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(istoveten HD 60364-4-443:2006)

Electrical installations of buildings - Part 4-44: Protection for safety - Protection against voltage disturbances and electromagnetic disturbances - Clause 443: Protection against overvoltages of atmospheric origin or due to switching (IEC 60364-4-44:2001/A1:2003, modified)

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HARMONIZATION DOCUMENT

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HD 60364-4-443

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English version

Electrical installations of buildings
Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances – Clause 443: Protection against overvoltages of atmospheric origin or due to switching

(IEC 60364-4-44:2001/A1:2003, modified)

Installations électriques des bâtiments
Partie 4-44: Protection pour assurer la sécurité – Protection contre les perturbations de tension et les perturbations électromagnétiques – Article 443: Protection contre les surtensions d'origine atmosphérique ou dues à des manoeuvres
(CEI 60364-4-44:2001/A1:2003, modifiée)

Elektrische Anlagen von Gebäuden
Teil 4-44: Schutzmaßnahmen – Schutz bei Störspannungen und elektromagnetischen Störgrößen – Abschnitt 443: Schutz bei Überspannungen infolge atmosphärischer Einflüsse oder von Schaltvorgängen
(IEC 60364-4-44:2001/A1:2003, modifiziert)

This Harmonization Document was approved by CENELEC on 2005-07-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for implementation of this Harmonization Document at national level.

Up-to-date lists and bibliographical references concerning such national implementations may be obtained on application to the Central Secretariat or to any CENELEC member.

This Harmonization Document exists in three official versions (English, French, German).

CENELEC members are the national electrotechnical committees of Austria, Belgium, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

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

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Foreword

The text of Amendment 1:2003 to the International Standard IEC 60364-4-44:2001, prepared by IEC TC 64, Electrical installations and protection against electric shock, together with the common modifications prepared by CENELEC SC 64A, Protection against electric shock, of Technical Committee CENELEC TC 64, Electrical installations of buildings, was submitted to the Unique Acceptance Procedure and was approved by CENELEC as HD 60364-4-443 on 2005-07-01.

In this Harmonization Document the common modifications to the International Standard are indicated by a vertical line in the left margin of the text.

This Harmonization Document supersedes HD 384.4.443 S1:2000.

The following dates were fixed:

– latest date by which the existence of the HD has to be announced at national level	(doa)	2006-01-01
– latest date by which the HD has to be implemented at national level by publication of a harmonized national standard or by endorsement	(dop)	2007-02-01
– latest date by which the national standards conflicting with the HD have to be withdrawn	(dow)	2008-07-01

Annexes ZA and ZB have been added by CENELEC.

443 Protection against overvoltages of atmospheric origin or due to switching

443.1 General

This clause of HD 60364-4-443 deals with protection of electrical installations against transient overvoltages of atmospheric origin transmitted by the supply distribution system and against switching overvoltages.

In general, switching overvoltages are lower than overvoltages of atmospheric origin and therefore the requirements regarding protection against overvoltages of atmospheric origin normally cover protection against switching overvoltages.

NOTE 1 Statistical evaluations of measurements have shown that there is a low risk of switching overvoltages higher than the level of overvoltages category II. See 443.2.

Consideration shall be given to the overvoltages which can appear at the origin of an installation, to the expected keraunic level and to the location and characteristics of surge protective devices, so that the probability of incidents due to overvoltage stresses is reduced to an acceptable level for the safety of persons and property, as well as for the continuity of service desired.

The values of transient overvoltages depend on the nature of the supply distribution system (underground or overhead) and the possible existence of a surge protective device upstream of the origin of the installation and the level of the supply system.

This clause provides guidance where protection against overvoltages is covered by inherent control or assured by protective control. If the protection according to this clause is not provided, insulation coordination is not assured and the risk due to overvoltages shall be evaluated.

This clause does not apply in case of overvoltages due to direct or nearby lightning. For protection against transient overvoltages due to direct lightning, the standards of the IEC 61024, IEC 61312 and IEC 61643 series are applicable. This clause does not cover overvoltage through data-transmission systems.

NOTE 2 As regards transient atmospheric overvoltages, no distinction is made between earthed and unearthed systems.

NOTE 3 Switching overvoltages generated outside the installation and transmitted by the supply network are under consideration.

NOTE 4 The risk due to overvoltages is considered in IEC 61662 and its amendment 1.

