fig. 4, as the difference between the maximum height and the minimum height of one end face measured on a hollow insulator the both end faces of which are ground, while the end face by which the hollow insulator is attached to a machinery or apparatus is taken as the reference face.



$$\text{Parallelism of the end faces: } d = H_{\max} - H_{\min}$$

Fig. 4 Measuring method for parallelism of the end faces

5.6 Eccentricity The eccentricity shall be obtained, by following the procedure illustrated in Fig. 5, on a hollow insulator the both end faces of which are ground, in such a manner that the end face by which the hollow insulator is attached to a machinery or apparatus is taken as the reference face and the difference between the normal passing through the centre of outer profile on this face and the centre of outer profile on the other end face is measured.



Eccentricity: e

Fig. 5 Measuring method for eccentricity

6 Visual test The visual test shall be carried out in accordance with JIS C 3802.

7 Temperature cycle test The temperature cycle test shall be made by immersing the specimen in the sequence of hot water, cold water, hot water and cold water, and the specimen shall be completely immersed into respective water baths. Number of times of immersing in hot water and cold water shall be three each, and the time taken to transfer from one bath to another shall be as short as possible. The immersion time, temperature range of cold water and temperature difference between cold water and hot water shall be as prescribed below.

Further, the quantity of cold water and that of hot water in water baths shall be sufficient enough, so that the water temperature does not change by more than 5 °C due to immersion of specimen.

Then, existence of abnormality on the specimen surface shall be checked by carrying out visual test, the power frequency withstand voltage test of 9 is made and the existence of abnormality shall be examined.

7.1 Temperature range of cold water The temperature range of cold water shall be 0 °C to 30 °C.

7.2 Immersion time The immersion time shall be as shown in Table 2 in relation with the outer diameter and height of the specimen.

7.3 Temperature difference The temperature difference between cold water and hot water shall be as shown in Table 2 in relation with the outer diameter and height of the specimen.

Table 2 Temperature difference between cold water and hot water

$D \times H$ cm ²	Immersion time min	Temperature difference °C
1 500 and under	15 min.	60 min.
Over 1 500 up to and incl. 4 000	20 min.	60 min.
Over 4 000 up to and incl. 7 000	20 min.	50 min.
Over 7 000 up to and incl. 10 000	20 min.	45 min.
Over 10 000	20 min.	40 min.

Remarks : *D* : maximum outer diameter (diameter of shed if any) of specimen

H : height of specimen

8 Porosity test

8.1 Test pieces The test pieces shall be fragments of the specimen having fresh fracture.

However, test pieces of the same composition as the hollow insulator fired adjacent to it, porcelain pieces cut out from the hollow insulator body by grinding, or porcelain pieces from the hollow insulator of the same lot broken by other tests may be used.

8.2 Testing liquid The testing liquid used for this test shall consist of approximately 3 % Astrazon dissolved into the methanol specified in **JIS K 8891**.

8.3 Test method The test pieces are immersed perfectly into the testing liquid, at room temperature, applied with a pressure of not less than 9.8 MPa allowed to stand under such condition for 4 h or more, taken out, dried and fractured, and whether the liquid is soaked into the fracture or not shall be checked.

9 Power frequency withstand voltage test

9.1 Mounting method of specimen The both electrodes shall consist of thin metallic sheet fitted on inner surface of specimen contacting with the whole length, and a conductor (chain, wire, etc.) wound on the shed at outside of specimen or as occasion demands, on the other part.