AMERICAN NATIONAL STANDARD

American National Standard

ANSI C29.12-1997

AMERICAN NATIONAL STANDARD

FOR INSULATORS-

COMPOSITES-

SUSPENSION TYPE

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
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Secretariat
National Electrical Manufacturers Association

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American National Standards Institute

American National Standard

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Foreword (This Foreword is not part of American National Standard C29.12-1997.)

This first edition of this standard was based on a NEMA proposed standards publication for composite suspension insulators used on overhead transmission lines. It was developed at the request of American National Standards Committee on Insulators for Electric Power Lines, ASC C-29.

This standard was processed and approved for submittal to ANSI by ASC C-29. Committee approval of the standard does not necessarily imply that all committee members voted for approval. At the time it approved this standard, the ASC C-29 Committee had the following members:

R. W. Harmon, Chairman
C. F. Merther, Secretary

Organization Represented	*Name of Representative*
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AMERICAN NATIONAL STANDARD **C29.12-1997**

for Insulators

Composites—
Suspension Type

1 Scope

This standard covers composite suspension insulators made of a fiberglass-reinforced resin rod core, polymer material weathersheds, and metal end fittings intended for use on overhead transmission lines for electric power systems, 70 kV and above. Mechanical and electrical performance levels specified herein are requirements for new insulators.

2 Definitions

See Section 3 of American National Standard for Composite Suspension Insulators for Overhead Transmission Lines—Tests, ANSI C29.11, and Section 2 of American National Standard Test Methods for Electrical Power Insulators, ANSI C29.1, for definition of terms.

3 General

3.1 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.

3.2 Manufacturer's drawings, if furnished, shall show the outline of the insulators, together with all pertinent dimensions, and mechanical, electrical, and leakage values. Any variations in these dimensions due to manufacturing tolerances shall be indicated.

4 Materials

4.1 Core

The core of the insulator shall consist of a fiberglass-reinforced resin rod. The rod shall be sound and free of defects that might adversely affect the insulator's electrical and mechanical properties.

4.2 Weathersheds

The weathersheds shall be made of polymer materials such as ethylene propylene or silicone elastomers. They may contain inorganic fillers and organic compounding agents.

4.3 Metal parts

Metal parts, except for cotter keys, shall be made of a good commercial grade of malleable iron, ductile iron, steel, or aluminum. All ferrous parts, other than stainless steel, shall be galvanized in accordance with specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware ASTM A153-82(latest revision). Cotter keys shall be made from cold-drawn bronze, brass, or austenitic stainless steel wire.

5 Dimensions and characteristics

5.1 Dimensions and characteristics of the insulators shall be in accordance with manufacturers drawings. General tolerances shall be in accordance with C29.11 clause 5. End fittings shall be in accordance with figure 1 or meet the ball and socket gauge requirements shown in figures 12, 13, 14, and 15 of ANSI C29.2. Requirements for a specific ANSI class shall be as shown in tables 1 or 2. The shapes of the weathersheds and spacing between them are not part of this standard.

5.2 Insulator end fittings of the Y-Clevis type (Fig. 1) shall be furnished with a bolt and nut, with a hump-type cotter key installed in the clevis bolt.

5.3 Grading for control of RIV and corona is required for composite insulators used at phase-to-phase operating voltages of 230 kV and above, and may also be necessary at lower voltages in extreme conditions.

5.4 All dimensions and other numerical values are given in customary English units except as otherwise stated.

6 Marking

Each insulator shall be clearly and indelibly marked with the name or trademark of the manufacturer, the year of manufacture, the specified mechanical load (S.M.L.), and the routine test load (R.T.L.). The routine test load shall be identified by the word "TEST".

7 Sampling, inspection and test

7.1 General

Prototype tests are required to verify the suitability of the materials and method of manufacture. These tests are described and specified in ANSI C29.11, Section 4.1 and 7. After successful completion of the prototype tests, insulators of specific design shall be subjected to tests described in this section. Tests described in 7.2 shall be required only on insulators of new design. Tests described in 7.3 shall be required on each lot of insulators Tests described in 7.4 shall be conducted on each insulator.

