IEC 61936-1

Edition 3.0 2021-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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

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

IEC 61936-1:2021-07(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 It also gives information on projects, replaced and withdrawn publications.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.

IEC online collection - oc.iec.ch
Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

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 18 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

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.

IEC online collection - oc.iec.ch
Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

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.

IEC 61936-1

Edition 3.0 2021-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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

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

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 29.020; 29.080.01

ISBN 978-2-8322-9887-9

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

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

Part 1: AC

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.

International Standard IEC 61936-1 has been prepared by IEC technical committee 99: Insulation co-ordination and system engineering of high voltage electrical power installations above 1,0 kV AC and 1,5 kV DC.

This third edition cancels and replaces the second edition published in 2010 and Amendment 1:2014. This edition constitutes a technical revision.

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

a) introduction has been rewritten to reflect the status when this document is produced;
b) the scope has been improved to clarify the application of this document;
c) missing and obsolete terms and definitions have been updated including improvement of existing terms;
d) Table 1 has been updated where agreements between supplier and user are needed;
e) requirements of electromagnetic compatibility have been clarified;

f) insulation coordination clause (Clause 5) has improved wording for better clarity and the technical content has an updated coordination to the latest versions of the insulation coordination standards;

g) wording regarding electrical equipment has been improved and made clearer;

h) subclause for fuses has been improved and reworded;

i) requirements have been added for labelling when multiple sources are required to be disconnected;

j) missing requirements for GIS have been reintroduced;

k) subclause regarding ventilation (HVAC) has been improved;

l) figures in Clause 7 have been updated and moved to the corresponding subclause;

m) requirements for transformer installations have been improved including adjustment of editorial typing-errors;

n) clause on protection, automation and auxiliary systems has been restructured and improved;

o) protection against lightning strokes has been extended;

p) clarification of content due to the distinction between erection (and providing electrical safety for the intended use of the electrical power installation) and subsequent activities such as maintenance and repair with safe working procedures;

q) where no provincial, national or regional regulations are available for safe working procedures, an informative guideline is provided in Annex F. This replaces the former parts of Figure 3 in Clause 7.

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

FDIS	Report on voting
99/311/FDIS	99/316/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/standardsdev/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.

A document on principles to be observed in the preparation of safety publications regarding high voltage installations is currently under development (IEC TS 61936-0).

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

The reader's attention is drawn to the fact that Annex G lists all of the "in-some-country" clauses on differing practices of a less permanent nature relating to the subject of this document.

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.

INTRODUCTION

This part of IEC 61936 contains the minimum requirements for the design, erection, and verification of high voltage power installations greater than 1 kV AC. The rules are intended to provide for the safety of persons, livestock and property against dangers and damage which may arise in the reasonable use of such electrical installations and to provide for the proper functioning of those installations.

There are many provincial, national and regional laws, standards and internal rules dealing with the matter coming within the scope of this document regarding high voltage power installations. These practices have been taken as a basis for this work.

This third edition of IEC 61936-1, first published in 2001, follows worldwide feedback to improve clarity. It continues the effort to towards the alignment all over the world of 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.

While national standards and regulations take precedence, jurisdictions may elect to adopt the requirements of this document.

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

Part 1: AC

1 Scope

This part of IEC 61936 provides requirements for the design and the erection of electrical power installations in systems with nominal voltages exceeding 1 kV AC and nominal frequency up to and including 60 Hz, so as to provide safety and proper functioning for the use intended.

For the purpose of interpreting this document, an electrical power installation is considered to be one of the following:

a) substation, including substation for railway power supply;

b) electrical power installations on mast, pole and tower, switchgear and/or transformers located outside a closed electrical operating area;

c) one (or more) power station(s) located on a single site, the electrical power installation includes generators and transformers with all associated switchgear and all electrical auxiliary systems. Connections between generating stations located on different sites are excluded;

d) the electrical system of a factory, industrial plant or other industrial, agricultural, commercial or public premises;

e) electrical power installations on offshore facilities for the purpose of generation, transmission, distribution and/or storage of electricity;

f) transition towers/poles (between overhead lines and underground lines).

