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Edition 1.2 2022-11
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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

General requirements for arc fault detection and protection devices (AFDDs)

Exigences générales des dispositifs pour la détection de défaut d'arcs (DPDA) et des dispositifs de protection



IEC 62606:2013-07+AMD1:2017-02+AMD2:2022-11 CSV(en-fr)



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

GENERAL REQUIREMENTS FOR ARC FAULT DETECTION AND PROTECTION DEVICES (AFDDs)

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In this Redline version, a vertical line in the margin shows where the technical content is modified by amendments 1 and 2. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 62606 has been prepared by subcommittee 23E: Circuit-breakers and similar equipment for household use, of IEC technical committee 23: Electrical accessories.

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INTRODUCTION

This International Standard aims to provide necessary requirements and testing procedures for devices to be installed by skilled people in households and similar uses to mitigate the risk of igniting an electrical fire downstream of the device.

Residual Current Devices (RCDs) are recognised as efficient to reduce the risk of fire by detection of leakage current and arcing to ground as a consequence of tracking currents within an electrical installation. However, RCDs as fuses or circuit-breakers are not able to reduce the risk of electrical fire due to series or parallel arcing between live conductors.

During a series arc fault, there is no leakage to ground therefore RCDs cannot detect such a fault. Moreover, the impedance of the series arc fault reduces the load current, which will keep the current below the tripping threshold of the circuit-breaker and the fuse. In the case of a parallel arc between phase and neutral conductor, the current is only limited by the impedance of the installation. In the worst cases of sporadic arcs, the conventional circuit breakers were not designed for that purpose.

Experience and information available confirmed that the r.m.s. current value of an earth fault current caused by an arcing fault, which is able to ignite a fire, is not limited to the rated power supply frequency of 50/60 Hz, but may contain a much higher frequency spectrum that is not taken into account for the testing of RCDs.

It has been recognised that the risk of igniting a fire within an electrical installation can also be a consequence of an overvoltage due to a broken neutral in a three phase installation.

This ~~standard~~ document covers devices designed to be installed in a distribution board at the origin of one ~~or several~~ final circuit~~s~~ of a fixed installation.

GENERAL REQUIREMENTS FOR ARC FAULT DETECTION AND PROTECTION DEVICES (AFDDs)

1 Scope

This International Standard applies to arc fault detection devices (AFDDs) for household and similar uses, intended to be used in a.c. circuits, for rated voltages not exceeding 440 V a.c, with rated frequencies of 50 Hz, 60 Hz or 50/60 Hz and rated currents not exceeding 63 A.

NOTE 1 In the USA, Arc Fault Circuit Interrupters (AFCI) are considered similar to AFDDs.

An AFDD is designed by the manufacturer:

– either as a single device having opening means able to open the protected circuit in specified conditions; or

– as a single device ~~integrating~~, with arc fault detection integrated in or assembled by manufacturer to a protective device; or

– as a separate unit, according to Annex D assembled on site with a declared protective device.

The integrated protection device is either a circuit-breaker in accordance with IEC 60898-1 or an RCD in accordance with IEC 61008-1, IEC 61009-1 or IEC 62423.

These devices are intended to mitigate the risk of fire in a final circuit~~s~~ of a fixed installation due to the effect of arc fault currents that pose a risk of fire ignition under certain conditions if the arcing persists.

Protection against fire ignition due to overvoltage due to a broken neutral within a three phase installation to be included in this type of equipment as an additional option is under consideration in 9.22.

NOTE 2 Tracking current leads to arcing and therefore may ignite fire.

This International Standard applies to devices performing simultaneously the detection and discrimination of arcing current with regards to fire hazards and defines operating criteria under specified conditions for the opening of the circuit when the arcing current exceeds the limit values given in this standard.

AFDDs complying with this standard, with the exception of those with an uninterrupted neutral, are suitable for use in IT systems.

