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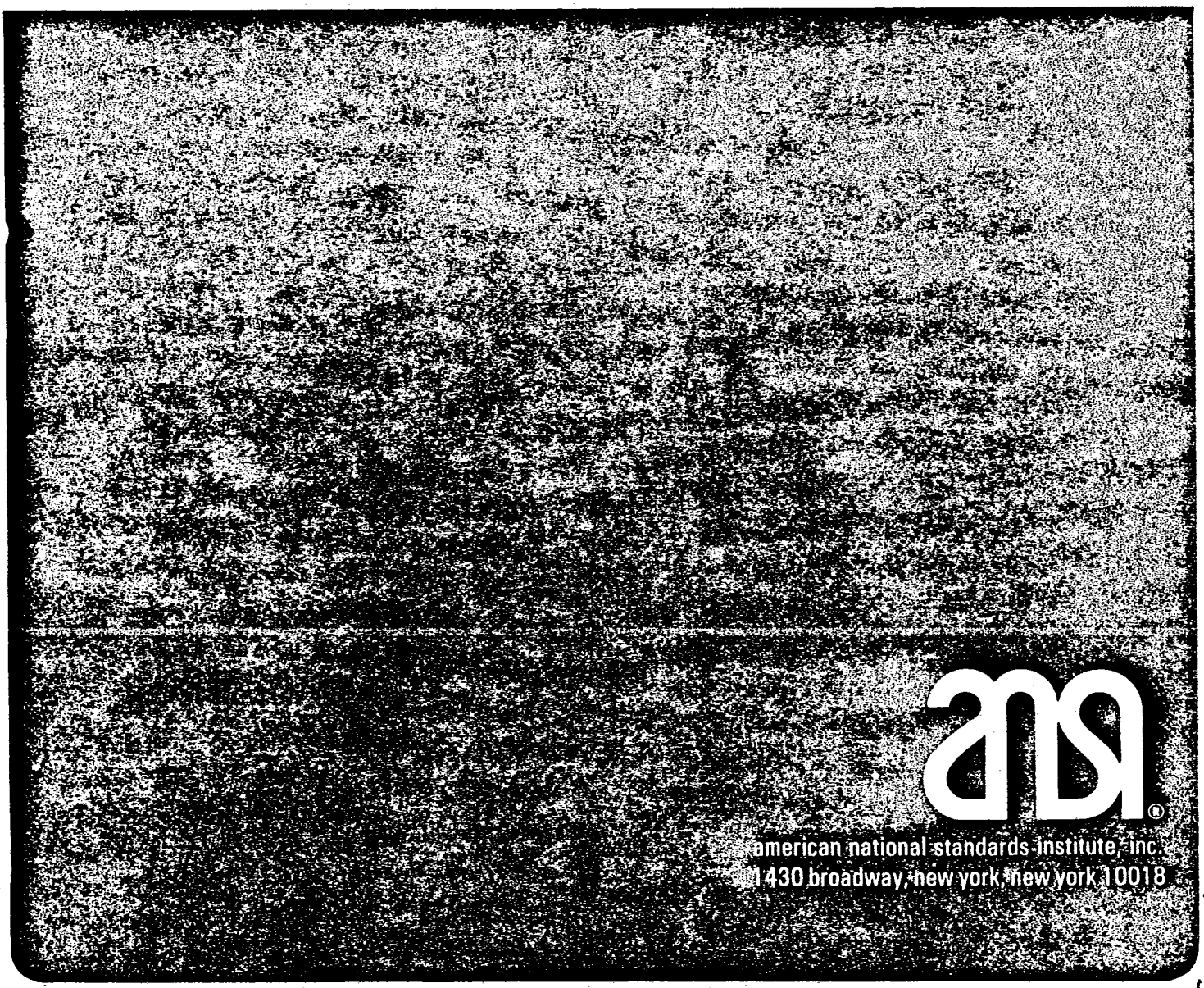
specifications for power fuses and fuse disconnecting switches



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1430 broadway, new york, new york 10018

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C37.46-1981
Revision of
ANSI C37.46-1969

American National Standard Specifications for Power Fuses and Fuse Disconnecting Switches

Secretariat

Institute of Electrical and Electronics Engineers
National Electrical Manufacturers Association

Approved May 22, 1980

American National Standards Institute, Inc

American National Standard

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Foreword

(This Foreword is not a part of American National Standard Specifications for Power Fuses and Fuse Disconnecting Switches, ANSI C37.46-1981.)

This standard is a revision of American National Standard Specifications for Power Fuses and Fuse Disconnecting Switches, ANSI C37.46-1969, to bring it up to date and in line with present requirements for high-voltage fuses and switches.

This standard was prepared by the C37 Subcommittee on High-Voltage Fuses with cooperation from the IEEE Subcommittee on High-Voltage Fuses and from NEMA. Liaison was maintained with EEI and IEC during the revision process in order to incorporate the latest thinking up to the time of publication.

