

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Power installations exceeding 1 kV a.c. –
Part 1: Common rules**

INTERNATIONAL STANDARD PREVIEW
(standards.iteh.ai)

**Installations électriques en courant alternatif de puissance supérieure à 1 kV –
Partie 1: Règles communes**

<https://standards.iteh.ai/catalog/standards/sist/c86bb512-7b00-488b-a826-8ab221bd8000/iec-61936-1-2010>



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CONTENTS

FOREWORD.....	7
INTRODUCTION.....	10
1 Scope.....	11
2 Normative references.....	12
3 Terms and definitions	14
3.1 General definitions.....	14
3.2 Definitions concerning installations	16
3.3 Definitions concerning types of installations	17
3.4 Definitions concerning safety measures against electric shock	17
3.5 Definitions concerning clearances.....	18
3.6 Definitions concerning control and protection	19
3.7 Definitions concerning earthing.....	19
4 Fundamental requirements	23
4.1 General.....	23
4.1.1 General requirements	23
4.1.2 Agreements between supplier (manufacturer) and user	24
4.2 Electrical requirements	25
4.2.1 Methods of neutral earthing.....	25
4.2.2 Voltage classification	25
4.2.3 Current in normal operation	25
4.2.4 Short-circuit current	25
4.2.5 Rated frequency	26
4.2.6 Corona standards.iteh.ai/catalog/standards/sist/c86bb512-7b00-488b-a826-8eb321119000/iec-61936-1-2010	26
4.2.7 Electric and magnetic fields.....	26
4.2.8 Overvoltages	26
4.2.9 Harmonics	27
4.3 Mechanical requirements	27
4.3.1 Equipment and supporting structures	27
4.3.2 Tension load.....	27
4.3.3 Erection load	27
4.3.4 Ice load	28
4.3.5 Wind load	28
4.3.6 Switching forces	28
4.3.7 Short-circuit forces.....	28
4.3.8 Loss of conductor tension	28
4.3.9 Vibration	28
4.3.10 Dimensioning of supporting structures.....	28
4.4 Climatic and environmental conditions	28
4.4.1 General	28
4.4.2 Normal conditions	29
4.4.3 Special conditions	30
4.5 Special requirements	31
4.5.1 Effects of small animals and micro-organisms.....	31
4.5.2 Noise level.....	31
4.5.3 Transport.....	31
5 Insulation.....	32
5.1 General	32

5.2	Selection of insulation level.....	32
5.2.1	Consideration of methods of neutral earthing	32
5.2.2	Consideration of rated withstand voltages	32
5.3	Verification of withstand values.....	32
5.4	Minimum clearances of live parts	33
5.4.1	General	33
5.4.2	Minimum clearances in voltage range I.....	33
5.4.3	Minimum clearances in voltage range II.....	33
5.5	Minimum clearances between parts under special conditions	35
5.6	Tested connection zones	36
6	Equipment.....	36
6.1	General requirements	36
6.1.1	Selection	36
6.1.2	Compliance	36
6.1.3	Personnel safety	36
6.2	Specific requirements	36
6.2.1	Switching devices	36
6.2.2	Power transformers and reactors	37
6.2.3	Prefabricated type-tested switchgear.....	38
6.2.4	Instrument transformers.....	38
6.2.5	Surge arresters.....	39
6.2.6	Capacitors	39
6.2.7	Line traps	39
6.2.8	Insulators.....	39
6.2.9	Insulated cables.....	39
6.2.10	Conductors and accessories.....	42
6.2.11	Rotating electrical machines	42
6.2.12	Generating units	43
6.2.13	Generating unit main connections	43
6.2.14	Static converters	43
6.2.15	Fuses	44
6.2.16	Electrical and mechanical Interlocking.....	44
7	Installations	44
7.1	General requirements	44
7.1.1	Circuit arrangement	44
7.1.2	Documentation.....	45
7.1.3	Transport routes	45
7.1.4	Aisles and access areas	46
7.1.5	Lighting	46
7.1.6	Operational safety.....	46
7.1.7	Labelling.....	46
7.2	Outdoor installations of open design	46
7.2.1	Protective barrier clearances.....	47
7.2.2	Protective obstacle clearances.....	47
7.2.3	Boundary clearances	47
7.2.4	Minimum height over access area	47
7.2.5	Clearances to buildings.....	48
7.2.6	External fences or walls and access doors	48
7.3	Indoor installations of open design.....	48