~~The maximum rated voltage is 240 V a.c. AFDDs, according to this standard, are supplied either between line and neutral or between two lines.~~

~~The maximum rated current (I_n) is 63 A a.c.~~

AFDDs energised from batteries or a circuit other than the protected circuit are not covered by this standard.

AFDDs provide isolation, they are intended to be operated by uninstructed persons and do not require maintenance.

Particular requirements may be necessary for:

– AFDDs incorporated in or intended only for association with plugs and socket-outlets or with appliance couplers for household or similar general purposes;

– AFDDs intended to be used at frequencies other than 50 Hz or 60 Hz.

NOTE 3 For AFDDs incorporated in, or intended only for socket-outlets the requirements of this standard can be used, as far as applicable, in conjunction with the requirements of IEC 60884-1 or the national requirements of the country where the product is placed on the market.

NOTE 4 In the UK, the plug part and the socket-outlet part(s) need not comply with any IEC 60884-1 requirements. In the UK, the plug part shall comply with BS 1363-1 and the socket-outlet part(s) shall comply with BS 1363-2.

Special precautions (e.g. surge protective devices) may be necessary when excessive overvoltages are likely to occur on the supply side.

The requirements of this standard apply for standard conditions of temperature and environment. They are applicable to AFDDs intended for use in an environment with pollution degree 2 and overvoltage category III. Additional requirements may be necessary for devices used in locations having more severe environmental conditions.

NOTE 5 AFDD for d.c. applications are under consideration.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-2-30:2005, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 + 12 h cycle)*

IEC 60068-3-4:2001, *Environmental testing – Part 3-4: Supporting documentation and guidance – Damp heat tests*

IEC 60228, *Conductors of insulated cables*

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 60417, *Graphical symbols for use on equipment*, available from: <http://www.graphical-symbols.info/equipment>

IEC 60479 (all parts), *Effects of current on human beings and livestock*

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

IEC 60664-1:2007, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60695-2-10:2000, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

~~IEC/TR 60755, *General requirements for residual current operated protective devices*~~

IEC 60898-1:~~2002~~2015, *Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations – Part 1: Circuit-breakers for a.c. operation*
IEC 60898-1:2015/AMD1:2019

IEC 61000-3-2:2014, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3 : Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2014, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*
IEC 61000-4-5:2014/AMD1:2017

IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase*

IEC 61000-4-16:2015, *Electromagnetic compatibility (EMC) – Part 4-16: Testing and measurement techniques – Test for immunity to conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz*

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 61009-1:2010, *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs) – Part 1: General rules*
IEC 61009-1:2010/AMD1:2012
IEC 61009-1:2010/AMD2:2013

IEC 61543:~~1995~~ ––[1], *Residual current-operated protective devices (RCDs) for household and similar use – Electromagnetic compatibility*
~~IEC 61543:1995/AMD1:2004~~
~~IEC 61543:1995/AMD2:2005~~

IEC 62423, *Type F and type B residual current operated circuit-breakers with and without integral overcurrent protection for household and similar uses*

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

CISPR 14-1:~~2009~~2020, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission*

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[1] Under preparation. Stage at the time of publication: IEC/RFDIS 61543:2022.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ~~IEC/TR 60755, IEC 60898-1, IEC 61008-1, IEC 61009-1, IEC 62423~~ IEC 62873-2 and the following apply.

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

NOTE Where the terms "voltage" or "current" are used, they imply r.m.s. values, unless otherwise specified.

3.1
arc
arcing
luminous discharge of electricity across an insulating medium, usually accompanied by the partial volatilization of the electrodes

Note 1 to entry: A complete sinusoidal current half cycle is not considered to be an arcing half cycle.

