# American National Standard

*for Insulators –*

## *Wet-Process Porcelain and Toughened Glass – Suspension Type*

ANSI C29.2-1992

ANSI American National Standards Institute
11 West 42nd Street
New York, New York
10036

**ANSI®**
**C29.2-1992**
Revision of
ANSI C29.2-1983

American National Standard
for Insulators –

# Wet-Process Porcelain and Toughened Glass – Suspension Type

Secretariat

**National Electrical Manufacturers Association**
**Institute of Electrical and Electronic Engineers**

Approved May 8, 1992

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American National Standard

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## Contents

## Foreword (This foreword is not part of American National Standard C29.2-1992.)

This standard was processed and approved for submittal to ANSI by American National Standards Committee on Insulators for Electric Power Lines, C29. Committee approval of the standard does not necessarily imply that all committee members voted for its approval.

This standard contains two annexes which are informative.

Suggestions for improvement of this standard will be welcome. They should be sent to the National Electrical Manufacturers Association, 2101 L Street, N.W., Washington, D.C. 20037.

At the time it approved this standard, the C29 Committee had the following members:

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AMERICAN NATIONAL STANDARD ANSI C29.2-1992

# American National Standard for Insulators –

# Wet-Process Porcelain and Toughened Glass – Suspension Type

## 1 Scope

This standard covers suspension-type insulators, 4-1/4 inches (108 millimeters) in diameter and larger, made of wet-process porcelain or of toughened glass and used in the transmission and distribution of electrical energy.

## 2 Normative references

This standard is intended to be used in conjunction with the following American National Standards. When the referenced standards are superseded by a revision approved by the American National Standards Institute, Inc., the revision shall apply.

ANSI C29.1-1988, *Test Methods of Electrical Power Insulators*

ANSI Z55.1-1967(R1973), *Gray Finishes for Industrial Apparatus and Equipment* [1)]

ANSI/IEEE 268-1982, *Metric Practice*

ASTM A153-82, *Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware* [2)]

ASTM C151-84, *Test Method for Autoclave Expansion of Portland Cement* [2)]

## 3 Definitions

See section 2 of American National Standard Test Methods for Electrical Power Insulators, ANSI C29.1-1988, for definitions of terms.

## 4 General

**4.1** Insulators shall conform in all respects to the requirements of this standard. The text and figures supplement each other and shall be considered part of this standard.

**4.2** Manufacturer's drawings, if furnished, shall show the outline of the insulators, together with all pertinent dimensions. Any variations in these dimensions due to manufacturing tolerances shall be indicated.

## 5 Material

### 5.1 Insulator shells

The insulator shells shall be made of wet-process porcelain or toughened glass. Shells shall be sound and free from defects that might adversely affect the insulators.

### 5.2 Shell surface

The surface of shells exposed after the assembly, which shall be glazed for porcelain insulators, shall be relatively smooth and free of imperfections.

Color is not a part of this standard. If gray is required, it shall be in accordance with ANSI Z55.1, and shall conform to Munsell notation 5BG 7.0/0.4 with the following tolerances:

a) Hue: ±12(3G to 7B)

b) Value: ±0.5

c) Chroma: -0.2 to +0.6

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1) This standard has been withdrawn but is still available in archive form. Contact ANSI's Sales Department.

2) Available from ASTM, 1916 Race Street, Philadelphia, PA 19103.

Table 1 – Metric equivalents[1)]

| Inches | Millimeters | Inches | Millimeters |
|---|---|---|---|
| 1/64 | 0.4 | 1 | 25.4 |
| 1/32 | 0.8 | 4-1/2 | 114.5 |
| 1/16 | 1.6 | 5-1/4 | 133.5 |
| 1/8 | 3.2 | 5-1/2 | 139.5 |
| 1/2 | 12.7 | 5-3/4 | 146.0 |
| 17/32 | 13.5 | 6-1/8 | 155.5 |
| 9/16 | 14.3 | 6-1/4 | 159.0 |
| 5/8 | 15.9 | 6-1/2 | 165.0 |
| 11/16 | 17.5 | 7 | 178.0 |
| 3/4 | 19.1 | 8 | 203.0 |
| 13/16 | 20.6 | 10-3/4 | 273.0 |
| 7/8 | 22.2 | 11-3/4 | 298.0 |
| 15/16 | 23.8 | 12-1/4 | 311.0 |

[1)] These metric equivalents are not applicable to the dimensions of gages shown in Figures 4 through 8 nor to the impact testing machine shown in Figure 10.

### 5.3 Metal parts

Metal parts, except for cotter keys, shall be made of a good commercial grade of malleable iron, ductile iron, steel, or aluminum. Ferrous parts, other than stainless steel, shall be galvanized in accordance with ASTM A153-82.

### 5.4 Cotter keys

#### 5.4.1 Material

Cotter keys shall be made from cold-drawn wire of any of the following materials:

a) For insulators of classes 52-1 and 52-9: bronze, brass, austenitic stainless steel, or aluminum.

b) For insulators of all other classes: bronze, brass, or austenitic stainless steel.

#### 5.4.2 Ball-and-socket insulators.

Ball-and-socket insulators shall be furnished with a positive locking device of the split cotter-key type. Cotter keys shall be humped to maintain the key in the locked and unlocked positions and shall have both prongs spread to prevent complete withdrawal from the socket. The cotter key shall prevent the ball of the adjacent insulator from unintentionally being uncoupled during normal handling and use.[3]

#### 5.4.3 Clevis insulators

Clevis insulators shall be furnished with a hump-type cotter key which shall prevent the cotter bolt from unintentionally being pulled out of the insulator cap during normal handling and use.[4]

## 6 Dimensions and characteristics

**6.1** All dimensions and other numerical values are given in customary English units. Except as otherwise stated, metric equivalents shall be as shown in Table 1.

**6.2** Dimensions and characteristics of the insulators shall be in accordance with Figures 1 through 3 and Tables 2 through 4. Ball gauges and socket gauges are shown in Figures 4 through 8.

[3)] Care should be exercised during installation and use of insulator strings to prevent damage to cotter keys.

[4)] Interchangeability of cotter keys and cotter bolts between manufacturers is not considered, since the insulator is normally supplied complete with these parts installed.

## 7 Marking

Each insulator unit shall bear symbols identifying the manufacturer and giving the year of manufacture and the tension-proof test load in pounds, identified by the word "TEST." In addition, each insulator unit except those of classes 52-1 and 52-9 shall be marked with the combined mechanical and electrical rating in pounds identified by the symbol "M&E." The markings shall be legible and durable.

## 8 Sampling, inspection, and tests

### 8.1 General

Tests described in 8.2 shall be required only on insulators of new design. Tests described in 8.3 shall be required on each lot of insulators. Tests described in 8.4 shall be made on each insulator.

### 8.2 Design tests

#### 8.2.1 Low-frequency dry flashover test

Three insulators shall be selected at random and tested in accordance with 4.2 of ANSI C29.1. Failure of the average dry flashover value of the three insulators to equal or exceed 95 percent of the rated dry flashover value, as given in the applicable table, shall constitute failure to meet the requirements of this standard.

#### 8.2.2 Low-frequency wet flashover test

Three insulators shall be selected at random and tested in accordance with 4.3 of ANSI C29.1 except that for distribution insulators normally used in a horizontal position, the mounting arrangement may be similar to service orientation. Failure of the average wet flashover value of the three insulators to equal or exceed 90 percent of the rated wet flashover value, as given in the applicable table, shall constitute failure to meet the requirements of this standard.

