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CONSOLIDATED VERSION

TECHNICAL REPORT

colour inside

Performance of high-voltage direct current (HVDC) systems with line-commutated converters –
Part 3: Dynamic conditions

IEC TR 60919-3:2009-10+AMD1:2016-03+AMD2:2021-10 CSV(en)

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Performance of high-voltage direct current (HVDC) systems with line-commutated converters – Part 3: Dynamic conditions

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IEC TR 60919-3:2009-10+AMD1:2016-03+AMD2:2021-10 CSV(en)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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PERFORMANCE OF HIGH-VOLTAGE DIRECT CURRENT (HVDC) SYSTEMS WITH LINE-COMMUTATED CONVERTERS –

Part 3: Dynamic conditions

FOREWORD

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This consolidated version of the official IEC Standard and its amendments has been prepared for user convenience.

IEC TR 60919-3 edition 2.2 contains the second edition (2009-10) [documents 22F/183/DTR and 22F/192/RVC], its amendment 1 (2016-03) [documents 22F/376/DTR and 22F/382A/RVC] and its amendment 2 (2021-10) [documents 22F/634/DTR and 22F/654/RVDTR].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendments 1 and 2. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC 60919-3, 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.

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

a) this report concerns only line-commutated converters;
b) significant changes have been made to the control system technology;
c) some environmental constraints, for example audible noise limits, have been added;
d) the capacitor coupled converters (CCC) and controlled series capacitor converters (CSCC) have been included.

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

A list of all parts of the IEC 60919 series, under the general title: *Performance of high-voltage direct current (HVDC) systems with line-commutated converters*, can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the stability date indicated on the IEC web site under 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.

PERFORMANCE OF HIGH-VOLTAGE DIRECT CURRENT (HVDC) SYSTEMS WITH LINE-COMMUTATED CONVERTERS –

Part 3: Dynamic conditions

1 Scope

This Technical Report provides general guidance on the dynamic performance of high-voltage direct current (HVDC) systems. Dynamic performance, as used in this specification, is meant to include those events and phenomena whose characteristic frequencies or time domain cover the range between transient conditions and steady state. It is concerned with the dynamic performance due to interactions between two-terminal HVDC systems and related a.c. systems or their elements such as power plants, a.c. lines and buses, reactive power sources, etc. at steady-state or transient conditions. The two-terminal HVDC systems are assumed to utilize 12-pulse converter units comprised of three-phase bridge (double way) connections. The converters are assumed to use thyristor valves as bridge arms, with gapless metal oxide arresters for insulation coordination and to have power flow capability in both directions. Diode valves are not considered in this specification. While multi-terminal HVDC transmission systems are not expressly considered, much of the information in this specification is equally applicable to such systems.

Only line-commutated converters are covered in this report, which includes capacitor commutated converter circuit configurations. General requirements for semiconductor line-commutated converters are given in IEC 60146-1-1, IEC 60146-1-2 and IEC 60146-1-3. Voltage-sourced converters are not considered.

This report (IEC 60919-3) which covers dynamic performance, is accompanied by publications for steady-state (IEC 60919-1) and transient (IEC 60919-2) performance. All three aspects should be considered when preparing two-terminal HVDC system specifications.

A difference exists between system performance specifications and equipment design specifications for individual components of a system. While equipment specifications and testing requirements are not defined herein, attention is drawn to those which would affect performance specifications for a system. There are many possible variations between different HVDC systems, therefore these are not considered in detail. This report should not be used directly as a specification for a specific project, but rather to provide the basis for an appropriate specification tailored to fit actual system requirements for a particular electric power transmission scheme. This report does not intend to discriminate between the responsibility of users and manufacturers for the work specified.

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.

IEC 60146-1-1, *Semiconductor converters – General requirements and line commutated converters – Part 1-1: Specification of basic requirements*

IEC/TR 60146-1-2, *Semiconductor convertors – General requirements and line commutated convertors – Part 1-2: Application guide*

IEC 60146-1-3, *Semiconductor convertors – General requirements and line commutated convertors – Part 1-3: Transformers and reactors*