IEC 60633

Edition 2.2 2015-07
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Terminology for high-voltage direct current (HVDC) transmission

Terminologie pour le transport d'énergie en courant continu à haute tension (CCHT)

IEC 60633:1998-12+AMD1:2009-05+AMD2:2015-07 CSV(en-fr)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

A propos de l'IEC
La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC
Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform
La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,…). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished
Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc
Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

Electropedia - www.electropedia.org
Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary
67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

IEC 60633

Edition 2.2 2015-07
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Terminology for high-voltage direct current (HVDC) transmission

Terminologie pour le transport d'énergie en courant continu à haute tension (CCHT)

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.200

ISBN 978-2-8322-2833-3

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

IEC 60633

Edition 2.2 2015-07
CONSOLIDATED VERSION

REDLINE VERSION

VERSION REDLINE

colour inside

Terminology for high-voltage direct current (HVDC) transmission

Terminologie pour le transport d'énergie en courant continu à haute tension (CCHT)

IEC 60633:1998-12+AMD1:2009-05+AMD2:2015-07 CSV(en-fr)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

TERMINOLOGY FOR HIGH-VOLTAGE DIRECT CURRENT (HVDC) TRANSMISSION

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.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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

IEC 60633 edition 2.2 contains the second edition (1998-12) [documents 22F/49/FDIS and 22F/53/RVD], its amendment 1 (2009-05) [documents 22F/153/CDV and 22F/163/RVC] and its amendment 2 (2015-07) [documents 22F/340/CDV and 22F/350A/RVC].

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

International Standard IEC 60633 has been prepared by subcommittee 22F: Power electronics for electrical transmission and distribution systems, of IEC technical committee 22: Power electronics.

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 "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.

TERMINOLOGY FOR HIGH-VOLTAGE DIRECT CURRENT (HVDC) TRANSMISSION

1 Scope

This International Standard defines terms for high-voltage direct current (HVDC) power transmission systems and for HVDC substations using electronic power converters for the conversion from a.c. to d.c. or vice versa.

This standard 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, e.g. semiconductor valves, are used.

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 60027 (all parts), *Letter symbols to be used in electrical technology*

IEC 60050-551~~:1998~~, *International Electrotechnical Vocabulary – Part 551: Power electronics*

IEC 60146-1-1~~:1991~~, *General requirements and line commutated convertors – Part 1-1: Specifications of basic requirements*

IEC 60617-5~~:1996~~, *Graphical symbols for diagrams – Part 5: Semiconductors and electron tubes*

IEC 60617-6~~:1996~~, *Graphical symbols for diagrams – Part 6: Production and conversion of electrical energy*

3 Symbols and abbreviations

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 and other standards listed in the normative references and the bibliography.

3.1 List of letter symbols

U_d	direct voltage (any defined value)
U_{d0}	~~conventional~~ nominal no-load direct voltage
U_{di0}	ideal no-load direct voltage
U_{dN}	rated direct voltage
U_L	line-to-line voltage on line side of converter transformer, r.m.s. value including harmonics
U_{LN}	rated value of U_L
U_{v0}	no-load phase-to-phase voltage on the valve side of transformer, r.m.s. value excluding harmonics

I_d	direct current (any defined value)
I_{dN}	rated direct current
I_L	current on line side of converter transformer, r.m.s. value including harmonics
I_{LN}	rated value of I_L
I_v	current on valve side of transformer, r.m.s. 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 List of 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 List of abbreviations

The following abbreviations 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 9.12)
ERTB	earth return transfer breaker (see 9.13)
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 standard. For a more complete list of the graphical symbols which have been adopted for static converters, see IEC 60617-5 and IEC 60617-6.

5 General terms related to converter circuits

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

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
in the context of HVDC, the transfer of energy from a.c. to d.c. 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, as illustrated in Figure 2, comprising six converter arms ~~which are connected~~ such that the centre terminals are the phase terminals of the a.c. circuit, and that the outer terminals of like polarity are connected together and are the d.c. terminals

~~NOTE – The term "bridge" may be used to describe either the circuit connection or the equipment implementing that circuit (see 6.2).~~

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 an operative circuit used for conversion which is connected between an a.c. terminal and a d.c. terminal, with the ability to conduct current in only one direction, defined as the forward direction (see 7.3)~~

~~NOTE – The main function of a converter arm is conversion; it may also perform additional functions such as voltage limiting, damping, etc.~~

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 d.c. terminals of one or several bridges excluding the a.c. circuit

NOTE – 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 6.20).