American National Standard

for wet-process porcelain insulators –

apparatus, cap and pin type

ANSI C29.8-1985

american national standards institute, inc
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American National Standard

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American National Standard for Wet-Process Porcelain Insulators – Apparatus, Cap and Pin Type

Secretariat

National Electrical Manufacturers Association

Approved December 17, 1984

American National Standards Institute, Inc

Foreword

(This Foreword is not part of American National Standard C29.8-1985.)

The first edition of this standard was essentially based on the EEI-NEMA Standard for Wet-Process Porcelain Insulators (Apparatus, Cap and Pin Type), EEI TDJ-58, NEMA 146-1956. (EEI is the Edison Electric Institute; NEMA is the National Electrical Manufacturers Association.) Subsequent revisions were developed by the American National Standards Committee on Insulators for Electric Power Lines, C29.

This standard has been revised four times by the C29 Committee. The principal differences between this revision and the 1980 edition include:

(1) moving packing recommendations to the Appendix
(2) changing the description of the test for ferrous metal parts galvanizing
(3) replacing the figures with a table of dimensions and characteristics
(4) requiring electrical tests to be made on completely assembled insulators

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 this standard does not necessarily imply that all committee members voted for its approval. At the time it approved this standard, the C29 Committee had the following members:

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American National Standard for Wet-Process Porcelain Insulators – Apparatus, Cap and Pin Type

1. Scope

This standard covers outdoor high-voltage cap-and-pin-type apparatus insulators made of wet-process porcelain and used in the transmission and distribution of electrical energy.

2. Referenced Standards

2.1 **American National Standards.** This standard is intended for use in conjunction with the following American National Standards. When these standards are superseded by a revision approved by the American National Standards Institute, Inc, the revision shall apply.

ANSI C29.1-1982, Test Methods for Electrical Power Insulators

ANSI Z55.1-1967, Gray Finishes for Industrial Apparatus and Equipment

2.2 **Other Standard.** This standard is intended for use in conjunction with Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware, ASTM A153-82.[1]

3. Definitions

3.1 See Section 2 of ANSI C29.1-1982 for definitions of terms used in this standard.

3.2 In this standard, the word "insulator" shall refer to a unit or to a stack of two or more units.

3.3 The technical reference numbers appearing in Table 1 are a widely used and recognized identification series for apparatus insulator units or stacks.

[1] Available from ASTM, 1916 Race Street, Philadelphia, PA 19103.

4. General

4.1 Insulators shall conform in all respects to the requirements 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 The insulators shall be made of good commercial-grade wet-process porcelain.

5.2 The entire porcelain surface of the insulators that will be exposed after assembly shall be glazed. The entire porcelain surface shall be relatively free from imperfections. Color is not a part of this standard. If gray is required, it shall be in accordance with ANSI Z55.1-1967 and shall conform to Munsell notation 5BG 7.0/0.4 with the following tolerances:

(1) Hue: ±12 (3G to 7B)
(2) Value: ±0.5
(3) Chroma: -0.2 to +0.6

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

6. Dimensions and Characteristics

6.1 Dimensions and characteristics shall be in accordance with Table 1.

6.2 Shell diameters given for the insulators listed in Table 1 shall not be exceeded by more than 3 percent to ensure physical clearances in assembled apparatus.

6.3 Minimum dimensions are limited by other specified characteristics.

6.4 The length tolerance for any individual unit shall be ±1/32 inch.

7. Marking

Each insulator unit shall bear symbols identifying the manufacturer and giving the year of manufacture. The marking 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 designs. Tests described in 8.3 shall be required on each lot of insulators. Tests described in 8.4 shall be made on each insulator. Electrical tests described in 8.2 shall be conducted on completely assembled insulators.

8.2 Design Tests

8.2.1 Low-Frequency Wet Withstand. Three insulators shall be selected at random and tested in accordance with 4.5 of ANSI C29.1-1982. Failure of any insulator to meet the rated wet-withstand value given in Table 1 shall constitute failure to meet the requirements of this standard.

