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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Portable residual current devices (PRCDs) without integral overcurrent protection for household and similar use

Dispositifs différentiels portables à courant résiduel (PCDM) sans protection incorporée contre les surintensités pour usages domestiques et analogues



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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PORTABLE RESIDUAL CURRENT DEVICES (PRCDS) WITHOUT INTEGRAL OVERCURRENT PROTECTION FOR HOUSEHOLD AND SIMILAR USE

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This second edition cancels and replaces the first edition published in 1997 and its Amendment 1:1998. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) The content of the document was revised and aligned with IEC 60755 (group safety publication for residual current devices) and standard library "blocks and modules".
b) Introduction of classification "4.3 According to behaviour after opening automatically in case of failure of the line voltage".

c) New requirements and tests were added to cover the introduced protection function against shock hazard:
   – Verification of correct performance in the case of missing protective conductor.
   – Verification of correct performance in the case of hazardous live protective conductor.
   – Verification of correct performance in the case of loss of protective conductor.
   – Verification of behaviour in the case of external fault current in the protective conductor.
d) Clearances/creepage distances revised and modified in alignment with IEC 62752 (IC-CPD).
e) Revision of values for minimum operating voltages.
f) Introduction of requirements and test for ambient air temperature between −25 °C and +40 °C.
g) Test of dielectric properties revised and aligned with standard library "blocks and modules".
h) Relevant clauses aligned with IEC 62752 (IC-CPD); IC-CPD is a product standard describing similar product/features.
i) All annexes revised and adapted to content of main document.

The text of this International Standard is based on the following documents:

Draft	Report on voting
23E/1320/FDIS	23E/1323/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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INTRODUCTION

A portable residual current device (hereafter referred to as PRCD), consists of a plug, a residual current device (RCD) and one or more socket-outlets or a provision for connection.

This document is harmonized as far as practicable with the rules and requirements of IEC 60755 (group safety publication for RCD) and the standard library "blocks and modules", as defined in IEC 62873-1.

PORTABLE RESIDUAL CURRENT DEVICES (PRCDS) WITHOUT INTEGRAL OVERCURRENT PROTECTION FOR HOUSEHOLD AND SIMILAR USE

1 Scope

This document applies to portable residual current devices (PRCDs) for household and similar uses, consisting of a plug, a residual current device (RCD) and one or more socket-outlets or a provision for connection. They do not incorporate overcurrent protection. They are intended for single- and two-phase systems for rated currents not exceeding 16 A for rated voltages not exceeding 250 V AC, or for rated current not exceeding 32 A for rated voltages not exceeding 130 V AC to earth. They are intended to provide protection against shock hazard in case of direct contact, in addition to the protection provided by the fixed installations for the circuit downstream.

PRCDs have a rated residual operating current not exceeding 0,03 A.

The plug and socket-outlet parts of a PRCD are covered by the national standard of the country where the PRCD is placed on the market. If no national requirements exist, IEC 60884-1 is used.

This document applies to portable devices performing simultaneously the functions of detection of the residual current, of comparison of the value of this current with the residual operating value and of opening of the protected circuit when the residual current exceeds this value.

PRCDs providing an additional function of detecting faults on the supply side with a defined behaviour in case of supply failures or miswiring (PRCD-S) are also covered by this document.

PRCDs are not intended to be used as parts of fixed installations. Their connecting means can be plugs, socket-outlets, terminals or cords.

NOTE 1 The requirements for PRCDs are in compliance with the general requirements of IEC 60755. PRCDs are essentially intended to be operated by ordinary persons and designed not to require maintenance.

NOTE 2 An integral fuse is used, if necessary, for the relevant plug and socket-outlet system.

The switching contacts of the PRCDs are not intended to provide isolation, as isolation can be ensured by disconnecting the plug.

The requirements of this document apply for environmental conditions as defined in 7.1. Additional requirements can be necessary for PRCDs used in locations having more severe environmental conditions.

PRCDs including batteries are not covered by this document.

