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AMENDMENT 1
AMENDEMENT 1

iTeh STANDARD PREVIEW
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Low-voltage electrical installations –
Part 4-41: Protection for safety – Protection against electric shock

IEC 60364-4-41:2005/AMD1:2017
<https://standards.iteh.ai/catalog/standards/sist/11e3bc55-264d-41b8-aa42-2505ecc8c396/iec-60364-4-41-2005-amd1-2017>

Installations électriques à basse tension –
Partie 4-41: Protection pour assurer la sécurité – Protection contre les chocs électriques





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FOREWORD

This amendment has been prepared by IEC technical committee 64: Electrical installations and protection against electric shock.

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

FDIS	Report on voting
64/2147/FDIS	64/2151/RVD

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

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
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- replaced by a revised edition, or
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410.2 Normative references

Replace the existing reference IEC 60364-5-52 and its footnote by the following entry:

IEC 60364-5-52, *Low-voltage electrical installations – Part 5-52: Selection and erection of electrical equipment – Wiring systems*

Replace the existing reference "IEC 60439-1" by the following new entry:

IEC 61439 (all parts), *Low-voltage switchgear and controlgear assemblies*

Add, after the entry "IEC 61558-2-6" the following new entry:

IEC 62477-1, *Safety requirements for power electronic converter systems and equipment – Part 1: General*

411.3.1.2 Protective equipotential bonding

Replace the existing text with the following new text:

In each building, incoming metallic parts which are liable to introduce a dangerous potential difference and do not form part of the electrical installation shall be connected to the main earthing terminal by protective bonding conductors; examples of such metallic parts may include:

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- pipes supplying services into the building, for example gas, water, district heating systems;
- structural extraneous-conductive-parts;
- accessible reinforcement of constructional reinforced concrete.

Where such conductive parts originate outside the building, they shall be bonded as close as practicable to their point of entry within the building.

Metallic pipes entering the building having an insulating section installed at their entrance need not be connected to the protective equipotential bonding.

NOTE Subclause 542.4.1 of IEC 60364-5-54:2011 lists other connections which are to be made to the main earthing terminal.

411.3.2.1

Replace the existing text and "NOTES" with the following new text and "NOTE":

411.3.2.1 A protective device shall automatically switch off the supply to the line conductor of a circuit or equipment in the event of a fault of negligible impedance between the line conductor and an exposed-conductive-part or a protective conductor in the circuit or equipment within the disconnection time required in 411.3.2.2, 411.3.2.3 or 411.3.2.4.

The device shall be suitable for isolation of at least the line conductor(s).

NOTE For IT systems, automatic disconnection is not necessarily required on the occurrence of a first fault (see 411.6.1). For the requirements for disconnection in the event of a second fault, occurring on a different live conductor, see 411.6.3.2 following the rules of this subclause.

411.3.2.2

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Replace the existing text and Table 41.1 with the following new text and new Table 41.1:

411.3.2.2 The maximum disconnection times stated in Table 41.1 shall be applied to final circuits with a rated current not exceeding

- 63 A with one or more socket-outlets, and
- 32 A supplying only fixed connected current-using equipment.

Table 41.1 – Maximum disconnection times

System	50 V < U_o ≤ 120 V		120 V < U_o ≤ 230 V		230 V < U_o ≤ 400 V		U_o > 400 V	
	s		s		s		s	
	a.c.	d.c.	a.c.	d.c.	a.c.	d.c.	a.c.	d.c.
TN	0,8	^a	0,4	1	0,2	0,4	0,1	0,1
TT	0,3	^a	0,2	0,4	0,07	0,2	0,04	0,1
Where in TT systems the disconnection is achieved by an overcurrent protective device and the protective equipotential bonding is connected with all extraneous-conductive-parts within the installation, the maximum disconnection times applicable to TN systems may be used.								
U_o is the nominal a.c. or d.c. line to earth voltage.								
NOTE Where disconnection is provided by an RCD, see Note to 411.4.4, Note 4 to 411.5.3 and Note 4 to 411.6.4 b).								
^a Disconnection may be required for reasons other than protection against electric shock.								

411.3.2.5

Replace the existing text with the following new text:

Where it is not feasible for an overcurrent protective device to interrupt the supply in accordance with 411.3.2 or the use of an RCD for this purpose is not appropriate, see Annex D.

