Tugevvoolupaigaldised nimivahelduvpingega üle 1 kV. Osa 1: Üldnõuded

Power installations exceeding 1 kV a.c. -
Part 1: Common rules
(IEC 61936-1:2010, modified + IEC 61936-1:2010/A1:2014)

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 61936-1:2010+A1:2014 sisaldab Euroopa standardi EN 61936-1:2010+AC:2011+AC:2012+AC:2013+A1:2014 ingliskeelset teksti.	This Estonian standard EVS-EN 61936-1:2010+A1:2014 consists of the English text of the European standard EN 61936-1:2010+AC:2011+AC:2012+AC:2013+A1:2014+A1:2014.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 05.11.2010, muudatuse A1 25.04.2014.	Date of Availability of the European standard is 05.11.2010, for amendment A1 25.04.2014.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 29.020, 29.080.01

Võtmesõnad: elektriohutus, elektripaigaldis, kõrgepingepaigaldis, maandussüsteem, paigalduspõhimõtted

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 61936-1

November 2010

ICS 29.020. 29.080.01

Supersedes HD 637 S1:1999 (partially)

English version

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

(IEC 61936-1:2010, modified)

Installations électriques en courant alternatif de puissance supérieure à 1 kV - Partie 1: Règles communes
(CEI 61936-1:2010, modifiée)

Starkstromanlagen mit Nennwechselspannungen über 1 kV - Teil 1: Allgemeine Bestimmungen
(IEC 61936-1:2010, modifiziert)

CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 61936-1:2010 E

Foreword

The text of document 99/95/FDIS, future edition 2 of IEC 61936-1, prepared by IEC TC 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, was submitted to the IEC-CENELEC parallel vote.

A draft amendment was prepared by the Technical Committee CENELEC TC 99X, Power installations exceeding 1 kV a.c. (1,5 kV d.c.) and was submitted to formal vote.

The combined texts were approved by CENELEC as EN 61936-1 on 201X-(dor).

This European Standard partially supersedes HD 637 S1:1999.

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

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	dor + 12 months
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	dor + 36 months

Annexes ZA, ZB and ZC have been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61936-1:2010 was approved by CENELEC as a European Standard without with agreed common modifications as given below.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

[5] IEC 60044-6	NOTE Harmonized as EN 60044-6.
[16] IEC 60068 series	NOTE Harmonized in EN 60068 series (not modified).
[17] IEC 60364-4-41	NOTE Harmonized as EN 60364-4-41.
[18] IEC 60480	NOTE Harmonized as EN 60480.
[19] IEC 60664-1	NOTE Harmonized as EN 60664-1.
[23] IEC 62271-100	NOTE Harmonized as EN 62271-100.
[24] IEC 62271-102	NOTE Harmonized as EN 62271-102.
[25] IEC 62271-103	NOTE Harmonized as EN 62271-103.
[26] IEC 62271-104	NOTE Harmonized as EN 62271-104.
[27] IEC 62271-105	NOTE Harmonized as EN 62271-105.

COMMON MODIFICATIONS

2 Normative references

Delete and **shift** to Bibliography:

IEEE 80, *The IEEE guide for safety in AC substation grounding*

IEEE 980, *Guide for containment and control of oil spills in substations*

3 Terms and definitions

3.5.5 **Add**:

NOTE Additional definition of danger zone (D_L) is given in EN 50110-1 and EN 50110-2.

3.5.6 **Add:**

NOTE 3 Additional definition of vicinity zone (D_V) is given in EN 50110-1 and EN 50110-2.

4 Fundamental requirements

4.2.9 **Add:**

NOTE For more information consult EN 50160.

4.3.10 **Add:**

NOTE For more information consult EN 50341 and EN 50423.

7 Installations

Figure 3 **Add:**

NOTE Deviant regulations for danger zone (D_L) and vicinity zone (D_V) are given in EN 50110-1 and EN 50110-2.

Figure 4 **Add:**

NOTE 2 Deviant regulations for vicinity zone (D_V) are given in EN 50110-1 and EN 50110-2.

Renumber the NOTE into NOTE 1.

10 Earthing systems

10.2.1 **Add** after the third last paragraph:

Annexes C and D are only informative for CENELEC. Details for permissible touch voltages are given in EN 50522.

Annex C Permissible touch voltage according IEEE 80

Change title “normative” by “informative”

Annex D Earthing system design flow chart

Change title “normative” by “informative”

Annex ZA
(normative)

Special national conditions

Special national condition: National characteristic or practice that cannot be changed even over a long period, e.g. climatic conditions, electrical earthing conditions.

NOTE If it affects harmonization, it forms part of the European Standard.

For the countries in which the relevant special national conditions apply these provisions are normative, for other countries they are informative.

