

Series capacitors for power systems —

Part 2: Protective equipment for series capacitor banks

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British Standard

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee PEL/33, Power capacitors, upon which the following bodies were represented:

- Association of Consulting Engineers
- BEAMA Capacitor Manufacturers' Association
- ERA Technology Ltd.
- Electricity Association
- Microwave Association
- Rotating Electrical Machines Association BEAMA Ltd.

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National foreword

This British Standard has been prepared by Technical Committee PEL/33 and is the English language version of EN 60143-2:1994 *Series capacitors for power systems — Part 2: Protective equipment for series capacitor banks*, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 143-2:1994, published by the International Electrotechnical Commission (IEC).

As a consequence of publishing BS EN 60143-2 it has become necessary to renumber by amendment BS EN 60143 as BS EN 60143-1.

Cross-references

International Standard	Corresponding British Standard
IEC 44-4:1980	BS 6184:1981 <i>Method for measuring partial discharges in instrument transformers</i>
IEC 50(436):1990	BS 4727 <i>Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms</i> Part 2 <i>Terms particular to power engineering</i> Group 14:1991 <i>Power capacitors</i>
HD 348 S4:1991 (IEC 56:1987)	BS 5311:1988 <i>Specification for high-voltage alternating-current circuit-breakers</i>
HD 558.1 S1:1991 (IEC 60-1:1989)	BS 923 <i>Guide on high-voltage testing techniques</i> Part 1:1990 <i>General</i>
HD 323.2.30 S3:1988 (IEC 63-2-30:1980)	BS 2011 <i>Environmental testing</i> Part 2.1 Db:1981 <i>Test Db and guidance: Damp heat, cyclic (12 + 12 hour cycle)</i> BS EN 60099 <i>Surge arresters</i> Part 1:1994 <i>Non-linear resistor type gapped surge arresters for a.c. systems</i> Part 4:1993 <i>Metal-oxide surge arresters without gaps for a.c. systems</i>
EN 60099-1:1994 (IEC 99-1:1991)	BS EN 60129:1994 <i>Specification for alternating current disconnectors and earthing switches</i>
EN 60129:1994 (IEC 129:1984)	BS EN 60143:1993 <i>Series capacitors for power systems</i>
EN 60143:1993 (IEC 143:1992)	
HD 553 S2:1993 (IEC 185:1987)	BS 7626:1993 <i>Specification for current transformers</i>
HD 554 S1:1992 (IEC 186:1987)	BS 7625:1993 <i>Specification for voltage transformers</i>
EN 60255-6:1994 (IEC 255-6:1988)	BS EN 60255 <i>Electrical relays</i> Part 6:1995 <i>Measuring relays and protection equipment</i>
BS EN 60289:1994 (IEC 289:1988)	BS EN 60289:1995 <i>Reactors</i>
IEC 595:1977	BS 7633:1993 <i>Internal fuses for series capacitors</i> BS 5967 <i>Operating conditions for industrial-process measurements and control equipment</i> Part 2:1980 <i>Specification for power</i>
HD 413 S2:1994 (IEC 654-2:1979)	
HD 413.3.S1:1987 (IEC 654-3:1983)	Part 3:1984 <i>Methods for assessing degree of immunity of systems or parts of systems when subjected to mechanical influences</i>
IEC 654-4:1987	Part 4:1988 <i>Classification of corrosive erosive environmental conditions</i>
HD 448 S2:1984 (IEC 694:1980)	BS 6581:1985 <i>Specification for common requirements for high-voltage switchgear and controlgear standards</i>

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, the EN title page, pages 2 to 32, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

ICS 31.060.00

Descriptors: Electronic-components, capacitors, power capacitors, capacitor banks, safety devices, overload protection, isolating switches, spark gaps, damping, current transformers, potential transformers, classifications, quality, tests

English version

Series capacitors for power systems
Part 2: Protective equipment for series capacitor banks
(IEC 143-2:1994)

Condensateurs série destinés à être installés
sur des réseaux
Partie 2: Matériel de protection pour les
batteries de condensateurs série
(CEI 143-2:1994)

Reihenkondensatoren für Starkstromanlagen
Teil 2: Schutzeinrichtungen für
Reihenkondensatorbatterien
(IEC 143-2:1994)

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 33(CO)115, as prepared by IEC Technical Committee 33, Power capacitors, was submitted to the IEC-CENELEC parallel vote in December 1993.

