IEC 61936-2

Edition 1.0 2023-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Power installations exceeding 1 kV AC and 1,5 kV DC – Part 2: DC

Installations électriques de puissance de tension supérieure à 1 kV en courant alternatif et 1,5 kV en courant continu – Partie 2: Courant continu



IEC 61936-2:2023-09(en-fr)



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Power installations exceeding 1 kV AC and 1,5 kV DC – Part 2: DC

Installations électriques de puissance de tension supérieure à 1 kV en courant alternatif et 1,5 kV en courant continu – Partie 2: Courant continu

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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POWER INSTALLATIONS EXCEEDING 1 kV AC AND 1,5 kV DC –

Part 2: DC

FOREWORD

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IEC 61936-2 has been prepared by IEC technical committee 99: Insulation co-ordination and system engineering and erection of electrical power installations above 1 kV AC and 1,5 kV DC. It is an International Standard.

This first edition cancels and replaces the IEC TS 61936-2 published in 2015. This edition constitutes a technical revision.

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

a) references to IEC 61936-1 updated to IEC 61936-1:2021;
b) alignment with IEC 61936-1:2021 where required;

c) the scope has been improved to clarify the application of this document, including an improved definition of a DC installation;

d) missing and obsolete terms and definitions have been updated including improvement of existing terms;

e) added new definitions of DC system and converter unit;

f) added symbols and abbreviated terms;

g) expansion and improvement of the general requirements, including addition of simplified diagrams showing examples of VSC and LCC DC systems (Figure 1 and Figure 2);

h) addition of Table 1 which shows where agreements between supplier and user are needed;

i) clause on electrical requirements has been restructured and improved;

j) schematic diagrams for various DC system configurations and neutral point locations added (Figure 3);

k) addition of new content for harmonics and new clauses for electromagnetic compatibility and radio interference;

l) addition of content specific to DC installations for normal and special conditions;

m) clause on insulation (Clause 5) has been significantly restructured and rewritten with a change in approach in the clauses on minimum clearances that references relevant parts of IEC 60071;

n) clause on electrical equipment has been restructured and improved;

o) clause on DC installations has been restructured and improved;

p) clause on protection, control and auxiliary systems has been restructured and improved, with content added to the clause on protection systems that is specific to DC installations;

q) clause on earthing has been restructured and improved;

r) clause on inspection and testing has been restructured and improved, including addition of references specific to DC installations;

s) Annex A has been replaced with a new Annex A (informative), where the table of rated insulation levels and minimum clearances in air have been replaced with a table of typical DC voltages and presumed switching and lightning impulse withstand voltages;

t) tables added to Annex A showing the correlation between presumed switching and lightning impulse withstand voltages and minimum phase-to-earth air clearances;

u) Annex B has been improved and references updated.

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

Draft	Report on voting
99/413/FDIS	99/436/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 61936 series, published under the general title *Power installations exceeding 1 kV AC and 1,5 kV DC*, can be found on the IEC website.

Notes concerning particular conditions in certain countries are provided in Annex G of IEC 61936-1: 2021.

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

- reconfirmed,
- withdrawn, or
- revised.

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INTRODUCTION

There are few national laws, standards and internal rules dealing with the matter coming within the scope of this standard, and these practices have been taken as a basis for this work.

This part of IEC 61936 contains the minimum requirements and some additional information which ensures an acceptable reliability of a DC installation with nominal voltages above 1,5 kV DC and its safe operation.

The publication of this document is believed to be a decisive step towards the gradual alignment all over the world of the practices concerning the design and erection of high voltage power installations.

Particular requirements for transmission and distribution installations as well as particular requirements for power generation and industrial installations are included in this document.

The relevant laws or regulations of an authority having jurisdiction take precedence.

POWER INSTALLATIONS EXCEEDING 1 kV AC AND 1,5 kV DC –

Part 2: DC

1 Scope

This part of IEC 61936 provides, in a convenient form, requirements for the design and the erection of DC installations in systems with nominal voltages above 1,5 kV DC, so as to provide safety and proper functioning for the use intended.

