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(Revision of IEEE Std C37.41-1988)

IEEE Standard Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories

Sponsor
**Switchgear Committee
of the
IEEE Power Engineering Society**

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IEEE Standards Board

Abstract: Required procedures for performing design tests for high-voltage distribution-class and power-class fuses, as well as for fuse disconnecting switches and enclosed single-pole air switches are specified. These design tests, as appropriate to a particular device, include the following test types—dielectric, interrupting, load-break, making-current, radio-influence, short-time current, temperature-rise, time-current, mechanical, and liquid-tightness.

Keywords: distribution enclosed single-pole air switches, fuse accessories, fuse design tests, fuse disconnecting switches, high-voltage fuses

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Introduction

(This introduction is not a part of IEEE Std C37.41-1994, IEEE Standard Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories.)

This standard is a revision of IEEE Std C37.41-1988 in order to bring it up to date and in agreement with present day requirements for high-voltage fuses and switches. Previously approved supplements have been incorporated, and some of the values in tables 4, 6, and 7 have been revised.

This standard was prepared by the IEEE Subcommittee on High-Voltage Fuses with cooperation from the C37 Subcommittee on High-Voltage Fuses and the National Electrical Manufacturers Association (NEMA).

This standard is one of a series of complementary standards covering various types of high-voltage fuses and switches, so arranged that two of the standards apply to all devices while each of the other standards provide additional specifications for a particular device. For each device, IEEE Std C37.40-1993, IEEE Std C37.41-1994, plus the standard covering that device constitute a complete set of standards for each device. In addition, IEEE Std C37.48-1987 is an application, operation, and maintenance guide for all the devices.

The following standards comprise this series:

ANSI C37.42-1989 , Specifications for Distribution Cutouts and Fuse Links.

ANSI C37.44-1981 (R1987), Specifications for Distribution Oil Cutouts and Fuse Links.

ANSI C37.45-1981 (R1992), Specifications for Distribution Enclosed Single-Pole Air Switches.

ANSI C37.46-1981 (R1992), Specifications for Power Fuses and Fuse Disconnecting Switches.

ANSI C37.47-1981 (R1992), Specifications for Distribution Fuse Disconnecting Switches, Fuse Supports, and Current-Limiting Fuses.

IEEE Std C37.40-1993, IEEE Standard Service Conditions and Definitions for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories (ANSI).

IEEE Std C37.41-1994, IEEE Standard Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories.

IEEE Std C37.48-1987 (Reaff 1992), IEEE Guide for Application, Operation, and Maintenance of High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories (ANSI).

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IEEE Standard Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories

1. Scope and references

1.1 Scope

This standard specifies design test requirements for high-voltage fuses (above 1000 V but also including fuses rated 601 V to 1000 V that were designed prior to 1985), distribution enclosed single-pole air switches, fuse disconnecting switches, and associated accessories, all of which are intended for use on ac distribution systems. These test requirements apply to the following equipment:

- a) Enclosed, open, and open-link types of distribution cutouts and fuses
- b) Distribution current-limiting fuses
- c) Distribution oil cutouts
- d) Distribution enclosed single-pole air switches
- e) Power fuses, including current-limiting types
- f) Fuses in enclosures
- g) Outdoor and indoor fuse disconnecting switches
- h) Fuse supports, fuse mountings, fuse hooks, and fuse links—all of the type used exclusively with products listed in a) through g)
- i) Removable switch blades for products listed in a) through c)

1.2 References

This standard shall be used in conjunction with the following publications. When these standards are superseded by a revision, the revision shall apply.

ANSI C37.42-1989, Specifications for Distribution Cutouts and Fuse Links.¹

ANSI C37.44-1981 (R1987), Specifications for Distribution Oil Cutouts and Fuse Links.

ANSI C37.45-1981 (R1992), Specifications for Distribution Enclosed Single-Pole Air Switches.

ANSI C37.46-1981 (R1992,) Specifications for Power Fuses and Fuse Disconnecting Switches.

ANSI C37.47-1981 (R1992), Specifications for Distribution Fuse Disconnecting Switches, Fuse Supports, and Current-Limiting Fuses.

ANSI C63.2-1987, Specifications for Electromagnetic Noise and Field-Strength Instrumentation, 10 kHz to 1 GHz.