This document does not contain additional requirements for PRCDs without earthing contacts for which specific requirements can apply. This document can, however, be used as a guide for such devices which are intended to be used with Class II appliances only.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60065, *Audio, video and similar electronic apparatus – Safety requirements*

IEC 60068-3-4, *Environmental testing – Part 3-4: Supporting documentation and guidance – Damp heat tests*

IEC 60068-2-30, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 + 12 h cycle)*

IEC 60112, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60227 (all parts), *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V*

IEC 60245 (all parts), *Rubber insulated cables – Rated voltages up to and including 450/750 V*

IEC 60364 (all parts), *Low-voltage electrical installations*

IEC 60364-4-44:2007, *Low-voltage electrical installations – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances*

IEC 60384-14, *Fixed capacitors for use in electronic equipment – Part 14: Sectional specification – Fixed capacitors for electromagnetic interference suppression and connection to the supply mains*

IEC 60417, *Graphical symbols for use on equipment,* available at http://www.graphical-symbols.info/equipment

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60664-1:2020, *Insulation coordination for equipment within low-voltage supply systems – Part 1: Principles, requirements and tests*

IEC 60664-3, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*

IEC 60695-2-10, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

IEC 60695-2-11, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end products (GWEPT)*

IEC 60755, *General safety requirements for residual current operated protective devices*

IEC 60884-1:2022, *Plugs and socket-outlets for household and similar purposes – Part 1: General requirements*

IEC 61008-1:2010, *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs) – Part 1: General rules*
IEC 61008-1:2010/AMD1:2012
IEC 61008-1:2010/AMD2:2013

IEC 61249-2 (all parts), *Materials for printed boards and other interconnecting structures*

IEC 61543:2022, *Residual current-operated protective devices (RCDs) for household and similar use – Electromagnetic compatibility*

IEC 62752, *In-cable control and protection device for mode 2 charging of electric road vehicles (IC-CPD)*

IEC 62873-2, *Residual current operated circuit-breakers for household and similar use – Part 2 – Residual current devices (RCDs) – Vocabulary*

CISPR 14-1, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission*

3 Terms and definitions, symbols and abbreviated terms

For the purposes of this document, the terms and definitions given in IEC 62873-2 and the following apply.

NOTE 1 Where the terms "voltage" and "current" are used, they imply RMS values, unless otherwise specified.

NOTE 2 Throughout this document, the word "PRCD" is used for "RCD".

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1 Definitions relating to plugs and socket-outlets

3.1.1
plug
accessory having pins designed to engage with the contacts of a socket-outlet, also incorporating means for the electrical connection and mechanical retention of flexible cables or cords

3.1.2
socket-outlet
accessory having socket-contacts designed to engage with the pins of a plug and having terminals for the connection of conductors

3.1.3
portable socket-outlet
socket-outlet intended to be connected to, or integral with, flexible cables or cords, and which can easily be moved from one place to another while connected to the supply

3.1.4
multiple socket-outlets, pl
combination of two or more socket-outlets

3.1.5
rewireable plug
accessory so constructed that the flexible cable or cord can be replaced

3.1.6
non-rewireable plug
non-rewireable portable socket-outlet
accessory so constructed that it forms a complete unit with the flexible cable or cord after connection and assembly by the manufacturer of the accessory

Note 1 to entry: See also 14.1 of IEC 60884-1:2022.

3.1.7
moulded-on accessory
non-rewireable accessory, the manufacture of which is completed by insulating material moulded around pre-assembled component parts and the terminations of the flexible cable or cord

3.1.8
cord extension set
assembly consisting of a flexible cable or cord fitted with a non-rewireable plug and a non-rewireable portable socket-outlet

3.1.9
terminal
insulated or non-insulated connecting device serving for reusable connection of the supply conductors

3.1.10
termination
insulated or non-insulated connecting device serving for non-reusable connection of the supply conductors

3.1.11
adaptor
accessory constructed as an integral unit incorporating both plug pins and socket contacts