7.2 Design tests

Design tests for composite insulators are classified as electrical tests. The electrical design of composite insulators is defined by the following characteristics:

a. Dry arcing distance
b. Leakage distance
c. Weathershed inclination
d. Weathershed diameter
e. Weathershed spacing

The insulator test specimens will be mounted for these tests in accordance with 3.1 of ANSI C29.1, except that the upper surface of the energized electrode shall be 4-8 inches (100-200 mm) from the connection point of the lower end fitting.

7.2.1 Low-frequency dry flashover test

Three composite insulators shall be selected and tested in accordance with 4.2 of ANSI C29.1. Failure of the average dry flashover value to equal or exceed 95% of the rated dry flashover value, as given on the manufacturer's drawing, shall constitute failure to meet the requirements of this standard.

7.2.2 Low-frequency wet flashover test

Three composite insulator shall be selected and tested in accordance with 4.3 of ANSI C29.1. Failure of the average wet flashover value to equal or exceed 90% of the rated wet flashover value, as given on the manufacturer's drawing, shall constitute failure to meet the requirements of this standard.

7.2.3 Critical impulse flashover tests—positive and negative

Three composite insulator shall be selected for the critical impulse flashover test, positive, and one 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 to equal or exceed 92% of the rated critical impulse flashover value, as given on the manufacturer's drawing, shall constitute failure to meet the requirements of this standard.

7.2.4 Radio-influence voltage

Three composite insulators shall be selected and tested in accordance with 4.9 of ANSI C29.1. For this test, the insulator will include corona rings or other corona suppression devices as shown on the manufacturer's drawing for the insulator. The maximum radio influence voltage (RIV) allowed is 100 microvolts when the insulator is energized at 115% of nominal line-to-ground voltage as given on the manufacturer's drawing.

7.3 Quality conformance tests

Samples for quality conformance shall be selected at random from each lot except that samples for mechanical load tests shall only be representative and may be of reduced length. A representative sample for mechanical load tests is one in which:

a. The diameter of the test insulator rod core is identical to that of the insulators in each lot.

b. The test insulator rod core is identical in material and manufacturing process to that of the insulators in each lot.

c. The insulator end fittings are identical in material, design, manufacturing process and assembly process to those of the insulators in each lot.

d. The test insulator section length is 20 inches (508 mm) or longer.

7.3.1 Dimensional tests

Three insulators shall be selected at random from the lot and their dimensions checked against the dimensions on the manufacturer's drawing. Clause 5 of ANSI C29.11 shall apply to all dimensions without tolerances specified by the manufacturer. Failure of more than one of these insulators to conform within tolerance to the dimensions on this drawing shall constitute failure to meet the requirements of this standard.

7.3.2 Galvanizing test

Three 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, six 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.

7.3.3 Specified mechanical load test

Three insulators shall be selected in accordance with 7.3 above and tested in accordance with 9.4 of ANSI C29.11. The test is passed if no failure occurs.

7.4 Routine tests

7.4.1 Tension-proof test

Each assembled insulator shall be subjected to a tension-proof test in accordance with 10.1 of ANSI C29.11. The load to be applied is the Routine Test Load which is equal to or greater than 50% of SML. rating given on the manufacturers drawing. All insulators that fail do not meet the requirements of this standard.

7.4.2 Visual examination

Each assembled insulator shall be subjected to a visual examination in accordance with 10.2 of ANSI C29.11. All insulators not in conformance with this section do not meet the requirements of this standard.

8 References to the text

8.1 Reference to American National Standards

When the following American National Standards referred to in this document are superseded by a revision approved by the American National Institute, Inc., the revision shall apply:

American National Standard Test Methods for Electrical Power Insulators, ANSI C29.1(latest revision).

American National Standard for Composite Suspension Insulators for Overhead Transmission Lines - Tests, ANSI C29.11 (latest revision).

8.2 Reference to other than American National Standards.

Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware, ASTM A153-82 (latest revision).