3.2
arc fault
arcing fault
dangerous unintentional ~~parallel or series~~ arc ~~between conductors~~

3.3
arc fault detection device
AFDD
device intended to mitigate the effects of arcing faults by disconnecting the circuit when an arc fault is detected

3.4
arc fault detection unit
AFD unit
part of the AFDD ensuring the function of detection and discrimination of dangerous earth, parallel and series arc faults and initiating the operation of the device to cause interruption of the current

Note 1 to entry: The interruption of the current can either be provided by opening means (see 4.1.1) or by a protective device integrating an AFD unit (see 4.1.2.1) or by a protective device assembled with an AFD unit (see 4.1.2.2 or 4.1.3).

3.5
detection
function consisting in sensing the presence of an arc fault current

3.6
interruption
function consisting in bringing automatically the main contacts of the AFDD from the closed position into the open position, thereby interrupting the arc fault current(s) flowing through them

3.7
earth arc fault
arc fault where the current is flowing from active conductor to the earth

Note 1 to entry: The earth arc current may have a value close to the parallel arc current in some installations (e.g. TN installation).

3.8
parallel arc fault
arc fault where the arc current is flowing between active conductors in parallel with the load of the circuit.

3.9
series arc fault
arc fault where the current is flowing through the load(s) of the final circuit protected by an AFDD

3.10
closed position
position in which the predetermined continuity of the main circuit of the AFDD is secured

3.11
open position
position in which the predetermined clearance between open contacts in the main circuit of the AFDD is secured

3.12
pole
that part of an AFDD associated exclusively with one electrically separated conducting path of its main circuit provided with contacts intended to connect and disconnect the main circuit itself and excluding those portions which provide a means for mounting and operating the poles together

3.13
switched neutral pole
pole only intended to switch the neutral and not intended to have a short-circuit capacity

3.14
isolation
isolating function
function intended to cut off the supply from the whole installation or a discrete section of it by separating it from every source of electrical energy for reasons of safety

[SOURCE: IEC 60947-1:2007, 2.1.19]

3.15
isolating distance
clearance between open contacts, meeting the safety requirements specified for isolation purposes

[SOURCE: IEC 60050-441:1984, 441-17-35, modified – "disconnectors" has been replaced by "isolation purposes".]

3.16
making capacity
value of the a.c. component of a prospective current that an AFDD is capable of making at a stated voltage under prescribed conditions of use and behaviour

3.17
breaking capacity
value of the a.c. component of a prospective current that an AFDD is capable of breaking at a stated voltage under prescribed conditions of use and behaviour

3.18
conditional short-circuit current
I_{nc}
value of the a.c. component of a prospective current, which an AFDD, protected by a suitable short-circuit protective device (SCPD) in series can withstand under specified conditions of use and behaviour

3.19
prospective current
current that would flow in the circuit, if each main current path of the AFDD were replaced by a conductor of negligible impedance

Note 1 to entry: The prospective current may be qualified in the same manner as an actual current, for example: prospective breaking current, prospective peak current, etc.

3.20
maximum prospective peak current (of an a.c. circuit)
prospective peak current, when the initiation of the current takes place at the instant which leads to the highest possible value

3.21
short-circuit (making and breaking) capacity
alternating component of the prospective current, expressed by its r.m.s. value, which the AFDD is designed to make, to carry for its opening time and to break under specified conditions

3.22
thread forming tapping screw
tapping screw having an uninterrupted thread

Note 1 to entry: It is not a function of this thread to remove material from the hole.

Note 2 to entry: An example of a thread forming tapping screw is shown in Figure 1.

3.23
thread cutting tapping screw
tapping screw having an interrupted thread

Note 1 to entry: It is a function of this thread to remove material from the hole.

Note 2 to entry: An example of a thread cutting tapping screw is shown in Figure 2.

3.24
live parts <in electrical installations and equipment>
conductive part intended to be energized under normal operating conditions, including the neutral conductor and mid-point conductor, but excluding the PEN conductor, PEM conductor and PEL conductor

[SOURCE: IEC 60050-195:2021, 195-02-19]