#### 8.2.3 Critical impulse flashover tests—positive and negative

Three insulators shall be selected at random for the critical impulse flashover test, positive, and three for the critical impulse flashover test, negative, and tested in accordance with 4.7 of ANSI C29.1. Failure of the average critical impulse flashover value of the three insulators to equal or exceed 92 percent of the rated critical impulse flashover value, as given in the applicable table, shall constitute failure to meet the requirements of this standard.

#### 8.2.4 Radio-influence voltage test

Three insulators shall be selected at random and tested in accordance with 4.9 of ANSI C29.1. If one or more insulators fail to meet the requirements as given in the applicable table, three additional insulators shall be selected at random and tested. Failure of one or more of these additional insulators shall constitute failure to meet the requirements of this standard.

#### 8.2.5 Thermal-mechanical load cycle test

Ten assembled insulators shall be selected at random and subjected to the thermal-mechanical load cycle test. The insulators, which may be connected in series or parallel provided each is equally loaded, shall be subjected to four 24 hour cycles of ambient air cooling and heating with a simultaneously applied minimum tensile load maintained at 60 percent of the rated combined mechanical and electrical strength of the insulators as described in Figure 9. Each 24 hour cycle shall start with a cooling period during which a low temperature of -22°F (-30°C) shall be maintained for at least a four hour period. A heating period will follow the cooling period. During the heating period a high temperature of 104°F (40°C) shall be maintained for at least a four hour period.

During the four hour extreme temperature periods, the ambient air temperature shall be maintained at the specified extreme temperature within 9°F (5°C). The rate of temperature change is not specified. The tensile load shall be applied at room temperature before starting the first thermal cycle. The tensile load shall be completely removed and reapplied after the first, second, and third 24 hour thermal cycle. After the fourth thermal cycle, upon cooling to room temperature, the tensile load shall be removed. The ten insulators shall then be subjected to a Combined Mechanical and Electrical Test in accordance with 5.2 of ANSI C29.1. The criteria for determining conformance with the standard are as given in 8.3.4.

#### 8.2.6 Thermal shock test

Five insulators shall be selected at random and tested for ten complete cycles in accordance with 5.5 of ANSI C29.1. The temperature of the hot water bath shall be approximately 205°F (96°C), and the temperature of the cold water bath shall be approximately 39°F (4°C). If one or more insulators fail, five additional insulators shall be selected at random and tested. Failure of one or more of these additional insulators shall constitute failure to meet the requirements of this standard.

#### 8.2.7 Residual-strength test

Twenty-five assembled units shall be selected at random and have the shells broken off. No portion of

the shell shall remain outside the maximum diameter of the cap. Each assembly shall then be subjected to a mechanical-strength test in accordance with 5.1 of ANSI C29.1. The criteria for determining conformance to this standard are:

$\overline{X}_R \geq (1.2 \times \text{tension–proofload}) + 1.645 S_R$

where

$\overline{X}_R$ = average residual strength of 25 units

$S_R$ = standard deviation of residual strength of the 25 units tested.[6)]

### 8.2.8 Impact test

Three assembled insulators shall be selected at random and tested in accordance with 5.1.2.2 of ANSI C29.1. The test specimen shall be mounted in the test machine shown in Figure 10. If one or more insulators fail to meet the requirements given in the applicable table, three additional assembled insulators shall be selected at random and tested. Failure of one or more of the additional insulators shall constitute failure to meet the requirements of this standard.

### 8.2.9 Cotter key test

For three test samples of ball-and-socket insulators, the disengagement force of the cotter key shall be between 25 and 150 pounds (111 and 667 newtons) force for three locking-to-unlocking operations.

### 8.2.10 Cement expansion

If Portland cement is used in the assembly of the insulators, it shall have an autoclave expansion limit of less than 0.12 percent when tested in accordance with ASTM C151-84, Test Method for Autoclave Expansion of Portland Cement.

## 8.3 Quality conformance tests[5)]

### 8.3.1 Visual and dimensional tests

Conformity with 5.2 of this standard may be determined by visual inspection. All insulators not conforming to 5.2 fail to meet the requirements of this standard.

Three insulators shall be selected at random from the lot and their dimensions checked against the dimensions on the manufacturer's drawing. Failure of more than one of these insulators to conform, within manufacturing tolerances, to the dimensions on this drawing shall constitute failure of the lot to meet the requirements of this standard.

### 8.3.2 Porosity test

Specimens shall be selected from porcelain insulators destroyed in other tests and tested in accordance with 5.4 of ANSI C29.1. Penetration of the dye into the body of the dielectric shall constitute failure of the lot to meet the requirements of this standard.

### 8.3.3 Galvanizing test

Five pieces representative of each type of galvanized hardware used with the insulators shall be selected at random and tested in accordance with Section 6 of ANSI C29.1. Five to ten measurements shall be randomly distributed over the entire surface. Both the average thickness value for each individual specimen and the average of the entire sample shall equal or exceed the following:

| | Average of Entire Sample | Average of Individual Specimen |
|---|---|---|
| Hardware (except nuts/bolts) | 3.4 mil | 3.1 mil |
| Nuts/bolts | 2.1 mil | 1.7 mil |

If the average of one specimen, or if the average of the entire sample, fails to comply with the table above, ten additional pieces of the same type of hardware shall be selected at random and tested. Failure of the retest sample to comply with the minimum thickness criteria shall constitute failure of the lot to meet the requirements of this standard.

### 8.3.4 Combined mechanical and electrical-strength tests

Ten assembled insulators shall be selected at random from the lot and tested in accordance with 5.2 of ANSI C29.1. The criteria for determining conformance with the standard are as follows:

$\overline{X} \geq \overline{X}_L$

$S \leq 1.72\ \overline{S}$

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5) Substantial test experience indicated that a total of 1/2 of 1% of the number of insulators in the lot is sufficient to establish characteristics demonstrable by destructive tests. For additional information, reference may be made to the ASTM Manual of Presentation of Data and Control Chart Analysis, 6th Edition 1990 (ASTM Manual Series; MNL7), and further references stated therein. This manual also contains additional information on methods of computation such as those given in 8.3.4.

where:

$\overline{X}$ is the average value obtained on the sample of the ten insulators tested

$\overline{X}_L$ is the lower limit for the average of the ten insulators tested

$\overline{X}_L$ is the rating + $1.2\overline{S}$

$S$ is the standard deviation for the ten insulators tested[6)]

$\overline{S}$ is the average standard deviation (the historical average of $S$ for a series of samples, determined over an extended period of time by quality conformance tests)

### 8.3.5 Puncture tests

Five assembled insulators shall be selected at random and tested in accordance with 4.11 of ANSI C29.1. The criteria for determining conformance to this standard are:

$$\overline{X} \geq \overline{X}_L$$

$$R \leq 2.1\overline{R}$$

where:

$\overline{X}$ is the average value obtained on the sample of the five insulators tested;

$\overline{X}_L$ is the lower control limit for the average of the five insulators tested

$\overline{X}_L$ = (0.9 rating) + $0.4\overline{R}$

NOTE – A manufacturer shall establish and make available before the test a value of $\overline{X}_L$ that satisfies this criterion.

$R$ is the range of values obtained on the sample of five insulators tested

$\overline{R}$ is the average range (the historical average of $R$ for a series of samples, determined over an extended period of time by quality conformance tests)

## 8.4 Routine tests

### 8.4.1 Cold-to-hot thermal shock test

Each toughened glass shell shall be submitted to a thermal shock, bringing it from ambient temperature to a temperature at least 540°F (300°C) higher, and shall be maintained at the higher temperature for at least 1 minute. All toughened glass shells that fracture do not meet the requirements of this standard.

