Irish Standard
I.S. EN IEC 61803:2020

# Determination of power losses in high-voltage direct current (HVDC) converter stations with line-commutated converters

**I.S. EN IEC 61803:2020**

*Incorporating amendments/corrigenda/National Annexes issued since publication:*

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## National Foreword

I.S. EN IEC 61803:2020 is the adopted Irish version of the European Document EN IEC 61803:2020, Determination of power losses in high-voltage direct current (HVDC) converter stations with line-commutated converters

This document does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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*In line with international standards practice the decimal point is shown as a comma (,) throughout this document.*

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN IEC 61803

December 2020

ICS 29.200

Supersedes EN 61803:1999 and all of its amendments and corrigenda (if any)

English Version

# Determination of power losses in high-voltage direct current (HVDC) converter stations with line-commutated converters (IEC 61803:2020)

Détermination des pertes en puissance dans les postes de conversion en courant continu à haute tension (CCHT) munis de convertisseurs commutés par la ligne (IEC 61803:2020)

Bestimmung der Leistungsverluste in Hochspannungsgleichstrom- (HGÜ-)Stromrichterstationen mit netzgeführten Stromrichtern (IEC 61803:2020)




European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**



Ref. No. EN IEC 61803:2020 E

# European foreword

The text of document 22F/563/CDV, future edition 2 of IEC 61803, 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 61803:2020.

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) 2021-08-23
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2023-11-23

This document supersedes EN 61803:1999 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

## Endorsement notice

The text of the International Standard IEC 61803:2020 was approved by CENELEC as a European Standard without any modification.

# Annex ZA
(normative)

# Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

| Publication | Year | Title | EN/HD | Year |
|---|---|---|---|---|
| IEC 60076-1 | - | Power transformers - Part 1: General | EN 60076-1 | - |
| IEC 60076-6 | - | Power transformers - Part 6: Reactors | EN 60076-6 | - |
| IEC 60633 | - | High-voltage direct current (HVDC) transmission - Vocabulary | EN IEC 60633 | - |
| IEC 60700-1 | 2015 | Thyristor valves for high voltage direct current (HVDC) power transmission - Part 1: Electrical testing | EN 60700-1 | 2015 |
| IEC 60871-1 | - | Shunt capacitors for a.c. power systems having a rated voltage above 1 000 V - Part 1: General | EN 60871-1 | - |

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IEC 61803

Edition 2.0 2020-10

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

## Determination of power losses in high-voltage direct current (HVDC) converter stations with line-commutated converters

## Détermination des pertes en puissance dans les postes de conversion en courant continu à haute tension (CCHT) munis de convertisseurs commutés par la ligne

IEC 61803:2020-10(en-fr)

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IEC 61803

Edition 2.0 2020-10

# INTERNATIONAL STANDARD

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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# DETERMINATION OF POWER LOSSES IN HIGH-VOLTAGE DIRECT CURRENT (HVDC) CONVERTER STATIONS WITH LINE-COMMUTATED CONVERTERS

## 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 61803 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 published in 1999, Amendment 1:2010 and Amendment 2:2016. This edition constitutes a technical revision.

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

a) to facilitate the application of this document and to ensure its quality remains consistent, 5.1.8 and 5.8 have been reviewed, taking into consideration that the present thyristor production technology provides considerably less thyristor parameters dispersion comparing with the situation in 1999 when the first edition of IEC 61803 was developed, and therefore the production records of thyristors can be used for the power losses calculation;

b) the calculation of the total station load losses (cases D1 and D2 in Annex C) has been corrected.

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

| CDV | Report on voting |
|---|---|
| 22F/563/CDV | 22F/580A/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.

# DETERMINATION OF POWER LOSSES IN HIGH-VOLTAGE DIRECT CURRENT (HVDC) CONVERTER STATIONS WITH LINE-COMMUTATED CONVERTERS

## 1 Scope

This document applies to all line-commutated high-voltage direct current (HVDC) converter stations used for power exchange (power transmission or back-to-back installation) in utility systems. This document presumes the use of 12-pulse thyristor converters but can, with due care, also be used for 6-pulse thyristor converters.

In some applications, synchronous compensators or static var compensators (SVC) may be connected to the AC bus of the HVDC converter station. The loss determination procedures for such equipment are not included in this document.

This document presents a set of standard procedures for determining the total losses of an HVDC converter station. The procedures cover all parts, except as noted above, and address no-load operation and operating losses together with their methods of calculation which use, wherever possible, measured parameters.

Converter station designs employing novel components or circuit configurations compared to the typical design assumed in this document, or designs equipped with unusual auxiliary circuits that could affect the losses, are assessed on their own merits.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60076-1, *Power transformers – Part 1: General*

IEC 60076-6, *Power transformers – Part 6: Reactors*

IEC 60633, *High-voltage direct current (HVDC) transmission – Vocabulary*

IEC 60700-1:2015, *Thyristor valves for high voltage direct current (HVDC) power transmission – Part 1: Electrical testing*

IEC 60871-1, *Shunt capacitors for a.c. power systems having a rated voltage above 1 000 V – Part 1: General*

## 3 Terms, definitions and symbols

For the purposes of this document, the terms and definition given in IEC 60633 and the following apply.