This publication is one of a series of complementary American National Standards covering various types of high-voltage fuses and switches, so arranged that certain of the standards apply to all devices, while each of the other standards provides additional specifications for a particular device. For any device, ANSI/IEEE C37.40-1981, ANSI/IEEE C37.41-1981, plus the additional standard covering that device constitute a complete standard for the device. In addition, ANSI C37.48-1969 is an application, operation, and maintenance guide for all the devices.

The following American National Standards make up this series:

American National Standard Service Conditions and Definitions for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories, ANSI/IEEE C37.40-1981

American National Standard Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories, ANSI/IEEE C37.41-1981

American National Standard Specifications for Distribution Cutouts and Fuse Links, ANSI C37.42-1981 [This revision includes pertinent data formerly contained in ANSI C37.43. The C37.43 standard is dropped as redundant.]

American National Standard Specifications for Distribution Oil Cutouts and Fuse Links, ANSI C37.44-1981

American National Standard Specifications for Distribution Enclosed Single-Pole Air Switches, ANSI C37.45-1981

American National Standard Specifications for Power Fuses and Fuse Disconnecting Switches, ANSI C37.46-1981

American National Standard Specifications for Distribution Fuse Disconnecting Switches, Fuse Supports, and Current Limiting Fuses, ANSI C37.47-1981

American National Standard Guide for Application, Operation, and Maintenance of Distribution Cutouts and Fuse Links, Secondary Fuses, Distribution Enclosed Single-Pole Air Switches, Power Fuses, Fuse Disconnecting Switches, and Accessories, ANSI C37.48-1969

Suggestions for improvement of this standard will be welcome. They should be sent to the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

This standard was processed and approved for submittal to ANSI by American National Standards Committee on Power Switchgear, C37. Committee approval of the standard does not

necessarily imply that all the committee members voted for its approval. At the time it approved this standard, the C37 Committee had the following members:

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The NEMA High-Voltage Fuse Technical Committee had the following members:

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Contents

American National Standard Specifications for Power Fuses and Fuse Disconnecting Switches

1. Scope

This standard applies to high-voltage fuses (above 600 volts) and accessories for alternating-current systems as follows:

(1) Power fuses, including current limiting types

(2) Outdoor and indoor fuse disconnecting switches

(3) Fuse supports, fuse mountings, fuse hooks, fuse tongs, fuse units, refill units, and fuse links of the type used exclusively with power fuses and fuse disconnecting switches.

2. Rating

2.1 Rating Information

2.1.1 Ratings of Power Fuse Supports and Fuse Disconnecting Switches. The ratings of power fuse supports and fuse disconnecting switches shall include:

(1) Rated continuous current, determined by temperature-rise design tests at rated continuous current as specified in 4.4. These tests shall be made under the usual service conditions specified in 2.1 of American National Standard Service Conditions and Definitions for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories, ANSI/IEEE C37.40-1981.

(2) Rated maximum voltage, determined by the rating of the fuse unit or insulator(s) employed therewith (whichever is lower); dielectric design tests specified in 4.1 made at altitudes up to 3300 feet (1000 meters), as specified in 2.1 of ANSI/IEEE C37.40-1981; and for fuse supports having fuse holders, the interrupting design tests specified in 4.2.

(3) Basic impulse insulation level (BIL), determined by the impulse withstand tests specified in 4.1.

2.1.2 Ratings of Fuse Holders, Fuse Units, Refill Units, and Fuse Links for Power Fuses. The ratings of fuse holders, power fuse units, refill units, and fuse links for power fuses shall include:

(1) Rated continuous current, determined by the electrical interchangeability requirements specified in 3.1 and the temperature-rise design tests specified in 4.4, and made under the usual service conditions specified in 2.1 of ANSI/IEEE C37.40-1981.

(2) Rated maximum voltages, as specified in 2.3.

(3) Rated frequency, as specified in 2.4.

(4) Rated maximum interrupting current for fuse units in terms of available rms short-circuit current, determined by the current interrupting design tests specified in 4.2.

(5) Rated minimum interrupting current (for back-up current-limiting power fuses only) in terms of available rms current, as specified in 2.6 and determined by the current interrupting tests specified in 4.2.1.

2.1.3 Performance Characteristics of Power Fuse Supports and Fuse Disconnecting Switches. The performance characteristics of power fuse supports and fuse disconnecting switches shall include:

(1) Normal-frequency dry-withstand voltages, as specified in 4.1.

(2) Normal-frequency wet- or dew-withstand voltages of outdoor and indoor power fuses, as specified in 4.1.

(3) Temperature-rise limitations, as specified in 4.4.

(4) Radio-influence voltage, as specified in 4.3.

2.1.4 Performance Characteristics of Fuse Units, Refill Units, and Fuse Links for Power Fuses. The performance characteristics of fuse units, refill units, and fuse links for power fuses shall include:

(1) Melting-time-current characteristics, specified as electrical interchangeability requirements in Section 3 and determined as specified in 4.5.

(2) Total clearing-time-current characteristics, determined as specified in 4.5.

(3) Cutoff characteristics, determined as specified in 6.6 of American National Standard Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories, ANSI/IEEE C37.41-1981 (for current-limiting power fuses only).

