

FINAL VERSION

VERSION FINALE



**Power losses in voltage sourced converter (VSC) valves for high-voltage direct current (HVDC) systems –
Part 2: Modular multilevel converters**

**Pertes de puissance dans les valves à convertisseur de source de tension (VSC) des systèmes en courant continu à haute tension (CCHT) –
Partie 2: Convertisseurs multiniveaux modulaires**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

POWER LOSSES IN VOLTAGE SOURCED CONVERTER (VSC) VALVES FOR HIGH-VOLTAGE DIRECT CURRENT (HVDC) SYSTEMS –

Part 2: Modular multilevel converters

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This Consolidated version of IEC 62751-2 bears the edition number 1.1. It consists of the first edition (2014-08) [documents 22F/303/CDV and 22F/322A/RVC] and its amendment 1 (2019-08) [documents 22F/479/CDV and 22F/488B/RVC]. The technical content is identical to the base edition and its amendment.

This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.

International Standard IEC 62751-2 has been prepared by subcommittee 22F: Power electronics for electrical transmission and distribution systems, of IEC technical committee 22: Power electronic systems and equipment.

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A list of all parts in the IEC 62751series, published under the general title *Power losses in voltage sourced converter (VSC) valves for high-voltage direct current (HVDC) systems*, can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,
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POWER LOSSES IN VOLTAGE SOURCED CONVERTER (VSC) VALVES FOR HIGH-VOLTAGE DIRECT CURRENT (HVDC) SYSTEMS –

Part 2: Modular multilevel converters

1 Scope

This part of IEC 62751 gives the detailed method to be adopted for calculating the power losses in the valves for an HVDC system based on the “modular multi-level converter”, where each valve in the converter consists of a number of self-contained, two-terminal controllable voltage sources connected in series. It is applicable both for the cases where each modular cell uses only a single turn-off semiconductor device in each switch position, and the case where each switch position consists of a number of turn-off semiconductor devices in series (topology also referred to as “cascaded two-level converter”). The main formulae are given for the two-level “half-bridge” configuration but guidance is also given in Annex A as to how to extend the results to certain other types of MMC building block configuration.

The standard is written mainly for insulated gate bipolar transistors (IGBTs) but may also be used for guidance in the event that other types of turn-off semiconductor devices are used.

Power losses in other items of equipment in the HVDC station, apart from the converter valves, are excluded from the scope of this standard.

This standard does not apply to converter valves for line-commutated converter HVDC systems.

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 60633, *Terminology for high-voltage direct-current (HVDC) transmission*

IEC 61803, *Determination of power losses in high-voltage direct current (HVDC) converter stations*

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

IEC 62751-1:2014, *Power losses in voltage sourced converter (VSC) valves for high-voltage direct current (HVDC) systems – Part 1: General requirements*

ISO/IEC Guide 98-3, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

3 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the terms and definitions given in IEC 60633, IEC 62747, IEC 62751-1, as well as the following apply.