For the purpose of interpreting this document, a DC installation is considered to be one of the following:

a) A converter station or DC switching station;

b) one (or more) DC generating or storage unit(s), such as solar farms or battery storage units, located on a single site, the DC installation includes DC equipment and cables with all associated power electronics, controlgear, switchgear and all electrical auxiliary systems. Connections between DC generating or storage units located on different sites are excluded;

c) DC installation erected on offshore facilities for the purpose of generation, transmission, distribution and/or storage of electricity; or

d) DC transition station (between overhead lines and underground cable or between different sections of underground cables).

This International Standard does not apply to the design and erection of any of the following:

– overhead and underground lines between separate installations;

– electric railways;

– mining equipment and installations;

– installations on ships according to IEC 60092 series and offshore units according to IEC 61892 series, which are used in the offshore petroleum industry for drilling, processing and storage purposes;

– electrostatic equipment (e.g. electrostatic precipitators, spray-painting units);

– test sites;

– medical equipment, e.g. medical X-ray equipment;

– valve hall or converter hall.

This document does not apply to the requirements for carrying out live working on electrical installations.

This document does not apply to the design of factory-built, type-tested thyristor valves, VSC valves and switchgear for which separate IEC standards exist.

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 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60071-1, *Insulation co-ordination – Part 1: Definitions, principles and rules*

IEC 60071-2:2023, *Insulation co-ordination – Part 2: Application guidelines*

IEC 60071-5[1], *Insulation co-ordination – Part 5: Procedures for high voltage direct current (HVDC) converter stations*

IEC 60071-11, *Insulation co-ordination – Part 11 : Definitions, principles and rules for HVDC system*

IEC 60079-10-1, *Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres*

IEC 60079-10-2, *Explosive atmospheres – Part 10-2: Classification of areas – Combustible dust atmospheres*

IEC 60479-1, *Effects of current on human beings and livestock – Part 1: General aspects*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60664-1*, Insulation coordination for equipment within low-voltage supply systems – Part 1: Principles, requirements and tests*

IEC TS 60815-1, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 1: Definitions, information and general principles*

IEC TS 60815-4, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 4: Insulators for d.c. systems*

IEC 61000-6-5:2015, *Electromagnetic compatibility (EMC) – Part 6-5: Generic standards – Immunity for equipment used in power station and substation environment*

IEC 61936-1:2021, *Power installations exceeding 1 kV AC and 1,5 kV DC – Part 1: AC*

IEC 61975, *High-voltage direct current (HVDC) installations – System tests*

IEC/IEEE 60076-57-129, *Power transformers – Part 57-129: Transformers for HVDC applications*

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1 IEC 60071-5 has been replaced by IEC 60071-11 and IEC 60071-12.

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61936-1 and the following apply.

3.1.1
electronic valve device
indivisible electronic device for electronic power conversion or electronic power switching, comprising a single non-controllable or bistably controlled unidirectionally conducting current path

Note 1 to entry: Typical electronic valve devices are thyristors, power rectifier diodes, power switching bipolar and field effect transistors and insulated-gate bipolar transistors (IGBT).

Note 2 to entry: Two or more electronic valve devices may be integrated on a common semiconductor chip (examples: a thyristor and a rectifier diode in a reverse conducting thyristor, a power switching field effect transistor with its inverse diode) or packaged in a common case (semiconductor power module). These combinations are to be considered as separate electronic valve devices.

[SOURCE: IEC 60050-551:1998, 551-14-02]

3.1.2
nominal DC voltage
U_{dn}
<of a DC system> suitable approximate value of DC voltage used to designate or identify a system, expressed as the absolute value of the pole to earth voltage

3.1.3
highest DC voltage
U_{dm}
<of a DC system> highest mean or average pole DC voltage to earth, excluding harmonics, commutation and dynamic overshoots, but including expected measurement tolerance, for which the installation is designed in respect of its insulation

3.1.4
DC neutral point
common point of two monopoles forming a bipole converter or the earthed point of a monopole converter

3.1.5
DC electrode line
electrical connection between a DC earth electrode and the DC installation

3.1.6
DC system
all interconnected parts of a power system installation that is installed between and including the DC side windings of the interface/converter transformers at each terminal except for the valve hall or converter hall

Note 1 to entry: Components connected to the AC side windings of the converter/interface transformers including the AC windings themselves are not considered to be part of the DC system as defined for this standard.

3.1.7
high voltage
DC voltage exceeding 1 500V DC