(4) Overvoltage characteristics, determined as specified in 6.5 of ANSI/IEEE C37.41-1981 (for current-limiting power fuses only).

2.2 Rated Continuous Current[1]

2.2.1 Fuse Units, Refill Units, and Fuse Links. The preferred rated continuous currents of the fuse units, refill units, and fuse links for E-rated power fuses are 0.5, 1, 2, 3, 5, 7, 10, 15, 20, 25, 30, 40, 50, 65, 80, 100, 125, 150, 200, 250, 300, and 400 amperes (see 3.2).

2.2.2 Fuse Supports and Fuse Disconnecting Switches. The rated continuous currents of fuse supports and fuse disconnecting switches shall be 10, 25, 100, 200, 300, 400, 450, and 700 amperes.

2.3 Rated Maximum Voltages. The rated maximum voltages of power fuse supports,[2] fuse disconnecting switches,[2] and the fuse units, refill units, and fuse links (rated 15 kV and above) for power fuses shall be 2.8, 5.1,[3] 5.5,[4] 8.3, 15.0,[4] 15.5, 25.8, 38.0, 48.3, 72.5, 121.0, 145.0, and 169.0 kV.

2.4 Rated Frequency. The rated frequency of power fuses shall be 50 or 60 Hz, or both.

2.5 Rated Maximum Interrupting Currents. The rated maximum symmetrical interrupting currents of power fuses in rms kiloamperes shall be in accordance with Table 1 for E-rated fuses and as specified in Section 9 for R-rated fuses (see 3.2).

2.6 Rated Minimum Interrupting Current (for Backup Current-Limiting Fuses Only). The rated minimum interrupting current for current-limiting power fuses shall be designated by the manufacturer.

2.7 Basic Impulse Insulation Level (BIL). The basic impulse insulation level of power fuses shall be as given in Table 2.

3. Interchangeability Requirements

3.1 Electrical Interchangeability Requirements of Fuse Units, Refill Units, and Fuse Links for Power Fuses

3.1.1 Melting-Time-Current Characteristics for E-Rated Fuses. The melting-time-current characteristics of fuse units, refill units, and fuse links for power fuses designated as E rated shall be as follows:

(1) The current-responsive element with ratings 100 amperes or below shall melt in 300 seconds at an rms current within the range of 200% to 240% of the continuous current rating of the fuse unit, refill unit, or fuse link.

(2) The current-responsive element with ratings above 100 amperes shall melt in 600 seconds at an rms current within the range of 220% to 264% of the continuous current rating of the fuse unit, refill unit, or fuse link.

(3) The melting-time-current characteristics of a power fuse at any current higher than the 200% to 240% or 264% specified in (1) or (2) above shall be shown by each manufacturer's published time-current curves, since the current-responsive element is a distinctive feature of each manufacturer.

(4) For any given melting time, the maximum steady-state rms current shall not exceed the minimum by more than 20%.

3.1.2 Melting Time-Current Characteristics for R-Rated Fuses. The melting-time-current characteristics of fuse units, refill units, and fuse links for power fuses designated as R rated shall be as follows:

(1) The fuse will melt in a range of 15 to 35 seconds at a value of current equal to 100 times the R number.

(2) The melting-time-current characteristic of an R-rated fuse at any current higher than the value of 100 times the R number specified in (1) shall be shown by each manufacturer's published time-current curves, since the current-responsive element is a distinctive feature of each manufacturer.

(3) For any given melting time, the maximum steady-state rms current shall not exceed the minimum by more than 20%.

3.2 Identification by Letter "E" or "R." Fuse units, refill units, or fuse links for power fuses shall be identified by the letter "E" or "R," indicating that their melting-time-current characteristics conform to the electrical interchangeability requirements specified in 3.1 (see 7.2).

4. Design Test Requirements

4.1 Dielectric Tests. Power fuse supports shall be capable of withstanding the test voltages specified in 4.1.1 when tested as specified in Section 4 of ANSI/IEEE C37.41-1981.

4.1.1 Test Voltages. The test voltages to be applied to power fuse supports and fuse disconnecting switches shall be as given in Tables 3 and 4.

4.2 Interrupting Tests

4.2.1 Determination of Interrupting Rating. Power fuses shall be tested as specified in Section 6 of ANSI/IEEE C37.41-1981.

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[1] R-rated fuses do not have rated current, but are assigned maximum continuous current ability at two ambient temperature conditions, as shown in Table 10.

[2] The rated voltage of a power fuse support and a fuse disconnecting switch shall correspond to the rated voltage of either the fuse unit or the supporting insulator unit, whichever is lower.

[3] Only for R-rated fuses.

[4] Only for indoor power fuses or fuse disconnecting switches.

