

INTERNATIONAL STANDARD

IEC 60364-4-41

Fourth edition
2001-08

GROUP SAFETY PUBLICATION

Electrical installations of buildings –

Part 4-41: Protection for safety – Protection against electric shock

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*This **English-language** version is derived from the original **bilingual** publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.*



Reference number
IEC 60364-4-41:2001(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE

V

For price, see current catalogue

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL INSTALLATIONS OF BUILDINGS –**Part 4-41: Protection for safety –
Protection against electric shock**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60364-4-41 has been prepared by IEC technical committee 64: Electrical installations and protection against electric shock.

It has the status of a group safety publication in accordance with IEC Guide 104.

The IEC 60364 series (parts 1 to 6), is currently being restructured, without any technical changes, into a more simple form (see annex A).

According to a unanimous decision by the Committee of Action (CA/1720/RV (2000-03-21)), the restructured parts of IEC 60364 have not been submitted to National Committees for approval.

The text of this fourth edition of IEC 60364-4-41 is compiled from and replaces

- part 4-41, third edition (1992) its amendments 1 and 2 (1996 and 1999 respectively),
- part 4-46, first edition (1981),
- part 4-47, first edition (1981) and its amendment 1 (1993) and
- part 4-481, first edition (1993).

This publication has been drafted, as close as possible, in accordance with the ISO/IEC Directives, Part 3.

Annex A is for information only.

The committee has decided that the contents of this publication will remain unchanged until 2003. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

Withdawn

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410 (400.1)¹ Introduction

(400.1.1) Part 4-41 of IEC 60364 specifies essential requirements for the protection of persons, livestock and property against direct contact and indirect contact. 410.3 deals with the application and co-ordination of these requirements, including the application in relation to particular classes of external influences.

Protection may be provided by

- a measure which combines protection against direct and indirect contact; or
- the combination of a measure of protection against direct contact and a measure of protection against indirect contact.

The measures which combine protection against direct and indirect contact are

- SELV and PELV (411.1);
- limitation of discharge energy (411.2) (under consideration);
- FELV (411.3).

The measures of protection against direct contact are

- insulation of live parts (412.1);
- barriers or enclosures (412.2);
- obstacles (412.3);
- placing out of reach (412.4).

The measures of protection against indirect contact are

- automatic disconnection of supply (413.1);
- class II equipment or equivalent insulation (413.2);
- non-conducting location (413.3);
- earth-free local equipotential bonding (413.4);
- electrical separation (413.5).

Requirements for additional protection against direct contact by residual current devices are given in 412.5.

(400.1.2, in part) Measures of protection may be applicable to an entire installation, to a part, or to an item of equipment.

(400.1.3) The order in which the measures of protection are specified does not imply any relative importance.

¹ In this standard, references in brackets refer to the previous numbering system.

ELECTRICAL INSTALLATIONS OF BUILDINGS –

Part 4-41: Protection for safety – Protection against electric shock

410.1 Scope

Part 4-41 of IEC 60364 describes how protection against electric shock is provided by application of the appropriate measures as specified in

- 411 for protection against both direct and indirect contact,
- 412 for protection against direct contact,
- 413 for protection against indirect contact.

410.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60364. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 60364 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60146-2:1999, *Semiconductor converters – Part 2: Semiconductor converters including direct d.c. converters*

IEC 60364-5-51:1997, *Electrical installations of buildings – Part 5: Selection and erection of electrical equipment – Chapter 51: Common rules*

IEC 60364-5-54:1980, *Electrical installations of buildings – Part 5: Selection and erection of electrical equipment – Chapter 54: Earthing arrangements and protective conductors*

IEC 60364-6 (all parts), *Electrical installations of buildings – Part 6: Verification*

IEC 60364-7 (all parts), *Electrical installations of buildings – Part 7: Requirements for special installations or locations*

IEC 60364-7-704:1989, *Electrical installations of buildings – Part 7: Requirements for special installations or locations – Section 704: Construction and demolition site installations*

IEC 60364-7-705:1984, *Electrical installations of buildings – Part 7: Requirements for special installations or locations – Section 705: Electrical installations of agricultural and horticultural premises*

IEC 60439 (all parts), *Low-voltage switchgear and controlgear assemblies*

IEC 60449:1973, *Voltage bands for electrical installations of buildings*

IEC 60664 (all parts), *Insulation co-ordination for equipment within low-voltage systems*

IEC 60742:1983, *Isolating transformers and safety isolating transformers – Requirements*

IEC 61008-1:1996, *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs) – Part 1: General rules*

IEC 61009-1:1996, *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs) – Part 1: General rules*

IEC 61140:1997, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61201:1992, *Extra-low voltage (ELV) – Limit values*

IEC Guide 104: *The preparation of safety publications and the use of basic safety publications and group safety publication*

410.3 (470) Application of measures of protection against electric shock

410.3.1 General

410.3.1.1 (470.1) Measures of protection shall be applied to every installation, part of an installation, and to equipment, as required by 410.3.

410.3.1.2 (470.2) The choice and application of measures of protection according to conditions of external influence shall be as specified in 410.3.4.

410.3.1.3 (470.3) Protection shall be ensured by

- the equipment itself,
- application of a measure of protection as a process of erection,
- a combination of these two.

410.3.1.4 (400.1.2 in part) If certain conditions of a measure of protection are not satisfied, supplementary measures shall be taken to ensure by such combined measures of protection the same degree of safety as complete compliance with those conditions.

NOTE An example of the application of this rule is given in 411.3.

410.3.1.5 (470.4) It shall be ensured that there is no mutual detrimental influence between different measures of protection applied to the same installation or part of an installation.

