SLOVENSKI STANDARD
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SIST EN 60633:2001
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Visokonapetostni enosmerni prenos (HVDC) - Slovar (IEC 60633:2019)

High-voltage direct current (HVDC) transmission - Vocabulary (IEC 60633:2019)

High-voltage direct current (HVDC) transmission - Vocabulary (IEC 60633:2019)

Transport d'énergie en courant continu à haute tension (CCHT) - Vocabulaire (IEC 60633:2019)

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EUROPEAN STANDARD

NORME EUROPÉENNE

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English Version

High-voltage direct current (HVDC) transmission - Vocabulary (IEC 60633:2019)

Transport d'énergie en courant continu à haute tension (CCHT) - Vocabulaire (IEC 60633:2019)

Hochspannungsgleichstrom-Übertragung (HGÜ) - Begriffe (IEC 60633:2019)

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European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

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European foreword

The text of document 22F/480/CDV, future edition 3 of IEC 60633, prepared by SC 22F "Power electronics for electrical transmission and distribution systems" of IEC/TC 22 "Power electronic systems and equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60633:2019.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2020-02-28
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2022-05-30

This document supersedes EN 60633:1999.

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The text of the International Standard IEC 60633:2019 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60027 (series)	NOTE	Harmonized as EN 60027 (series)
IEC 60076 (series)	NOTE	Harmonized as EN 60076 (series)
IEC 60099 (series)	NOTE	Harmonized as EN 60099 (series)
IEC 60146-1-1	NOTE	Harmonized as EN 60146-1-1
IEC 60146-1-3:1991	NOTE	Harmonized as EN 60146-1-3:1993 (not modified)
IEC 60700-2	NOTE	Harmonized as EN 60700-2
IEC/TR 60919-2:2008	NOTE	Harmonized as CLC/TR 60919-2:2010 (not modified)

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

High-voltage direct current (HVDC) transmission – Vocabulary

Transport d'énergie en courant continu à haute tension (CCHT) – Vocabulaire

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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HIGH-VOLTAGE DIRECT CURRENT (HVDC) TRANSMISSION – VOCABULARY

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60633 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 third edition cancels and replaces the second edition published in 1998, Amendment 1:2009 and Amendment 2:2015. This edition constitutes a technical revision.

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

a) 40 terms and definitions have been amended and 31 new terms and definitions have been added mainly on converter units and valves, converter operating conditions, HVDC systems and substations and HVDC substation equipment;
b) a new Figure 13 on capacitor commutated converter configurations has been added.

The text of this International Standard is based on the following documents:

CDV	Report on voting
22F/480/CDV	22F/491A/RVC

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

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

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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

HIGH-VOLTAGE DIRECT CURRENT (HVDC) TRANSMISSION – VOCABULARY

1 Scope

This document defines terms for high-voltage direct current (HVDC) power transmission systems and for HVDC substations using electronic power converters for the conversion from AC to DC or vice versa.

This document is applicable to HVDC substations with line commutated converters, most commonly based on three-phase bridge (double way) connections (see Figure 2) in which unidirectional electronic valves, for example semiconductor valves, are used. For the thyristor valves, only the most important definitions are included in this document. A more comprehensive list of HVDC valve terminology is given in IEC 60700-2.

2 Normative references

There are no normative references in this document.

3 Symbols and abbreviated terms

The list covers only the most frequently used symbols. For a more complete list of the symbols which have been adopted for static converters, see IEC 60027 (all parts) and other standards listed in the Bibliography.

3.1 Letter symbols

U_d	direct voltage (any defined value)
U_{d0}	nominal no-load direct voltage
U_{di0}	ideal no-load direct voltage
U_{dN}	rated direct voltage
U_L	phase-to-phase voltage on line side of converter transformer, RMS value including harmonics
U_{LN}	rated value of U_L
U_{v0}	no-load phase-to-phase voltage on the valve side of transformer, RMS value excluding harmonics
I_d	direct current (any defined value)
I_{dN}	rated direct current
I_L	current on line side of converter transformer, RMS value including harmonics
I_{LN}	rated value of I_L
I_v	current on valve side of transformer, RMS value including harmonics
α	(trigger) delay angle
β	(trigger) advance angle
γ	extinction angle
μ	overlap angle
p	pulse number
q	commutation number

3.2 Subscripts

0 (zero)	at no load
N	rated value or at rated load
d	direct current or voltage
i	ideal
L	line side of converter transformer
v	valve side of converter transformer
max	maximum
min	minimum
n	pertaining to harmonic component of order *n*

3.3 Abbreviated terms

The following abbreviated terms are always in capital letters and without dots.

HVDC	high-voltage direct current
MVU	multiple valve (unit) (see 6.3.2)
SCR	short-circuit ratio (see 7.32)
ESCR	effective short-circuit ratio (see 7.33)
MTDC	multiterminal HVDC transmission system (see 8.2.2)
MRTB	metallic return transfer breaker (see 9.22)
ERTB	earth return transfer breaker (see 9.23)
VDCOL	voltage dependent current order limit (see 12.9)
SSTI	sub-synchronous torsional interaction (see 10.10)

4 Graphical symbols

Figure 1 shows the specific graphical symbols which are defined only for the purposes of this document. For a more complete list of the graphical symbols which have been adopted for static converters, see IEC 60617.