The electrical power installation includes, among others, the following equipment:

– rotating electrical machines;
– switchgear;
– transformers and reactors;
– converters;
– cables;
– wiring systems;
– batteries;
– capacitors;
– earthing systems;
– buildings and fences which are part of a closed electrical operating area;
– associated protection, control and auxiliary systems;
– large air core reactor.

NOTE 1 In general, equipment standards take precedence over the requirements of this document.

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

– overhead and underground lines between separate electrical power installations;
– electrified railway tracks and rolling stock;
– mining equipment and installations;

– fluorescent lamp installations;
– installations on ships according to IEC 60092 (all parts) and offshore units according to IEC 61892 (all parts), 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.

This document does not apply to the design of prefabricated, type-tested switchgear and high voltage/low voltage prefabricated substation, for which separate IEC standards exist.

NOTE 2 The scope of this document does not include the requirements for carrying out live working on electrical power installations.

NOTE 3 The scope of this document considers safety requirements for HV installations and the influences of HV installations on LV installations. For electrical installations up to 1 kV, IEC 60364 (all parts) applies.

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 60034-1, *Rotating electrical machines – Part 1: Rating and performance*

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

IEC 60071-1:2019, *Insulation co-ordination – Part 1: Definitions, principles and rules*

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

IEC 60076 (all parts), *Power transformers*

IEC 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*

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 – Explosive dust atmospheres*

IEC 60255 (all parts), *Measuring relays and protection equipment*

IEC 60331-1, *Tests for electric cables under fire conditions – Circuit integrity – Part 1: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV and with an overall diameter exceeding 20 mm*

IEC 60331-21, *Tests for electric cables under fire conditions – Circuit integrity – Part 21: Procedures and requirements – Cables of rated voltage up to and including 0,6/1,0 kV*

IEC 60332 (all parts), *Tests on electric and optical fibre cables under fire conditions*

IEC 60364 (all parts), *Low-voltage electrical installations*

IEC 60479-1:2018, *Effects of current on human beings and livestock – Part 1: General aspects*

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

IEC 60754 (all parts), *Test on gases evolved during combustion of materials from cables*

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 60815-2, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 2: Ceramic and glass insulators for a.c. systems*

IEC TS 60815-3, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 3: Polymer insulators for a.c. systems*

IEC TR 61000-5-2, *Electromagnetic compatibility (EMC) – Part 5: Installation and mitigation guidelines – Section 2: Earthing and cabling*

IEC 61034-1, *Measurement of smoke density of cables burning under defined conditions – Part 1: Test apparatus*

IEC 61219, *Live working – Earthing or earthing and short-circuiting equipment using lances as a short-circuiting device – Lance earthing*

IEC 61230, *Live working – Portable equipment for earthing or earthing and short-circuiting*

IEC TS 61463, *Bushings – Seismic qualification*

IEC 62271-1:2017, *High-voltage switchgear and controlgear – Part 1: Common specifications for alternating current switchgear and controlgear*

IEC 62271-200, *High-voltage switchgear and controlgear – Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*

IEC 62271-201, *High-voltage switchgear and controlgear – Part 201: AC solid-insulation enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*

IEC 62271-202, *High-voltage switchgear and controlgear – Part 202: High-voltage/low-voltage prefabricated substation*

IEC 62271-203, *High-voltage switchgear and controlgear – Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV*

IEC 62271-207, *High-voltage switchgear and controlgear – Part 207: Seismic qualification for gas-insulated switchgear assemblies for rated voltages above 52 kV*

IEC TR 62271-300, *High-voltage switchgear and controlgear – Part 300: Seismic qualification of alternating current circuit-breakers*

IEC 62305 (all parts), *Protection against lightning*

IEC/IEEE 82079-1, *Preparation of information for use (instructions for use) of products – Part 1: Principles and general requirements*