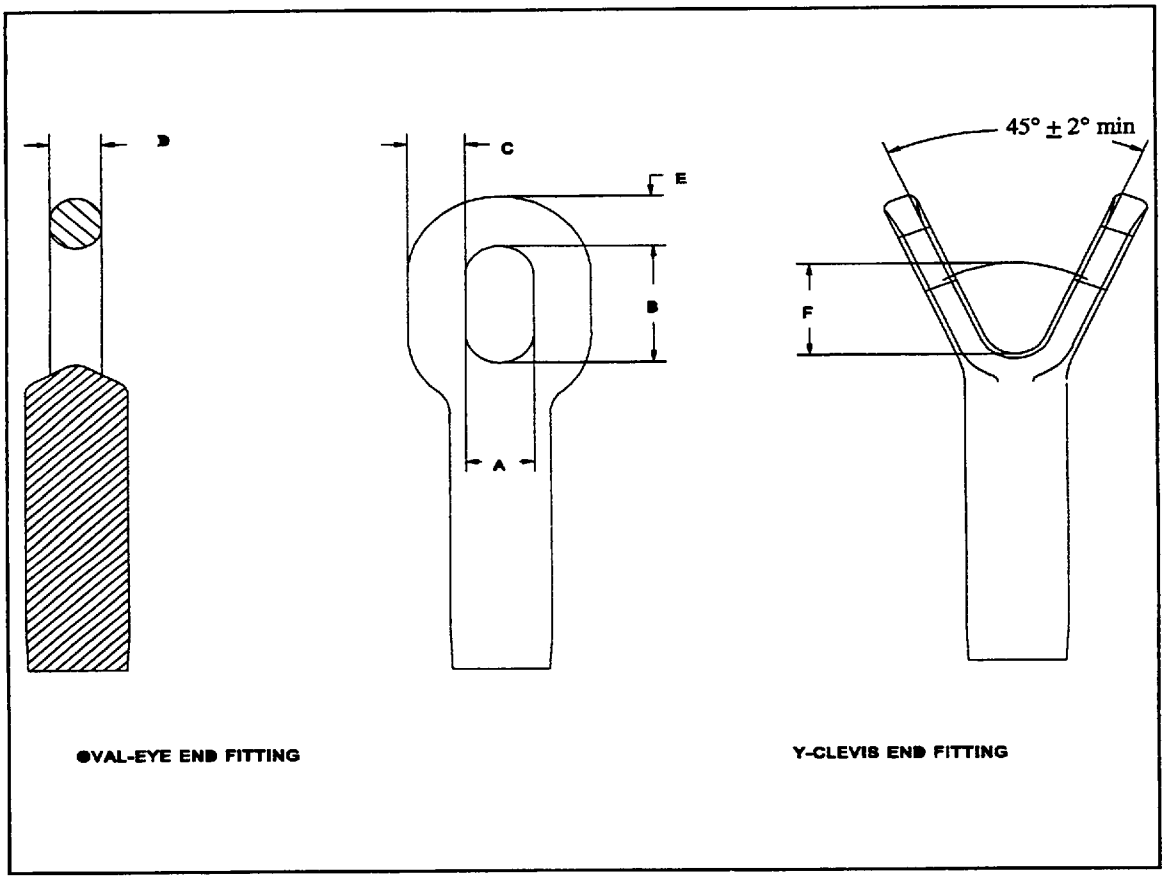
ANNEX A
(Informational)

(This appendix is not part of American National Standard C29.12-1997, but is included for information only.)

A.1 Packaging

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

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



SML RATINGS	A min	B min	C max	D max	E max	F min
20,000 LBS 25,000 LBS	0.94	1.88	.75	.75	.75	.94
36,000 LBS 40,000 LBS	0.98	1.94	.88	.88	1.03	1.38

NOTE: ALL DIMENSIONS ARE IN INCHES.

ANSI BALL AND SOCKET (NOT SHOWN) SHALL CONFORM TO DIMENSIONS SPECIFIED IN C29.2.