Table 1
Rated Symmetrical Interrupting Currents*

Maximum Voltage (kilovolts)																					
2.8		5.5		8.3		15 and 15.5		25.8		38.0		48.3		72.5		121		145		169	
Rated Interrupting rms Current (kiloamperes)																					
Sym	Asym	Sym	Asym	Sym	Asym	Sym	Asym	Sym	Asym	Sym	Asym	Sym	Asym	Sym	Asym	Sym	Asym	Sym	Asym	Sym	Asym
																1.25	2.0	1.25	2.0		
														2.5	4.0	2.5	4.0	2.5	4.0	2.5	4.0
												3.15	5.0								
				4.0	6.3	4.0	6.3	4.0	6.3			4.0	6.3	4.0	6.3	4.0	6.3	4.0	6.3	4.0	6.3
				5.0	8.0	5.0	8.0	5.0	8.0	5.0	8.0	5.0	8.0	5.0	8.0	5.0	8.0	5.0	8.0	5.0	8.0
				6.3	10.0	6.3	10.0	6.3	10.0	6.3	10.0	6.3	10.0	6.3	10.0	6.3	10.0	6.3	10.0	6.3	10.0
				8.0	12.5	8.0	12.5	8.0	12.5	8.0	12.5	8.0	12.5	8.0	12.5	8.0	12.5	8.0	12.5	8.0	12.5
				10.0	16.0	10.0	16.0	10.0	16.0	10.0	16.0	10.0	16.0	10.0	16.0	10.0	16.0	10.0	16.0	10.0	16.0
				12.5	20.0	12.5	20.0	12.5	20.0	12.5	20.0	12.5	20.0	12.5	20.0	12.5	20.0	12.5	20.0	12.5	20.0
				16.0	25.0	16.0	25.0	16.0	25.0	16.0	25.0	16.0	25.0	16.0	25.0	16.0	25.0				
				20.0	31.5	20.0	31.5	20.0	31.5	20.0	31.5	20.0	31.5	20.0	31.5						
				25.0	40.0	25.0	40.0	25.0	40.0	25.0	40.0	25.0	40.0	25.0	40.0						
31.5	50.0	31.5	50.0	31.5	50.0	31.5	50.0	31.5	50.0	31.5	50.0	31.5	50.0								
40.0	63.0	40.0	63.0	40.0	63.0	40.0	63.0	40.0	63.0	40.0	63.0										
50.0	80.0	50.0	80.0	50.0	80.0	50.0	80.0	50.0	80.0												
63.0	100.0					63.0	100.0														
						80.0	125.0														

*Asymmetrical values are provided for information only.

NOTES:
(1) Ratios of asymmetrical to symmetrical currents are between 1.56 and 1.6.
(2) Rated currents follow the 10-series of preferred numbers in American National Standard Preferred Numbers, ANSI Z17.1-1973.

Table 2
Basic Impulse Insulation Level

Rated Maximum Voltage (kV, rms)	Basic Impulse Insulation Level (kV, crest)
Outdoor Power Fuses	
8.3	95
15.5	110
25.8	150
38	200
48.3	250
72.5	350
121	550
145	650
169	750
Indoor Power Fuses	
2.8	45
5.1	60
5.5	60
8.3	75
15	95
15.5	110
25.8	150

Table 3
Outdoor Power Fuses

Rated Maximum Voltage (kV, rms)	Terminal-to-Ground Withstand Test Voltage			Terminal-to-Terminal Withstand Test Voltage for Break Distances	
	Normal-Frequency Dry Test, 1 min (kV, rms)	Normal-Frequency Wet Test, 10s* (kV, rms)	Impulse Test (BIL), 1.2 × 50 μs (kV, crest)	Normal-Frequency Dry Test, 1 min (kV, rms)	Impulse Test, 1.2 × 50 μs (kV, crest)
8.3	35	30	95	39	105
15.5	50	45	110	55	121
25.8	70	60	150	77	165
38	95	80	200	105	220
48.3	120	100	250	132	275
72.5	175	145	350	193	385
121	280	230	550	308	605
145	335	275	650	368	715
169	385	315	750	424	825

*Normal-frequency wet-withstand test voltages on the insulators that meet these values will be satisfactory in lieu of this test, provided the design of the complete device does not decrease the normal-frequency withstand test voltages of the insulators.

Table 4
Indoor Power Fuses

Rated Maximum Voltage (kV, rms)	Terminal-to-Ground Withstand Test Voltage			Terminal-to-Terminal Withstand Test Voltage for Break Distances	
	Normal-Frequency Dry Test, 1 min (kV, rms)	Normal-Frequency Dew Test, 10s* (kV, rms)	Impulse Test (BIL), 1.2 × 50 μs (kV, crest)	Normal-Frequency Dry Test, 1 min (kV, rms)	Impulse Test, 1.2 × 50 μs (kV, crest)
2.8	15	10	45	17	50
5.1	19	15	60	21	66
5.5	19	15	60	21	66
8.3	26	24	75	29	83
15	36	26	95	40	105
15.5	50	30	110	55	121
25.8	60	40	150	66	165

*Normal-frequency dew-withstand test voltages on the insulators, which meet these values, will be satisfactory in lieu of this test, provided the design of the complete device does not decrease the normal-frequency withstand test voltages of the insulators.