The reference document was approved by CENELEC as EN 60143-2 on 5 July 1994.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1995-07-01
- latest date of withdrawal of conflicting national standards (dow) 1995-07-01

For products which have complied with the relevant national standard before 1995-07-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2000-07-01.

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given only for information. In this standard, Annex A is informative and Annex ZA is normative.

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Section 1. General

1.1 Scope and object

This part of IEC 143 covers protective equipment for series capacitor banks, with a size larger than 10 Mvar per phase. Protective equipment is defined as the main circuit apparatus and ancillary equipment, which are part of a series capacitor installation, but which are external to the capacitor part itself. The recommendations for the capacitor part are given in IEC 143. The protective equipment is mentioned in clauses 1.3 and 7.6 of IEC 143.

The protective equipment, treated in this standard, comprises the following items listed below.

- overvoltage protector,
- protective spark gap,
- non-linear resistor (varistor),
- by-pass circuit-breaker,
- disconnectors,

- current-limiting damping equipment,
- discharge reactor,
- voltage transformer,
- current transformer,
- signal column,
- relay protection, control equipment and platform to ground communication equipment.

See Figure 1.

Principles involved in the application and operation of series capacitors are given in section 3.

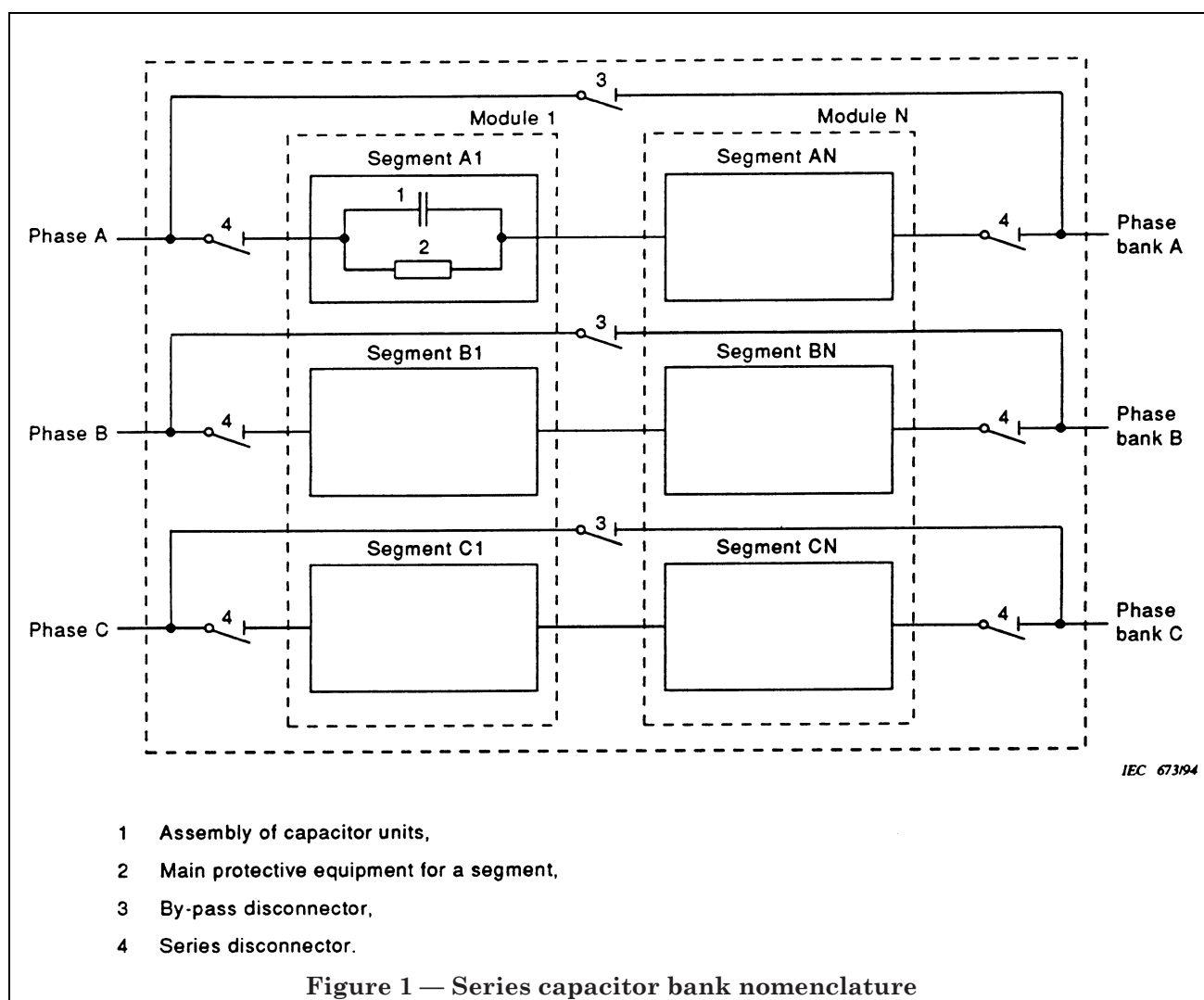
Examples of fault scenarios are given in section 3.

