

INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 2
AMENDEMENT 2

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

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

[IEC 62606:2013/AMD2:2022](https://standards.iteh.ai/catalog/standards/sist/e3481359-9288-4346-bbd1-e54a70de9342/iec-62606-2013-amd2-2022)

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Amendment 2 to IEC 62606:2013 has been prepared by subcommittee 23E: Circuit-breakers and similar equipment for household use, of IEC technical committee 23: Electrical accessories.

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

Draft	Report on voting
23E/1267/FDIS	23E/1304/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 Amendment 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/standardsdev/publications/.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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

The contents of the corrigendum 1 (2023-03) have been included in this copy.

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GENERAL REQUIREMENTS FOR ARC FAULT DETECTION DEVICES

Replace the existing title of this document with the following new title:

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

INTRODUCTION

Replace the last paragraph of the Introduction with the following new text:

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

1 Scope

Replace the text of the existing second dash of the second paragraph of the Scope with the following new text:

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

Add, in the second sentence of the last paragraph, after "pollution degree 2", "and overvoltage category III".

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2 Normative references

Replace the following existing references with the following new references:

IEC 60898-1:2015, *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 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: —¹, *Residual current-operated protective devices (RCDs) for household and similar use – Electromagnetic compatibility*

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

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

Add the following new references:

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

Remove the existing reference to IEC/TR 60755, General requirements for residual current operated protective devices

3 Terms and definitions

Replace the first sentence of Clause 3 with the following new text:

For the purposes of this document, the terms and definitions given in 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>

3.4 arc fault detection unit

Replace the existing Note 1 to entry with the following new text:

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).

Add, at the end of Subclause 3, the following new term:

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]

4 Classification

4.1 According to the method of construction

Replace the existing text of 4.1.2 with the following new text:

4.1.2 AFDD as one single device, comprising an AFD unit and a protective device

4.1.2.1 AFD unit integrated in a protective device complying with one of the following standards: IEC 60898-1, IEC 61008-1, IEC 61009-1 or IEC 62423.

4.1.2.2 AFD unit assembled by the manufacturer to a protective device complying with one of the following standards: IEC 60898-1, IEC 61008-1, IEC 61009-1 or IEC 62423.

For the classification indicated in 4.1.2, the protective device is unchanged from the existing compliant version except for marking and/or catalogue/serial number.

5 Characteristics of AFDDs

5.4 Standard values of rated impulse withstand voltage (U_{imp})

Replace the existing text of the second paragraph of 5.4 with the following new text:

In case an AFDD is intended to be connected in series (see 4.1.1) or integrated (see 4.1.2.1) or assembled (see 4.1.2.2 or 4.1.3) with one or several declared protective devices whose standard values of rated impulse withstand voltage are more severe than those mentioned in Table 4, the standard conditions for operation in service and for installation of the most severe protective device standard shall apply.

5.5 Coordination with short-circuit protective devices (SCPDs)

5.5.1 General

Replace the existing text of the first paragraph of 5.5.1 with the following new text:

AFDDs classified according to 4.1.2 and 4.1.3 using an RCCB as protective device (IEC 61008-1 or IEC 62423) and AFDDs classified according to 4.1.1 shall be protected against short-circuits by means of circuit-breakers or fuses complying with their relevant standards according to the installation rules of the IEC 60364 series.

6 Marking and other product information

6.1 Marking

Remove the existing second paragraph of 6.1.

Remove, in the existing sixth paragraph after Table 5, the sentence "Provisionally the use of national indications only is allowed."

Replace the existing text of the existing fourteenth paragraph after Table 5 with the following new text:

The markings shall appear on the AFDD or, if the space available is not sufficient, on the smallest package unit or in technical information.