Clause	Special national condition

4.3.2 Finland

The combinations used in Finland 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.

4.3.4 France

In France, ice load is not considered; only heavy snow is taken into account on the basis of 600 kg/m^3 density.

4.4.2.2 Finland

In Finland even class – 50 °C could be needed.

4.4.2.2 France

In metropolitan France solar radiation limit is 900 W/m².

7.2.1 Finland

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.

7.2.2 Sweden

The height H for outdoor installations shall be at least $H = N$ + 2 500 mm, with a minimum of 3 000 mm.

7.2.4 Finland

The height H for outdoor installations shall be at least $H = N$ + 2 600 mm with a minimum of 2 800 mm.

7.2.4 Sweden

The hight H for outdoor installations shall be at least $H = N$ + 2 500 mm, with a minimum of 3 000 mm.

7.2.6 Finland

The height of the external fence shall be at least 2 000 mm. The local conditions of snow shall be taken into account.

7.7 Finland

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.

12 Finland

In Finland only emergency phone number is required.

Annex ZB
(informative)

A-deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CENELEC national member.

This European Standard does not fall under any Directive of the EC.

In the relevant CENELEC countries these A-deviations are valid instead of the provisions of the European Standard until they have been removed.

Clause	Deviation
General	**France**

In France many laws and decrees are mandatory for the design, the construction, the verification and the control of HV installations. All the French safety and legal requirements, mainly driven by the ministry of industry (arrêté du 17 mai 2001), the ministry of labour (décret du 14 novembre 1988) and the grid codes for HV and MV public networks are incorporated in two national standards; NFC 13-100 and NFC 13-200. Both NFC 13-100 and NFC 13-200 are globally in line with EN 61936-1. Their application is mandatory in France and they cannot be superseded by the European Standard, which provide only general rules.

EN 61936-1 does not cover a large part of the field of the French regulation. It cannot be used in France as a contracting basis between various players involved in HV installation business, since it may create difficulties, interpretation problems, and confused situations.

The main additional rules and deviations from EN 61936-1 are covered by NFC 13-100 and NFC 13-200.

Additional rules:

- limits of private installations and interfaces with the HV public grid;
- mandatory requirements for private installations including power generation;
- mandatory requirements for HV substations interfacing private installation to public grid;
- rules for architecture design of HV private installations;
- detailed rules concerning neutral systems;
- detailed rules concerning design and construction of a global earthing system;
- additional rules concerning the protection against direct and indirect contact;
- additional rules concerning the protection against fire and explosion;
- rules dedicated to the protection against over voltages, under voltages, temporary loss of supply, harmonics;
- protection against the noise including French directives;
- detailed rules dedicated to HV cables sizing;
- additional rules for selection, installation and protection of generators, motors and transformers;
- dedicated rules for metering according to utility requirements;
- dedicated rules to the data to be exchanged with the grid operator system and associated communication equipment;
- design and construction of buildings according French directives;
- verification and control of HV installations according to French legislation;
- detailed information concerning the classification of environmental conditions.

Main A-deviations: see appropriate (sub)clause number.

4.2.4 Norway

(Regulation on electrical network and with guide to the regulation. FEF 2006 § 4-3)

One phase to earth shall be disconnected as fast as possible and within:

Directly earthed net:	8 s
Resistance earthed net:	30 s

Insulated and coil earthed net:

Aerial network and mixed cable/aerial network with distribution transformer:	10 s
Aerial network and mixed cable/aerial network without distribution transformer:	120 min
Cable grid (without aerial conductor) with global earthing:	240 min

Net shall be monitored continuously, and clearance for disconnection of earth fault is activated immediately.

4.2.7 Norway

(Regulation on electrical network and with guide to the regulation. FEF 2006 § 2-9)

In private houses, kindergartens and schools maximum 0,4 µT.

4.3.7 France

Short-circuit mechanical stresses are not taken into account for the design of foundations in France. They are considered to be second order effects and covered by other stress limit.

4.5.2 France

According to the French regulation (arrêté technique – Article 12), in France the noise level is defined and measured in conformity with the French national standard NF S31 010.

5 Norway

(Regulation on electrical network and with guide to the regulation. FEF 2006 § 4-2)

Insulated and coil earthed cable and aerial network with voltage less or equal to 24 kV shall have a minimum transition resistance towards earth. If the resistance is less then this value, operator shall be warned automatically, alternatively the installation can be disconnected.

The value are:

- Cable grid	minimum 1 000 Ω;
- Aerial network and mixed network	minimum 3 000 Ω.