5 General terms related to converter circuits

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

NOTE For a more complete list of the terms which have been adopted for static converters, see IEC 60050-551 and IEC 60146-1-1.

5.1
conversion
<HVDC> transfer of energy from AC to DC or vice versa, or a combination of these operations

5.2
converter connection
electrical arrangement of arms and other components necessary for the functioning of the main power circuit of a converter

5.3
bridge converter connection
double-way connection comprising six converter arms such that the centre terminals are the phase terminals of the AC circuit, and that the outer terminals of like polarity are connected together and are the DC terminals

Note 1 to entry: The double-way connection is illustrated in Figure 2.

5.3.1
uniform bridge
bridge where all converter arms are either controllable or non-controllable

5.3.2
non-uniform bridge
bridge with both controllable and non-controllable converter arms

5.4
converter arm
part of a bridge connecting two points of different potentials within a bridge, for example, between an AC terminal and a DC terminal

5.4.1
controllable converter arm
converter arm in which the start of forward conduction may be determined by an externally applied signal

5.4.2
non-controllable converter arm
converter arm in which the start of forward conduction is determined solely by the voltage applied to its terminals

5.5
by-pass path
low resistance path between the DC terminals of one or several bridges excluding the AC circuit

Note 1 to entry: The by-pass path may either constitute a unidirectional path, e.g. a by-pass arm (see 5.5.1), or a by-pass pair (see 5.5.2), or it may constitute a bidirectional path, e.g. a by-pass switch (see 9.30).

5.5.1
by-pass arm
unidirectionally conducting by-pass path connected only between DC terminals, commonly used with mercury arc valve technology

Note 1 to entry: By-pass arm is not shown in Figure 2.

5.5.2
by-pass pair
two converter arms of a bridge connected to a common AC terminal and forming a by-pass path

SEE: Figure 2.

5.6
commutation
transfer of current between any two paths with both paths carrying current simultaneously during this process

Note 1 to entry: Commutation may occur between any two converter arms, including the connected AC phases, between a converter arm and a by-pass arm, or between any two paths in the circuit.

5.6.1
line commutation
method of commutation whereby the commutating voltage is supplied by the AC system

5.7
commutating group
group of converter arms which commutate cyclically and independently from other converter arms and where the commutations are normally not simultaneous

Note 1 to entry: In the case of a bridge, a commutating group is composed of the converter arms connected to a common DC terminal. In certain cases, e.g. when large currents and/or large commutation inductances are involved, the commutation in the two commutating groups belonging to the same bridge need not be independent.

SEE: Figure 2.

5.8
commutation inductance
total inductance included in the commutation circuit, in series with the commutating voltage

5.9
pulse number
p
characteristic of a converter connection expressed as the number of non-simultaneous symmetrical commutations occurring during one cycle of the AC line voltage

Note 1 to entry: The pulse number of a bridge converter connection defined in 5.3 is always $p = 6$.

5.10
commutation number
q
number of commutations during one cycle of the AC line voltage occurring in each commutating group

Note 1 to entry: In a bridge converter connection, each commutating group has a commutation number $q = 3$.

5.11
capacitor commutated converter
converter in which series capacitors are included between the converter transformer and the valves

SEE: Figure 13 a).

5.12
controlled series capacitor converter
converter in which series capacitors are inserted between the AC filter bus and the AC network

SEE: Figure 13 b).

5.13
commutating voltage
voltage which causes the current to commutate

[SOURCE: IEC 60050-551:1998, 551-16-02]

5.14
controlled capacitor commutated converter
converter in which controlled series capacitors are included between the converter transformer and the valves

5.15
series capacitor converter
converter in which fixed series capacitors are inserted between the AC filter bus and the AC network

6 Converter units and valves

6.1
converter unit
indivisible operative unit comprising all equipment between the point of common coupling on the AC side (see 8.24) and the point of common coupling-DC side (see 8.25), essentially one or more converter bridges, together with one or more converter transformers, converter unit control equipment, essential protective and switching devices and auxiliaries, if any, used for conversion

SEE: Figure 3.

6.2
converter bridge
equipment used to implement the bridge converter connection and the by-pass arm, if used

Note 1 to entry: The term "bridge" may be used to describe either the circuit connection or the equipment implementing that circuit (see 5.3).

6.2.1
anode/cathode valve commutating group
equipment used to implement the converter arms of one commutating group of a bridge with interconnected anode/cathode terminals

6.3
valve
complete operative controllable or non-controllable valve device assembly, normally conducting in only one direction (the forward direction), which can function as a converter arm in a converter bridge

6.3.1
single valve unit
single structure comprising only one valve

6.3.2
multiple valve unit
MVU
single structure comprising more than one valve

Note 1 to entry: Examples of multiple valve units are double valves, quadrivalves and octovalves with two, four and eight series-connected valves respectively.

Note 2 to entry: This note applies to the French language only.

6.4
main valve
valve in a converter arm

6.5
by-pass valve
valve in a by-pass arm