[IEC 62606:2013/AMD2:2022](https://standards.iteh.ai/catalog/standards/sist/e3481359-9288-4346-bbd1-e54a70de9342/iec-62606-2013/AMD2-2022)

[https://standards.iteh.ai/catalog/standards/sist/e3481359-9288-4346-bbd1-e54a70de9342/iec-](https://standards.iteh.ai/catalog/standards/sist/e3481359-9288-4346-bbd1-e54a70de9342/iec-62606-2013/AMD2-2022)

7 Standard conditions for operation in service and for installation

7.1 Standard conditions

Table 6 – Standard conditions for operation in service

Replace the existing text of Note b of Table 6 with the following new text:

Values outside the range are admissible where more severe climatic conditions prevail.

Remove note g of Table 6.

Replace, in the second row of Table 6, "Ambient temperature ^a g" by "Ambient temperature ^a"

Replace the existing text of the second paragraph of 7.1 with the following new text:

In case an AFDD is connected in series (see 4.1.1) or integrated (see 4.1.2.1) or assembled (see 4.1.2.2 or 4.1.3) with one or several associated declared protective devices whose standard conditions for operation in service and for installation are more severe than those mentioned in Table 6, the standard conditions for operation in service and for installation of the most severe protective device standard shall apply.

8 Requirements for construction and operation

8.1 General

Replace the existing text of the tenth and eleventh paragraphs of 8.1 with the following new text:

AFDDs classified according to 4.1.2.1 shall comply with the relevant standard of the protective device with which it is integrated (according to IEC 60898-1, IEC 61008-1, IEC 61009-1, or IEC 62423 as applicable) and additionally to the requirements and tests given in this document.

Where tests included in this document are also included in IEC 60898-1, IEC 61008-1, IEC 61009-1, or IEC 62423, a selection of the most stringent requirements and tests among all applicable standards shall be applied only once.

AFDDs classified according to 4.1.2.2 shall comply with the requirements given in this document which include the verification (according to IEC 60898-1, IEC 61008-1, IEC 61009-1, or IEC 62423 as applicable) of the correct operation of the protective device with which it is assembled.

8.2.2 Mechanism

Remove, in the twelfth paragraph of 8.2.2, the text "for particular application".

8.2.3 Clearances and creepage distances (see Annex B)

Remove, in the third paragraph of Subclause 8.2.3, "and e)".

Remove, in the second dash after the third paragraph of 8.2.3, "e)".

8.3 Protection against electric shock

Replace the existing text of the third paragraph of 8.3 with the following new text:

For AFDDs other than those of the plug-in type, external parts, other than screws or other means for fixing covers and labels, which are accessible when the AFDDs are mounted and wired as in normal conditions of use, shall either be of insulating material, or be lined throughout with insulating material.

8.5 Temperature rise

8.5.1 Temperature-rise limits

Replace the existing text of the third paragraph of 8.5.1 with the following new text:

In case an AFDD is connected in series (see 4.1.1) or integrated (see 4.1.2.1) or assembled (see 4.1.2.2 or 4.1.3) with one or several associated declared protective devices whose standard conditions for temperature rise are more severe than those mentioned in Table 9, the standard conditions for operation in service and for installation of the most severe protective device standard shall apply (IEC 60898-1, IEC 61008-1, IEC 61009-1 and IEC 62423).

8.6 Operating characteristics

8.6.1 Operating characteristics of the protective device part

Replace the existing text of the second paragraph of 8.6.1 with the following new text:

Compliance is checked by carrying out the relevant tests of the specified relevant standard, according to 9.1.1.

8.15 Electromagnetic compatibility (EMC)

Replace the existing text of the first paragraph of 8.15 with the following new text:

AFDDs shall comply with the EMC requirements of this document.

9 Testing procedure

9.1 General

9.1.1 General testing procedure for the different type of AFDDs

Replace the text of the existing fourth paragraph of 9.1.1 with the following new text:

AFDDs classified according to 4.1.2.1 where the AFD unit is integrated in the MPD, shall first be tested according to IEC 60898-1, IEC 61008-1, IEC 61009-1, or IEC 62423, as applicable.

