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## COMMENTED VERSION

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### **Spänningsstyva strömriktare (VSC) för elöverföring med högspänd likström (HVDC) – Elektrisk provning**

*Voltage sourced converter (VSC) valves for high-voltage direct current (HVDC) power transmission – Electrical testing*

En så kallad "Commented Version" (CMV) innehåller både den fastställda IEC-standardens och en kommenterad och ändringsmarkerad standard. Alla tillägg och borttagningar sedan den tidigare utgåvan är markerade med färg. Med en CMV sparar du mycket tid när du ska identifiera och förklara aktuella ändringar i standarden. SEK Svensk Elstandard kan bara ge ut CMV i de fall den finns tillgänglig från IEC.



IEC 62501

Edition 2.0 2024-04  
COMMENTED VERSION

# INTERNATIONAL STANDARD



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**Voltage sourced converter (VSC) valves for high-voltage direct current (HVDC)  
power transmission – Electrical testing**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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**VOLTAGE SOURCED CONVERTER (VSC)  
VALVES FOR HIGH-VOLTAGE DIRECT CURRENT (HVDC)  
POWER TRANSMISSION – ELECTRICAL TESTING****FOREWORD**

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**This commented version (CMV) of the official standard IEC 62501:2024 edition 2.0 allows the user to identify the changes made to the previous IEC 62501:2009+AMD1:2014 +AMD2:2017 CSV edition 1.2. Furthermore, comments from IEC SC 22F experts are provided to explain the reasons of the most relevant changes, or to clarify any part of the content.**

**A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text. Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.**

**This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.**

IEC 62501 has been prepared by subcommittee 22F: Power electronics for electrical transmission and distribution systems, of IEC technical committee 22: Power electronic systems and equipment. It is an International Standard.

This second edition cancels and replaces the first edition published in 2009, Amendment 1:2014 and Amendment 2:2017. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Conditions for use of evidence in lieu are inserted as a new Table 1;
- b) Test parameters for valve support DC voltage test, 7.3.2, and MVU DC voltage test, 8.4.1, updated;
- c) AC-DC voltage test between valve terminals, Clause 9, is restructured and alternative tests, by individual AC and DC voltage tests, added in 9.4.2;
- d) Partial discharge test in routine test program is removed;
- e) More information on valve component fault tolerance, Annex B, is added;
- f) Valve losses determination is added as Annex C.

The text of this International Standard is based on the following documents:

Draft	Report on voting
22F/731/CDV	22F/748A/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under [webstore.iec.ch](http://webstore.iec.ch) in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

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# VOLTAGE SOURCED CONVERTER (VSC) VALVES FOR HIGH-VOLTAGE DIRECT CURRENT (HVDC) POWER TRANSMISSION – ELECTRICAL TESTING

## 1 Scope

This International Standard applies to self-commutated converter valves, for use in a three-phase bridge voltage sourced converter (VSC) for high voltage DC power transmission or as part of a back-to-back link, and to dynamic braking valves. It is restricted to electrical type and production tests.

~~The scope of this standard includes the electrical type and production tests of dynamic braking valves which may be used in some HVDC schemes for d.c. overvoltage limitation.~~

This document can be used as a guide for testing of high-voltage VSC valves used in energy storage systems (ESS). **1**

The tests specified in this document are based on air insulated valves. ~~For other types of valves, The test requirements and acceptance criteria should be agreed between the purchaser and the supplier.~~ The test requirements and acceptance criteria can be used for guidance to specify the electrical type and production tests of other types of valves.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

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

IEC 60071 (all parts), *Insulation co-ordination*

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

IEC 60700-1:2015, *Thyristor valves for high voltage direct current (HVDC) power transmission – Part 1: Electrical testing*  
IEC 60700-1:2015/AMD1:2021

IEC 62747, *Terminology for voltage-sourced converters (VSC) for high-voltage direct current (HVDC) systems*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*



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## Spänningsstyva strömriktare (VSC) för elöverföring med högspänd likström (HVDC) – Elektrisk provning

*Voltage sourced converter (VSC) valves for high-voltage direct current (HVDC) power transmission – Electrical testing*

Som svensk standard gäller europastandarden EN IEC 62501:2024. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 62501:2024.

### Nationellt förord

Europastandarden EN IEC 62501:2024

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 62501, Second edition, 2024 - Voltage sourced converter (VSC) valves for high-voltage direct current (HVDC) power transmission – Electrical testing**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN 62501, utg 1:2010 med eventuella tillägg, ändringar och rättelser gäller ej fr o m 2027-05-15.