### 8.4.2 Hot-to-cold thermal shock test

Each toughened glass shell shall be quickly and completely immersed in water at a temperature not exceeding 122°F (50°C), the shell having been heated by hot air or other suitable means to a uniform temperature at least 180°F (100°C) higher than that of the water. All toughened glass shells that fracture do not meet the requirements of this standard.

### 8.4.3 Tension proof test

Each assembled insulator shall be subjected to a tension-proof test in accordance with 7.2.1. of ANSI C29.1. The load applied shall be that shown in the applicable table (tables 2–4). All insulators that fail do not meet the requirements of this standard.

### 8.4.4 Flashover test

Each porcelain insulator shall be subjected to a routine flashover test in accordance with 7.1 of ANSI C29.1. All insulators that puncture fail to meet the requirements of this standard.

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6) The standard deviation is computed as follows: $S = \left[\frac{(X_1 - \overline{X})^2 + (X_2 - \overline{X})^2 + \ldots + (X_n - \overline{X})^2}{(n-1)}\right]^{\frac{1}{2}}$ where $X_1$, $X_2$, ... are the $n$ individual values obtained and $n$ is the number of units tested.

**Table 2 – Dimensions and characteristics of distribution insulators (ANSI CLASSES 52-1, 52-2, 52-9-A, and 52-9-B)**

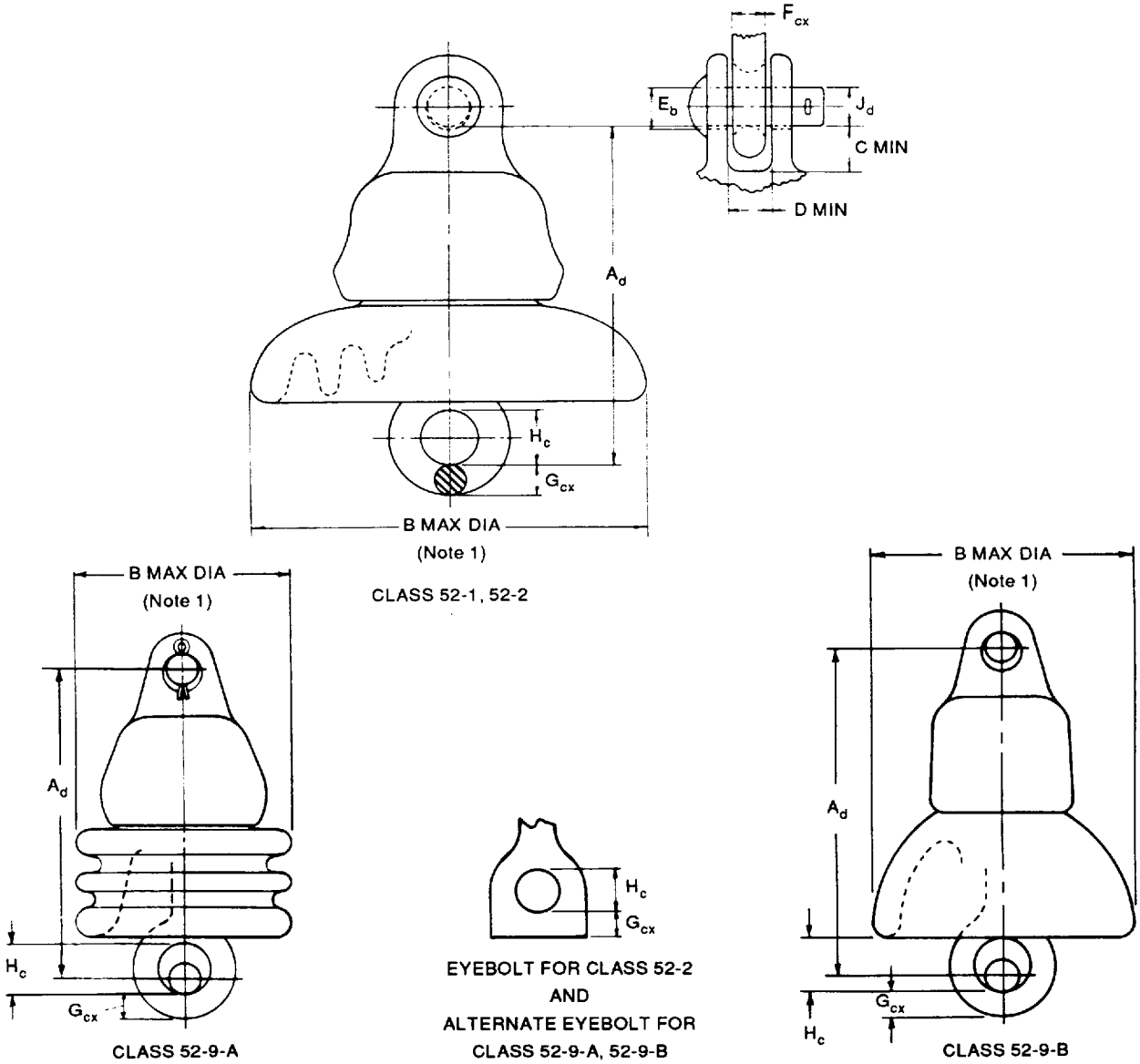
| Dimensional Data | See ANSI C29.1-1988 Section | ANSI CLASS 52-1 (See Figure 1) | ANSI CLASS 52-2 (See Figure 1) | ANSI CLASS 52-9-A (See Figure 1) | ANSI CLASS 52-9-B (See Figure 1) |
|---|---|---|---|---|---|
| Connecting hardware coupling | — | Clevis | Clevis | Clevis | Clevis |
| Leakage distance, inches (mm) | 2.5.2 | 7(178) | 8-1/4(210) | 6-3/4(171) | 6-3/4 (171) |
| Unit spacing dimension "A", inches | — | 5-1/2 | 5-3/4 | 6-1/4 | 6-1/4 |
| Shell diameter dimension "B", inches | — | 6-1/2 | 8 | 4-1/2 | 5-1/4 |
| Clevis cap dimension "C", inches | — | 11/16 | 11/16 | 11/16 | 11/16 |
| Clevis cap dimension "D", inches | — | 11/16 | 11/16 | 11/16 | 11/16 |
| Clevis cap dimension "E", inches | — | 11/16 | 11/16 | 11/16 | 11/16 |
| Eyebolt dimension "F", inches | — | 1/2 | 1/2 | 1/2 | 1/2 |
| Eyebolt dimension "G", inches | — | 1/2 | 17/32 | 1/2 | 1/2 |
| Eyebolt dimension "H", inches | — | 7/8 | 11/16 | 7/8 | 7/8 |
| Cotter bolt dimension "J", inches | — | 5/8 | 5/8 | 5/8 | 5/8 |
| **Mechanical Data** | | | | | |
| Combined mechanical & electrical strength, pounds (kN) | 5.2 | 10000 (44) | 15000 (67) | 10000 (44) | 10000 (44) |
| Mechanical impact strength, inch-pounds, (N-m) | 5.1.2.2 | 45 (5.0) | 50 (5.5) | 45 (5.0) | 45 (5.0) |
| Tension proof, pounds (kN) | 7.2.1 | 5000 (22) | 7500(33.5) | 5000 (22) | 5000 (22) |
| **Electrical Data** | | | | | |
| Low-frequency dry flashover, kilovolts | 4.2 | 60 | 65 | 60 | 60 |
| Low-frequency wet flashover, kilovolts | 4.3 | 30 | 35 | 30 | 30 |
| Critical impulse flashover, positive, kilovolts | 4.7 | 100 | 115 | 100 | 100 |
| Critical impulse flashover, negative, kilovolts | 4.7 | 100 | 115 | 90 | 90 |
| Low-frequency puncture, kilovolts | 4.11 | 80 | 90 | 80 | 80 |
| **Radio-Influence Voltage Data** | | | | | |
| Low-frequency test voltage, rms to ground, kilovolts | 4.9 | 7.5 | 7.5 | 7.5 | 7.5 |
| Maximum RIV at 1000 kHz, microvolts | 4.9 | 50 | 50 | 50 | 50 |