For AFDDs classified according to 4.1.2.2 where the AFD unit is assembled to the MPD, the MPD shall comply with IEC 60898-1, IEC 61008-1, IEC 61009-1 or IEC 62423, as applicable.

The AFD unit assembled to the MPD shall not inhibit the correct operation of the main protective device. The following verifications of the mechanism and the operating characteristics of the combination shall be made on the devices having the largest number of poles, highest I_n and lowest $I_{\Delta n}$, as applicable:

- a) 8.1.2, 9.10.2.1, 9.10.3 (only at the upper limit of instantaneous tripping current) and 9.11 of IEC 60898-1:2015 and IEC 60898-1:2015/AMD1:2019 for circuit-breakers;
- b) 8.1.2, 9.2.1, 9.9.2.2, 9.9.2.3a), 9.10 of IEC 61008-1:2010, IEC 61008-1:2010/AMD1:2012 and IEC 61008-1:2010/AMD2:2013 for RCCBs;
- c) 8.1.2, 9.9.1.2a), 9.9.1.2b), 9.9.1.2c) 1), 9.9.2.1, 9.9.2.2 (only at the upper limit of instantaneous tripping current), 9.10 of IEC 61009-1:2010, IEC 61009-1:2010/AMD1:2012 and IEC 61009-1:2010/AMD2:2013 for RCBOs.

For tests according to 8.1.2 of the relevant product standard, only inspection and manual tests apply.

Replace the existing text of the fifth paragraph of 9.1.1 with the following new text:

After completion of the required above tests of IEC 60898-1, IEC 61008-1, IEC 61009-1, or IEC 62423, the additional tests given in this document shall be applied in order to show conformity to this document.

9.1.2 The characteristics of AFDDs are checked by means of type tests

Table 10 – List of type tests

Remove, in the eighth row of Table 10, the existing Note ^a after 9.10.

Replace, in Table 10, the existing text of Note ^a with the following new text:

For AFDDs classified according to 4.1.2.1, these tests are already covered by the tests according to the relevant standard for RCDs or circuit breakers and need not to be repeated here.

9.7 Test of dielectric properties

9.7.3 Insulation resistance of the main circuit

Remove item d) and its associated note.

Rename existing item e) as item d).

Replace the existing text of the sixth paragraph of 9.7.3 with the following new text:

For the measurements according to b), c) and d), the metal foil is applied in such a way that the sealing compound, if any, is effectively tested.

9.7.4 Dielectric strength of the main circuit

Replace the existing text of the fifth paragraph of 9.7.4 with the following new text:

The values of the test voltage shall be as follows:

- 2 000 V for a) to c) of 9.7.3;
- 2 500 V for d) of 9.7.3.

9.7.6 Capability of control circuits connected to the main circuit in respect of withstanding high DC voltages due to insulation measurements

Replace the existing text of the fourth paragraph of 9.7.6 with the following new text:

After this treatment, the functionality of the AFDD is verified by repeating the test of 9.9.2.4 at the lowest current of Table 1 or Table 2, as applicable, without measurement of break time.

9.7.7 Verification of impulse withstand voltages (across clearances and across solid insulation) and of leakage current across open contacts

9.7.7.2 Verification of clearances with the impulse withstand voltage

Remove, in the first paragraph of Subclause 9.7.7.2, "e)".

Remove, in the sixth paragraph of Subclause 9.7.7.2, "e)".

9.7.7.5 Verification of the behaviour of components bridging the basic insulation

Replace the existing text of the sixth paragraph of 9.7.7.5 with the following new text:

Then, the AFDD is connected to the mains in accordance with the manufacturer's instructions. The functionality of the AFDD is verified by the test of 9.9.2.4 at the lowest current of Table 1 or Table 2, as applicable, without measurement of break time.