NOTE 5 The IEC 61024 series is replaced by the IEC 62305 series.

443.2 Classification of impulse withstand categories

443.2.1 Purpose of classification of impulse withstand categories

NOTE 1 Overvoltages categories are defined within electrical installations for the purpose of insulation coordination and a related classification of equipment with impulse withstand voltages is provided. See Table 1.

NOTE 2 The rated impulse withstand voltage is an impulse withstand voltage assigned by a manufacturer to the equipment or to a part of it, characterizing the specified withstand capability of its insulation against overvoltages (in accordance with 1.3.9.2 of IEC 60664-1).

The impulse withstand voltage (overvoltage category) is used to classify equipment energized directly from the mains.

Impulse withstand voltages for equipment selected according to the nominal voltage are provided to distinguish different levels of availability of equipment with regard to continuity of service and on an acceptable risk of failure. By selection of equipment with a classified impulse withstand voltage, insulation co-ordination can be achieved in the whole installation, reducing the risk of failure to an acceptable level.

NOTE 3 Transient overvoltages transmitted by the supply distribution system are not significantly attenuated downstream in most installations.

443.2.2 Description of impulse withstand categories

Equipment with an impulse withstand voltage corresponding to overvoltage category IV is suitable for use at, or in the proximity of, the origin of the electrical installations, for example upstream of the main distribution board. Equipment of category IV has a very high impulse withstand capability providing the required high degree of reliability.

NOTE 1 Examples of such equipment are electricity meters, main incoming overcurrent protection device and ripple control units.

Equipment with an impulse withstand voltage corresponding to overvoltage category III is for use in the fixed installations downstream of, and including the main distribution board, providing a high degree of availability.

NOTE 2 Examples of such equipment are distribution boards, circuit-breakers, wiring systems (see IEC 60050(826) definition IEV 826-15-01), including cables, bus-bars, junction boxes, switches, socket-outlets) in the fixed installation, and equipment for industrial use and some other equipment, e.g. stationary motors with permanent connection to the fixed installation.

Equipment with an impulse withstand voltage corresponding to overvoltage category II is suitable for connection to the fixed electrical installations, providing a normal degree of availability normally required for current-using equipment.

NOTE 3 Examples of such equipment are household appliances, portable tools and similar loads. Computers, audio video appliances and other electronic systems equipment may be sensitive to transient and/or temporary overvoltages of less than 2,5 kV between line conductors, due to embedded protective or filtering devices.

Equipment with an impulse withstand voltage corresponding to overvoltage category I is only suitable for use in the fixed installations of buildings where protective means are applied outside the equipment – to limit transient overvoltages to the specified level.

NOTE 4 Examples of such equipment are those household appliances containing electronic circuits which are very sensitive with regards to overvoltages.

Equipment with an impulse withstand voltage corresponding to overvoltage category I shall not have direct connection to a public supply system.

443.3 Arrangements for overvoltage control

Overvoltage control is arranged in accordance with the following requirements.

443.3.1 Inherent overvoltage control

This subclause does not apply when a risk assessment according to 443.3.2.2 is used.

Where an installation is supplied by a completely buried low-voltage system and does not include overhead lines, the impulse withstand voltage of equipment in accordance with Table 1 is sufficient and no specific protection against overvoltages of atmospheric origin is necessary.

NOTE 1 A suspended cable having insulated conductors with earthed metallic screen is considered as equivalent to an underground cable.

Where an installation is supplied by or includes a low-voltage overhead line and the keraunic level is lower than or equal to 25 days per year (AQ 1) , no specific protection against overvoltages of atmospheric origin is required.

NOTE 2 Irrespective of the AQ value, protection against overvoltages may be necessary in applications where a higher reliability or higher risks (e.g. fire) are expected.

In both cases, consideration regarding protection against transient overvoltages shall be given to equipment with an impulse withstand voltage according to overvoltage category I (see 443.2.2).

443.3.2 Protective overvoltage control

The decision as to which of the following methods are applied in a country with regard to the provision of surge protective devices (SPDs) is left to the national committee based on the local conditions.

In all cases, consideration regarding protection against transient overvoltages shall be given to equipment with an impulse withstand voltage according to overvoltage category I (see 443.2.2.).

443.3.2.1 Protective overvoltage control based on conditions of external influences

Where an installation is supplied by, or includes, an overhead line, and the keraunic level of the location is greater than 25 days per year (AQ 2), protection against overvoltages of atmospheric origin is required. The protection level of the protective device shall not be higher than the level of overvoltage category II, given in Table 1.