IEEE Std 4-1978, IEEE Standard Techniques for High-Voltage Testing (ANSI).²

IEEE Std C37.20.3-1987 (Reaff 1992), IEEE Standard for Metal-Enclosed Interrupter Switchgear (ANSI).³

IEEE Std C37.40-1993, IEEE Standard Service Conditions and Definitions for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories (ANSI).

IEEE Std C37.48-1987 (Reaff 1992), IEEE Guide for Application, Operation, and Maintenance of High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories (ANSI).

2. Design tests

2.1 Test specifications

The design tests to be conducted upon completion of a design or following a change that affects the performance are specified in the following standards:

ANSI C37.42-1989 ⁴

ANSI C37.44-1981

ANSI C37.45-1981

ANSI C37.46-1981

ANSI C37.47-1981

These tests need not be performed on each design modification of a previously qualified design. To assure that overall performance has not been adversely affected as a result of design modification, the manufacturer shall ensure that the modified design will have performance at least equal to the design tested.

2.2 Required tests

See listing in table 1.

¹ANSI publications are available from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

²IEEE Std 4-1978 has been withdrawn; however, copies can be obtained from the IEEE Standards Department, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA.

³IEEE publications are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA.

⁴Information on references can be found in 1.2.

Table 1— Design tests

Design test given in following clauses of this standard	ANSIC37.42-1989			ANSIC37.44-1981			ANSIC37.45-1981	ANSIC37.46-1981	ANSIC37.47-1981
	Specifications for distribution cutouts and fuse links			Specifications for distribution oil cutouts and fuse links			Specifications for distribution enclosed single-pole air switches	Specifications for power fuses and fuse disconnecting switches	Specifications for distribution fuse disconnecting switches, fuse supports and current-limiting fuses
	Fuse cutouts	Disconnecting cutouts	Fuse links	Fuse cutouts	Disconnecting cutouts	Fuse links			
4 Dielectric	X	X	—	X	X	—	X	X	X
5 Expendable cap static relief pressure	X*	—	—	—	—	—	—	—	—
6 Interrupting	X	—	X [†]	X	—	—	—	X	X
7 Load-break	X [‡]	X [‡]	—	X	X	—	—	—	—
8 Making-current	—	—	—	X ^{**}	—	—	—	—	—
9 Radio-influence	X	X	—	X	X	—	X	X	X
10 Short-time current	—	X	—	—	X	—	X	—	—
11 Temperature-rise	X	X	X	X	X	X	X	X	X
12 Time-current	—	—	X	—	—	X	—	X	X
13 Mechanical	X	X	—	—	—	—	—	—	—
14 Liquid-tightness	—	—	—	—	—	—	—	X ^{††}	X ^{††}
NOTE — X indicates a required test.									

*Only on expendable caps for expendable-cap cutouts.

†Only on open-link fuses.

‡Only on load-break cutouts having means provided for breaking load current.

**Only on fuse cutouts that combine the functions of a current-interrupting device and a load-switching device.

††Only on liquid-submersible FEPs used in enclosures.

3. Common test practices

3.1 General test conditions

Test conditions prevailing at the test site shall conform to usual service conditions in accordance with 2.1 of IEEE Std C37.40-1993, except that temperature-rise tests shall be conducted in an ambient temperature of 10 °C to 40 °C, and time-current tests shall be conducted in an ambient temperature of 20 °C to 30 °C.

3.2 Condition of device to be tested

The device shall be new and in good condition, and tests shall be applied before the device is put into commercial service, unless otherwise specified.

3.3 Mounting of specimen and grounding

3.3.1 Mounting of power fuses

The fuse equipment shall be mounted on a structure in the normal service position or positions for which it is designed, and with the base grounded.

3.3.2 Mounting of distribution cutouts and enclosed air switches

Distribution enclosed, open and open-link cutouts, and enclosed air switches, shall be mounted on a wood crossarm that measures 3 1/2 in × 4 1/2 in (8.9 cm × 11.4 cm) in cross-section and shall be mounted in the position normally used in service.

Distribution oil cutouts shall be mounted on a rigid structure in the position normally used in service.

3.3.3 Grounding of distribution cutouts and enclosed air switches

The fuse mounting bracket or housing shall be grounded by a lead attached to the housing or to the mounting bracket on the side of the crossarm opposite the fuse support.

3.3.4 Lead connections of distribution cutouts

The source-side lead shall be connected to the upper terminal of the cutout, and the load-side lead shall be connected to the lower terminal when interrupting tests are being performed.