8.2.2 Critical-Impulse Flashover, Positive. Three insulators shall be selected at random for the critical-impulse flashover test, positive, and tested in accordance with 4.7 of ANSI C29.1-1982. 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 given in Table 1 shall constitute failure to meet the requirements of this standard.

8.2.3 Impulse Withstand. Three insulators shall be selected at random and tested in accordance with 4.8 of ANSI C29.1-1982. Failure of any insulator to meet the rated impulse-withstand value given in Table 1 shall constitute failure to meet the requirements of this standard.

8.2.4 Radio-Influence Voltage. Five insulators shall be selected at random and tested in accordance with 4.9 of ANSI C29.1-1982. If one or more insulators fail to meet the requirements given in Table 1, 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.

8.2.5 Compression Strength. Three insulators shall be selected at random and tested in accordance with 5.1.4.4 of ANSI C29.1-1982. Failure of the average strength of the three insulators to meet the strength requirement given in Table 1 or failure of any one insulator to equal 85 percent of that strength requirement shall constitute failure to meet the requirements of this standard.

8.2.6 Thermal Shock. Three insulators shall be selected at random and tested for ten complete cycles in accordance with 5.5 of ANSI C29.1-1982. The temperature of the hot-water bath shall be approximately 150°F (66°C), and the temperature of the cold-water bath shall be approximately 39°F (4°C). If one insulator fails, three additional insulators shall be selected at random and tested. Failure of more than one insulator from the first sample or from the first and second samples combined shall constitute failure to meet the requirements of this standard.

8.3 Quality Conformance Tests[2]

8.3.1 Visual and Dimensional Tests. Conformity with 5.2 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 C29.1-1982. 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 C29.1-1982. Five to ten measurements shall be uniformly and randomly distrib-

[2] Substantial test experience indicates that a total of 1/2% of the number of insulators in the lot is sufficient to establish characteristics demonstrable by destructive tests.

uted over the entire surface. The average thickness value for each individual specimen and the average of the entire sample shall equal or exceed the following:

Hardware	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 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 Cantilever Strength. Three insulators shall be selected at random and tested in accordance with 5.1.4.1 of ANSI C29.1-1982. Failure of the average strength of the three insulators to meet the strength requirement given in Table 1 or failure of any one insulator to equal 85 percent of that strength requirement shall constitute failure of the lot to meet the requirements of this standard.

8.3.5 Torsional Strength. Three insulators shall be selected at random and tested in accordance with 5.1.4.2 of ANSI C29.1-1982. Failure of the average strength of the three insulators to meet the strength requirement given in Table 1 or failure of any one insulator to equal 85 percent of that strength requirement shall constitute failure of the lot to meet the requirements of this standard.

8.3.6 Tensile Strength. Three insulators shall be selected at random and tested in accordance with 5.1.4.3 of ANSI C29.1-1982. Failure of the average strength of the three insulators to meet the strength requirements given in Table 1 or failure of any one insulator to equal 85 percent of that strength requirement shall constitute failure of the lot to meet the requirements of this standard.

8.3.7 Puncture. Three assembled insulators shall be selected at random and tested in accordance with 4.11 of ANSI C29.1-1982. If the average puncture voltage of the three insulators fails to meet the requirement given in Table 1 or if the percent average variation exceeds 15, this shall constitute failure of the lot to meet the requirements of this standard.

8.4 Routine Tests

8.4.1 Tension Proof. Each insulator unit shall be tested in tension in accordance with 7.2.2 of ANSI C29.1-1982. The load applied shall be that shown in Table 1. All units that fail do not meet the requirements of this standard.

8.4.2 Flashover. Each insulator unit shall be subjected to a routine flashover test in accordance with 7.1 of ANSI C29.1-1982. All units that puncture fail to meet the requirements of this standard.

Appendix

(This Appendix is not part of American National Standard C29.8-1985, but is included for information only.)

Packing

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 pieces contained therein; the catalog number, or class number, or description of the contents; and the manufacturer's name.