However, disconnection may be required for reasons other than protection against electric shock.

411.3.3 Additional protection

Replace the existing Subclause 411.3.3, including its title, with the following new title and new text:

411.3.3 Further requirements for socket-outlets and for the supply of mobile equipment for use outdoors

Additional protection by means of a residual current protective device (RCD) with a rated residual operating current not exceeding 30 mA shall be provided for

- a.c. socket-outlets with a rated current not exceeding 32 A that are liable to be used by ordinary persons and are intended for general use, and
- a.c. mobile equipment for use outdoors with a rated current not exceeding 32A.

This subclause does not apply for IT systems in which the fault current, in the event of a first fault, does not exceed 15 mA.

IEC 60364-4-41:2005/AMD1:2017

NOTE Additional protection in d.c. systems is under consideration.

Add, after the end of 411.3.3, the following new Subclause 411.3.4:

411.3.4 Additional requirements for circuits with luminaires in TN- and TT-systems

In premises designed to accommodate a single household, additional protection by a residual current protective device (RCD) with a rated residual operating current not exceeding 30 mA shall be provided for a.c. final circuits supplying luminaires.

411.4.1

Replace the existing “NOTE 1” and “NOTE 2” with the following “NOTE”:

NOTE Examples of conditions include:

- the PEN is connected to earth at a number of points and is installed in such a way as to minimize the risk arising from a break in the PEN conductor;
- $R_B/R_E \leq 50/(U_o - 50)$

where

R_B is the earth electrode resistance, in ohms, of all earth electrodes in parallel;

R_E is the minimum contact resistance with earth, in ohms, of extraneous-conductive-parts not connected to a protective conductor, through which a fault between line and earth may occur;

U_o is the nominal a.c. r.m.s. voltage to earth, in volts.

411.4.2

Delete the existing "NOTE 1" and replace it with the following paragraph of normal text:

If other effective earth connections exist, it is recommended that the protective conductors also be connected to such points wherever possible. Earthing at additional points, distributed as evenly as possible, may be necessary to ensure that the potentials of protective conductors remain, in case of a fault, as near as possible to that of earth.

Delete the existing "NOTE 2" and replace it with the following paragraph of normal text:

It is recommended that protective conductors (PE and PEN) should be earthed where they enter any buildings or premises taking account of any diverted neutral currents of multiple earthed PEN conductors.

411.4.4

Add, in the second item after "where", spaces before "or" (two occurrences) and a semi-colon instead of a colon at the end as follows:

I_a is the current in amperes (A) causing the automatic operation of the disconnecting device within the time specified in 411.3.2.2, or 411.3.2.3. When a residual current protective device (RCD) is used this current is the residual operating current providing disconnection in the time specified in 411.3.2.2, or 411.3.2.3;

Replace the existing "NOTE" with the following new "NOTE":

NOTE In TN systems the residual fault currents are significantly higher than $5 I_{\Delta n}$. Therefore, the disconnection times in accordance with Table 41.1, are fulfilled where residual current protective devices (RCDs) according to IEC 61008-1, IEC 61009-1 or IEC 62423, including selective and time delayed types, are installed. Circuit-breakers providing residual current protection (CBR) and MRCDs according to IEC 60947-2 can be used, provided the time delay is adjusted to afford compliance with Table 41.1.

411.4.5

Delete, before the existing "NOTE 2", the existing paragraph "Where an RCD is used in a TN-C-S system, a PEN conductor shall not be used on the load side. The connection of the protective conductor to the PEN conductor shall be made on the source side of the RCD".

411.5.2

Add, in the first paragraph, second sentence after Z_s , "(see 411.5.4)", as follows:

.... low value of Z_s (see 411.5.4) is permanently and reliably assured.

411.5.4

Replace, in the first paragraph, the existing word "over-current" by "overcurrent".

411.6.2

Replace the existing second paragraph with the following new text:

In a.c. systems the following condition shall be fulfilled to limit the touch voltage to:

$$R_A \times I_d \leq 50 \text{ V}$$

where

R_A is the sum of the resistance in Ω of the earth electrode and protective conductor for the exposed-conductive-parts;

I_d is the fault current in A of the first fault of negligible impedance between a line conductor and an exposed-conductive-part. The value of I_d takes account of leakage currents and the total earthing impedance of the electrical installation.