Table 1 – 20,000 or 25,000 lbs. SML, oval eye-ball end fitting combination

ANSI class	Section Length Nominal Range Inches [mm]	Electrical Values			
		Low Frequency Flashover		Critical Impulse Flashover	
		Dry (kv)	Wet (kv)	Positive (kv)	Negative (kv)
60-1	46.0 - 50.0 [1168 - 1270]	365	310	610	585
60-2	51.0 - 54.5 [1295 - 1384]	410	350	675	670
60-3	57.0 - 60.5 [1448 - 1537]	470	415	780	760
60-4	62.5 - 65.5 [1587 - 1664]	485	455	860	845
60-5	68.0 - 71.5 [1727 - 1816]	560	490	925	930
60-6	73.0 - 77.5 [1854 - 1968]	620	545	1025	1015
60-7	79.0 - 83.0 [2007 - 2108]	670	580	1105	1105
60-8	84.0 - 89.0 [2134 - 2235]	720	620	1185	1190
60-9	93.0 - 99.0 [2362 - 2515]	810	690	1345	1360
60-10	104.0 - 108.0 [2642 - 2743]	900	755	1490	1530
60-11	109.0 - 115.0 [2769 - 2896]	925	795	1575	1600
60-12	115.0 - 120.2 [2921 - 3053]	980	830	1665	1700
60-13	126.0 - 137.5 [3200 - 3492]	1060	890	1825	1870
60-14	175.0 - 184.2 [4445 - 4679]	1345	1290	2530	2630

NOTES:

1 Electrical values given are averages without corona rings (see Section 5.3).

2 The section length and nominal range shown correlate to a string of 5 3/4" porcelain/glass (ceramic) suspension insulators of Class 52-3 or 52-5 (ANSI C29.2) of the same length with respect to low frequency (60Hz wet flashover) electrical performance. The critical impulse flashover voltages shown are lower than those for an equivalent length of ceramic insulators.

3 Due to insufficient information regarding the leakage distance required for composite insulators, most users have specified leakage distance of composite insulators to be greater than or equal to existing ceramic insulator strings.

4 Nominal section length applies only to oval eye-ball end fitting combinations. Other end fitting combinations may result in section lengths outside of the nominal range.

Table 2 – 36,000 lbs. or 40,000 lbs. SML, oval eye-ball end fitting combination

ANSI class	Section Length Nominal Range Inches [mm]	Electrical Values			
		Low Frequency Flashover		Critical Impulse Flashover	
		Dry (kv)	Wet (kv)	Positive (kv)	Negative (kv)
70-1	77.0 - 81.0 [1956 - 2057]	625	495	1025	1015
70-2	87.0 - 92.0 [2210 - 2311]	720	620	1185	1190
70-3	97.0 - 102.0 [2464 - 2591]	800	680	1315	1360
70-4	106.0 - 112.0 [2794 - 2845]	885	745	1460	1530
70-5	121.0 - 124.0 [3073 - 3124]	985	830	1665	1700
70-6	130.0 - 137.0 [3327 - 3454]	1045	895	1825	1870
70-8	141.0 - 149.0 [3581 - 3785]	1135	955	1985	2040
70-9	151.0 - 159.0 [3835 - 4039]	1180	1010	2125	2175
70-10	165.0 - 175.0 [4191 - 4445]	1275	1090	2365	2425
70-11	182.0 - 187.0 [4622 - 4750]	1330	1175	2450	2550

NOTES:

1 Electrical values given are averages without corona rings (see Section 5.3).

2 The section length and nominal range shown correlate to a string of 5 3/4" porcelain/glass (ceramic) suspension insulators of Class 52-8 (ANSI C29.2) of the same length with respect to low frequency (60Hz wet flashover) electrical performance. The critical impulse flashover voltages shown are lower than those for an equivalent length of ceramic insulators.

3 Due to insufficient information regarding the leakage distance required for composite insulators, most users have specified leakage distance of composite insulators to be greater than or equal to existing ceramic insulator strings.

4 Nominal section length applies only to oval eye-ball end fitting combinations. Other end fitting combinations may result in section lengths outside of the nominal range.