Table 1
Dimensions and Characteristics of Cap-and-Pin-Type Apparatus Insulators

Technical Reference Number		Number of Units per Stack	Height per Stack (in)	Diameter (in)	Maximum Cap Diameter (in)	Bolt Circle Diameter[1] (in)	Cantilever Strength (lb)		Tensile Strength (lb)	Torsional Strength (in·lb)	Compression Strength (lb)	Tension Proof (lb)	Radio-Influence-Voltage Data		Low-Frequency Puncture (kV)	Leakage Distance[2] (in)	Low-Frequency Wet Withstand[3] (kV)	Impulse Withstand[3] (kV)	Critical Impulse Flashover, Positive (kV)	Technical Reference Number	
													Low-Frequency Test Voltage (kV)	Maximum RIV (μV at 1000 kHz)							
Stack	Unit						Upright	Underhung												Stack	Unit
–	1	1	7-1/2	7	5	3	2 000	1 000	5 000	6 000	10 000	1 250	5	50	80	7-1/2	30	95	105	–	1
–	4	1	10	8	5	3	2 000	1 000	5 000	7 000	10 000	1 250	10	50	115	12	45	110	125	–	4
–	7	1	12	10-1/2	6	3	2 000	1 000	5 000	8 000	10 000	1 250	15	100	145	20	60	150	170	–	7
–	10	1	15	13	6	3	2 000	1 000	7 000	10 000	15 000	1 750	22	100	195	28	80	200	225	–	10
–	13	1	18	14	7-5/8	3	2 000	1 000	8 000	12 000	15 000	2 000	30	200	225	36	100	250	280	–	13
16	147	2	29	14	8	3	1 500	1 000	12 000	15 000	25 000	–	44	200	–	52	145	350	390	16	147
–	41	1	8	9	6-1/2	5	4 000	3 000	10 000	12 000	20 000	2 000	5	50	90	8	30	95	105	–	41
–	44	1	10	10	6-3/4	5	4 000	3 000	10 000	14 000	20 000	2 000	10	50	115	14	45	110	125	–	44
–	46	1	12	12	8	5	4 000	3 000	10 000	16 000	20 000	2 000	15	100	145	18	60	150	170	–	46
–	49	1	15	14	8-1/4	5	4 000	3 000	14 000	20 000	30 000	2 000	22	100	195	28	80	200	225	–	49
56	140	2	29	17	9-3/4	5	3 000	2 350	20 000	40 000	60 000	–	44	200	–	66	160	350	410	56	140
19	140	3	43-1/2	17	9-3/4	5	1 700	1 470	20 000	40 000	60 000	–	73	200	–	99	230	550	610	19	140
25	140	4	58	17	9-3/4	5	1 200	1 070	20 000	40 000	60 000	–	103	500	–	132	315	750	810	25	140
123	141	4	58	18	10-7/8	5	2 000	1 750	25 000	90 000	75 000	–	103	500	–	132	315	750	810	123	141
126	140	5	72-1/2	17	9-3/4	5	910	840	20 000	40 000	60 000	–	125	500	–	165	385	900	1 010	126	140
27	141	5	72-1/2	18	10-7/8	5	1 450	1 350	25 000	90 000	75 000	–	125	500	–	165	385	900	1 010	27	141
128	140	6	87	17	9-3/4	5	750	700	20 000	40 000	60 000	–	146	500	–	198	455	1 050	1 210	128	140
28	141	6	87	18	10-7/8	5	1 170	1 100	25 000	90 000	75 000	–	146	500	–	198	455	1 050	1 210	28	141
129	142	6	87	18	10-7/8	7	1 170	1 100	25 000	90 000	75 000	–	146	500	–	198	455	1 050	1 210	129	142
133	142	7	101-1/2	18	10-7/8	7	1 000	950	25 000	90 000	75 000	–	180	1 000	–	231	525	1 300	1 410	133	142
135	142	8	116	18	10-7/8	7	900	860	25 000	90 000	75 000	–	210	1 000	–	264	590	1 470	1 610	135	142
–	147	1	14-1/2	14	8	3	3 000	2 000	12 000	15 000	25 000	2 000	22	100	195	26	70	190	210	–	147
–	140	1	14-1/2	17	9-3/4	5	7 000	4 000	20 000	40 000	60 000	2 000	22	100	215	33	75	210	235	–	140