7.4	Installation of prefabricated type-tested switchgear	49
7.4.1	General	49
7.4.2	Additional requirements for gas-insulated metal-enclosed switchgear	49
7.5	Requirements for buildings	51
7.5.1	Introduction	51
7.5.2	Structural provisions	51
7.5.3	Rooms for switchgear	52
7.5.4	Maintenance and operating areas	52
7.5.5	Doors	53
7.5.6	Draining of insulating liquids	53
7.5.7	Air conditioning and ventilation	53
7.5.8	Buildings which require special consideration	54
7.6	High voltage/low voltage prefabricated substations	54
7.7	Electrical installations on mast, pole and tower	54
8	Safety measures	60
8.1	General	60
8.2	Protection against direct contact	60
8.2.1	Measures for protection against direct contact	60
8.2.2	Protection requirements	61
8.3	Means to protect persons in case of indirect contact	62
8.4	Means to protect persons working on electrical installations	62
8.4.1	Equipment for isolating installations or apparatus	62
8.4.2	Devices to prevent reclosing of isolating devices	63
8.4.3	Devices for determining the de-energized state	63
8.4.4	Devices for earthing and short-circuiting	63
8.4.5	Equipment acting as protective barriers against adjacent live parts	64
8.4.6	Storage of personal protection equipment	65
8.5	Protection from danger resulting from arc fault	65
8.6	Protection against direct lightning strokes	65
8.7	Protection against fire	66
8.7.1	General	66
8.7.2	Transformers, reactors	67
8.7.3	Cables	70
8.7.4	Other equipment with flammable liquid	70
8.8	Protection against leakage of insulating liquid and SF ₆	70
8.8.1	Insulating liquid leakage and subsoil water protection	70
8.8.2	SF ₆ leakage	72
8.8.3	Failure with loss of SF ₆ and its decomposition products	72
8.9	Identification and marking	72
8.9.1	General	72
8.9.2	Information plates and warning plates	72
8.9.3	Electrical hazard warning	73
8.9.4	Installations with incorporated capacitors	73
8.9.5	Emergency signs for emergency exits	73
8.9.6	Cable identification marks	73
9	Protection, control and auxiliary systems	78
9.1	Monitoring and control systems	78
9.2	DC and AC supply circuits	79
9.2.1	General	79

9.2.2	AC supply	79
9.2.3	DC supply	80
9.3	Compressed air systems	80
9.4	SF ₆ gas handling plants	81
9.5	Hydrogen handling plants	81
9.6	Basic rules for electromagnetic compatibility of control systems	82
9.6.1	General	82
9.6.2	Electrical noise sources in high voltage installations	82
9.6.3	Measures to be taken to reduce the effects of high frequency interference	82
9.6.4	Measures to be taken to reduce the effects of low frequency interference	83
9.6.5	Measures related to the selection of equipment	83
9.6.6	Other possible measures to reduce the effects of interference	84
10	Earthing systems	84
10.1	General	84
10.2	Fundamental requirements	84
10.2.1	Safety criteria	84
10.2.2	Functional requirements	85
10.2.3	High and low voltage earthing systems	85
10.3	Design of earthing systems	86
10.3.1	General	86
10.3.2	Power system faults	87
10.3.3	Lightning and transients	87
10.4	Construction of earthing systems	88
10.5	Measurements	88
10.6	Maintainability	88
10.6.1	Inspections	88
10.6.2	Measurements	88
11	Inspection and testing	89
11.1	General	89
11.2	Verification of specified performances	90
11.3	Tests during installation and commissioning	90
11.4	Trial running	90
12	Operation and maintenance manual	91
Annex A (normative)	Values of rated insulation levels and minimum clearances based on current practice in some countries	92
Annex B (normative)	Method of calculating permissible touch voltages	95
Annex C (normative)	Permissible touch voltage according IEEE 80	96
Annex D (normative)	Earthing system design flow chart	97
Annex E (informative)	Protection measures against direct lightning strokes	97
Bibliography	101
Figure 1	– Protection against direct contact by protective barriers/protective obstacles within closed electrical operating areas	55
Figure 2	– Boundary distances and minimum height at the external fence/wall	56
Figure 3	– Minimum heights and working clearances within closed electrical operating areas	57
Figure 4	– Approaches with buildings (within closed electrical operating areas)	58

