



**SLOVENSKI STANDARD**  
**SIST HD 384.4.41 S2:2000**

**01-februar-2000**

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Electrical installations of buildings -- Part 4: Protection for safety -- Chapter 41:  
Protection against electric shock

Elektrische Anlagen von Gebäuden -- Teil 4: Schutzmaßnahmen -- Kapitel 41: Schutz  
gegen elektrischen Schlag

Installations électriques des bâtiments -- Partie 4: Protection pour assurer la sécurité --  
Chapitre 41: Protection contre les chocs électriques

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Ta slovenski standard je istoveten z: **HD 384.4.41 S2:1996**

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**ICS:**

91.140.50      Sistemi za oskrbo z elektriko    Electricity supply systems

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**en**

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HARMONIZATION DOCUMENT  
DOCUMENT D'HARMONISATION  
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**HD 384.4.41 S2**

April 1996

ICS 91.140.50

Supersedes HD 384.4.41 S1:1980

Descriptors: Electrical installation, safety, electric shock, direct contact, indirect contact, live parts, exposed conductive parts, extraneous conductive parts, insulation, barriers, enclosures, obstacles, out of reach, fault current, touch voltage, equipotential bonding, earthing, protective conductor, residual current protective device, isolating transformer, safety isolating transformer, safety extra-low voltage

English version

**Electrical installations of buildings**  
**Part 4: Protection for safety**  
**Chapter 41: Protection against electric shock**  
(IEC 364-4-41:1992, modified)

Installations électriques des bâtiments  
Partie 4: Protection pour assurer la  
sécurité  
Chapitre 41: Protection contre les  
chocs électriques  
(CEI 364-4-41:1992, modifiée)

Elektrische Anlagen von Gebäuden  
Teil 4: Schutzmaßnahmen  
Kapitel 41: Schutz gegen elektrischen  
Schlag  
(IEC 364-4-41:1992, modifiziert)

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This Harmonization Document was approved by CENELEC on 1995-11-28. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for implementation of this Harmonization Document on a national level.

Up-to-date lists and bibliographical references concerning such national implementation 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, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

**CENELEC**

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

### Foreword

The text of the International Standard IEC 364-4-41:1992, prepared by IEC TC 64, Electrical installations of buildings, together with common modifications prepared by SC 64A, Protection against electric shock, of Technical Committee CENELEC TC 64, Electrical installations of buildings, was submitted to three separate formal votes and was approved by CENELEC as HD 384.4.41 S2 on 1995-11-28.

The following dates were fixed:

- latest date by which the existence of the HD has to be announced at national level (doa) 1996-06-01
- latest date by which the HD has to be implemented at national level by publication of a harmonized national standard or by endorsement (dop) 1996-12-01
- latest date by which the national standards conflicting with the HD have to be withdrawn (dow) 1996-12-01

Annexes designated "normative" are part of the body of the standard.  
Annexes designated "informative" are given for information only.  
In this standard, annex ZA is normative and annex ZB is informative.  
Annexes ZA and ZB have been added by CENELEC.

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STANDARD PREVIEW  
CENELEC  
TECHNICAL COMMITTEE  
ELECTRICAL INSTALLATIONS OF BUILDINGS  
SC 64A  
PROTECTION AGAINST ELECTRIC SHOCK  
1996-12-01

## ELECTRICAL INSTALLATION OF BUILDINGS

Part 4: Protection for safetyChapter 41: Protection against electric shock4 Protection for safety

## 400.1 Introduction

400.1.1 Chapter 41 and Chapters 42 to 46 (see HD's 384.4.42, 384.4.43, 384.4.45 and 384.4.46) specify essential requirements for protection of persons, livestock and property. Chapter 47 (see HD's 384.4.47 and 384.4.473) deals with the application and coordination of these requirements and Chapter 48 (relevant HD's under preparation) qualifies those requirements in relation to particular classes of external influences. Requirements for the selection and erection of equipment are specified in Part 5 (see HD's 384.5.51, 384.5.52, 384.5.523, 384.5.537 and 384.5.54) and verification requirements in Part 6 (see HD 384.6.61).