3.4 Frequency and wave shape of test voltage

3.4.1 Power-frequency tests

The frequency for all power-frequency tests shall be either 50 Hz or 60 Hz with limits of ± 2 Hz, except as otherwise specified. A sine wave of acceptable commercial standards shall be applied to the device. For the definition of the wave shape, see IEEE Std 4-1978.

3.4.2 Impulse tests

The wave shape and application of the 1.2/50 μ s full wave test voltage are described in IEEE Std 4-1978 and shall have the following limits for design tests.

The impulse test wave shall have a virtual front time equal to or less than $1.2\text{ }\mu\text{s}$, a crest voltage equal to or exceeding the rated full wave impulse withstand voltage, and a time to the 50% value of the crest voltage on the tail equal to or greater than $50\text{ }\mu\text{s}$.

NOTES:

- 1 — For fuses designed and tested prior to the time of issuance of this new requirement, the impulse voltage limit wave shape is $1.5/40\text{ }\mu\text{s}$. The manufacturer has the option of assigning a $1.2/50\text{ }\mu\text{s}$ rating on the basis of a prior design test with a -20% tail tolerance (time to 50% of crest voltage). For fuses designed and tested after the issuance of the 1978 requirement, the impulse voltage limit wave shape is $1.2/50\text{ }\mu\text{s}$.
- 2 — In the event that laboratory limitations are encountered due to the capacitance of the test fuse, then the maximum rise achievable may be used if it is mutually acceptable to the user and the manufacturer.

4. Dielectric tests

4.1 Test practices

Dielectric test practices shall be as specified in clause 3.; 4.1.1 through 4.1.3; and 4.3 (if applicable).

4.1.1 Electrical connections

4.1.1.1 Distribution enclosed, open, and open-link cutouts

Electrical connections shall be made by means of AWG No. 6, or equivalent solid bare wire, inserted in each terminal.

4.1.1.1.1 Connector dimensions

These bare wires shall project horizontally, at least 12 in (30.5 cm) from the terminals, in a straight line approximately parallel to the face of the crossarm or steel structure and in such a manner as not to decrease the withstand value. Any necessary bends may be made at the terminals. For enclosed cutouts (and air switches), the bare wires shall be located approximately in the center of the entrance holes.

4.1.1.1.2 Terminal-to-ground tests

The test lead connections shall be made to one of the wires projecting from the terminals and to all groundable metal parts, with the fuse holder, including the conducting element (fuse link) or equivalent, or the blade in the closed position.

4.1.1.1.3 Terminal-to-terminal tests

The test lead connections shall be made to the wire projecting from the top terminal, with wire to the bottom terminal grounded and with the fuse holder or blade in the open position. The hanger shall not be grounded as specified in 3.3.3.

4.1.1.2 Distribution enclosed air switches

Electrical connections shall be made by means of an AWG No. 2/0, or equivalent stranded bare wire, inserted in each terminal.

The specifications in 4.1.1.1.1, 4.1.1.1.2, and 4.1.1.1.3 also apply to distribution enclosed air switches.

4.1.1.3 Distribution oil cutouts

Electrical connections shall be made by means of an AWG No. 6, or equivalent solid bare wire, connected to each terminal, to the end of the full length of insulated cables furnished with the cutout, or to the end of an insulated cable attached to the terminal in accordance with the manufacturer's instructions. Entrance terminals requiring taping or compound filling shall be assembled and taped or filled in accordance with the manufacturer's instructions. The connections projecting from the cutout shall not approach the metal parts of the cutout closer than a projection of the center line of the entrance terminal. Insulated conductors shall terminate 12 in (30.5 cm) or more from any grounded metal member of the terminal or of a cable sheathing attached to the grounded metal member in the normal assembly thereof.

Terminal-to-ground tests shall be made. The test lead connections shall be made to one of the wires projecting from the terminals and to all groundable metal parts, with the fuse carrier, including the conducting element (fuse link) or the blade in the closed position.

4.1.1.4 Power and distribution fuses (including current-limiting fuses) and fuse disconnecting switches

Fuse electrical connections shall be made by means of a bare wire inserted in each terminal.

4.1.1.4.1 Conductor position

These conductors shall project from the terminals of the fuse in substantially a straight line parallel to the fuse unit or fuse holder for an unsupported distance of at least the break distance of the fuse.