Table 5
Maximum Permissible Overvoltages for Current-Limiting E-Rated Power Fuses

Rated Maximum Voltage (kV, rms)	Maximum Peak Overvoltages (kV, crest)	
	0.5 to 12 Amperes	Over 12 Amperes
2.8	13	9
5.5	25	18
8.3	38	26
15.0	68	47
15.5	70	49
25.8	117	81
38.0	173	119

Power fuses, except current-limiting types, shall interrupt available short-circuit currents having all degrees of asymmetry and symmetric values ranging from those that just melt the current-responsive element to those equal to the interrupting rating of the fuse. The *X/R* ratio of the test circuit prior to melting of the current-responsive element shall be in accordance with 6.1.2.1 of ANSI/IEEE C37.41-1981.

Current-limiting power fuses shall meet the interrupting performance requirements specified in 6.1.2.3 of ANSI/IEEE C37.41-1980.

4.2.1.1 Peak Overvoltages for Current-Limiting E-Rated Power Fuses. Peak overvoltages for current-limiting power fuses, as determined in accordance with 6.5 of ANSI/IEEE C37.41-1981, shall not exceed those given in Table 5.

4.2.2 Interrupting Performance Tests. Power fuses shall withstand the interrupting performance tests specified in 6.1.2 of ANSI/IEEE C37.41-1981.

4.2.3 Cutoff (Peak Let-Through) Current. Cutoff (peak let-through) current for current-limiting fuses shall be determined as specified in 6.6 of ANSI/IEEE C37.41-1981.

4.3 Radio-Influence Tests. Power fuses, when new and clean and when tested at the point of manufacture as specified in Section 9 of ANSI/IEEE C37.41-1981, shall be capable of meeting the limits of radio-influence voltage at the test voltages specified in Table 6.

4.4 Temperature-Rise Limitations. Power fuses shall be capable of carrying their rated continuous current when tested as specified in Section 11 of ANSI/IEEE C37.41-1981 and in 4.4.1 and 4.4.2.

4.4.1 After carrying the rated continuous current for the time specified in 11.2.1 of ANSI/IEEE C37.41-

Table 6
Limits of Radio-Influence Voltage

Rated Maximum Voltage of Power Fuses (kV, rms)	Test Voltage (volts)	Limit of Radio-Influence Voltage (μV at 1 MHz)
2.8	1 670	500
5.1	3 340	500
5.5	3 340	500
8.3	5 010	500
15.5	9 410	500
25.8	15 700	650
38	23 000	650
48.3	29 300	1250
72.5	44 000	1250
121	73 400	2500
145	88 000	2500
169	102 500	2500

1981, there shall be no deterioration of any part of the fuse. The temperature rise of the power fuse, when fused with a maximum rated fuse unit and tested within an ambient temperature range of 10°C to 40°C as specified in 11.2.2 of ANSI/IEEE C37.41-1981, shall not exceed the values listed in Table 2 of ANSI/IEEE C37.40-1981.

If the power fuses are used in an enclosure in which the ambient temperature may reach 55°C, the fuses may have to be derated in order to meet the operating temperature limits for both conducting and insulating parts.

4.4.2 Power fuses shall be suitable for use in enclosures exposed to solar radiation provided that the ambient temperature inside the enclosure does not exceed 55°C and the temperature rises are at least 15°C lower than specified in Table 2 of ANSI/IEEE C37.40-1981, under either of the following conditions:

(1) The fuse is tested in the enclosure, and the rises are measured over the inside ambient.

(2) The fuse is tested outside the enclosure, and the rises are measured over the outside ambient.

Power fuses shall be suitable for use in enclosures not exposed to solar radiation provided that when tested in the enclosure, the temperature rise over the outside ambient temperature does not exceed the temperature rises specified in 4.4.1, and the limits of total temperature of 4.4.1 are not exceeded when all internal heat generating devices are operating at maximum rating.

4.5 Time-Current Tests. The time-current curves for power fuse units, refill units, and fuse links shall be determined as specified in Section 12 of ANSI/IEEE C37.41-1981. A sufficient number of tests shall be made to ensure that all fuse units, refill units, and fuse links meet the accuracy specified in 3.1.1(4).

5. Conformance Tests for Power Fuses

Conformance tests, as defined in 3.3 of ANSI/IEEE C37.40-1981, shall consist of a normal-frequency dry-withstand voltage test. The test shall be conducted as specified in 4.1 above and 4.2.1 of ANSI/IEEE C37.41-1981.

6. Construction Requirements

6.1 Break Distance of Power Fuse Supports and Fuse Disconnecting Switches. The break distance of outdoor and indoor power fuse supports or fuse disconnecting switches, when in the full open position or with the fuse holder or fuse unit removed, shall be at least 10% in excess of the dry-arcing distance over the insulators and shall be such that the break distance shall withstand between live parts the test voltages specified in 4.1.1 for break distance.

6.2 Shipment of Power Fuse Supports. Power fuse supports shall be shipped completely assembled with insulators if the supports are rated 48.3 kV or below; insulators for supports rated above 48.3 kV shall be shipped separately.