Figure 5 – Minimum approach distance for transport.....	59
Figure 6 – Separating walls between transformers.....	74
Figure 7 – Fire protection between transformer and building.....	75
Figure 8 – Sump with integrated catchment tank.....	76
Figure 9 – Sump with separate catchment tank.....	76
Figure 10 – Sump with integrated common catchment tank.....	77
Figure 11 – Example for small transformers without gravel layer and catchment tank.....	77
Figure 12 – Permissible touch voltage U_{Tp}	89
Figure C.1 – Permissible touch voltage U_{Tp} according IEEE 80.....	96
Figure E.1 – Single shield wire.....	99
Figure E.2 – Two shield wires.....	99
Figure E.3 – Single lightning rod.....	100
Figure E.4 – Two lightning rods.....	100
Table 1 – Minimum clearances in air – Voltage range I ($1 \text{ kV} < U_m \leq 245 \text{ kV}$).....	34
Table 2 – Minimum clearances in air – Voltage range II ($U_m > 245 \text{ kV}$).....	34
Table 3 – Guide values for outdoor transformer clearances.....	68
Table 4 – Minimum requirements for the installation of indoor transformers.....	69
Table 5 – Minimum requirements for interconnection of low-voltage and high-voltage earthing systems based on EPR limits.....	86
Table A.1 – Values of rated insulation levels and minimum clearances in air for $1 \text{ kV} < U_m \leq 245 \text{ kV}$ for highest voltage for installation U_m not standardized by the IEC based on current practice in some countries.....	92
Table A.2 – Values of rated insulation levels and minimum clearances in air for $1 \text{ kV} < U_m \leq 245 \text{ kV}$ for highest voltage for installation U_m not standardized by IEC based on current practice in some countries.....	93
Table A.3 – Values of rated insulation levels and minimum clearances in air for $U_m > 245 \text{ kV}$ for highest voltages for installation U_m not standardized by IEC based on current practice in some countries.....	94

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POWER INSTALLATIONS EXCEEDING 1 kV AC –

Part 1: Common rules

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International Standard IEC 61936-1 has been prepared by IEC technical committee 99: System engineering and erection of electrical power installations in systems with nominal voltages above 1 kV a.c. and 1,5 kV d.c., particularly concerning safety aspects.

This second edition cancels and replaces the first edition, published in 2002. It constitutes a technical revision.

The main changes with respect to the previous edition are listed below:

- new table of references for additional agreements between manufacturer/contractor/planer and user/orderer/owner (4.1.2)
- addition of minimum clearances in air not standardized by IEC but based on current practice in some countries (Annex A)
- deletion of nominal voltages (Table 1, Table 2, Clause 5)
- addition of regulations for fuses (6.2.15)
- simplification of regulations for escape routes (7.5.4)

- deletion of special regulations for operating aisles (7.5.4)
- modification of clearances for fire protection (Table 3)
- modification of safety criteria for earthing systems (10.2.1)
- modified curves of permissibly touch voltages (Figure 12, Annex B)
- deletion of numbering of subclauses without headlines
- change of "should" to "shall" in many cases or change of subclauses with "should" to a note

The text of this standard is based on the following documents:

FDIS	Report on voting
99/95/FDIS	99/96/RVD

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

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

A list of all the parts¹ in the IEC 61936 series, under the general title *Power installations exceeding 1 kV a.c.*, can be found on the IEC website

The committee has decided that the contents of this publication 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.