NOTE 1 The overvoltage level may be controlled by surge protective devices applied close to the origin of the installation either in the overhead lines (see Annex A) or in the building installation.

NOTE 2 According to IEC 61024-1, 25 thunderstorm days per year are equivalent to a value of 2,24 flashes per km^2 and year. This is derived from the formula

$$N_g = 0{,}04\ T_d^{1{,}25}$$

where

N_g is the frequency of flashes per km^2 and year;

T_d is the number of thunderstorm days per year (keraunic level).

443.3.2.2 Protective overvoltage control based on risk assessment

NOTE 1 A method of general risk assessment is described in IEC 61662. As far as Clause 443 is concerned, an essential simplification of this method has been accepted. It is based on the critical length d_c of the incoming lines and the level of consequences as described below.

The following are different consequential levels of protection:

a) consequences related to human life, e.g. safety services, medical equipment in hospitals;

b) consequences related to public services, e.g. loss of public services, IT centres, museums;

c) consequences to commercial or industrial activity, e.g. hotels, banks, industries, commercial markets, farms;

d) consequences to groups of individuals, e.g. large residential buildings, churches, offices, schools;

e) consequences to individuals, e.g. small or medium residential buildings, small offices;

For levels of consequences a) to c) protection against overvoltage shall be provided.

NOTE 2 There is no need to perform a risk assessment calculation according to Annex B for levels of consequences a) to c) because this calculation always leads to the result that the protection is required.

For levels of consequences d) to e) requirements for protection depends on the result of a calculation. The calculation shall be carried out using the formula in Annex B for the determination of the length d, which is based on a convention and called conventional length.

Protection is required if:

$$d > d_c$$

where

d is the conventional length in km of the supply line of the considered structure with a maximum value of 1 km;

d_c is the critical length;

d_c in km, is equal to $1/N_g$ for level of consequences d) and equal to $2/N_g$ for level of consequences e) where N_g is the frequency of flashes per km^2 per year.

If this calculation indicates that an SPD is required, the protection level of these protective devices shall not be higher than the level of overvoltage category II, given in Table 1.

443.4 Required impulse withstand voltage of equipment

Equipment shall be selected so that its rated impulse withstand voltage is not less than the required impulse withstand voltage as specified in Table 1. It is the responsibility of each product committee to require the rated impulse withstand voltage in their relevant standard, according to IEC 60664-1.

Table 1 – Required rated impulse withstand voltage of equipment

Nominal voltage of the installation [a] V	**Required impulse withstand voltage for** KV [b]			
Three-phase systems	**Equipment at the origin of the installation (impulse withstand category IV)**	**Equipment of distribution and final circuits (impulse withstand category III)**	**Appliances (impulse withstand category II)**	**Specially protected equipment (impulse withstand category I)**
230/400 277/480	6	4	2,5	1,5
400/690	8	6	4	2,5
1 000	12	8	6	4

[a] According to IEC 60038.

[b] This impulse withstand voltage is applied between live conductors and PE.

Annex A
(informative)

Guidance for overvoltage control by SPDs applied to overhead lines

In the conditions of 443.3.2.1 and according to note 1, the protective control of the overvoltage level may be obtained either by installing surge protective devices directly in the installation, or with the consent of the network operator, in the overhead lines of the distribution network.

As an example, the following measures may be applied:

a) in the case of overhead distribution networks, overvoltage protection is erected at network junction points and especially at the end of each feeder longer than 500 m. Overvoltage protective devices should be erected at every 500 m distance along the supply distribution lines. The distance between overvoltage protective devices should be less than 1 000 m;

b) if a supply distribution network is erected partly as overhead network and partly as underground network, overvoltage protection in the overhead lines should be applied in accordance with a) at each transition point from and overhead line to an underground cable;

c) in a TN distribution network supplying electrical installations, where protection against indirect contact is provided by automatic disconnection of supply, the earthing conductors of the overvoltage protective devices connected to the line conductors are connected to the PEN conductor or to the PE conductor;

d) in a TT distribution network supplying electrical installations, where protection against indirect contact is provided by automatic disconnection of supply, overvoltage protective devices are provided for the phase conductors and for the neutral conductor. At the place where the neutral conductor of the supply network is effectively earthed, an overvoltage protective device for the neutral conductor is not necessary.