Examples of protective schemes utilizing different overvoltage protectors are given in clause 2.1.

NOTE Capacitor fuses are not treated in this standard, since they are treated in IEC 143 and IEC 595.

The object of this standard is:

- to formulate uniform rules regarding performance, testing and rating,



- to illustrate different kinds of overvoltage protectors,
- to provide a guide for installation and operation.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 143. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 143 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

The following IEC publications and reports are quoted in this standard:

- IEC 44-4:1980, *Instrument transformers — Part 4: Measurement of partial discharges*.
- IEC 50(436):1990, *International Electrotechnical Vocabulary (IEV) — Chapter 436: Power Capacitors*.
- IEC 56:1987, *High-voltage alternating-current circuit-breakers*.
- IEC 60-1:1989, *High-voltage test techniques — Part 1: General definitions and test requirements*.
- IEC 68-2-30:1980, *Basic environmental testing procedures — Part 2: Tests — Test Db and guidance: Damp heat, cyclic (12 + 12 hour cycle)*.
- IEC 76-1:1993, *Power transformers — Part 1: General*.
- IEC 99-1:1991, *Surge arresters — Part 1: Non-linear resistor type gapped arresters for a.c. systems*.
- IEC 99-4:1991, *Surge arresters — Part 4: Metal-oxide surge arresters without gaps for a.c. systems*.
- IEC 129:1984, *Alternating current disconnectors and earthing switches*.
- IEC 143:1992, *Series capacitors for power systems*.
- IEC 185:1987, *Current transformers*.
- IEC 186:1987, *Voltage transformers*.
- IEC 255-6:1988, *Electrical relays — Part 6: Measuring relays and protection equipment*.
- IEC 289:1988, *Reactors*.
- IEC 383 (Parts 1-2):1993, *Tests on insulators of ceramic material or glass for overhead lines with a nominal voltage greater than 1 000 V*.
- IEC 595:1977, *Internal fuses for series capacitors*. Amendment 2, 1987

IEC 654 (Parts 1-4):1979-1987, *Operating conditions for industrial-process measurement and control equipment*.

IEC 694:1980, *Common clauses for high-voltage switchgear and controlgear standards*.

IEC 794-1:1993, *Optical fibre cables — Part 1: Generic specification*.

IEC 794-2:1989, *Optical fibre cables — Part 2: Product specifications*.

NOTE No standard exists for varistors for series capacitors (S.C.). The relevant tests for series capacitors varistors are therefore dealt with in this standard.

1.3 Definitions

For the purpose of this part of IEC 143, the following definitions apply:

1.3.0 definitions of capacitor parts and accessories

they are in accordance with IEC 143

1.3.1 back-up gap

supplementary gap which may be set to spark over at a voltage level higher than the protective level of the primary protective device, and which is normally placed in parallel with the primary protective device

1.3.2 bank protection

general term for all protective equipment for a capacitor bank, or part thereof

1.3.3 by-pass current

current flowing through the by-pass device or devices in parallel with the series capacitor. This current can either be a fault current or a normal current

1.3.4 by-pass device

device such as a switch or a circuit-breaker used in parallel with a series capacitor and its overvoltage protector to shunt line current for a specified time, or continuously. Besides by-passing the capacitor, this device may also have the capability of inserting the capacitor into a circuit and carrying a specified current

1.3.5 by-pass disconnector

device to short-circuit the series capacitor after it is by-passed by the by-pass device