

**Jadakondensaatorid energiasüsteemidele. Osa 2:
Kaitseseadmed jadakondensaatorite rühmadele**

**Series capacitors for power systems - Part 2: Protective
equipment for series capacitor banks (IEC 60143-2:2012)**

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 60143-2:2013 sisaldab Euroopa standardi EN 60143-2:2013 ingliskeelset teksti.	This Estonian standard EVS-EN 60143-2:2013 consists of the English text of the European standard EN 60143-2:2013.
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**Series capacitors for power systems -
Part 2: Protective equipment for series capacitor banks
(IEC 60143-2:2012)**

Condensateurs série destinés
à être installés sur des réseaux -
Partie 2: Matériel de protection pour les
batteries de condensateurs série
(CEI 60143-2:2012)

Reihenkondensatoren für
Starkstromanlagen -
Teil 2: Schutzeinrichtungen für
Reihenkondensatorbatterien
(IEC 60143-2:2012)

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Foreword

The text of document 33/517/FDIS, future edition 2 of IEC 60143-2, prepared by IEC/TC 33 "Power capacitors and their applications" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60143-2:2013.

The following dates are fixed:

- latest date by which the document has to be (dop) 2013-12-14
implemented at national level by
publication of an identical national
standard or by endorsement
- latest date by which the national (dow) 2016-01-15
standards conflicting with the
document have to be withdrawn

This document supersedes EN 60143-2:1994.

EN 60143-2:2013 includes the following significant technical changes with respect to EN 60143-2:1994:

- updated with respect to new and revised component standards;
- updates with respect to technology changes. Outdated technologies have been removed, i.e. series capacitors with dual self-triggered gaps. New technologies have been added, i.e. current sensors instead of current transformers;
- the testing of spark gaps has been updated to more clearly specify requirements and testing procedures. A new bypass making current test replaces the old discharge current test;
- Clause 5, Guide, has been expanded with more information about different damping circuits and series capacitor protections.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

Endorsement notice

The text of the International Standard IEC 60143-2:2012 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60068-1	NOTE	Harmonised as EN 60068-1.
IEC 60068-2-2	NOTE	Harmonised as EN 60068-2-2.
IEC 60068-2-78	NOTE	Harmonised as EN 60068-2-78.
IEC 60068-2-30	NOTE	Harmonised as EN 60068-2-30.
IEC 60071-1	NOTE	Harmonised as EN 60071-1.
IEC 60071-2	NOTE	Harmonised as EN 60071-2.
IEC 60143-3	NOTE	Harmonised as EN 60143-3.
IEC 60255-1	NOTE	Harmonised as EN 60255-1.
IEC 60383-1	NOTE	Harmonised as EN 60383-1.

IEC 60383-2	NOTE	Harmonised as EN 60383-2.
IEC 60507	NOTE	Harmonised as EN 60507.
IEC 60549	NOTE	Harmonised as EN 60549.
IEC 60654-1	NOTE	Harmonised as EN 60654-1.
IEC 60654-4	NOTE	Harmonised as EN 60654-4.
IEC 60871-1	NOTE	Harmonised as EN 60871-1.
IEC 60909 Series	NOTE	Harmonised as EN 60909 Series (not modified).
IEC 61000-4-2	NOTE	Harmonised as EN 61000-4-2.
IEC 61000-4-11	NOTE	Harmonised as EN 61000-4-11.
IEC 62217	NOTE	Harmonised as EN 62217.
IEC 62271-100	NOTE	Harmonised as EN 62271-100.
IEC 62223	NOTE	Harmonised as EN 62223.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60044	Series	Instrument transformers	EN 60044	Series
IEC 60044-1	-	Instrument transformers - Part 1: Current transformers	EN 60044-1	-
IEC 60044-8	-	Instrument transformers - Part 8: Electronic current transformers	EN 60044-8	-
IEC 60060	Series	High-voltage test techniques	EN 60060	Series
IEC 60076-1	-	Power transformers - Part 1: General	EN 60076-1	-
IEC 60076-6	2007	Power transformers - Part 6: Reactors	EN 60076-6	2008
IEC 60099-4 (mod)	2004	Surge arresters - Part 4: Metal-oxide surge arresters without gaps for a.c. systems	EN 60099-4	2004
+ A1	2006		+A1	2006
+ A2	2009		+A2	2009
IEC 60143-1	2004	Series capacitors for power systems - Part 1: General	EN 60143-1	2004
IEC 60255-5	-	Electrical relays - Part 5: Insulation coordination for measuring relays and protection equipment - Requirements and tests	EN 60255-5	-
IEC 60255-21-1	-	Electrical relays - Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment - Section 1: Vibration tests (sinusoidal)	EN 60255-21-1	-
IEC 60270	-	High-voltage test techniques - Partial discharge measurements	EN 60270	-
IEC 60358-1	-	Coupling capacitors and capacitor dividers - Part 1: General rules	EN 60358-1	-
IEC 60358-2	-	Coupling capacitors and capacitor dividers - Part 2: AC or DC single-phase coupling capacitor connected between line and ground for power line carrier-frequency (PLC) application	EN 60358-2	-
IEC 60794-1-1	-	Optical fibre cables - Part 1-1: Generic specification - General	EN 60794-1-1	-
IEC 60794-2	-	Optical fibre cables - Part 2: Indoor cables - Sectional specification	EN 60794-2	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61000-4-29	-	Electromagnetic compatibility (EMC) - Part 4-29: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests	EN 61000-4-29	-
IEC 61109	-	Insulators for overhead lines - Composite suspension and tension insulators for a.c. systems with a nominal voltage greater than 1 000 V - Definitions, test methods and acceptance criteria	EN 61109	-
IEC 61300-3-4	-	Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Part 3-4: Examinations and measurements - Attenuation	EN 61300-3-4	-
IEC 61869-3	-	Instrument transformers - Part 3: Additional requirements for inductive voltage transformers	EN 61869-3	-
IEC 61869-5	-	Instrument transformers - Part 5: Additional Requirements for capacitor voltage transformers	EN 61869-5	-
IEC 62271-1	-	High-voltage switchgear and controlgear - Part 1: Common specifications	EN 62271-1	-
IEC 62271-102 + corr. April + corr. May + corr. February	2001 2002 2003 2005	High-voltage switchgear and controlgear - Part 102: Alternating current disconnectors and earthing switches	EN 62271-102 + corr. March + corr. July	2002 2005 2008
IEC 62271-109	2008	High-voltage switchgear and controlgear - Part 109: Alternating-current series capacitor by-pass switches	EN 62271-109	2009