**Table 3 – Dimensions and characteristics of ball-and-socket transmission insulators (ANSI classes 52-3, 52-5, 52-8, and 52-11)**

| Dimensional Data | See ANSI C29.1-1988 Section | ANSI CLASS 52-3 (See Figure 2) | ANSI CLASS 52-5 (See Figure 2) | ANSI CLASS 52-8 (See Figure 2) | ANSI CLASS52-11 (See Figure 2) |
|---|---|---|---|---|---|
| Connecting hardware coupling | — | B & S Type B | B & S Type J | B & S Type K | B & S Type K |
| Applicable hardware gauges further described by: | — | Figures 4 & 5 | Figures 5 & 6 | Figures 7 & 8 | Figures 7 & 8 |
| Leakage Distance, inches (mm) | 2.5.2 | 11-1/2 (292) | 11 (279) | 11 (279) | 15 (381) |
| Unit spacing dimension "A", inches | — | 5-3/4 | 5-3/4 | 5-3/4 | 6-1/8 |
| Shell diameter dimension "B", inches | — | 10-3/4 | 10-3/4 | 11-3/4 | 12-1/4 |
| **Mechanical Data** | | | | | |
| Combined mechanical & electrical strength, pounds (kN) | 5.2 | 15000 (67) | 25000 (111) | 36000 (160) | 50000 (222) |
| Mechanical impact strength, inch-pounds, (N-m) | 5.1.2.2 | 55 (6.0) | 60 (7.0) | 90 (10) | 90 (10) |
| Tension proof, pounds (kN) | 7.2.1 | 7500 (33.5) | 12500 (55.5) | 18000 (80) | 25000 (111) |
| **Electrical Data** | | | | | |
| Low-frequency dry flashover, kilovolts | 4.2 | 80 | 80 | 80 | 80 |
| Low-frequency wet flashover, kilovolts | 4.3 | 50 | 50 | 50 | 50 |
| Critical impulse flashover, positive, kilovolts | 4.7 | 125 | 125 | 125 | 140 |
| Critical impulse flashover, negative, kilovolts | 4.7 | 130 | 130 | 130 | 140 |
| Low-frequency puncture, kilovolts | 4.11 | 110 | 110 | 110 | 125 |
| **Radio-Influence Voltage Data** | | | | | |
| Low-frequency test voltage, rms to ground, kilovolts | 4.9 | 10 | 10 | 10 | 10 |
| Maximum RIV at 1000 kHz, microvolts | 4.9 | 50 | 50 | 50 | 50 |

**Table 4 – Dimensions and characteristics of clevis transmission insulators (ANSI classes 52-4, 52-6, 52-10, and 52-12)**

| Dimensional Data | See ANSI C29.1-1988 Section | ANSI CLASS 52-4 (See Figure 3) | ANSI CLASS 52-6 (See Figure 3) | ANSI CLASS 52-10 (See Figure 3) | ANSI CLASS 52-12 (See Figure 3) |
|---|---|---|---|---|---|
| Connecting hardware coupling | — | Clevis | Clevis | Clevis | Clevis |
| Leakage Distance, inches (mm) | 2.5.2 | 11-1/2 (292) | 11 (279) | 11 (279) | 15 (381) |
| Unit spacing dimension "A", inches | — | 5-3/4 | 5-3/4 | 6-1/2 | 7 |
| Shell diameter dimension "B", inches | — | 10-3/4 | 10-3/4 | 11-3/4 | 12-1/4 |
| Clevis cap dimension "C", inches | — | 11/16 | 11/16 | 11/16 | 3/4 |
| Clevis cap dimension "D", inches | — | 11/16 | 11/16 | 7/8 | 1 |
| Clevis cap dimension "E", inches | — | 11/16 | 11/16 | 13/16 | 15/16 |
| Eyebolt dimension "F", inches | — | 1/2 | 1/2 | 3/4 | 7/8 |
| Eyebolt dimension "G", inches | — | 17/32 | 17/32 | 1/2 | 9/16 |
| Eyebolt dimension "H", inches | — | 11/16 | 11/16 | 13/16 | 15/16 |
| Cotter bolt dimension "J", inches | — | 5/8 | 5/8 | 3/4 | 7/8 |
| **Mechanical Data** | | | | | |
| Combined mechanical & electrical strength, pounds (kN) | 5.2 | 15000 (67) | 25000 (111) | 36000 (160) | 50000 (222) |
| Mechanical impact strength, inch-pounds, (N-m) | 5.1.2.2 | 55 (6.0) | 60 (7.0) | 90 (10) | 90 (10) |
| Tension proof, pounds (kN) | 7.2.1 | 7500 (33.5) | 12500 (55.5) | 18000 (80) | 25000 (111) |
| **Electrical Data** | | | | | |
| Low-frequency dry flashover, kilovolts | 4.2 | 80 | 80 | 80 | 80 |
| Low-frequency wet flashover, kilovolts | 4.3 | 50 | 50 | 50 | 50 |
| Critical impulse flashover, positive, kilovolts | 4.7 | 125 | 125 | 125 | 140 |
| Critical impulse flashover, negative, kilovolts | 4.7 | 130 | 130 | 130 | 140 |
| Low-frequency puncture, kilovolts | 4.11 | 110 | 110 | 110 | 125 |
| **Radio-Influence Voltage Data** | | | | | |
| Low-frequency test voltage, rms to ground, kilovolts | 4.9 | 10 | 10 | 10 | 10 |
| Maximum RIV at 1000 kHz, microvolts | 4.9 | 50 | 50 | 50 | 50 |




ALLOWABLE VARIATIONS: The lowercase letters appearing on the figures above stand for the following tolerances. A single letter indicates a plus or minus tolerance; for example, a = ±1/64 in. When two letters are used, the first is a plus tolerance, and the second a minus; for example, ax = 1/64 in., –0.

a = 1/64 in. c = 1/16 in.

b = 1/32 in. d = 1/8 in.