–	141	1	14-1/2	18	10-7/8	5	10 000	6 000	25 000	90 000	75 000	2 000	22	100	215	33	75	210	235	–	141
–	142	1	14-1/2	18	10-7/8	7	10 000	6 000	25 000	90 000	75 000	2 000	22	100	215	33	75	210	235	–	142
–	191	1	14-1/2	18	10-7/8	7	20 000	12 000	40 000	120 000	100 000	2 000	22	100	215	33	75	210	235	–	191
196	191	6	87	18	10-7/8	7	2 300	2 300	40 000	120 000	100 000	–	146	500	–	198	455	1 050	1 210	196	191
197	191	7	101-1/2	18	10-7/8	7	2 000	2 000	40 000	120 000	100 000	–	180	1 000	–	231	525	1 300	1 410	197	191
198	191	8	116	18	10-7/8	7	1 750	1 750	40 000	120 000	100 000	–	210	1 000	–	264	590	1 470	1 610	198	191
–	139	1	14-1/2	17	9-3/4	5	10 000	6 000	25 000	90 000	75 000	2 000	22	100	215	33	75	210	235	–	139
174	139	4	58	17	9-3/4	5	2 000	1 750	25 000	90 000	75 000	–	103	500	–	132	315	750	810	174	139
175	139	5	72-1/2	17	9-3/4	5	1 450	1 350	25 000	90 000	75 000	–	125	500	–	165	385	900	1 010	175	139
176	139	6	87	17	9-3/4	5	1 170	1 100	25 000	90 000	75 000	–	146	500	–	198	455	1 050	1 210	176	139
–	164	1	14-1/2	14	7-5/8	3	4 000	3 500	12 000	30 000	60 000	2 000	22	100	225	33	75	210	235	–	164
166	164	2	29	14	7-5/8	3	2 000	2 000	12 000	30 000	60 000	–	44	200	–	66	160	350	410	166	164
167	164	3	43-1/2	14	7-5/8	3	1 000	1 000	12 000	30 000	60 000	–	73	200	–	99	230	550	610	167	164
168	164	4	58	14	7-5/8	3	1 000	1 000	12 000	30 000	60 000	–	103	500	–	132	315	750	810	168	164
–	165	1	18	14	7-5/8	3	3 000	2 000	12 000	30 000	60 000	2 000	30	200	225	36	100	250	280	–	165
169	165	2	36	14	7-5/8	3	1 000	1 000	12 000	30 000	60 000	–	73	200	–	72	200	450	470	169	165
170	165	3	54	14	7-5/8	3	1 000	1 000	12 000	30 000	60 000	–	88	200	–	108	275	650	710	170	165

[1] The following bolt circles are standard. When tapped, the tapping shall be:
3-inch bolt circle – 4 tapped holes 1/2-13 unified form special, pitch diameter 0.4715-0.4650, length of engagement 0.50 (tap after hot dip galvanizing)
5-inch bolt circle – 4 tapped holes 5/8-11 unified form special, pitch diameter 0.5882-0.5810, length of engagement 0.625 (tap after hot dip galvanizing)
7-inch bolt circle – 4 tapped holes 3/4-10 unified form special, pitch diameter 0.7077-0.7000, length of engagement 0.75 (tap after hot dip galvanizing)
10-inch bolt circle – 8 tapped holes 5/8-11 unified form special, pitch diameter 0.5882-0.5810, length of engagement 0.625 (tap after hot dip galvanizing)

[2] If high resistance coatings are applied to the insulators, such coatings shall be considered effective leakage surfaces, and the distance over them shall be included in the leakage distance.

[3] Withstand ratings for stacks containing Technical Reference Numbers 139, 140, 141, 142, 164, 165, and 191 are predicated on the use of a subbase 3-1/2 inches high, or its equivalent.

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