400.1.2 Protective measures may be applicable to an entire installation, to a part, or to an item of equipment.

If certain conditions of a protective measure are not satisfied, supplementary measures shall be taken to ensure by such combined protective measures the same degree of safety as complete compliance with those conditions.

Note - An example of the application of this rule is given in Clause 471.3 of HD 384.4.47 S2.

400.1.3 The order in which the protective measures are specified does not imply any relative importance.

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## 41 Protection against electric shock

### 410.1 General

Protection against electric shock shall be provided by application of the appropriate measures specified in Sections:

- 411 for protection both in normal service and in case of a fault, or
- 412 for protection in normal service, and
- 413 for protection in case of a fault,

as required by Section 471 and Chapter 48.

## 411 Protection against both direct and indirect contact

### 411.1 Protection by extra-low voltage: SELV and PELV

Note - A summary of extra-low voltages is given in the Informative Annex to this Chapter.

411.1.1 Protection against electric shock is deemed to be provided when:

- the nominal voltage cannot exceed the upper limit of voltage Band I (see IEC Publication 449: Voltage Bands for Electrical Installations of Buildings), and
- the supply is from one of the sources listed in subclause 411.1.2, and
- the conditions of subclause 411.1.3 and, in addition, either
  - subclause 411.1.4 for SELV circuits (unearthed), or
  - subclause 411.1.5 for PELV circuits (circuits and exposed-conductive-parts may be earthed),
 are fulfilled.

#### Notes

- 1 If the system is supplied from a higher voltage system by other equipment such as autotransformers, potentiometers, semiconductor devices, etc., the output circuit is deemed to be an extension of the input circuit and shall be protected by the protective measures applied to the input circuit.
- 2 For certain external influences covered by Part 7, lower voltage limits may be required.

#### 411.1.2 Sources for SELV and PELV

411.1.2.1 A safety isolating transformer in accordance with EN 60742.

Note - In certain cases (e.g. protective screening) protection by PELV depends on protective measures on the primary side (e.g. automatic disconnection of supply and application of PELV inside the same building).

411.1.2.2 A source of current providing a degree of safety equivalent to that of the safety isolating transformer specified in subclause 411.1.2.1 (e.g. motor generators with windings providing equivalent isolation).

411.1.2.3 An electrochemical source (e.g. a battery) which is independent or separated by protective separation from FELV circuits or circuit of a higher voltage.

411.1.2.4 Other sources which are independent from FELV circuits or circuits with higher voltage (e.g. a combustion-engine-driven generator).

411.1.2.5 Certain electronic devices complying with appropriate standards where measures have been taken in order to provide that, even in the case of an internal fault, the voltage at the outgoing terminals cannot exceed the values specified in subclause 411.1.1. However higher voltages at the outgoing terminals are admitted, in the case of PELV if, in case of direct or indirect contact, the voltage at the output terminals is reduced, in a time according to Table 41A, to values equal to the upper limit of voltage Band I (see subclause 411.1.1) or less.

#### Notes

- 1 - Examples of such devices include insulation testing equipment complying with the requirements of the relevant Publications.
- 2 - Where higher voltages exist at the outgoing terminals, compliance with this subclause may be assumed if the voltage at the outgoing terminals is within the limits specified in subclause 411.1.1, first indent, when measured with a voltmeter having an internal resistance of at least 3000  $\Omega$ .