The following differences exist in the countries indicated below.

- 4.3.2: The combinations are for example: –40 °C without ice and without wind; –0 °C with ice and without wind; –20 °C with wind. For special projects even value –50 °C without ice and without wind could be needed (Finland)
- 4.4.2.2a: Even class –50 °C could be needed (Finland)
- 6.2.4.1: It shall not be fuses in conductors from current transformers (Norway)
- 7.2.1: Barriers for outdoor installations shall have a minimum height of 2,0 m. They shall fulfil the same requirements as the external fence. The minimum height of live parts behind a barrier shall be $N + 300$ mm with a minimum of 800 mm (Finland)
- 7.2.2: The use of protective method obstacles is not allowed in electrical installations outside of buildings (Finland)
- 7.2.2: Rails, chains and ropes are not allowed as obstacles (Sweden)
- 7.2.2: The height H for outdoor installations shall be at least $H = N + 2\ 500$ mm, with a minimum of 3 000 mm (Sweden)
- 7.2.4: The height H for outdoor installations shall be at least $H = N + 2\ 500$ mm, with a minimum of 3 000 mm (Sweden)
- 7.2.4: The height H for outdoor installations shall be at least $H = N + 2\ 600$ mm, with a minimum of 2 800 mm (Finland)
- 7.2.6: The height of the external fence shall be at least 2 000 mm. The local conditions of snow shall be taken into account (Finland)
- 7.2.6: The height of the external fence shall be at least 2 500 mm (Australia)
- 7.3: The use of indoor installations of open design is not allowed (Finland)
- 7.3: A rail shall be of not conductive material in the colours yellow/black behind (cell) doors and openings wider than 0,5 m (Norway)

¹ At the time of writing, future parts are still under consideration.

- 7.3: Rails, chains and ropes are not allowed as obstacle (Sweden)
- 7.4.1: Outside closed electrical operation areas equipment and cables shall either be constructed with an earthed intermediate shield or be protected against unintentional contact by placing out of reach. With an earthed intermediate shield, a metal enclosure for equipment or a screen for cables are understood (Sweden)
- 7.5.4: Gangways longer than 10 m shall be accessible from both ends. Indoor closed restricted access areas with length exceeding 20 m shall be accessible by doors from both ends (See IEC 60364-7-729) (Sweden)
- 7.5.8: Installations that are difficult to evacuate like Installations in underground, in mountains, wind-power stations e.g. special conditions shall be imposed to secure safe evacuation in case of fire or accident (Norway)
- 7.7: The minimum height H' of live parts above surfaces accessible to the general public shall be:
 - $H' = 5\,500$ mm for rated voltages U_m up to 24 kV
 - $H' = N + 5\,300$ mm for rated voltages U_m above 24 kV (Finland)
- 8.2: Exposed conductive parts shall be earthed. Also extraneous conductive parts which by faults, induction, or influence could become live and be a hazard to persons or damage to property shall be earthed (Sweden)
- 8.2.1.2: The minimum height of protective barriers is 2 300 mm (Finland)
- 8.2.1.2: Rails, chains and ropes are not allowed as obstacles (Sweden)
- 8.2.2.1: Outside closed electrical operation areas equipment and cables shall either be constructed with an earthed intermediate shield or be protected against unintentional contact by placing out of reach. With an earthed intermediate shield, a metal enclosure for equipment or a screen for cables are understood (Sweden)
- 8.2.2.2: Rails, chains and ropes are not allowed as obstacles (Sweden)
- 8.2.2.2: The use of protective method obstacles is not allowed in electrical installations of buildings. The use of protective method placing out of reach is restricted only to situations where the use of insulation or enclosures or barriers is not practicable (Finland)
- 8.7.2.1: For transformers with below 1000 I special conditions are listed in FEF 2006 §4-9 (Norway)
- 8.9.1: Warning signs, markings and identifications shall be in Norwegian and special cases additional marking in other language (Norway)
- 10.2.1 and Annex B: Health & Safety Executive (HSE) has advised that HV earthing systems should be designed according to tolerable voltages based on body impedances not exceeded by 5% of the population, as given in Table 1 of IEC60479-1:2005 (UK)
- 10.2.1: Permissible touch and step voltages in power installations shall be in accordance with the Federal law concerning electrical installations (High and low voltage) (SR 734.0) and the Regulations for electrical power installations (SR 743.2 StV) (Switzerland)
- Figure 1: Rails, chains and ropes are not allowed as obstacles (Sweden)

