



BSI Standards Publication

Performance of high-voltage direct current (HVDC) systems with line-commutated converters

Part 3: Dynamic conditions

National foreword

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The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by A1 A1.

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TECHNICAL REPORT

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

**Fonctionnement des systèmes à courant continu haute tension (CCHT) munis
de convertisseurs commutés par le réseau –
Partie 3: Conditions dynamiques**

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CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references	6
3 Outline of HVDC dynamic performance specifications	7
3.1 Dynamic performance specification.....	7
3.2 General comments	8
4 AC system power flow and frequency control	8
4.1 General.....	8
4.2 Power flow control	8
4.2.1 Steady-state power control requirements	8
4.2.2 Step change power requirement.....	9
4.3 Frequency control.....	11
5 AC dynamic voltage control and interaction with reactive power sources	12
5.1 General.....	12
5.2 Voltage and reactive power characteristics of an HVDC substation and other reactive power sources.....	12
5.2.1 General	12
5.2.2 Converter as active/reactive power source	13
5.2.3 Voltage characteristics of a.c. networks depending on the power loading at the busbar of the HVDC substation	15
5.2.4 Voltage characteristics of a.c. filters, capacitor banks and shunt reactors for power compensation at the HVDC substation	17
5.2.5 Voltage characteristics of static var compensator (SVC)	17
5.2.6 Voltage characteristics of synchronous compensator (SC).....	18
5.2.7 Voltage characteristics of static synchronous compensator (STATCOM)	18 A1
5.3 Voltage deviations on the busbar of an HVDC substation	18
5.4 Voltage and reactive power interaction of the substation and other reactive power sources	19
5.4.1 HVDC converters, switchable a.c. filters, capacitor banks and shunt reactors	19
5.4.2 HVDC converters, switchable reactive power sources, SVC.....	20
5.4.3 HVDC converters, switchable reactive power sources and synchronous compensators	21
5.4.4 HVDC convertors, switchable reactive power sources, STATCOM	21 A1
6 AC system transient and steady-state stability	22
6.1 General.....	22
6.2 Characteristics of active and reactive power modulation.....	22
6.2.1 General	22
6.2.2 Large signal modulation	23
6.2.3 Small signal modulation	24
6.2.4 Reactive power modulation	24
6.3 Classification of network situations	25
6.4 AC network in parallel with the HVDC link.....	25
6.5 Improvement of the stability within one of the connected a.c. networks.....	29
6.6 Determination of the damping control characteristics.....	29
6.7 Implementation of the damping controller and telecommunication requirements.....	30

7	Dynamics of the HVDC system at higher frequencies	30
7.1	General	30
7.2	Types of instability	31
7.2.1	Loop instability (harmonic instability)	31
7.2.2	Current loop instability	31
7.2.3	Core saturation instability	31
7.2.4	Harmonic interactions	31
7.3	Information required for design purposes	32
7.4	Means available for preventing instabilities	33
7.5	Damping of low order harmonics by control action	33
7.6	Demonstration of satisfactory performance at higher frequencies	33
8	Subsynchronous oscillations	34
8.1	General	34
8.2	Criteria for subsynchronous torsional interaction with an HVDC system	35
8.3	Screening criteria for identifying generator units susceptible to torsional interactions	36
A1 8.4	Performance considerations for utilizing subsynchronous damping controls	37 A1
8.5	Performance testing	37
8.6	Turbine generator protection	37
9	Power plant interaction	38
9.1	General	38
9.2	Specific interactions	38
9.2.1	General	38
9.2.2	Frequency variation effects	38
9.2.3	Frequency controls interactions	38
9.2.4	Overvoltage effects	39
9.2.5	Harmonics	39
9.2.6	Subsynchronous and shaft impact effects	39
9.2.7	Resonance	40
9.2.8	Overvoltages	40
9.2.9	Stresses in a.c. switching equipment	40
9.2.10	Under-frequency	40
9.2.11	Starting procedure for an HVDC converter	40
9.3	Special considerations for a nuclear plant	40
	Bibliography	41
	Figure 1 – Elements for reactive power compensation at an HVDC substation	13
	Figure 2 – P/Q diagram of a converter	14
	Figure 3 – Reactive power requirements of a weak a.c. system depending on the active power loading for various constant voltage characteristics at the a.c. bus of an HVDC substation	16
	Figure 4 – Representation of the a.c. network	16
	Figure 5 – An example of voltage – current characteristic showing possible current modulation range in the absence of telecommunication between rectifier and inverter	24
	Figure 6 – Reactive power modulation in an HVDC transmission operating at minimum extinction angle γ_{\min}	26
	Figure 7 – Reactive power modulation in an HVDC transmission operating at extinction angle $\gamma > \gamma_{\min}$	27
	Figure 8 – Stability improvement of an a.c. link or network	28
	Figure 9 – Principle arrangements of a damping controller	28

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**PERFORMANCE OF HIGH-VOLTAGE DIRECT CURRENT (HVDC)
SYSTEMS WITH LINE-COMMUTATED CONVERTERS –****Part 3: Dynamic conditions**

FOREWORD

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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 second edition cancels and replaces the first edition, which was issued as a technical specification in 1999. It constitutes a technical revision.

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.

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

Enquiry draft	Report on voting
22F/183/DTR	22F/192/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.

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 this publication will remain unchanged until the maintenance result 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.

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 converters – General requirements and line commutated converters – Part 1-2: Application guide*

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