5.4.1 France

According to French regulation, the minimum clearances distances in air of Tables 1 and 2 are replaced by Table 32B of the NFC 13-200 for industrial installations and by the following table for public network substations:

Nominal voltage (kV)	Highest voltage (kV)	Rated switching impulse voltage (kV)	Rated lightning impulse (kV)	Minimum phase to earth distance (mm)	Minimum phase to phase distance (mm)
63	72,5		325	660	760
90	100		450	920	1 060
225	245		1 050	2 140	2 470
400	420	1 050/1 575 (5)	1 425	2 900 (1) 3 500 (2)	4 000 (3) 4 200 (4)

(1) Between conductors and metal frames.
(2) In rod-rod configuration.
(3) Between parallel conductors.
(4) In rod-conductor configuration.
(5) Phase-earth and phase-phase.

6.2.1 France

According to French regulation, the design and operation of switching devices shall respect the requirements of the document UTE-C 18510.

6.2.4.1 Norway
(Regulation on electrical network and with guide to the regulation. FEF 2006 § 4-4)

There shall not be fuses in conductors from current transformers.

6.2.9.5 Norway
(Regulation on electrical network and with guide to the regulation. FEF 2006 § 4-4)

Laying of cables in earth minimum depth 0,4 m. Cables shall be protected minimum 1,5 m above (the ground) where they emerge from water or soil.

Where cables emerge from water it shall be a warning sign.

Cables shall have clear identification and marking e.g. imprinting on the cable protector every 1,0 m.

6.2.15 and
7.7 Norway
(Regulation on electrical network and with guide to the regulation. FEF 2006 § 4-6)

All electrical installations on mast, pole and tower shall be arranged so that operation and switching operations can be carried out from the ground. Installations with fuses shall have multipolar switch, so that the fuses can be operated in dead (without voltage) condition.

7.2.1 Norway
(Regulation on electrical network and with guide to the regulation. FEF 2006 § 4-5)

Height of protection in front of cubicle shall be a minimum of 2 200 mm.

7.2.2 Finland
(Decision of the Ministry of trade and industry on safety of electrical installations (1193/1999))

The use of protective method obstacles is not allowed.

7.2.2 Sweden
(ELSÄK-FS 2008:1, kap 5, § 2)

Rails, chains and ropes are not allowed as obstacles.

7.2.3 Norway
(Regulation on electrical network and with guide to the regulation. FEF 2006 § 4-5)

Minimum boundary clearance wire mesh/screens $E = N$ + 2 500 mm.

7.2.6 Norway
(Regulation on electrical network and with guide to the regulation. FEF 2006 § 4-5)

The height of fence/wall including barbed wire shall be at least 2 500 mm high.

7.3 Finland
(Decision of Ministry of trade and industry on safety of electrical installations (1193/1999))

Use of indoor installations of open design is not allowed in Finland.

7.3 Norway
(Regulation on electrical network and with guide to the regulation. FEF 2006 § 4-5)

Behind (cell) doors and openings wider than 0,5 m it shall be a rail in a not conductive material in the colours yellow/black.

7.3 Sweden
(ELSÄK-FS 2008:1, kap 5, § 2)

Rails, chains and ropes are not allowed as obstacles.

7.4.1 Sweden
(ELSÄK-FS 2008:1, kap 5, § 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.

7.5.4 Norway
(Regulation on electrical network and with guide to the regulation. FEF 2006 § 4-5)

Aisles shall be at least 1 000 mm wide.

7.5.4 Sweden
(ELSÄK-FS 2008:1, kap 3, § 9)

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.)

7.5.5 Norway
(Regulation on electrical network and with guide to the regulation. FEF 2006 § 4-7)

It shall be possible to open emergency doors from the inside without a key by using a latch or other simple means also when crawling, even when they are locked from the outside.

7.7 Norway
(Regulation on electrical network and with guide to the regulation. FEF 2006 § 4-5)

The minimum height of live parts above area accessible to the general public $H' = N + 5\,000$ mm.

The minimum effect of snow in Norway is 700 mm.

Figure 1 Sweden
(ELSÄK-FS 2008:1, kap 5, § 2)

Rails, chains and ropes are not allowed as obstacles.

8.2 Sweden
(ELSÄK-FS 2008:1, kap 5, § 1)

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.

8.2.1.2 Norway
(Regulation on electrical network and with guide to the regulation. FEF 2006 § 4-5)

Protection by obstacle is only acceptable in Norway in front of a distribution transformer and in front of a generator unit. Rail in a non conductive material in the colours yellow/black must be used.

8.2.2.1 Sweden
(ELSÄK-FS 2008:1, kap 5, § 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.

8.2.2.2 Finland
(Decision of Ministry of trade and industry on safety of electrical installations (1193/1999))

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.

8.2.2.2 Sweden
(ELSÄK-FS 2008:1, kap 5, § 2)

Rails, chains and ropes are not allowed as obstacles.