9.9.2 Series arc fault tests

9.9.2.1 General

Replace the existing text of Subclause 9.9.2.1 (as modified by IEC 62606:2013/AMD1:2017) with the following new text:

An AFDD shall clear the arcing fault in the time specified in Table 1 or Table 2 for the arc current level being tested. AFDDs shall be tested up to their rated current.

The AFDD being supplied with all phases and neutral (if any), the tests shall be performed, if applicable, between one phase, chosen at random and neutral, and between two phases chosen at random.

The tests shall be conducted by connecting a cable specimen (prepared in accordance with 9.9.2.6) in series with the AFDD according to Figure 4 for tests of 9.9.2.2 to 9.9.2.5 and according to Figure 38 for tests of 9.9.2.8 and 9.9.2.9.

The adjustment of the test currents without arcing, in the line where the cable specimen is placed, is achieved by application of the line to neutral voltage reduced by 50 V to take into account the value of the arc voltage during the test. For two-pole AFDDs rated 400 V the adjustment of the test current without arcing is achieved by application of the line to line voltage reduced by 50 V. For three-pole AFDDs, and for the adjustment of the test current only, the mid-point of the resistors in Figure 38 shall be connected directly to the neutral. For tests of 9.9.2.2, and at the rated current only, the adjustment of the test current in the cable specimen without arcing is achieved by application of the rated voltage.

The break time is measured at each arc current level and the measured value shall not exceed the times specified in Table 1 or Table 2.

When the break time exceeds the times specified in Table 1 or Table 2 because the arc is not persistent during this test, the test shall be repeated.

An arc is considered as not persistent if during at least 2 cycles, not necessarily consecutive, the arc peak current is less than 1.5 A or the arc peak voltage is less than 10 V.

NOTE One cycle is 20 ms for 50 Hz.

9.9.2.5 Test at the temperature limits

Add, at the end of the first dash, the following new text:

, under the conditions of 9.9.2.1

Add, at the end of the first sentence of the second dash, the following new text:

, under the conditions of 9.9.2.1

9.9.2.8 Verification of correct operation in case of arc in a three-phase system with unbalanced load

Replace the existing text of the second paragraph of 9.9.2.8 (as modified by IEC 62606:2013/AMD1:2017), with the following new text:

The detection test shall be performed for each phase. Whatever the rated current value, the current in the three phases shall be adjusted at 2,5 A, 5 A and the rated current (see Figure 38), by application of the rated line to neutral voltage reduced by 50 V for all phases, deviating from the adjustment requirements in 9.9.2.1. The arc test shall then be performed on each phase, in turn, at the rated voltage and at the previously adjusted current.

9.9.3 Parallel arc fault tests

9.9.3.1 Verification of correct operation in case of parallel arc with limited current

Replace the existing text of the fourth paragraph of 9.9.3.1 with the following new text:

The AFDD being supplied with all phases and neutral (if any), the tests shall be performed, if applicable, between one phase (chosen at random) and neutral, and between two phases (chosen at random).

9.9.3.2 Verification of correct operation in case of parallel arc cable cutting test

Replace the existing text of the sixth paragraph of 9.9.3.2 with the following new text:

The steel blade shall be 1,2 mm thick (nominal) for a 120 V rated AFDD or 3 mm thick (nominal) for a 230 V AFDD. The blade shall be sharp and shall be replaced or re-sharpened as necessary. The blade shall be attached to a lever arm to maintain a cutting angle to produce that effect. Using the test apparatus shown in Figure 8, or equivalent, the blade is to be positioned so that solid contact is made with one conductor and arcing contact is made with the second conductor.

NOTE Typically, the steel blade has approximate dimensions of 32 mm by 140 mm.

9.9.4 Masking test, verification of correct operation

9.9.4.1 General

Replace the existing text of the last sentence of the first paragraph of 9.9.4.1 with the following new text:

Either an arc generator or carbonized cable specimen, as declared by the manufacturer, can be used to generate an arc fault, this shall be indicated in the test report.

