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IEC 62501

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COMMENTED VERSION

INTERNATIONAL STANDARD



**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

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

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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:

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| 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. The main document types developed by IEC are described in greater detail at 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.

~~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*

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

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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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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

VALVES À CONVERTISSEUR DE SOURCE DE TENSION (VSC) POUR LE TRANSPORT D'ÉNERGIE EN COURANT CONTINU À HAUTE TENSION (CCHT) – ESSAIS ÉLECTRIQUES

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Cette deuxième édition annule et remplace la première édition parue en 2009, son Amendement 1:2014 et son Amendement 2:2017. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

- a) un nouveau tableau relatif aux conditions d'utilisation de la substitution de preuve (Tableau 1) a été inséré;
- b) les paramètres d'essai relatifs à l'essai de support de valve sous tension continue (7.3.2) et à l'essai de MVU sous tension continue (8.4.1) ont été mis à jour;
- c) l'Article 9 concernant l'essai sous tension alternative-continue entre les bornes de valve a été réorganisé et des variantes ont été ajoutées en 9.4.2 pour les essais individuels sous tension alternative et continue;
- d) l'essai de décharge partielle a été supprimé du programme des essais individuels de série;
- e) des informations complémentaires relatives à la tolérance aux pannes des composants de valve ont été ajoutées à l'Annexe B;
- f) la détermination des pertes de valve a été ajoutée à l'Annexe C.

Le texte de cette Norme internationale est issu des documents suivants:

| Projet | Rapport de vote |
|-------------|-----------------|
| 22F/731/CDV | 22F/748A/RVC |

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

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VALVES À CONVERTISSEUR DE SOURCE DE TENSION (VSC) POUR LE TRANSPORT D'ÉNERGIE EN COURANT CONTINU À HAUTE TENSION (CCHT) – ESSAIS ÉLECTRIQUES

1 Domaine d'application

La présente Norme internationale s'applique aux valves à convertisseur auto-commuté, conçues pour être utilisées dans un convertisseur de source de tension (VSC) en pont triphasé pour le transport d'énergie en courant continu à haute tension ou dans une liaison dos-à-dos, ainsi qu'aux valves à freinage dynamique. Elle est limitée aux essais de type électriques et de série.

Le présent document peut servir de guide pour les essais des valves à VSC à haute tension utilisées dans les systèmes de stockage d'énergie (ESS).

Les essais spécifiés dans le présent document sont basés sur des valves isolées par l'air. Les exigences d'essai et les critères d'acceptation peuvent servir de guide pour spécifier les essais de type électriques et de série d'autres types de valves.

2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60060 (toutes les parties), *Techniques des essais à haute tension*

IEC 60071 (toutes les parties), *Coordination de l'isolement*

IEC 60270, *Techniques des essais à haute tension – Mesures des décharges partielles*

IEC 60700-1:2015, *Valves à thyristors pour le transport d'énergie en courant continu à haute tension (CCHT) - Partie 1: Essais électriques*
IEC 60700-1:2015/AMD1:2021

IEC 62747, *Terminologie relative aux convertisseurs de source de tension (VSC) des systèmes en courant continu à haute tension (CCHT)*

ISO/IEC 17025, *Exigences générales concernant la compétence des laboratoires d'étalonnages et d'essais*