Add, at the end of the subclause, the following new "NOTE":

NOTE No touch voltage limitation is considered in d.c. systems as the value of I_d can be considered to be negligibly low.

411.6.3

Add, "(IFLS)" at the end of the third indent, so that the indent reads:

- insulation fault location systems (IFLS);

Replace the existing "NOTE" by a new "NOTE 1" and add a new "NOTE 2" as follows:

NOTE 1 Where a residual current protective device (RCD) is used, tripping of the RCD in the event of a first fault cannot be excluded due to capacitive leakage currents.

NOTE 2 In case of faults in two different items of class I current-using equipment supplied by different line conductors, the operation of a residual current protective device (RCD) is only likely to be achieved if every single item of current using equipment is protected by an individual residual protective device (RCD). The use of overcurrent protective devices to provide fault protection is also suitable.

411.6.3.1

Replace the existing text with the following new text:

Where an IT system is designed not to disconnect in the event of first fault, the occurrence of the first fault shall be indicated by either:

- an insulation monitoring device (IMD), which may be combined with an insulation fault location system (IFLS), or
- a residual current monitor (RCM), provided the residual current is sufficiently high to be detected.

NOTE RCMs are not able to detect symmetrical insulation faults.

The device shall initiate an audible and/or visual signal which shall continue as long as the fault persists. The signal can be initiated via a relay contact output, an electronic switching output or a communication protocol.

A visual and/or an audible alarm system shall be arranged at a suitable place, so that it is perceived by responsible persons.

If there are both audible and visible signals, it is permissible for the audible signal to be cancelled.

It is recommended that a first fault be eliminated with the shortest practicable delay.

In addition, an insulation fault location system (IFLS) according to IEC 61557-9 may be provided to indicate the location of a first fault from a live part to exposed-conductive-parts or earth or another reference point.

411.6.3.2

Delete the entire text and subclause number of 411.6.3.2.

412.1.1

Add the following new paragraph after the "NOTE":

The protective measure by double or reinforced insulation is applicable in all situations, unless some limitations are given in the corresponding Part 7 of IEC 60364.

412.1.2

Replace the existing text with the following new text:

Where this protective measure is to be used as the sole protective measure (i.e. where a whole installation or circuit is intended to consist entirely of equipment with double insulation or reinforced insulation), it shall be verified that effective measures, for example by adequate supervision, are in place so that no change can be made that would impair the effectiveness of the protective measure.

Therefore this protective measure shall not be applied to any circuit that includes, for example, a socket-outlet with an earthing contact.

412.1.3


Delete the entire text and subclause number of 412.1.3.

412.2.1.1

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Replace, in the second indent, "(see IEC 60439-1)" by "(see the IEC 61439 series)".

Replace the existing "NOTE" with the following new "NOTE":

NOTE This equipment is identified by the symbol  IEC 60417-5172:2003-02.


412.2.1.2

Replace the existing "NOTE" with the following new paragraph.

The symbol  should be fixed in a visible position on the exterior and interior of the enclosure. See IEC 60417-5019:2006-08 and IEC 80416-3:2002, Clause 7.

412.2.1.3

Replace the existing "NOTE" with the following new paragraph.

The symbol  should be fixed in a visible position on the exterior and interior of the enclosure. See IEC 60417-5019:2006-08 and IEC 80416-3:2002, Clause 7.

412.2.3.2



Replace, in the first paragraph, the existing reference to "412.1.3" by "412.1.2".

412.2.4.1

Replace the existing text with the following new text:

Wiring systems installed in accordance with IEC 60364-5-52 are considered to meet the requirements of 412.2 if they consist of:

- a) conductors having insulation with a rated voltage not less than the nominal voltage of the system and at least 300 V to 500 V, enclosed in trunking or ducting with electrical insulating characteristics complying with the IEC 61084 series, or conduit with electrical insulating characteristics complying with the IEC 61386 series, or
- b) cable adequate to withstand electric, thermal, mechanical and environmental stresses with the same reliability of protection as provided by double insulation.

NOTE 1 Such wiring systems are not identified by the symbol  IEC 60417-5172:2003-02, or by the symbol  IEC 60417-5019:2006-08 and IEC 80416-3:2002, Clause 7.