4.1.1.4.2 Terminal-to-ground tests

The test lead connections shall be made to one of the wires projecting from the terminals and to all groundable metal parts, with the fuse unit or fuse holder, including the conducting element (fuse link) or equivalent, or the switch blade in the closed position.

4.1.1.4.3 Terminal-to-terminal tests

The test lead connection shall be made to the wire projecting from the upper terminal, with the wire connected to the lower terminal grounded and with the fuse unit, fuse holder, or switch blade in one of the following positions:

- a) For fuse disconnecting switches, in the fully open position
- b) For dropout fuses, with the fuse holder or fuse unit in the dropout position
- c) For non-dropout fuses, with the fuse holder or fuse unit removed from the support

A fuse or fuse disconnecting switch rated 72.5 kV and above shall be equipped with standard strength insulator units, and one or more insulator units identical to those supporting the current-carrying parts shall be added to each of the insulator supports or columns (only for the test).

A fuse or fuse disconnecting switch rated 48.3 kV or below shall be mounted with its base insulated from a grounded metal structure by means of insulator units identical to those assembled on the fuse. In the case of a rear-connected indoor power fuse, bus-support insulators of equivalent electrical characteristics shall be used to support the base (only for the test).

NOTE — Successful completion of these tests does not necessarily ensure that a fuse support or fuse disconnecting switch when open will always flash over to ground instead of across the open gap.

4.1.2 Temperature during testing

See 3.1.

4.1.3 Measurement of voltage

The voltage for dielectric tests shall be measured in accordance with IEEE Std 4-1978.

4.2 Test procedures

Dielectric tests shall be conducted as follows.

4.2.1 Power-frequency dry withstand voltage tests

4.2.1.1 Test voltage and time

The test voltage specified for the device, with appropriate atmospheric corrections, shall be applied to the specimen for 1 min without flashover or damage to the insulating material.

4.2.1.2 Voltage application

The application of 75% of the rated dry withstand voltage may be done in one step and gradually raised to the required value in not less than 5 s and not more than 30 s.

4.2.1.3 Correction of test voltage to standard conditions

The specified withstand voltage as given for standard atmospheric condition shall be corrected for the existing atmospheric conditions at the time of the test. This correction shall be made in accordance with IEEE Std 4-1978.

4.2.2 Power-frequency wet withstand voltage tests on outdoor devices

4.2.2.1 Test voltage and time

The test voltage specified for the device, with appropriate atmospheric corrections, shall be applied to the specimen for 10 s without flashover or damage to the insulating material.

4.2.2.2 Precipitation

See 1.3.3 of IEEE Std 4-1978. The water shall be projected downward toward the front of the device and at an angle of 45 degrees to the vertical and horizontal planes of the crossarm so that the spray strikes equally on the front and on one side wall of the device.

4.2.2.3 Voltage application

The application of 75% of the rated wet withstand voltage may be done in one step and gradually raised to the required value in not less than 5 s and not more than 30 s.

4.2.2.4 Correction of test voltage to standard conditions

The specified wet withstand voltage shall be corrected to standard air density in accordance with IEEE Std 4-1978. Corrections for relative humidity shall not be made on wet withstand tests.

4.2.3 Power-frequency dew withstand voltage tests on indoor devices

4.2.3.1 Test voltage and time

The test voltage specified for the device, with appropriate atmospheric corrections, shall be applied to the specimen for 10 s without flashover or damage to the insulating material.

4.2.3.2 Procedures

Thoroughly clean the insulation of the device. Place the cleaned device in a cold chamber (refrigerator) having temperature of -10°C to -15°C until it is thoroughly cooled (may take 10 h to 12 h). Then mount the device, as specified in 3.3, in a test chamber having a normal temperature of 22°C to 25°C and a humidity of approximately 100%. When the device is completely covered with dew, immediately apply the test voltage as specified in 4.2.3.1 and 4.2.3.3

4.2.3.3 Voltage application

Application of 75% of the rated dew withstand voltage may be done in one step and gradually raised to the required value in not less than 5 s and not more than 30 s.

4.2.3.4 Correction of the test voltage to standard conditions

The specified dew withstand voltage shall be corrected to standard air density in accordance with IEEE Std 4-1978. Correction for relative humidity shall not be made in dew withstand tests.