x = 0

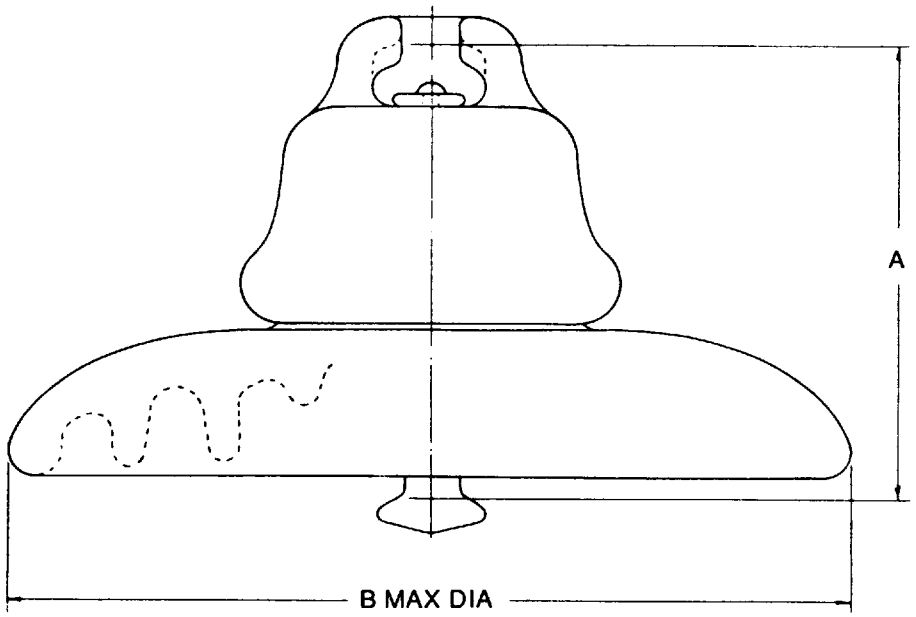
NOTES

1 For specific diameter and tolerance, see manufacturer's drawings.

2 All dimensions are in inches; for metric equivalents, see table 1.

3 Tolerances apply after galvanizing, where applicable.

**Figure 1 – Classes 52-1, 52-2, 52-9-A, and 52-9-B**




NOTES

1 For specific diameter and tolerance, see manufacturer's drawings.

2 The connecting length of a string of six insulators selected at random shall be equal to six times the nominal spacing of the insulators ±3/4 in (±19.1 mm).

3 Dimensions and tolerances shall be determined, after galvanizing (where applicable), by the ball and socket gauges in figures 4, 5, 6, 7, and 8.

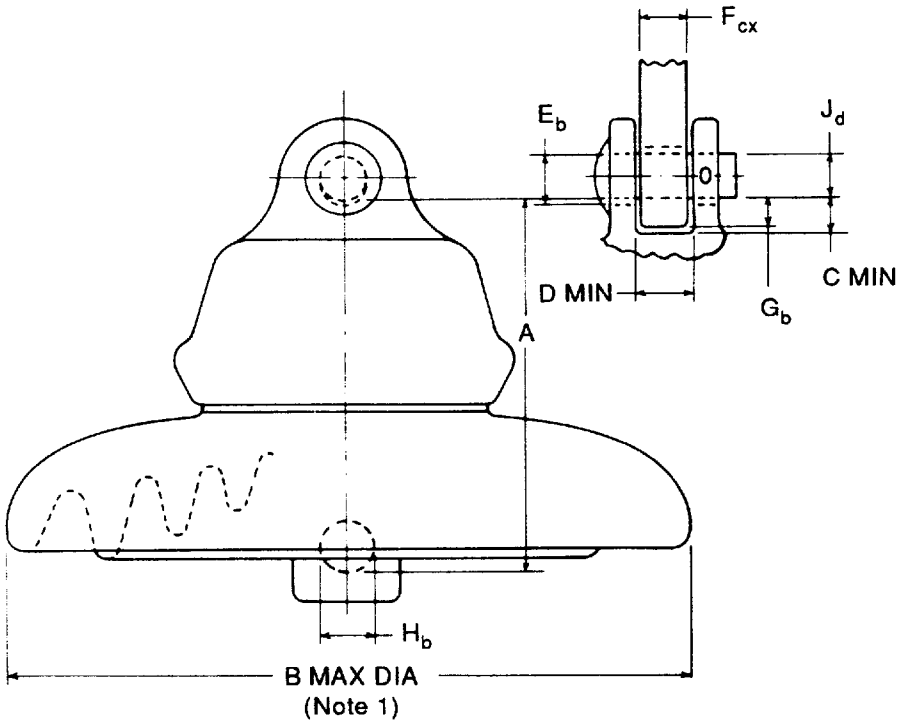
4 Connecting hardware parts are designated by Type according to applicable gauges as follows:

Type B defined by gauges in figures 4 and 5.

Type J defined by gauges in figures 5 and 6.

Type K defined by gauges in figures 7 and 8.

**Figure 2 – Ball-and-socket suspension insulators classes 52-3, 52-5, 52-8, and 52-11**




ALLOWABLE VARIATIONS: The lowercase letters appearing on the figure above stand for the following tolerances. A single letter indicates a plus or minus tolerance; for example, a = ±1/64 in. When two letters are used, the first is a plus tolerance, and the second a minus; for example, ax = 1/64 in., –0.

a = 1/64 in. c = 1/16 in.

b = 1/32 in. d = 1/8 in.

x = 0

NOTES

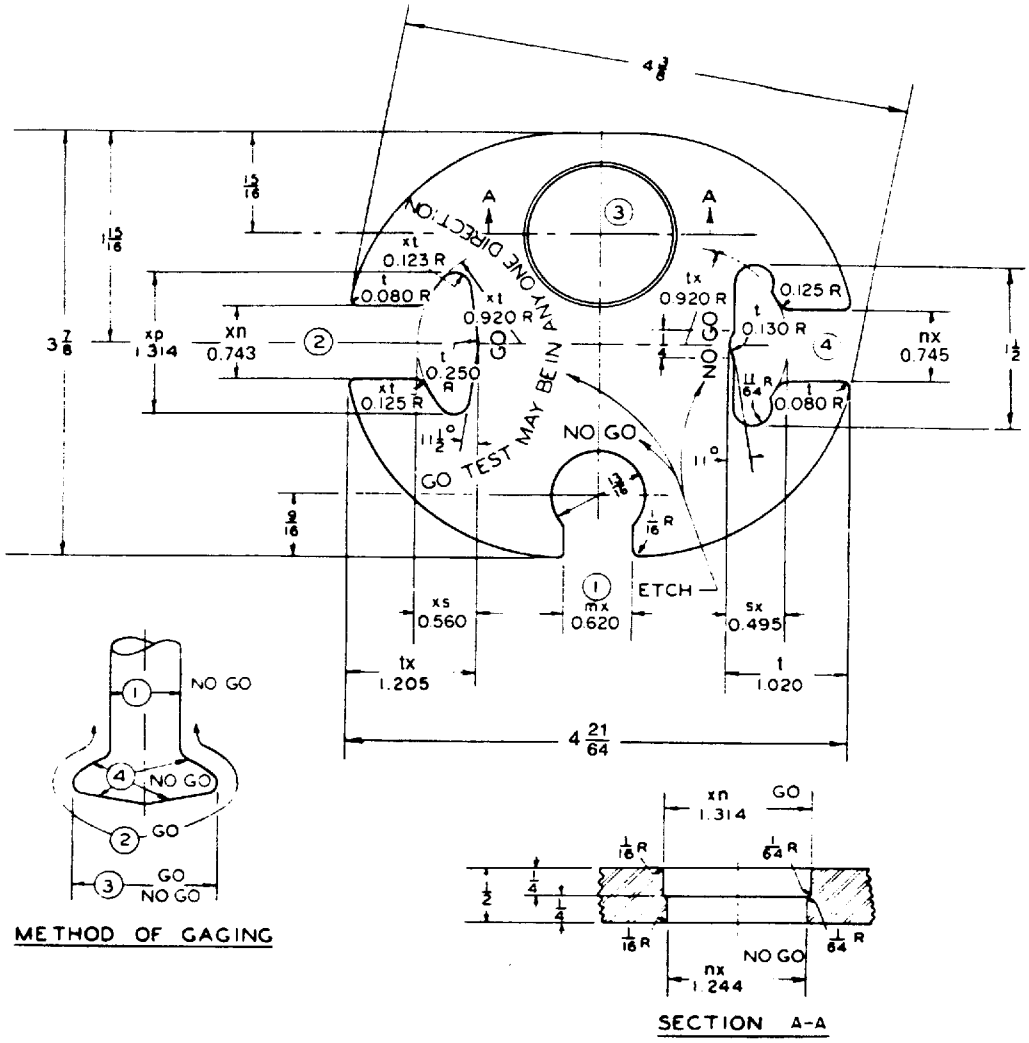
1 For specific diameter and tolerance, see manufacturer's drawings.

