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BSI Standards Publication

# High-voltage direct current (HVDC) power transmission using voltage sourced converters (VSC)

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# National foreword

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The UK participation in its preparation was entrusted to Technical Committee PEL/22, Power electronics.

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# TECHNICAL REPORT

colour inside

## High-voltage direct current (HVDC) power transmission using voltage sourced converters (VSC)

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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# Contents

Page

# FOREWORD

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IEC/TR 62543, which is a technical report, has been prepared by subcommittee 22F: Power electronics for electrical transmission and distribution systems, of IEC technical committee 22: Power electronic systems and equipment.

The present technical report cancels and replaces IEC/PAS 62543:2008 (Ed.1) which was published by IEC and CIGRÉ jointly, and combined with engineering experience.

The present IEC/TR 62543 bears the edition number 1.

The text of this technical report is based on the following documents:

| Enquiry draft | Report on voting |
|---|---|
| 22F/230/DTR | 22F/239A/RVC |

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication 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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

A bilingual version of this publication may be issued at a later date.

# 1 Scope

This technical report gives general guidance on the subject of voltage-sourced converters used for transmission of power by high voltage direct current (HVDC). It describes converters that are not only voltage-sourced (containing a capacitive energy storage medium and where the polarity of d.c. voltage remains fixed) but also self-commutated, using semiconductor devices which can both be turned on and turned off by control action. A1 The scope includes 2-level and 3-level converters with pulse-width modulation (PWM), along with multi-level converters, modular multi-level converters and cascaded two-level converters, but excludes 2-level and 3-level converters operated without PWM, in square-wave output mode. A1

HVDC power transmission using voltage sourced converters is known as "VSC transmission".

The various types of circuit that can be used for VSC transmission are described in the report, along with their principal operational characteristics and typical applications. The overall aim is to provide a guide for purchasers to assist with the task of specifying a VSC transmission scheme.

Line-commutated and current-sourced converters are specifically excluded from this report.

# 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.

A2 *Text deleted* A2

IEC 61975, *High-voltage direct current (HVDC) installations — System tests*

A2 IEC 62501, *Voltage sourced converter (VSC) valves for high-voltage direct current (HVDC) power transmission — Electrical testing*

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

IEC 62751 (all parts), *Power losses in voltage sourced converter (VSC) valves for high voltage direct current (HVDC) systems* A2

# 3 Terms and definitions

A2 For the purposes of this document, the terms and definitions given in IEC 62747, IEC 62501 and the following apply. A2

## 3.1 General

A2 Basic terms and definitions for voltage sourced converters used for HVDC transmission are given in IEC 62747. Terminology on electrical testing of VSC valves for HVDC transmission is given in IEC 62501.

To support the explanations, Figure 1 presents the basic diagram of a VSC system. Dependent on the converter topology and the requirements in the project, some components can be omitted or can differ.