6.3 Base Mounting Dimensions. Dimensions for the base mounting holes for outdoor power fuses shall be as shown in Fig. 1. Base mounting holes shall not be less than 9/16 inch (1.43 cm) in diameter.

7. Nameplate Marking

7.1 Fuse Supports or Fuse Disconnecting Switches. The following minimum information shall be placed on the fuse supports or fuse disconnecting switches:

(1) Manufacturer's name or trademark (or monogram)

(2) Manufacturer's type or identification number

(3) Rated continuous current (maximum or, if limited, minimum sizes of fuse units, refill units, or fuse links to be used)

(4) Rated maximum voltage

(5) Basic impulse insulation level (BIL)

7.2 Fuse Links, Fuse Units, or Refill Units. The following minimum information shall be placed on the fuse links, fuse units, refill units, or on the shipping containers. The minimum information that shall appear on the fuse links, fuse units, and refill units is indicated by an asterisk (*).

(1) Manufacturer's name or trademark (or monogram)

(2) Manufacturer's type or identification number*

(3) Manufacturer's type or identification number of the fuses for which the fuse units, refill units, or fuse links are designed

(4) Rated continuous current*

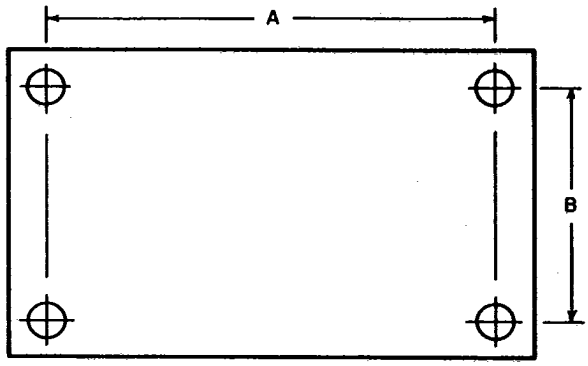
(5) Rated maximum voltage

(6) Rated maximum interrupting current

(7) Rated minimum interrupting current (for back-up current-limiting power fuses only)

(8) Type identification E or R following the rated continuous current (where applicable)*

(9) Rated frequency



Rated Maximum Voltage (kV, rms)	Dimensions			
	A		B	
	Inches	Centimeters	Inches	Centimeters
8.3	18	45.7	2 or 7	5 or 18
15.5	21	53.3	2 or 7	5 or 18
25.8	24 or 27	61 or 69	2 or 7	5 or 18
38.0	30 or 33	76.2 or 84	2, 3, or 7	5, 8, or 18
48.3	39	99	3 or 8-1/4	7.6 or 21
72.5	51	130	3 or 8-1/4	7.6 or 21
121	66	168	8-1/4	21
145	78	198	8-1/4	21
169	90	229	8-1/4	21

Fig. 1
Base Mounting Dimensions

8. Application Requirements

See also American National Standard Guide for Application, Operation, and Maintenance of Distribution Cutouts and Fuse Links, Secondary Fuses, Distribution Enclosed Single-Pole Air Switches, Power Fuses, Fuse Disconnecting Switches, and Accessories, ANSI C37.48-1969.

8.1 Selection of Rated Voltage of Power Fuses. The rated voltage of a power fuse shall be selected on the basis of maximum line-to-line voltage, regardless of whether the fuse is to be applied on a grounded or ungrounded neutral system.

8.2 Electrical Clearances and Spacings

8.2.1 Electrical Spacings for Outdoor Mounted Power Fuses, except Those of the Expulsion Type. The minimum electrical spacings for outdoor mounted power fuses, except those of the expulsion type, shall be in accordance with Table 7.

8.2.2 Electrical Spacings for Outdoor Mounted Expulsion Power Fuses. The phase spacings for outdoor power fuses of the expulsion type given in Table 8 should apply in the absence of specific manufacturer's recommendations.

8.2.3 Electrical Clearances for Indoor Mounted Power Fuses. The minimum electrical clearances for indoor mounted power fuses shall be as given in Table 9.

Table 7
Minimum Electrical Spacings for Outdoor Mounted Power Fuses of the Nonexpulsion Type

Rated Maximum Voltage of Power Fuses (kV rms)	Minimum Phase-to-Phase Centerline Spacing	
	Inches	Centimeters
8.3	18	46
15.5	24	61
25.8	30	76
38.0	36	91
48.3	48	122
72.5	60	152
121	84	213
145	96	244
169	108	274

Table 8
Phase Spacings for Outdoor Mounted Power Fuses of the Expulsion Type

Rated Maximum Voltage of Power Fuses (kV, rms)	Minimum Phase-to-Phase Centerline Spacing	
	Inches	Centimeters
8.3	36	91
15.5	36	91
25.8	48	122
38.0	60	152
48.3	72	183
72.5	84	213
121	120	305
145	144	366
169	168	427

Table 9
Electrical Clearances for Indoor Mounted Power Fuses

Rated Maximum Voltage of Power Fuses (kV, rms)	Minimum Clearance between Live Parts Phase-to-Phase	
	Inches	Centimeters
2.8	3.5	9
5.1	4.5	11
5.5	4.5	11
8.3	6.0	15
15.0	7.5	19
15.5	9.0	23
25.8	13	33
38	18	46

NOTES:
(1) Fuses that eject expulsion products may require greater clearances.
(2) Barriers may be used to facilitate insertion or removal of fuse units. Provision of adequate insulating barriers may result in modification of these clearances.
(3) When the fuses are mounted in equipment covered by other standards, minimum electrical clearances may be modified in accordance with those standards.