Replace the existing text of the second paragraph of 9.9.4.1 with the following new text:

The AFDD being supplied with all phases and neutral (if any), the tests shall be performed, if applicable, between one phase, chosen at random and neutral, and between two phases chosen at random.

9.9.4.2 Masking test with inhibition loads

Replace the existing text of the first paragraph of 9.9.4.2 (as modified by IEC 62606:2013/AMD1:2017) with the following new text:

This test applies to single-pole AFDDs with two current paths, two-pole AFDDs and four-pole AFDDs.

Replace the first sentence of the fifth paragraph and items a), b), c) and d) of Subclause 9.9.4.2 (as modified by IEC 62606:2013/AMD1:2017) with the following new text (items e), f), and g) being not modified):

The AFDD shall be tested with each of the following masking loads operating in a steady state:

- a) a vacuum cleaner, rated at 5 A to 7 A for a 230 V rated voltage AFDD and at 10 A to 14 A for a 120 V rated voltage AFDD, full load having a universal motor;
- b) an electronic switching mode power supply (or power supplies), having a total load current of at least 2,5 A for a 230 V rated voltage AFDD and 5 A for a 120 V rated voltage AFDD, with a minimum total harmonic distortion (THD) of 100 %, and individual minimum current harmonics of 75 % at the 3rd, 50 % at the 5th, and 25 % at the 7th;

NOTE 1 THD can be calculated with the formula of IEC 61000-3-2:2014, 3.14.2, for total harmonic distortion.

$$THD = \sqrt{\sum_{h=2}^{40} \left(\frac{I_h}{I_1} \right)^2}$$

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- c) a capacitor start (air compressor type) motor (compressor operating with open valve to prevent pressure in the air tank).
- for AFDD rated 120 V, use a compressor motor with a peak inrush current of 130 A ± 10 %;
 - for AFDD rated 230 V, use a 2,2 kW compressor motor.
- d) for AFDD with rated voltage of 120 V, an electronic lamp dimmer (thyristor type) 1 000 W with a filtering coil controlling a 1 000 W tungsten load consisting of four 150 W bulbs and four 100 W bulbs.

For AFDD with rated voltage of 230 V, an electronic lamp dimmer (thyristor type) 600 W with a filtering coil controlling a 600 W tungsten load.

NOTE 2 In case incandescent tungsten bulbs cannot be found, they can be replaced by a resistive load with the same power.

Five different tests at various conduction angle shall be done. The five different conduction angles shall be chosen to cover the entire load range of the electronic lamp dimmer.

9.9.4.5 Masking test with inhibition loads for three-pole and four-pole AFDDs

Replace the existing text of the first paragraph of Subclause 9.9.4.5 (as modified by IEC 62606:2013/AMD1:2017) with the following new text:

A series of tests, according to 9.9.2.9, is performed with the following inhibition loads. The AFDD and arc fault tester are connected in the circuit according to Figure 39.

Replace the existing text of item b) and the two following paragraphs of Subclause 9.9.4.5 (as modified by IEC 62606:2013/AMD1:2017) with the following new text:

- b) a variable speed drive with a three-phase asynchronous motor adjusted in such a way that the voltage applied to the motor is equal to the 80 % of the AFDD rated voltage and the ratio U_n/f on the motor remains constant where U_n is the rated voltage and f the rated frequency.

The asynchronous motor consumption shall be adjusted for consuming 2,5 A +0/+20 % per AFDD pole for 400 V rated voltage AFDD and 5 A +0/+20% per AFDD pole for 230 V rated voltage AFDD. The switching frequency of the variable speed drive shall be between 10 kHz and 12 kHz.

9.9.5 Unwanted tripping test

9.9.5.4 Test with various disturbing loads for single-pole AFDD with two current path and two-pole AFDD

Replace the existing title of 9.9.5.4 (as modified by IEC 62606:2013/AMD1:2017) with the following new title:

9.9.5.4 Test with various disturbing loads for single-pole AFDD with two current paths, two-pole AFDDs and four-pole AFDDs