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SERIES CAPACITORS FOR POWER SYSTEMS –

Part 2: Protective equipment for series capacitor banks

1 Scope

This part of IEC 60143 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 60143-1:2004. The protective equipment is mentioned in Clause 3 and 10.6 of IEC 60143-1:2004.

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

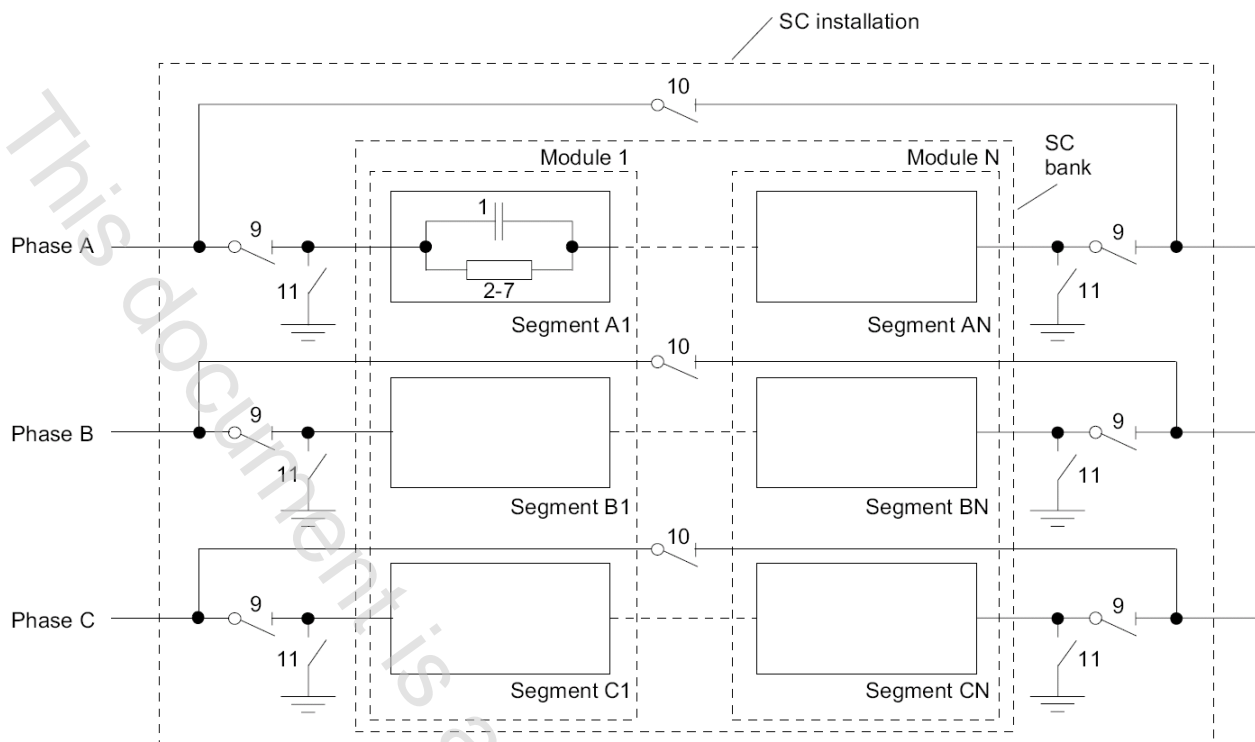
- overvoltage protector,
- protective spark gap,
- varistor,
- bypass switch,
- disconnectors and earthing switches,
- discharge current-limiting and damping equipment,
- voltage transformer,
- current sensors,
- coupling capacitor,
- signal column,
- fibre optical platform links,
- relay protection, control equipment and platform-to-ground communication equipment.