3.1.12
intermediate adaptor
adaptor which allows the connection of one or more plugs to a socket-outlet via a control device such as a dimmer, clock switch, photoelectric switch, residual current device, etc., which is connected to it by a flexible cord

3.2 Definitions relating to residual current devices (RCDs)

3.2.1 Definitions relating to currents flowing from live parts to earth

3.2.1.1
hazardous situation
shock hazard situation occurring when an earth fault current higher than $I_{\Delta n}$ (see 5.2.3) flows through the RCD for a time longer than that specified in Table 2

3.2.1.2
supply failure
situation occurring in the event of

– broken neutral;
– broken phase in the case of systems supplied between phases;
– broken protective earth (PE)

3.2.2 Definitions relating to the energization of a residual current device (RCD)

3.2.2.1
limiting impedance value
R_x
maximum impedance value between the PE-connection of the PRCD and the supply source for which protection is ensured when the PRCD is supplied from any one phase only and PE

3.2.2.2
PRCD type LNSE
type LNSE
device with a switched protective conductor that is used on a line (phase) to neutral supply (L, N, PE)

Note 1 to entry: See Annex E for example.

3.2.2.3
PRCD type LLSE
type LLSE
device with a switched protective conductor that is used on a line (phase) to line (phase) supply (L1, L2, PE)

Note 1 to entry: See Annex E for example.

3.2.2.4
PRCD type LNE
type LNE
device with a non-switched protective conductor that is used on a line (phase) to neutral supply (L, N, PE)

3.2.2.5
PRCD type LLE
type LLE
device with a non-switched protective conductor that is used on a line (phase) to line (phase) supply (L1, L2, PE)

3.2.2.6
protective conductor
PE
<identification> conductor provided for purposes of safety, for example protection against electric shock

3.2.2.7
hazardous live protective conductor
miswiring or fault condition where the protective contact of the socket outlet becomes live and, under certain conditions, can give a harmful electric shock

3.2.3 Definitions relating to the operation and to the functions of a residual current device

3.2.3.1
t_u
value of time of interruption of the line voltage supply below which a PRCD does not open automatically in the absence of a residual current (see 9.17.2)

3.2.3.2
trip-free PRCD
PRCD, the moving contacts of which return to and remain in the open position when the automatic opening operation is initiated after the initiation of the closing operation, even if the closing command is maintained

Note 1 to entry: To ensure proper breaking of the current which may have been established, it may be necessary that the contacts momentarily reach the closed position.

3.2.3.3
break-time
<of a PRCD> time which elapses between the instant when the residual operating current is suddenly attained and the instant of arc extinction in all poles

3.2.3.4
PRCD-S
PRCDs providing an additional function of detecting faults on the supply side with a defined behaviour in case of supply failures or miswiring

3.2.4 Definitions relating to values and ranges of energizing quantities

3.2.4.1
rated value
quantity value assigned by the manufacturer for a specific operating condition of a PRCD

[SOURCE: IEC 62873-2:2016, 3.4.1, modified – In the definition, "generally" deleted, "specified" replaced with "specific" and "RCD" replaced with "PRCD".]

3.2.4.2
non-operating overcurrent
<in the main circuit> maximum value of overcurrent of a single-phase load which, in the absence of any fault to frame or to earth, and in the absence of an earth leakage current, can flow through a two-pole PRCD without causing it to operate

Note 1 to entry: In the case of overcurrent in the main circuit, in the absence of residual current, operation of the detecting device may occur as a consequence of asymmetry existing in the detecting device itself.

3.2.4.3 Definitions relating to limiting values (U_x and U_y) of the line voltage for PRCDs functionally dependent on line voltage

3.2.4.3.1
U_x
minimum value of the line voltage at which a PRCD still operates under specified conditions in case of decreasing line voltage (see 9.17.1)

3.2.4.3.2
U_y
minimum value of the line voltage below which a PRCD opens automatically in the absence of any residual current (see 9.17.2)

4 Classification

4.1 According to the type of connection

NOTE See Figure 1.

4.1.1 PRCD intermediate adaptor

PRCD incorporating one plug and one or two socket-outlets.