



IEEE Standard Requirements for Capacitor Switches for AC Systems (1 kV to 38 kV)

IEEE Power Engineering Society

Sponsored by the
Switchgear Committee

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Abstract: Required definitions, ratings, and procedures for performing design tests, production tests, and construction requirements for capacitor switches for ac systems from 1 kV to 38 kV are covered.

Keywords: back-to-back capacitor switching, capacitor load, capacitor switches, inrush current, operation, pole discrepancy, probability of restrike classification, restrike, simultaneous operation

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Introduction

This introduction is not part of IEEE Std C37.66-2005, IEEE Standard Requirements for Capacitor Switches for AC Systems (1 kV to 38 kV).

This standard has been revised and updated from the 1969 version of ANSI C37.66-1969 (R1982), incorporating significant improvements that reflect present capacitor switch technology. These improvements include changes and additions in the following areas:

- a) Inclusion of solid and gas insulated switches
- b) Expansion of the ratings data through 38 kV
- c) Creation of probability of restrike classifications C2, C1, and C0
- d) Addition of Annex A (informative)—Fault handling ratings for capacitor switches
- e) Addition of Annex B (informative)—Consideration of inrush current in back-to-back capacitor switching
- f) Addition of Annex C (informative)—Simultaneous opening of single-phase capacitor switches on ungrounded wye capacitor installations
- g) Addition of Annex D (informative)—Altitude correction factors

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IEEE Standard Requirements for Capacitor Switches for AC Systems (1 kV to 38 kV)

1. Scope

This standard applies to single- or multi-pole ac switches for rated maximum voltage above 1 kV to 38 kV for use in switching shunt capacitor banks (see the note in this clause). This standard covers the application of capacitive load switching wherein the capacitive loads are separated by sufficient inductance to limit the high-frequency transient-making peak current to the peak values shown in Table 2 and Table 3. Switches designed and built in accordance with this standard are not intended for use as fault current or non-capacitive load current interrupting devices.

NOTE—This standard is intended to be a comprehensive standard for all “specific duty” applications of switches in the area of switching shunt capacitor banks, but it is limited in scope up to and including 38 kV. However, subject to agreement between the user and manufacturer, it may be used as a specification guide for other rated voltages.¹

2. Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

ANSI C63.2-1996, American National Standard for Electromagnetic Noise and Field Strength Instrumentation, 10 kHz to 40 GHz—Specifications.²

IEC 60694-2002, Common Specifications for High-Voltage Switchgear and Controlgear Standards.³

IEEE Std 4™-1995, IEEE Standard Techniques for High-Voltage Testing.^{4,5}

¹ Notes in text, tables, and figures of a standard are given for information only, and do not contain requirements needed to implement the standard.

² This standard is available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA (<http://standards.ieee.org/>).

³ IEC publications are available from the Sales Department of the International Electrotechnical Commission, Case Postale 131, 3, rue de Varembe, CH-1211, Genève 20, Switzerland/Suisse (<http://www.iec.ch/>). IEC publications are also available in the United States from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

⁴ IEEE publications are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA (<http://standards.ieee.org/>).

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IEEE Std 1247™-1998, IEEE Standard for Interrupter Switches for Alternating Current Rated Above 1000 Volts.

IEEE Std C37.100™-1992 (Reaff 2001), IEEE Standard Definitions for Power Switchgear.

NEMA 107-1987 (Reaff 1993), Methods of Measurement of Radio Influence Voltage (RIV) of High-Voltage Apparatus.⁶

3. Definitions

For the purposes of this standard, the following terms and definitions apply. *The Authoritative Dictionary of IEEE Standards Terms* should be referenced for terms not defined in this clause.

The definitions of terms contained in this standard, or in other standards referred to in this document, are not intended to embrace all legitimate meanings of the terms. They are applicable only to the subject treated in this standard. For additional definitions, see IEEE Std C37.100-1992.⁷

An asterisk (*) indicates that, at the time this standard was approved, there was no corresponding definition in IEEE Std C37.100-1992. A dagger (†) indicates that the definition in this standard differs from that of IEEE Std C37.100-1992.

3.1 capacitive load: A lumped capacitance that is switched as a unit.

3.2 capacitor switch: A switch capable of making and breaking capacitive currents of capacitor banks.

3.3 operation: A closing followed by an opening.†

3.4 pole discrepancy: The time interval, in electrical degrees, between the first capacitor switch pole contact and the final capacitor switch pole contact to mechanically close or open when single-pole capacitor switches are configured as a three-phase system.*

3.5 rated capacitor switching current: The rms symmetrical value of the highest capacitive load current that a device is required to make and interrupt at a rated maximum voltage as part of its designated operation duty cycle.

NOTE—When applying a capacitor switch, the capacitive switching current rating should be at least 125% of the nominal capacitor bank current for ungrounded capacitor banks and at least 135% for grounded capacitor banks. The excess current can be caused by harmonics, overvoltage, and/or plus tolerance in the capacitance of the capacitor bank units. The current multipliers for grounded and ungrounded applications are different because the potential for harmonic current flow is higher in grounded banks when compared to the current flow in ungrounded banks.

3.6 rated high-frequency transient-making current: The peak value of the high-frequency current, with specified damping, against which a device is required to close and latch under specified conditions.

3.7 rated symmetrical-making current: The maximum peak current at rated power frequency, without dc component, against which a device is required to close and hold in the presence of two times the rated high-frequency transient-making current at a frequency equal to one-half of the rated transient inrush frequency.*

3.8 rated transient inrush frequency: The highest frequency of the transient inrush current of a designated operating duty.

⁶ NEMA publications are available from Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112, USA (<http://global.ihs.com/>).

⁷ For information on references, see Clause 2.