4.2.4 Impulse withstand voltage tests

4.2.4.1 General

Withstand voltage tests are made to determine that the test specimen is capable of withstanding a specified impulse voltage without disruptive discharge.

4.2.4.2 Procedure

Withstand voltage tests shall be made with an impulse of that polarity (usually the positive) that produces the lower withstand voltage on the test specimen. Three consecutive impulses shall be applied to the test specimen. The crest voltage of each shall be not less than the specified withstand voltage properly corrected.

4.2.4.3 Correction of test voltage to standard conditions

The specified impulse withstand voltage as given for standard atmospheric conditions shall be corrected for the existing atmospheric conditions at the time of test. Such corrections shall be made in accordance with IEEE Std 4-1978.

4.2.4.4 Interpretation of tests

If no disruptive discharge occurs during any of the three consecutive impulses, the test specimen has passed the test. If more than one disruptive discharge occurs, the test specimen has failed to pass the test. If one disruptive discharge occurs, then nine additional impulses are applied, and, if no disruptive discharge occurs, the test specimen has passed the test. If any failure in a non-self-restoring part of the insulation is observed, the test specimen has failed to pass the test.

4.3 Tests for in-air expulsion fuses in enclosures

When in-air expulsion fuses are used in an enclosure, a dielectric test of the complete fuse/enclosure combination is required. Using fuse links or fuse units of any convenient current rating, dielectric testing shall be conducted as specified for switches in enclosures in IEEE Std C37.20.3-1987, except test values shall be in accordance with table 4 of ANSI C37.46-1981, and the basic fuse device shall be capable of passing the dew withstand test specified in that standard.

5. Expendable cap static relief pressure tests

5.1 Test practices

The test specimen shall be tested without a fuse link. It shall be mounted and a means provided for exerting a prescribed test pressure through the medium of a liquid.

5.2 Test procedures

The test pressure shall be transmitted through the medium of a liquid and shall be exerted against the entire area of the pressure-responsive section.

6. Interrupting tests

6.1 Test practices

Interrupting test practices shall be as specified in clause 3. and in 6.2 through 6.5.

6.2 Test samples

In making tests on renewable fuses, use fuse links or refill units of the same manufacture as the fuses, fuse holders, or fuse units, or as recommended by the fuse manufacturer.

6.3 Characteristics of the test circuit

The interrupting tests shall be made in a single-phase ac circuit. The circuit elements used to control the current and X/R ratio shall be in series with each other and the fuse. The testing circuit frequency shall be rated frequency ± 2 Hz. If 60 Hz test facilities are not available, tests at 50 Hz ± 2 Hz are acceptable for verifying 60 Hz ratings. Note that 50 Hz tests may produce lower peak let-through currents, but may let through more I^2t than 60 Hz tests.

The parameters of the test circuits are specified in tables 2 through 14. Typical test circuits are shown in a) and b) of figure D.1 in annex D. Methods of determining transient recovery voltage (TRV) parameters are shown in annex D. Overvoltage protective equipment used on the test circuit shall be such that no sparkover occurs during the normal interrupting operation of the fuse.

6.4 Determination of prospective (available) short-circuit current of the test circuit

Short-circuit the device properly connected in the test circuit with a connection having negligible impedance and apply the power at the point of the voltage wave that produces maximum offset in the first loop. A fuse link may be used as the short-circuiting means, provided it is of sufficient capacity so that melting does not occur in the first major current loop.

Where desirable, and where the circuit will be cleared within the first loop of available current, the power applied may be with reduced voltage. Where this is done, the prospective current shall be equal to the measured current in the test circuit multiplied by the ratio of full power-frequency recovery voltage to measured reduced power-frequency test voltage.

Calculate the rms total current, including the direct-current component, in accordance with figures A.2, A.3, or A.4 in annex A for currents of 1-cycle duration or more, or with curve M of figure A.5 in annex A for currents of less than 1-cycle duration. The symmetrical current for the test shall be the asymmetrical value divided by the multiplying factor corresponding to the X/R used in the test circuit. See figure C.1 of annex C and the following note.

NOTE — If tests are made at an X/R ratio higher than specified in the appropriate table, the prospective asymmetrical current shall be equal to, or greater than, the rated symmetrical interrupting current multiplied by the appropriate multiplying factor for the X/R ratio specified in the appropriate table.

