

**Series capacitors for power systems - Part 4:
Thyristor controlled series capacitors**

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 60143-4:2010 sisaldab Euroopa standardi EN 60143-4:2010 ingliskeelset teksti.

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**Series capacitors for power systems -
Part 4: Thyristor controlled series capacitors
(IEC 60143-4:2010)**

Condensateurs série destinés à être
installés sur des réseaux -
Partie 4: Condensateurs série
commandés par thyristors
(CEI 60143-4:2010)

Reihenkondensatoren für
Starkstromanlagen -
Teil 4: Thyristorgesteuerte
Reihenkondensatoren
(IEC 60143-4:2010)

This European Standard was approved by CENELEC on 2010-12-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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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 33/472/FDIS, future edition 1 of IEC 60143-4, prepared by IEC TC 33, Power capacitors, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60143-4 on 2010-12-01.

This part of EN 60143 is to be used in conjunction with the following standards:

- EN 60143-1:2004, *Series capacitors for power systems – Part 1: General*
- EN 60143-2:1994, *Series capacitors for power systems – Part 2: Protective equipment for series capacitor banks*
- EN 60143-3:1998, *Series capacitors for power systems – Part 3: Internal fuses*

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

The following dates were fixed:

- | | | |
|--|-------|------------|
| – latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2011-09-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | 2013-12-01 |

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60143-4:2010 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:

- | | | |
|-------------------|------|-----------------------------|
| [1] IEC 60068-1 | NOTE | Harmonized as EN 60068-1. |
| [2] IEC 60721-1 | NOTE | Harmonized as EN 60721-1. |
| [3] IEC 60068-3-3 | NOTE | Harmonized as EN 60068-3-3. |
| [4] IEC 60060-2 | NOTE | Harmonized as EN 60060-2. |
| [5] IEC 61000-4-2 | NOTE | Harmonized as EN 61000-4-2. |
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Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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) 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 60050-436	-	International Electrotechnical Vocabulary (IEV) - Chapter 436: Power capacitors	-	-
IEC 60060-1	-	High-voltage test techniques - Part 1: General definitions and test requirements	EN 60060-1	-
IEC 60068-1	-	Environmental testing - Part 1: General and guidance	EN 60068-1	-
IEC 60068-2-2	-	Environmental testing - Part 2-2: Tests - Test B: Dry heat	EN 60068-2-2	-
IEC 60068-2-78	-	Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state	EN 60068-2-78	-
IEC 60071-1	-	Insulation co-ordination - Part 1: Definitions, principles and rules	EN 60071-1	-
IEC 60071-2	-	Insulation co-ordination - Part 2: Application guide	EN 60071-2	-
IEC 60076-1	1993	Power transformers - Part 1: General	EN 60076-1	1997
IEC 60076-6	2007	Power transformers - Part 6: Reactors	EN 60076-6	2008
IEC 60143-1	2004	Series capacitors for power systems - Part 1: General	EN 60143-1	2004
IEC 60143-2	1994	Series capacitors for power systems - Part 2: Protective equipment for series capacitor banks	EN 60143-2	1994
IEC 60143-3	1998	Series capacitors for power systems - Part 3: Internal fuses	EN 60143-3	1998

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60255-5	-	Electrical relays - Part 5: Insulation coordination for measuring relays and protection equipment - Requirements and tests	EN 60255-5	-
IEC 60255-21	Series	Electrical relays - Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment	EN 60255-21	Series
IEC 60270	-	High-voltage test techniques - Partial discharge measurements	EN 60270	-
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 61954	1999	Power electronics for electrical transmission and distribution systems - Testing of thyristor valves for static VAR compensators	EN 61954	1999

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SERIES CAPACITORS FOR POWER SYSTEMS –

Part 4: Thyristor controlled series capacitors

1 Scope

This part of IEC 60143 specifies testing of thyristor controlled series capacitor (TCSC) installations used in series with transmission lines. This standard also addresses issues that consider ratings for TCSC thyristor valve assemblies, capacitors, and reactors as well as TCSC control characteristics, protective features, cooling system and system operation.

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) applies.

NOTE If there is a conflict between this part of IEC 60143 and a standard listed below in Clause 2, this standard prevails.

IEC 60050-436, *International Electrotechnical Vocabulary – Chapter 436: Power capacitors*

IEC 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60068-1, *Environmental Testing – Part 1: General and guidance*

IEC 60068-2-2, *Basic environmental testing procedures – Part 2-2: Tests – Tests B: Dry heat*

IEC 60068-2-78, *Basic environmental testing procedures – Part 2-78: Tests – Tests C: Damp heat, steady state*

IEC 60071-1, *Insulation co-ordination – Part 1: Definitions, principles and rules*

IEC 60071-2, *Insulation co-ordination – Part 2: Application guide*

IEC 60076-1:1993, *Power transformers – Part 1: General*

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

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

IEC 60143-2:1994, *Series capacitors for power systems – Part 2: Protective equipment for series capacitor banks*

IEC 60143-3:1998, *Series capacitors for power systems – Part 3: Internal fuses*

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

IEC 60255-21 (all parts), *Electrical relays – Vibration, shock, bump and seismic tests on measuring relays and protection equipment*

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

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 61954:1999, *Power electronics for electrical transmission and distribution systems – Testing of thyristor valves for static VAR compensators*

NOTE Additional useful references, not explicitly referenced in the text, are listed in the Bibliography .

3 Terms, definitions and abbreviations

For the purposes of this document, the following terms, definitions and abbreviations as well as those given in IEC 60143-1, IEC 60143-2, IEC 60143-3 and some taken from IEC 60050-436 apply.

NOTE In some instances, the IEC definitions may be either too broad or too restrictive. In such a case, an additional definition or note has been included.

3.1 Abbreviations

ETT	Electrically triggered thyristors
FACTS	Flexible ac transmission systems
FSC	Fixed series compensation
LTT	Light-triggered thyristors
MC	Master control
MTBF	Mean time between failure
MTTR	Mean time to repair
POD	Power oscillation damping
RAM	Reliability, availability, and maintainability
RIV	Radio influence voltage
RTU	Remote terminal unit
SCADA	Supervisory control and data acquisition
ER	Events recorder
FR	Fault recorder
RTDS	Real time digital simulation
SSR	Sub synchronous resonance
SVC	Static var compensator
TCR	Thyristor-controlled reactor
RMS	Root mean square

3.2 Terms and definitions

3.2.1 thyristor valve

electrically combined assembly of thyristor levels, complete with all connections, auxiliary components and mechanical structures, which can be connected in series with each phase of the reactor or capacitor of a TCSC