8.2.2.3 Finland
(Decision of the Ministry of trade and industry on safety of electrical installations (1193/1999))

In installations with U_m ≤ 52 kV, where doors or covers have to be opened in order to carry out normal operation or maintenance, a rigid non-conductive rail shall be used as an additional protective measure.

8.4.2 Norway
(Regulation on electrical network and with guide to the regulation. FEF 2006 § 4-4)

Breakers and earth breakers shall be referred inoperative by suitable locking facilities.

8.7 Finland
(Land Use and Building Act (132/1999))

Regulations of fire safety are given in National Building Code part E1 Structural safety of buildings.

8.7.2.1 Norway
(Regulation on electrical network and with guide to the regulation. FEF 2006 § 4-9)

For transformers with below 1 000 l special conditions for Norway are listed in FEF 2006 § 4-9.

8.7.3 Norway
(Regulation on electrical network and with guide to the regulation. FEF 2006 § 4-5)

In installations where it is difficult to evacuate or the voltage is above 30 kV, cables for emergency power, control and communication shall be separated from other cables and protected against fire.

8.8.1.3 France

Figures 8, 9 and 10 are not authorised in France since the use of gravels layer may maintain high temperature in case of fire hazard (see NFC 13-200).

8.9.1 Norway
(Regulation on electrical network and with guide to the regulation. FEF 2006 § 2-12)

Warning signs, markings and identifications in Norway shall be in Norwegian and special cases additional marking in other language.

9.1 Norway
(Regulation on electrical network and with guide to the regulation. FEF 2006 § 4-10)

Blocking of remote operations should be possible locally. The blocking shall be indicated in the control centre.

10.2.1 France

In France protection against electric shock, including global earthing system and disconnection on first faults, is provided according to:

- arrêté technique du 17 mai 2001 for public network substations;
- NFC 13-200 for industrial installations.

10.2.1 UK

(Health & Safety Executive (HSE)

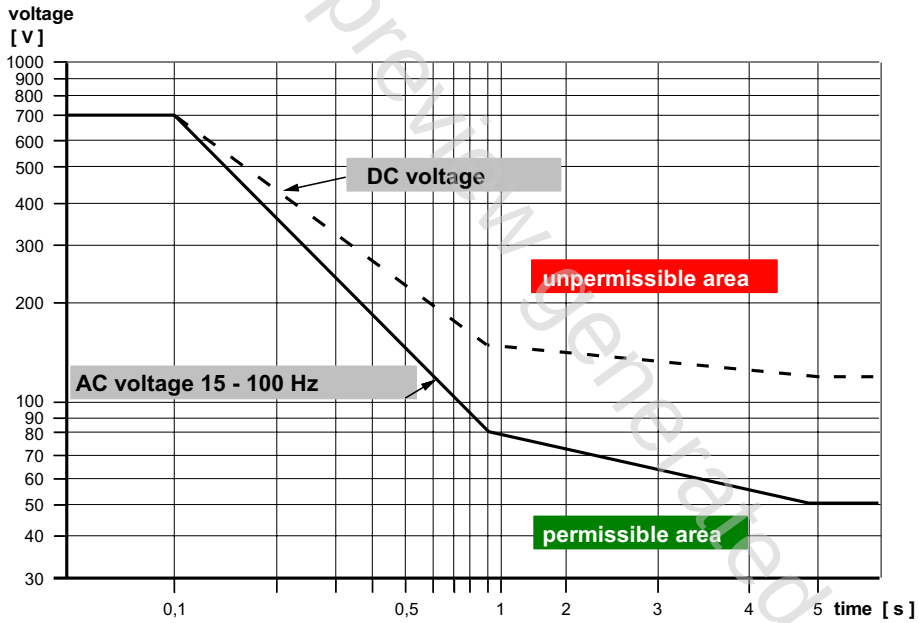
HV earthing systems should be designed according to tolerable voltages based on body impedances not exceeded by 5 % of the population, as given in Table 1 of IEC 60479-1.

10.2.1 Switzerland

(Federal law concerning electrical installations (High and low voltage) (SR 734.0), Regulation for electrical power installations (SR 734.2))

Dimensioning with regard to touch and step voltages permissible values, SR 734.2: Art. 54 (Permissible touch and step voltages in power installations), Art. 55 (Permissible touch voltages in low voltage installations) and Art. 57 (Earthing in high voltage installations).

(Appendix 4 (Art. 54, 55 and 57) Permissible touch voltages.)



Permissible touch voltages and step voltages

10.2.3.3 France

According to the French regulation (arrêté technique du 17 mai 2001 – Article 45), in case of a single phase HV faults, the overvoltage induced in reference to local earth of a BT installation, shall not exceed 1 500 V rms.

11 Norway

(Regulation on electrical network and with guide to the regulation. FEF 2006 § 3-1)

Inspection, testing and final test of the installation shall be carried out to verify compliance with national legislation.