See Figure 1.

Principles involved in the application and operation of series capacitors are given in Clause 5.

Examples of fault scenarios are given in Clause 5.

Examples of protective schemes utilizing different overvoltage protectors are given in 4.1.



IEC 2904/03

Key

- 1 assembly of capacitor units
- 2-7 main protective equipment
- 9 isolating disconnector
- 10 bypass disconnector
- 11 earth switch

Figure 1 – Typical nomenclature of a series capacitor installation

NOTE Most series capacitors are configured with a single module, unless the reactance and current requirements result in a voltage across the bank that is impractical for the supplier to achieve with one module. Normally each module has its own bypass switch but a common bypass switch can be used for more than one module. See 10.2.3 of IEC 60143-1:2004 for additional details.

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.

2 Normative references

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

IEC 60044 (all parts), *Instrument transformers*

IEC 60044-1, *Instrument transformers – Part 1: Current transformers*

IEC 60044-8, *Instrument transformers – Part 8: Electronic current transformers*

IEC 60060 (all parts), *High-voltage test techniques*

IEC 60076-1, *Power transformers – Part 1: General*

IEC 60076-6:2007, *Power transformers – Part 6: Reactors*

IEC 60099-4:2009, *Surge arresters – Part 4: Metal-oxide surge arresters without gaps for a.c. systems*

IEC 60143-1:2004, *Series capacitors for power systems – Part 1: General*

IEC 60255-5, *Electrical relays – Part 5: Insulation coordination for measuring relays and protection equipment – Requirements and tests*

IEC 60255-21, *Electrical relays – Part 21: Vibration, shock, bump and seismic test on measuring relays and protection equipment – Section One – Vibration tests (sinusoidal)*

IEC 60270, *High-voltage test techniques – Partial discharge measurements*

IEC 60358-1, *Coupling capacitors and capacitor dividers – Part 1: General rules*

IEC 60358-2, *Coupling capacitors and capacitor dividers – Part 2: AC or DC single-phase coupling capacitor connected between line and ground for power line carrier frequency (PLC) application¹*

IEC 60794-1-1, *Optical fibre cables - Part 1: Generic specification – General*

IEC 60794-2, *Optical fibre cables - Part 2: Indoor cables – Sectional specification*

IEC 61000-4-29, *Electromagnetic compatibility (EMC) – Part 4-29: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on d.c. input port immunity tests*

IEC 61109, *Insulators for overhead lines – Composite suspension and tension insulators for a.c. systems with a nominal voltage greater than 1 000 V – Definitions, test methods and acceptance criteria*

IEC 61300-3-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-4: Examinations and measurements – Attenuation*

IEC 61869-3, *Instrument transformers – Part 3: Additional requirements for inductive voltage transformers*

IEC 61869-5, *Instrument transformers – Part 5: Additional requirements for capacitor voltage transformers*

IEC 62271-1, *High-voltage switchgear and controlgear – Part 1: Common specifications*

IEC 62271-102:2001, *High-voltage switchgear and controlgear – Part 102: Alternating current disconnectors and earthing switches*

IEC 62271-109:2008, *High-voltage switchgear and controlgear – Part 109: Alternating current series capacitor bypass switches*

¹ To be published.

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

3 Terms and definitions

For the purpose of this document, the following terms and definitions apply:

NOTE The definitions of capacitor parts and accessories in this standard are in accordance with IEC 60143-1:2004.

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

3.2

bank protection

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

3.3

bypass current

current flowing through the bypass switch or spark gap in parallel with the series capacitor

3.4

bypass switch

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

Note 1 to entry: Besides bypassing the capacitor, this device may also have the capability of inserting the capacitor into a circuit and carrying a specified current.

Note 2 to entry: This device shall also have the capability of bypassing the capacitor during specified power system fault conditions. The operation of the device is initiated by the capacitor control, remote control or an operator. The device may be mounted on the platform or on the ground near the platform.

3.5

bypass disconnecter

device to short-circuit the series capacitor after it is bypassed by the bypass switch

Note 1 to entry: Installed to keep the line in service while the bypass switch or series capacitor bank are maintained.

3.6

bypass fault current

current flowing through the bypassed series capacitor bank caused by a fault on the line

Note 1 to entry: See also "through fault current" and "partial fault current".

3.7

bypass gap (protective gap)

gap, or system of gaps, to protect either the capacitor (type K) against overvoltage or the varistor (type M) against overload by carrying load or fault current around the protected parts for a specified time

3.8

bypass interlocking device

device that requires all three poles of the bypass switch to be in the same open or closed position