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### 411.1.3 Arrangement of circuits

411.1.3.1 Live parts of SELV and PELV circuits shall be separated by protective separation from each other, from FELV circuits and from higher voltage circuits by protective separation according to subclause 411.1.3.2

#### Notes

- 1 This requirement does not exclude the connection of the PELV circuit to earth (see subclause 411.1.5).
- 2 In particular, protective separation is necessary between the live parts of electrical equipment such as relays, contactors, auxiliary switches, and any part of a higher voltage circuit.
- 3 Basic requirements for a protective separation of live parts of SELV from PELV circuits and from those of other circuits, for example within the electrical equipment, are given in IEC 1140 (\*)

411.1.3.2 Protective separation between circuit conductors of each SELV and PELV system and conductors of any other circuit shall be arranged by using one of the following methods:

- physically separated conductors;
- SELV and PELV circuit conductors shall be enclosed in an insulating sheath additional to their basic insulation;
- conductors of circuits at different voltages shall be separated by an earthed metallic screen or an earthed metallic sheath;

Note - In the above arrangements an adequate basic insulation of any conductor needs to be provided only for the voltage of the circuit of which it is a part.

- circuits at different voltages may be contained in a multiconductor cable or other grouping of conductors but the conductors of SELV and PELV circuits shall be insulated, individually or collectively, for the highest voltage present.

411.1.3.3 Plugs and socket-outlets for SELV and PELV circuits shall comply with the following:

- plugs shall not be able to enter socket-outlets of other voltage systems;

Note 1 - FELV is considered to be another voltage system (see also subclause 471.3.4 of HD 384.4.47 S2: 1995).

(\*) 2<sup>nd</sup> Edition under preparation: for the time being see subclause 5.3.2 of IEC document 64/808/CDV.



- socket-outlets shall not admit plugs of other voltage systems;
- plugs and socket-outlets of SELV circuits shall not have a protective conductor contact;
- SELV plugs shall not be able to enter PELV socket-outlets; and
- PELV plugs shall not be able to enter SELV socket-outlets.

Note 2 - PELV Plugs and PELV socket-outlets may have a protective conductor contact.

#### 411.1.4 Requirements for SELV circuits

411.1.4.1 Live parts of SELV circuits shall not be connected to earth or to live parts or protective conductors forming part of other circuits.

411.1.4.2 Exposed-conductive-parts shall not be intentionally connected to:

- earth, or
- protective conductors or exposed-conductive parts of another circuit, or
- extraneous-conductive-parts, except that, where electrical equipment is inherently required to be connected to extraneous-conductive-parts, it is arranged that those parts cannot attain a voltage exceeding the voltage specified in subclause 411.1.1, first indent.

Note - If exposed-conductive-parts of SELV circuits are liable to come into contact with the exposed-conductive-parts of other circuits, protection against electric shock no longer depends solely on protection by SELV but on the protective measure to which the latter exposed-conductive-parts are subject.

411.1.4.3 If the nominal voltage exceeds 25 V r.m.s. a.c. or 60 V ripple free d.c., protection against direct contact shall be provided by:

- barriers or enclosures affording at least the degree of protection IP2X or IPXXB, or
- insulation capable of withstanding a test voltage of 500 V r.m.s. a.c. for 1 min.

If the nominal voltage does not exceed 25 V r.m.s. a.c. or 60 V ripple free d.c., protection against direct contact is generally unnecessary; however, certain conditions of external influences may necessitate it.

Note - "Ripple free" is conventionally defined for sinusoidal ripple voltage as a ripple content of not more than 10 % r.m.s.; the maximum peak value does not exceed 140 V for a nominal 120 V ripple free d.c. system and 70 V for a nominal 60 V ripple free d.c. system.

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#### 411.1.5 Requirements for PELV circuits

Where the circuits are earthed and when the SELV according to sub clause 411.1.4 is not required, the requirements of subclauses 411.1.5.1 and 411.1.5.2 shall be fulfilled.

Note - The earthing of circuits may be achieved by an appropriate connection to the protective conductor of the primary circuit of the installation.

411.1.5.1 Protection against direct contact shall be provided either by:

- barriers or enclosures affording at least the degree of protection IP2X or IPXXB, or

- insulation capable of withstanding a test voltage of 500 V r.m.s. a.c. for 1 min.

411.1.5.2 Protection against direct contact in compliance with subclause 411.1.5.1 is not necessary if equipment is inside a building where exposed-conductive-parts or extraneous-conductive-parts, simultaneously accessible, are connected to the same earthing system and the nominal voltage does not exceed:

- 25 V r.m.s. a.c. or 60 V ripple free d.c., when equipment is normally used in dry locations only, and large-area contacts of live parts with the human or animal body are not to be expected;

- 6 V r.m.s. a.c. or 15 V ripple free d.c., in all other cases.