2 All dimensions are in inches; for metric equivalents, see table 1.

3 The connecting length of a string of six insulators selected at random shall be equal to six times the nominal spacing of the insulators ±3/4 in (±19.1 mm).

4 Tolerances apply after galvanizing, where applicable.

**Figure 3 – Clevis suspension insulators classes 52-4, 52-6, 52-10, and 52-12**




ALLOWABLE VARIATIONS: The letters appearing on the figure above stand for the following tolerances; for example, m = ±0.0002 in. When two letters are used, the first is a plus tolerance, and the second a minus; for example, mx = +0.0002 in., −0.0000.

| | |
|---|---|
| m = 0.0002 in. | s = 0.004 in. |
| n = 0.001 in. | t = 0.005 in. |
| p = 0.002 in. | x = 0.000 in. |

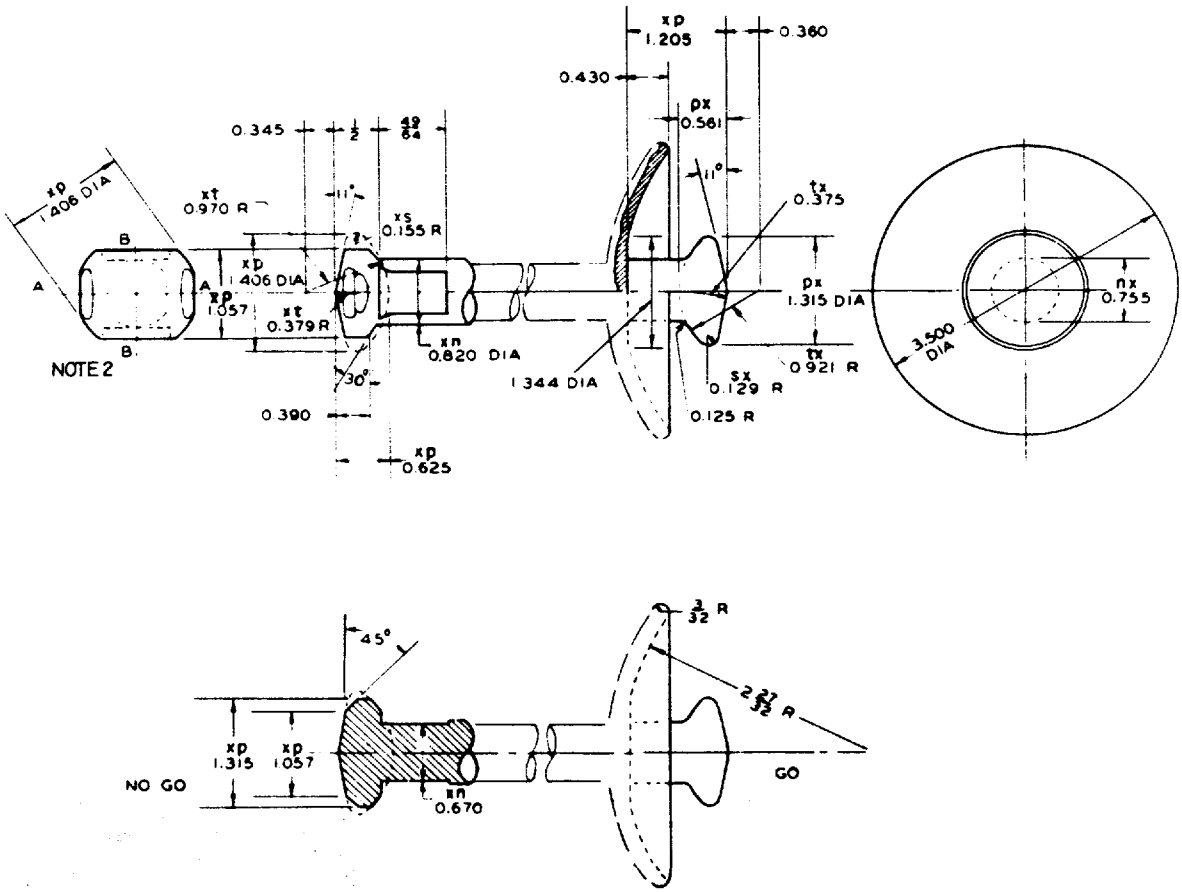
NOTES

1 All dimensions are in inches unless otherwise indicated. For determination of equivalent metric dimensions, see ANSI/IEEE 268.

2 "No-go" test shall be for all directions. "Go" test may be in any one direction.

3 For position (3), the pin shall not pass through the "no-go" gauge at any inclination.

**Figure 4 – Ball gauge for class 52-3 insulator**




ALLOWABLE VARIATIONS: The letters appearing on the figure above stand for the following tolerances; for example, m = ±0.0002 in. When two letters are used, the first is a plus tolerance, and the second a minus; for example, mx = +0.0002 in., −0.0000.

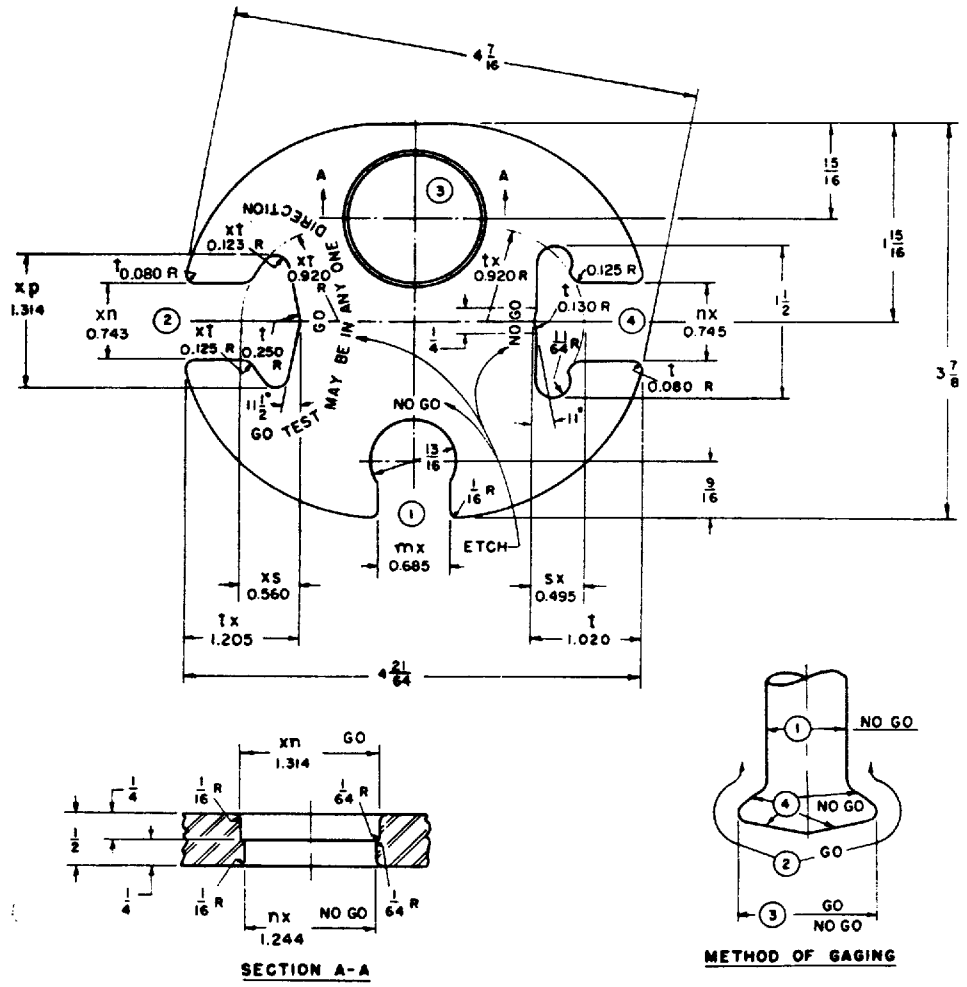
| | |
|---|---|
| m = 0.0002 in. | s = 0.004 in. |
| n = 0.001 in. | t = 0.005 in. |
| p = 0.002 in. | x = 0.000 in. |