9. Current-Limiting Motor Circuit Fuses

Motor circuit fuses shall be backup fuses with rated maximum voltages of 2540 or 5080 volts. Minimum melting- and total clearing-time-current characteristic curves shall be terminated at a maximum time of 100 seconds. These fuses are used with high-voltage motor starters to increase the interrupting rating of the combined package. The fuses may be designated by an R number, which signifies that the fuse will melt in a range of 15 to 35 seconds at a value of current equal to 100 times the R number. The rms current-interrupting rating of these fuses shall be 50 000 amperes symmetrical, 80 000 amperes asymmetrical, or 40 000 amperes symmetrical, 63 000 amperes asymmetrical.

These fuses have ratings as shown in Table 10 and may be used at ambient temperatures up to 55°C.

Table 10
Maximum Continuous Currents for R-Rated Power Fuses

Fuse R Designations	Maximum Continuous Current (amperes)	
	At 55°C Ambient	At 40°C Ambient
1.5	36	40
2.0	63	70
3.0	90	100
4.0	115	130
5.0	135	150
6.0	150	170
9.0	180	200
12.0	210	230
18.0	350	390
24.0	400	450
26.0	430	480
30.0	490	550
32.0	540	600
36.0	580	650
38.0	630	700
42.0	540	600
50.0	630	700

10. Revision of American National Standards Referred to in This Document

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

American National Standard Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories, ANSI/IEEE C37.41-1981

American National Standard Guide for Application, Operation, and Maintenance of Distribution Cutouts and Fuse Links, Secondary Fuses, Distribution Enclosed Single-Pole Air Switches, Power Fuses, Fuse Disconnecting Switches, and Accessories, ANSI C37.48-1969

American National Standard Preferred Numbers, ANSI Z17.1-1973

American National Standard Service Conditions and Definitions for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories, ANSI/IEEE C37.40-1981