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English Version

Voltage sourced converter (VSC) valves for high-voltage direct  
current (HVDC) power transmission - Electrical testing  
(IEC 62501:2024)

Valves à convertisseur de source de tension (VSC) pour le  
transport d'énergie en courant continu à haute tension  
(CCHT) - Essais électriques  
(IEC 62501:2024)

Ventile von Spannungszwischenkreis-Stromrichtern (VSC)  
für die Hochspannungsgleichstromübertragung (HGÜ) -  
Elektrische Prüfung  
(IEC 62501:2024)

This European Standard was approved by CENELEC on 2024-05-15. 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.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

## **European foreword**

The text of document 22F/731/CDV, future edition 2 of IEC 62501, prepared by SC 22F "Power electronics for electrical transmission and distribution systems" of IEC/TC 22 "Power electronic systems and equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62501:2024.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2025-02-15 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2027-05-15 document have to be withdrawn

This document supersedes EN 62501:2009 and all of its amendments and corrigenda (if any).

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The text of the International Standard IEC 62501:2024 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 standard indicated:

IEC 60146-2 NOTE Approved as EN 60146-2

IEC 62751-1 NOTE Approved as EN 62751-1

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cenelec.eu](http://www.cenelec.eu).

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60060	series	High-voltage test techniques	EN 60060	series
IEC 60071	series	Insulation co-ordination	EN IEC 60071	series
IEC 60270	-	High-voltage test techniques - Partial discharge measurements	EN 60270	-
IEC 60700-1	2015	Thyristor valves for high voltage direct current (HVDC) power transmission - Part 1: Electrical testing	EN 60700-1	2015
+ AMD1	2021		+ A1	2021
IEC 62747	-	Terminology for voltage-sourced converters (VSC) for high-voltage direct current (HVDC) systems	EN 62747	-
ISO/IEC 17025	-	General requirements for the competence of testing and calibration laboratories	EN ISO/IEC 17025 -	

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



**Voltage sourced converter (VSC) valves for high-voltage direct current (HVDC) power transmission – Electrical testing**

**Valves à convertisseur de source de tension (VSC) pour le transport d'énergie en courant continu à haute tension (CCHT) – Essais électriques**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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**VOLTAGE SOURCED CONVERTER (VSC)  
VALVES FOR HIGH-VOLTAGE DIRECT CURRENT (HVDC)  
POWER TRANSMISSION – ELECTRICAL TESTING****FOREWORD**

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This second edition cancels and replaces the first edition published in 2009, Amendment 1:2014 and Amendment 2:2017. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Conditions for use of evidence in lieu are inserted as a new Table 1;
- b) Test parameters for valve support DC voltage test, 7.3.2, and MVU DC voltage test, 8.4.1, updated;
- c) AC-DC voltage test between valve terminals, Clause 9, is restructured and alternative tests, by individual AC and DC voltage tests, added in 9.4.2;

- d) Partial discharge test in routine test program is removed;
- e) More information on valve component fault tolerance, Annex B, is added;
- f) Valve losses determination is added as Annex C.

The text of this International Standard is based on the following documents:

Draft	Report on voting
22F/731/CDV	22F/748A/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

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# **VOLTAGE SOURCED CONVERTER (VSC) VALVES FOR HIGH-VOLTAGE DIRECT CURRENT (HVDC) POWER TRANSMISSION – ELECTRICAL TESTING**

## **1 Scope**

This International Standard applies to self-commutated converter valves, for use in a three-phase bridge voltage sourced converter (VSC) for high voltage DC power transmission or as part of a back-to-back link, and to dynamic braking valves. It is restricted to electrical type and production tests.

This document can be used as a guide for testing of high-voltage VSC valves used in energy storage systems (ESS).

The tests specified in this document are based on air insulated valves. The test requirements and acceptance criteria can be used for guidance to specify the electrical type and production tests of other types of valves.

## **2 Normative references**

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

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

IEC 60071 (all parts), *Insulation co-ordination*

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

IEC 60700-1:2015, *Thyristor valves for high voltage direct current (HVDC) power transmission – Part 1: Electrical testing*  
IEC 60700-1:2015/AMD1:2021

IEC 62747, *Terminology for voltage-sourced converters (VSC) for high-voltage direct current (HVDC) systems*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*