NOTES

1 All dimensions are in inches unless otherwise indicated. For determination of equivalent metric dimensions, see ANSI/IEEE 268.

2 Check for "no-go" dimensions along axis A-A and B-B.

**Figure 5 – Socket gauge for class 52-3 and 52-5 insulator**




ALLOWABLE VARIATIONS: The letters appearing on the figure above stand for the following tolerances; for example, m = ±0.0002 in. When two letters are used, the first is a plus tolerance, and the second a minus; for example, mx = +0.0002 in., −0.0000.

| | |
|---|---|
| m = 0.0002 in. | s = 0.004 in. |
| n = 0.001 in. | t = 0.005 in. |
| p = 0.002 in. | x = 0.000 in. |

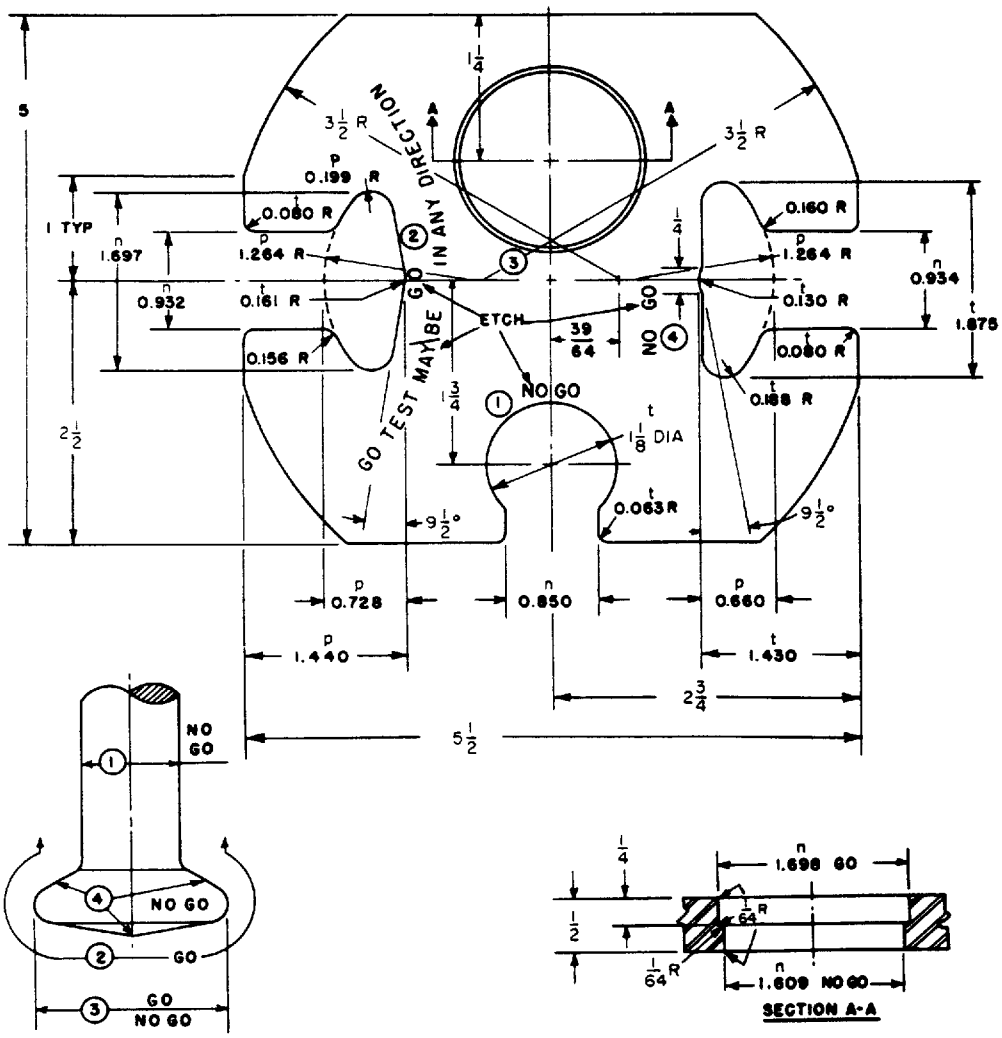
NOTES

1 All dimensions are in inches unless otherwise indicated. For determination of equivalent metric dimensions, see ANSI/IEEE 268.

2 "No-go" test shall be for all directions. "Go" test may be in any one direction.

3 For position (3), the pin shall not pass through the "no-go" gauge at any inclination.

**Figure 6 – Ball gauge for class 52-5 insulator**




ALLOWABLE VARIATIONS: The letters appearing on the figure above stand for the following tolerances; for example, m = ±0.0002 in. When two letters are used, the first is a plus tolerance, and the second a minus; for example, mx = +0.0002 in., −0.0000.

| | |
|---|---|
| m = 0.0002 in. | s = 0.004 in. |
| n = 0.001 in. | t = 0.005 in. |
| p = 0.002 in. | x = 0.000 in. |