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The contents of the corrigendum of March 2011 have been included in this copy.

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

There are many 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 valid for IEC countries and some additional information which ensures an acceptable reliability of an installation and its safe operation.

The publication of this standard 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 standard.

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

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POWER INSTALLATIONS EXCEEDING 1 kV AC –

Part 1: Common rules

1 Scope

This part of IEC 61936 provides common rules for the design and the erection of electrical power installations in systems with nominal voltages above 1 kV a.c. 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 standard, an electrical power installation is considered to be one of the following:

- a) Substation, including substation for railway power supply
- b) Electrical 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 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

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 In general, a standard for an item of equipment takes precedence over this standard.

This 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;
- fluorescent lamp installations;
- installations on ships and off-shore installations;
- electrostatic equipment (e.g. electrostatic precipitators, spray-painting units);

- test sites;
- medical equipment, e.g. medical X-ray equipment.

This standard does not apply to the design of factory-built, type-tested switchgear for which separate IEC standards exist.

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

If not otherwise required in this standard, for low-voltage electrical installations the standard series IEC 60364 applies.

2 Normative references

The following referenced documents are indispensable for the application 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 60034-3, *Rotating electrical machines – Part 3: Specific requirements for synchronous generators driven by steam turbines or combustion gas turbines*

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 60071-2:1996, *Insulation co-ordination – Part 2: Application guide*

IEC 60076-2:1993, *Power transformers – Part 2: Temperature rise*

IEC 60076-11, *Power transformers – Part 11: Dry-type 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 60255 (all parts), *Measuring relays and protection equipment*

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

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

IEC/TS 60479-1:2005, *Effects of current on human beings and livestock – Part 1: General aspects*

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

IEC 60617, *Graphical symbols for diagrams*

IEC 60721-2-6, *Classification of environmental conditions – Part 2-6: Environmental conditions appearing in nature – Earthquake vibration and shock*

IEC 60721-2-7, *Classification of environmental conditions – Part 2-7: Environmental conditions appearing in nature. Fauna and flora*

IEC 60754-1, *Test on gases evolved during combustion of materials from cables – Part 1: Determination of the amount of halogen acid gas*

IEC 60754-2, *Test on gases evolved during combustion of electric cables – Part 2: Determination of degree of acidity of gases evolved during the combustion of materials taken from electric cables by measuring pH and conductivity*

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 60826, *Design criteria of overhead transmission lines*

IEC 60865-1, *Short-circuit currents – Calculation of effects – Part 1: Definitions and calculation methods*

IEC 60909 (all parts), *Short-circuit currents in three-phase a.c. systems*

IEC 60949, *Calculation of thermally permissible short-circuit currents, taking into account non-adiabatic heating effects*

IEC 61936-1:2010

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 61082-1, *Preparation of documents used in electrotechnology – Part 1: Rules*

IEC 61100, *Classification of insulating liquids according of fire-point and net calorific value*

IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*

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

IEC 61243 (all parts), *Live working – Voltage detectors*

IEC 62271-1:2007, *High-voltage switchgear and controlgear – Part 1: Common specifications*

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*