NOTE 2 In Italy, wiring systems installed in accordance with IEC 60364-5-52 in electrical systems with nominal voltages not higher than 690 V, are considered to meet the requirements of 412.2 if the following cables or insulated conductors are used:

- cables, provided with a non-metallic sheath, having a rated voltage one step higher than the nominal voltage of the system; or
- insulated conductors installed in insulating conduits or insulating trunkings complying with the relevant standards; or
- cables, provided with a metallic sheath, having between the conductors and the metallic sheath and between such metallic sheath and the external surface, an insulation adequate for the nominal voltage of the electrical system.

415.2.2

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Replace the existing first paragraph with the following new text:

The resistance R between simultaneously accessible exposed-conductive-parts and extraneous-conductive-parts shall fulfil the following condition:

C.3.8

Replace, in the existing text "100 000 V/m" by "100 000".

Annex D – Correspondence between IEC 60364-4-41:2001 and the present standard

Replace the existing Annex D, including its title, with the following new Annex D and new title:

Annex D (normative)

Provisions where automatic disconnection according to 411.3.2 is not feasible

D.1 Where automatic disconnection is not feasible in circumstances where

- electronic equipment with limited short-circuit current is installed, or
- the required disconnection times cannot be achieved by a protective device,

the following provisions are applicable.

D.2 For installations with power electronic converters with nominal voltage U_0 greater than 50 V a.c. or 120 V d.c. and where automatic disconnection is not feasible, the output voltage of the source shall be reduced to 50 V a.c. or 120 V d.c. or less in the event of a fault between a live conductor and the protective conductor or earth in a time as given in 411.3.2.2, 411.3.2.3 or 411.3.2.4, as appropriate (see IEC 62477-1).

The power electronic converter shall be one for which the manufacturer gives adequate methods for the initial and periodic verification of the installation.

D.3 Except where D.1 applies, if automatic disconnection cannot be achieved in the time required by 411.3.2.2, 411.3.2.3, or 411.3.2.4 as appropriate, supplementary protective equipotential bonding shall be provided in accordance with 415.2 and the voltage between simultaneously accessible conductive parts shall not exceed 50 V a.c. or 120 V d.c.

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Annex E
(informative)

List of notes concerning certain countries

Country	Clause N°	Nature (permanent or less permanent according to IEC Directives)	Rationale (detailed justification for the requested country note)	Wording
IE	410.3			In Ireland, the protective measure “Protection by Reduced Low Voltage”(i.e. 120V a.c. with centre-point earthing) is a statutory requirement in certain places of work
BE	411.3.2.2			In Belgium, the maximum discontinuation time is not applicable; the Belgian safety curve as given in the Belgian Wiring Rules needs to be followed.
NL	411.3.2.2			In the Netherlands the maximum disconnection time stated in Table 41.1 is applied to all circuits not exceeding 32 A and all circuits supplying socket-outlets.
GB	411.3.3			In the United Kingdom additional protection by means of an RCD is required to be provided for: (i) socket-outlets with a rated current not exceeding 20 A, and (ii) mobile equipment with a current rating not exceeding 32 A for use outdoors.
IE	411.3.3			In Ireland additional protection is provided for socket-outlets with a rated current up to 32 A intended for use by ordinary persons.
BE	411.3.3			In Belgium, every electrical installation under the supervision of ordinary persons must be protected by a RCD with a rated operating residual current not exceeding 300 mA. For circuits supplying bathrooms, washing machines, dishwashers, etc, an additional protection by means of a RCD with a rated residual operating current not exceeding 30 mA is mandatory. The above is valid for electrical installations whose earthing resistance is lower than 30 Ω. In case of earthing resistance higher than 30 Ω and lower than 100 Ω, additional RCDs with a rated operating residual current not exceeding 100 mA should be provided. An earthing resistance higher than 100 Ω is not permitted.
NO	411.3.3			In Norway all commercial and industrial companies are covered by regulations requiring procedures for qualifications and training of employees. Except for areas open for the public, socket-outlets in such locations are normally not considered to be for general use of ordinary people. Socket-outlets in dwellings and BA2 locations are intended for general use by ordinary people.
BE	411.3.4			In Belgium, this requirement is not applicable.
DE	411.4.1			In Germany, it is mandatory for DSOs to fulfil the conditions of the formula given in the Note.
DE				In Germany, every new building shall have a foundation earth electrode, erected in accordance with DIN 18014.
AT				In Austria, in a TN system every installation shall have an earth electrode. In Austria a