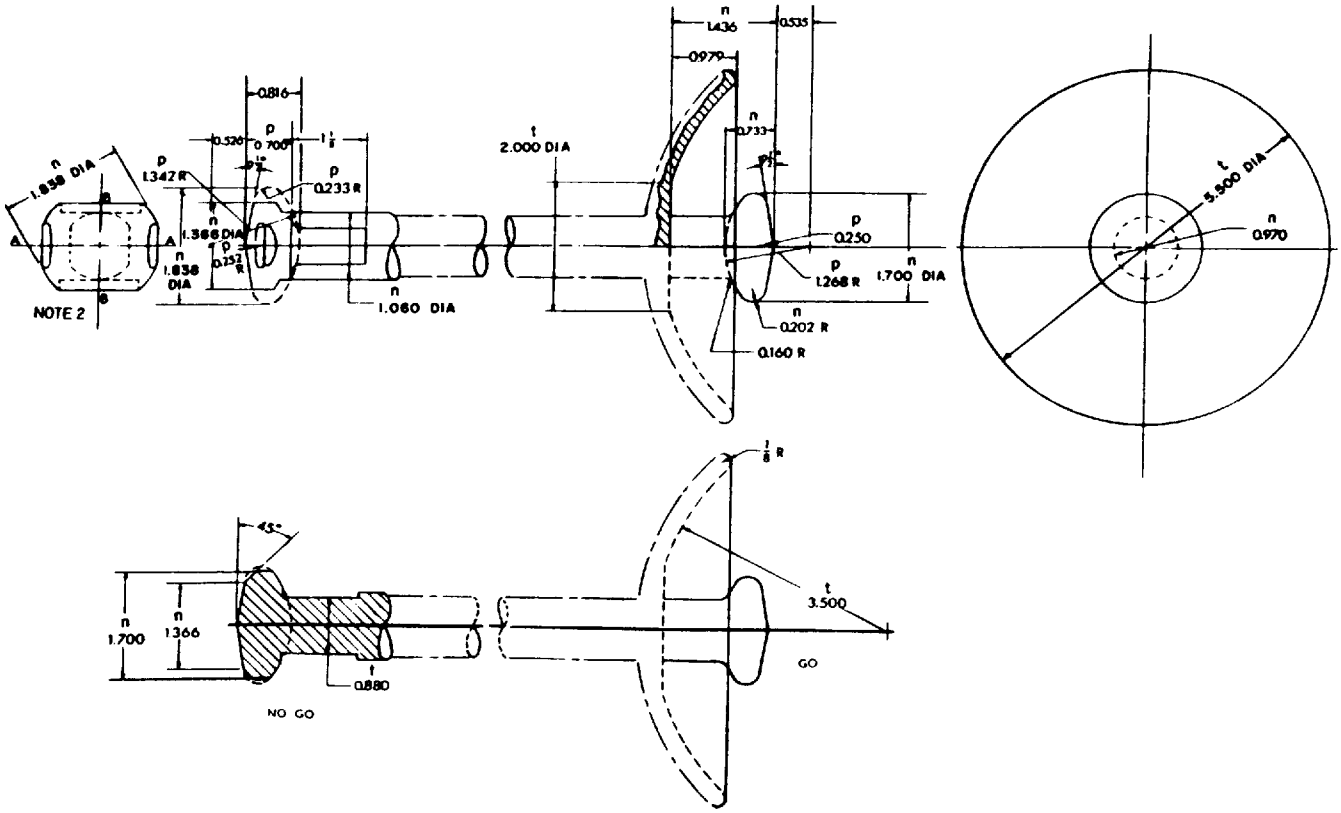
NOTES

1 All dimensions are in inches unless otherwise indicated. For determination of equivalent metric dimensions, see ANSI/IEEE 268.

2 "No-go" test shall be for all directions. "Go" test may be in any one direction.

3 For position (3), the pin shall not pass through the "no-go" gauge at any inclination.

**Figure 7 – Ball gauge for class 52-8 and 52-11 insulators**




ALLOWABLE VARIATIONS: The letters appearing on the figure above stand for the following tolerances. A single letter indicates a plus or minus tolerance; for example, m = ±0.0002 in. When two letters are used, the first is a plus tolerance, and the second a minus; for example, mx = +0.0002 in., −0.0000.

| | |
|---|---|
| m = 0.0002 in. | s = 0.004 in. |
| n = 0.001 in. | t = 0.005 in. |
| p = 0.002 in. | x = 0.000 in. |

NOTES

1 All dimensions are in inches unless otherwise indicated. For determination of equivalent metric dimensions, see ANSI/IEEE 268.

2 Check for "no-go" dimensions along axis A-A and axis B-B.

**Figure 8 – Socket gauge for class 52-8 and 52-11 insulators**

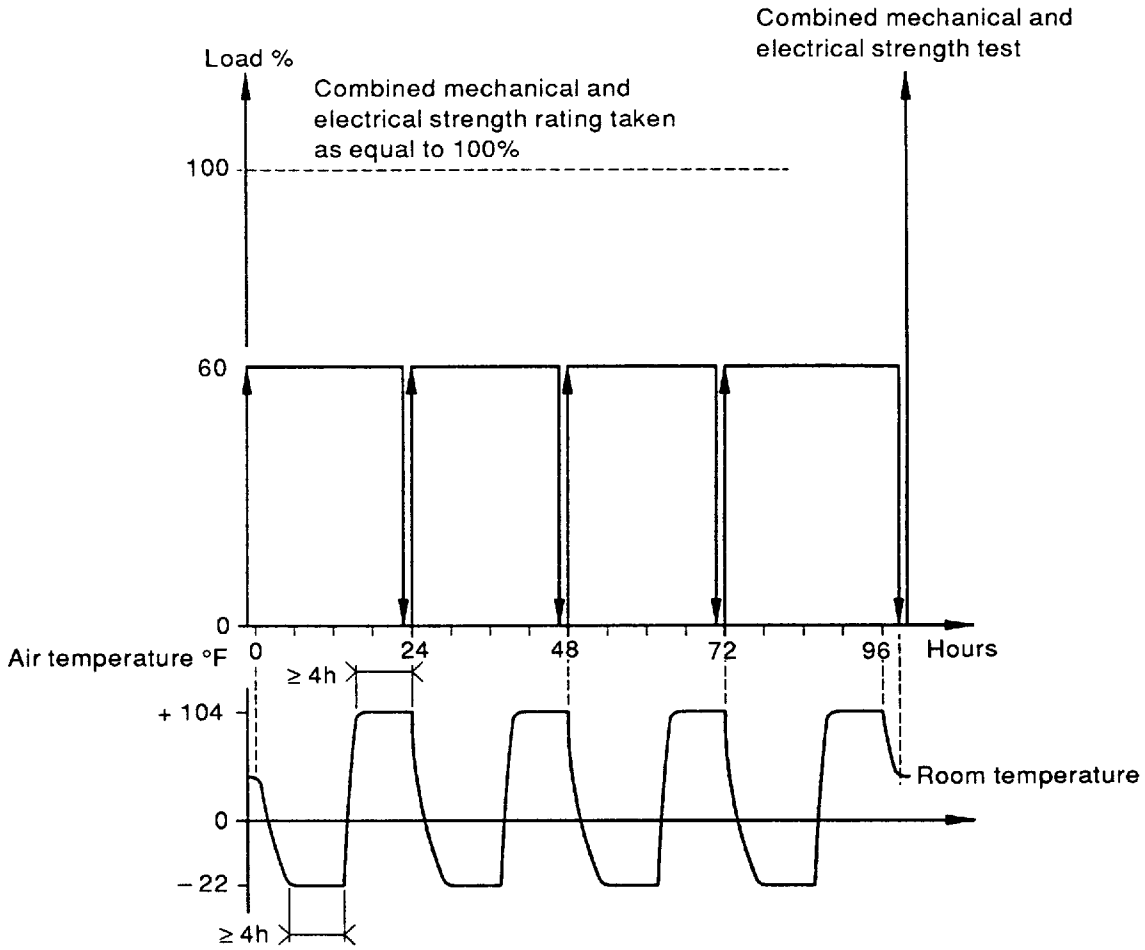



**Figure 9 – Schematic representation of thermal-mechanical performance test**

## Annex A
(informative)

## Packaging

Packaging of insulators should be such as to afford reasonable and proper protection to the insulators in shipping and handling.

Each box or container should be marked with the number of insulators contained therein, the catalog number, class number, or a description of the contents; and the manufacturer's name.

## Annex B
(informative)

## Bibliography

*ASTM Manual of Presentation of Data and Control Chart Analysis*, 6th edition 1990 (ASTM Manual Series; MNL7)[2)]