6.5 Tests on the device

The device shall be tested in the circuit described in 6.4 with the negligible-impedance connection removed. Power shall be applied at the point on the voltage wave to produce the conditions specified in table 2, 5, 8, 10, or 13 covering the particular device being tested.

6.6 Description of interrupting performance tests

6.6.1 Power fuses (except current-limiting)

Tests shall be made in accordance with table 2 and shall consist of six series of tests. The six series are as follows:

Series 1: Verification of the operation with prospective currents equal to the rated interrupting current at 87% of rated maximum voltage

Series 2: Verification of the operation with prospective currents ranging from 87% to 91% of rated interrupting current at rated maximum voltage

Series 3: Verification of the operation with prospective currents ranging from 60% to 70% of rated interrupting current at rated maximum voltage

Series 4: Verification of the operation with prospective currents ranging from 20% to 30% of rated interrupting current at rated maximum voltage

Series 5: Verification of the operation with prospective currents in the 400 A to 500 A range at rated maximum voltage

Series 6: Verification of the operation with small overload currents at rated maximum voltage

6.6.2 Distribution cutouts (except oil cutouts and open link cutouts)

6.6.2.1 Cutouts with single-voltage rating

Tests shall be made at rated maximum voltage in accordance with table 5 and shall consist of five series of tests. The five series that are conducted at rated maximum voltage are as follows:

Series 1: Verification of the operation with prospective currents equal to the rated interrupting current

Series 2: Verification of the operation with prospective currents ranging from 70% to 80% of the rated interrupting current

Series 3: Verification of the operation with prospective currents ranging from 20% to 30% of the rated interrupting current

Series 4: Verification of the operation with prospective current in the range of 400 A to 500 A

Series 5: Verification of the operation with small overload currents

6.6.2.2 Cutouts with slant-voltage (multiple-voltage) rating

Tests shall be made in accordance with table 8 and shall consist of six series of tests. The six series are as follows:

Series 1: Verification of the operation with prospective currents equal to the rated interrupting current at rated maximum voltage to left of slant (Example of a maximum voltage rating: 7.8/15 kV)

Series 2: Verification of the operation with prospective currents ranging from 70% to 80% of the rated interrupting current at rated maximum voltage to left of slant

Series 3: Verification of the operation with prospective currents ranging from 20% to 30% of the rated interrupting current at rated maximum voltage to right of slant

Series 4: Verification of the operation with prospective currents in the range of 400 A to 500 A, at rated maximum voltage to right of slant

Series 5: Verification of the operation with small overload currents and at rated maximum voltage to right of slant

Series 6: Verification of the operation of two cutouts in electrical series connection with prospective currents equal to the rated interrupting current and at rated maximum voltage to right of slant

6.6.3 Distribution oil cutouts

Five tests shall be made at maximum rated voltage with prospective current equal to the rated interrupting current. The X/R ratio of the test circuit shall be in accordance with table 7.

6.6.4 Distribution open link cutout

A sufficient number of tests shall be made at maximum rated voltage to satisfy the specified interrupting requirements. The X/R ratio of the test circuit shall be 1.3 for all values of test current and a lumped capacitance not exceeding 0.65 μF may be shunted across the fuse during the test.

6.6.5 Current-limiting power and distribution fuses

Tests shall be made in accordance with table 10 and shall consist of three series of tests. The three series are listed below. It is not necessary to make interrupting tests on fuse units of all current ratings of a homogeneous series. See 6.6.5.3 for requirements to be met and tests to be performed.

Series 1:

a) *Power fuses.* Verification of the operation with prospective currents equal to the rated interrupting current, I_1 , at 87% of rated maximum voltage and with prospective currents equal to 87% of the rated interrupting current, I_1 , at rated maximum voltage.

b) *Distribution fuses.* Verification of operation with prospective currents equal to the rated interrupting current, I_1 , at rated maximum voltage.

Series 2: Verification of the operation with prospective current, I_2 , at which current limitation occurs when a high level of energy is stored in the inductance of the circuit.

Series 3: Verification of the operation at low current, I_3 .

a) For back-up type fuses, I_3 is the rated minimum interrupting current.

b) For general-purpose type fuses, I_3 is the current that causes melting of the fuse in not less than 1 h.

c) For full-range fuses, I_3 is the minimum test current, which is a current less than the minimum continuous current that causes melting of the fusible element(s) when the fuse is applied at the maximum ambient