Related American National Standards in the C37 Series

ANSI/IEEE C37.04-1979 Rating Structure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis (including Supplements C37.04a-1964, C37.04b-1970, and C37.04c)
ANSI C37.06-1979 Preferred Ratings and Related Required Capabilities for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
ANSI/IEEE C37.09-1979 Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
ANSI/IEEE C37.010-1979 Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
ANSI/IEEE C37.011-1979 Application Guide for Transient Recovery Voltage for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
ANSI/IEEE C37.012-1979 Application Guide for Capacitance Current Switching of AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
ANSI/IEEE C37.1-1979 Definition, Specification, and Analysis of Manual, Automatic, and Supervisory Station Control and Data Acquisition
ANSI/IEEE C37.2-1979 Electrical Power System Device Function Numbers
ANSI C37.4-1953 (R1976) Definitions and Rating Structure for AC High-Voltage Circuit Breakers Rated on a Total Current Basis (including Supplements C37.4a-1958, C37.4b-1970, and C37.4c-1980)
ANSI/IEEE C37.5-1979 Guide for Calculation of Fault Currents for Application of AC High-Voltage Circuit Breakers Rated on a Total Current Basis
ANSI C37.6-1971 (R1976) Schedules of Preferred Ratings for AC High-Voltage Circuit Breakers Rated on a Total Current Basis
ANSI C37.7-1960 (R1976) Interrupting Rating Factors for Reclosing Service for AC High-Voltage Circuit Breakers Rated on a Total Current Basis
ANSI C37.9-1953 (R1976) Test Code for AC High-Voltage Circuit Breakers Rated on a Total Current Basis (including Supplement C37.9a-1970)
ANSI C37.11-1979 Requirements for Electrical Control for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis or a Total Current Basis
ANSI C37.12-1969 (R1974) Guide Specifications for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis and a Total Current Basis
ANSI/IEEE C37.13-1980 Low-Voltage AC Power Circuit Breakers Used in Enclosures
ANSI/IEEE C37.14-1979 Low-Voltage DC Power Circuit Breakers Used in Enclosures
ANSI C37.16-1980 Preferred Ratings, Related Requirements, and Application Recommendations for Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors
ANSI C37.17-1979 Trip Devices for AC and General-Purpose DC Low-Voltage Power Circuit Breakers
ANSI/IEEE C37.18-1979 Field Discharge Circuit Breakers Used in Enclosures for Rotating Electric Machinery
ANSI/IEEE C37.20-1974 Switchgear Assemblies Including Metal-Enclosed Bus (including Supplements C37.20a-1970, C37.20b-1972, and C37.20c-1974; Supplement C37.20d-1976 available separately)
ANSI/IEEE C37.23-1970 (R1976) Guide for Calculating Losses in Isolated-Phase Bus
ANSI/IEEE C37.24-1971 (R1976) Guide for Evaluating the Effect of Solar Radiation on Outdoor Metal-Clad Switchgear
ANSI/IEEE C37.26-1972 (R1977) Methods of Power Factor Measurements for Low-Voltage Inductive Test Circuits
ANSI/IEEE C37.27-1972 Application Guide for Low-Voltage AC Non-Integrally Fused Power Circuit Breakers (Using Separately Mounted Current-Limiting Fuses)
ANSI/IEEE C37.29-1974 Low-Voltage AC Power Circuit Protectors Used in Enclosures
ANSI/IEEE C37.30-1971 Definitions and Requirements for High-Voltage Air Switches, Insulators, and Bus Supports (including Supplements C37.30a-1975 and C37.30g-1980)
ANSI C37.31-1962 (R1976) Electrical and Mechanical Characteristics of Indoor Apparatus Insulators
ANSI C37.32-1972 Schedules of Preferred Ratings, Manufacturing Specifications, and Application Guide for High-Voltage Air Switches, Bus Supports, and Switch Accessories
ANSI C37.33-1970 (R1976) Rated Control Voltages and Their Ranges for High-Voltage Air Switches
ANSI/IEEE C37.34-1971 (R1977) Test Code for High-Voltage Air Switches (including Supplement C37.34a-1975)
ANSI C37.35-1976 Guide for the Application, Installation, Operation, and Maintenance of High-Voltage Air Disconnecting and Load Interrupter Switches
ANSI/IEEE C37.37-1979 Loading Guide for AC High-Voltage Air Switches (In Excess of 1000 Volts)
ANSI C37.40-1981 Service Conditions and Definitions for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories
ANSI C37.41-1981 Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories
ANSI C37.42-1981 Specifications for Distribution Cutouts and Fuse Links
ANSI C37.43-1969 (R1974) Specifications for Distribution Fuse Links for Use in Distribution Enclosed, Open, and Open-Link Cutouts.
ANSI C37.44-1981 Specifications for Distribution Oil Cutouts and Fuse Links
ANSI C37.45-1981 Specifications for Distribution Enclosed Single-Pole Air Switches
ANSI C37.46-1981 Specifications for Power Fuses and Fuse Disconnecting Switches
ANSI C37.47-1981 Specifications for Distribution Fuse Disconnecting Switches, Fuse Supports, and Current-Limiting Fuses
ANSI C37.48-1969 (R1974) Guide for Application, Operation, and Maintenance of Distribution Cutouts and Fuse Links, Secondary Fuses, Distribution Enclosed Single-Pole Air Switches, Power Fuses, Fuse Disconnecting Switches, and Accessories
ANSI C37.50-1973 Test Procedures for Low-Voltage AC Power Circuit Breakers Used in Enclosures (including Supplements C37.50a-1975 and C37.50b-1975)
ANSI C37.51-1979 Conformance Testing of Metal-Enclosed Low-Voltage AC Power Circuit Breaker Switchgear Assemblies
ANSI C37.52-1974 (R1980) Test Procedures for Low-Voltage AC Power Circuit Protectors Used in Enclosures
ANSI/IEEE C37.60-1980 Overhead, Pad-Mounted, Dry Vault and Submersible Automatic Circuit Reclosers and Fault Interrupters for Alternating-Current Systems
ANSI/IEEE C37.61-1973 (R1979) Guide for the Application, Operation, and Maintenance of Automatic Circuit Reclosers
ANSI C37.63-1969 (R1974) Requirements for Automatic Line Sectionalizers for Alternating-Current Systems (including Supplement C37.63a-1973)
ANSI C37.66-1969 (R1974) Requirements for Oil-Filled Capacitor Switches for Alternating-Current Systems
ANSI C37.85-1972 (R1978) Safety Requirements for X-Radiation Limits for AC High-Voltage Power Vacuum Interrupters Used in Power Switchgear (including Supplement C37.85a-1972)
ANSI/IEEE C37.90-1978 Relays and Relay Systems Associated with Electric Power Apparatus
ANSI C37.90a-1974 (R1980) Guide for Surge Withstand Capability (SWC) Tests
ANSI/IEEE C37.91-1972 (R1980) Guide for Protective Relay Applications to Power Transformers
ANSI/IEEE C37.93-1976 Guide for Protective Relay Applications of Audio Tones over Telephone Channels
ANSI/IEEE C37.95-1974 (R1980) Guide for Protective Relaying of Utility-Consumer Interconnections
ANSI/IEEE C37.96-1975 Guide for AC Motor Protection
ANSI/IEEE C37.97-1979 Guide for Protective Relay Applications to Power System Buses
ANSI/IEEE C37.98-1978 Seismic Testing of Relays
ANSI/IEEE C37.99-1980 Guide for Protection of Shunt Capacitor Banks
ANSI C37.100-1972 Definitions for Power Switchgear