410.3.2 Application of measures of protection against direct contact

410.3.2.1 (471.1) All electrical equipment shall be subject to one of the measures of protection against direct contact described in 411 and 412.

410.3.2.2 (481.2.1) The measures of protection by insulation of live parts (412.1) or by barriers or enclosures (412.2) are applicable in all conditions of external influences.

410.3.2.3 (481.2.2) The measures of protection by means of obstacles (412.3) or placing out of reach (412.4) are permitted only under the conditions which will be given in a future part 7 of IEC 60364 (under consideration).

410.3.3 Application of measures of protection against indirect contact

410.3.3.1 (471.2.1) Except as provided in 410.3.3.5, all electrical equipment shall be subject to one of the measures of protection against indirect contact described in 411 and 413, and to the conditions given in 410.3.3.2 to 410.3.3.4.

410.3.3.2 (471.2.1.1) Protection by automatic disconnection of supply (see 413.1) shall be applied to any installation, except to parts of the installation to which another measure of protection is applied.

410.3.3.3 (471.2.1.2) Where the application of the requirements of 413.1 for protection by automatic disconnection of supply is impracticable or undesirable, protection by the provision of a non-conducting location (413.3) or earth-free local equipotential bonding (413.4) may be applied to certain parts of an installation.

410.3.3.4 (471.2.1.3) Protection by SELV (411.1) by the use of class II equipment or equivalent insulation (413.2) and by electrical separation (413.5) may be applied in every installation, usually to certain equipment and certain parts of an installation.

410.3.3.5 (471.2.2) Protection against indirect contact may be omitted for the following equipment:

- overhead line insulator wall brackets and metal parts connected to them (overhead line fittings) if they are not situated within arm's reach;
- steel reinforced concrete poles in which the steel reinforcement is not accessible;
- exposed-conductive-parts which, owing to their reduced dimensions (approximately 50 mm × 50 mm) or their disposition, cannot be gripped or come into significant contact with a part of the human body and provided that connection with a protective conductor could only be made with difficulty or would be unreliable;
NOTE This requirement applies, for example, to bolts, rivets, nameplates and cable clips.
- metal tubes or other metal enclosures protecting equipment in accordance with 413.2.

410.3.4 Application of measures of protection in relation to external influences

410.3.4.1 (481.1.1) The requirements of 410.3.4.2 indicate the measures for protection against electric shock defined in this standard to be applied as a function of assessed conditions of external influences.

NOTE 1 In practice, only the following conditions of external influences are relevant to the selection of measures of protection against electric shock:

- BA: qualification of persons;
- BB: electrical resistance of the human body;
- BC: contact at persons with earth potential.

NOTE 2 Other conditions of external influences have practically no influence on the selection and implementation of measures of protection against electric shock, but should be taken into consideration for the selection of equipment (see IEC 60364-5-51, table 51A).

410.3.4.2 (481.1.2) Where, for a given combination of external influences, several measures of protection are permitted, the selection of the appropriate measure depends on local conditions and the nature of the equipment concerned.

NOTE For special installations or special locations, see IEC 60364-7.

410.3.4.3 (481.3.1 in part) The measure of protection by automatic disconnection of the supply according to 413.1 is applicable in any installation.

410.3.4.4 (481.3.2) The measure of protection by use of class II equipment or by equivalent insulation, according to 413.2, is applicable in all situations, unless some limitations are given in IEC 60364-7.

NOTE For safety reasons it is important that the equipment be selected according to the external influences.

410.3.4.5 (481.3.3) The measure of protection by non-conductive location is permitted in accordance with 413.3.

410.3.4.6 (481.3.4) The measure of protection by earth-free local equipotential bonding is permitted only in the condition of external influences BC 1.

410.3.4.7 (481.3.5) The measure of protection by electrical separation is applicable in all situations. However, in condition BC 4, it shall be limited to the supply of one item of mobile apparatus from one transformer.

410.3.4.8 (481.3.6) The use of SELV according to 411.1.4, or PELV according to 411.1.5, is considered as a measure of protection against indirect contact in all situations.

NOTE 1 In certain cases IEC 60364-7 limits the value of the extra-low voltage at a value lower than 50 V, i.e. 25 V or 12 V.

NOTE 2 The use of FELV requires another measure of protection against indirect contact (see 411.3.3).

410.3.4.9 (481.3.7) In certain installations or parts of the installation, for example, in locations where persons may be immersed in water, the corresponding part of IEC 60364-7 requires particular measures of protection.

411 Protection against both direct and indirect contact

411.1 SELV and PELV

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 60449),
- the supply is from one of the sources listed in 411.1.2,
- all the conditions of 411.1.3 and, in addition, either
 - 411.1.4 for unearthed circuits (SELV), or
 - 411.1.5 for earthed circuits (PELV) are fulfilled.

NOTE 1 If the system is supplied from a higher voltage system by other equipment such as auto-transformers, potentiometers, semiconductor devices, etc., the output circuit is deemed to be an extension of the input circuit and is protected the measures of protection are applied to the input circuit.

NOTE 2 For certain external influences, lower voltage limits may be required. See also IEC 60364-7.

NOTE 3 In d.c. systems with batteries, the battery charging and floating voltages exceed the battery nominal voltage, depending on the type of battery. This does not require any measures of protection in addition to those specified in this clause. The charging voltage should not exceed a maximum value of 75 V a.c. or 150 V d.c. as appropriate, according to the environmental situation as given in table 1 of IEC 61201.

411.1.2 Sources for SELV and PELV

411.1.2.1 A safety isolating transformer in accordance with IEC 60742.

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