Note - Dry condition is described by AD1 in the Informative Annex to HD 384.3.

#### 411.2 Protection by limitation of steady state touch current and charge

Under consideration.

### 412 Protection against electric shock in normal service (Protection against direct contact or basic protection)

#### 412.1 Protection by insulation of live parts

Note - The insulation is intended to prevent any contact with live parts.

Live parts shall be completely covered with insulation which can only be removed by destruction.

For factory-built equipment the insulation shall comply with the relevant standards for the electrical equipment.

For other equipment, protection shall be provided by insulation capable of durably withstanding the stresses to which it may be subjected in service, such as mechanical, chemical, electrical and thermal influences. Paints, varnishes, lacquers and similar products alone are generally not considered to provide adequate insulation for protection against electric shock in normal service.

Note - Where insulation is applied during the erection of the installation, the quality of the insulation should be confirmed by tests similar to those which ensure the quality of insulation of similar factory-built equipment.

## 412.2 Protection by barriers or enclosures

Note - Barriers and enclosures are intended to prevent any contact with live parts.

412.2.1 Live parts shall be inside enclosures or behind barriers providing at least the degree of protection IP2X or IPXXB except that, where larger openings occur during the replacement of parts, such as certain lampholders or fuses, or where larger opening are necessary to allow the proper functioning of equipment according to the relevant requirements for the equipment:

- suitable precautions shall be taken to prevent persons or livestock from unintentionally touching live parts, and
- it shall be ensured, as far as practicable, that persons will be aware that live parts can be touched through the opening and should not be touched intentionally.

412.2.2 Horizontal top surfaces of barriers or enclosures which are readily accessible shall provide a degree of protection of at least IP4X or IPXXD.

412.2.3 Barriers and enclosures shall be firmly secured in place and have sufficient stability and durability to maintain the required degrees of protection and appropriate separation from live parts in the known conditions of normal service, taking account of relevant external influences.

412.2.4 Where it is necessary to remove barriers or open enclosures or to remove parts of enclosures, this shall be possible only:

- by the use of a key or tool, or
- after disconnection of the supply to live parts against which the barriers or enclosures afford protection, restoration of the supply being possible only after replacement or reclosure of the barriers or enclosures, or

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- where an intermediate barrier providing a degree of protection of at least IP2X or IPXXB prevents contact with live parts, such a barrier being removable only by the use of a key or tool.

### 412.3 Protection by obstacles

Note - Obstacles are intended to prevent unintentional contact with live parts but not intentional contact by deliberate circumvention of the obstacle.

412.3.1 Obstacles shall prevent either:

- unintentional bodily approach to live parts, or
- unintentional contact with live parts during the operation of the equipment in normal service.

412.3.2 Obstacles may be removed without using a key or tool but shall be so secured as to prevent unintentional removal.

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### 412.4 Protection by placing out of reach

Note - Protection by placing out of reach is intended only to prevent unintentional contact with live parts.

412.4.1 Simultaneously accessible parts at different potentials shall not be within arm's reach.

Note - Two parts are deemed to be simultaneously accessible if they are not more than 2,50 m apart (see figure 41C).

412.4.2 If a normally occupied position is restricted in the horizontal direction by an obstacle (e.g. handrail, mesh screen) affording a degree of protection less than IP2X or IPXXB, arm's reach shall extend from that obstacle. In the overhead direction, arm's reach is 2,50 m from the surface S not taking into account any intermediate obstacle providing a degree of protection less than IP2X or IPXXB.

Note - The value of arm's reach apply to contact directly with bare hands without assistance (e.g. tools or ladder).

412.4.3 In places where bulky or long conductive objects are normally handled, the distances required by subclauses 412.4.1 and 412.4.2 shall be increased taking account of the relevant dimensions of those objects.