IEC 60898-2

Edition 2.0 2016-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations –
Part 2: Circuit-breakers for AC and DC operation

Petit appareillage – Disjoncteurs pour la protection contre les surintensités pour installations domestiques et analogues –
Partie 2: Disjoncteurs pour le fonctionnement en courant alternatif et en courant continu

IEC 60898-2:2016-08(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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International Standard IEC 60898-2 has been prepared by subcommittee 23E: Circuit-breakers and similar equipment for household use, of IEC technical committee 23: Electrical accessories.

This second edition cancels and replaces the first edition published in 2000 and Amendment 1:2003. This edition constitutes a technical revision.

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

a) alignment with second edition of IEC 60898-1;
b) introduction of test I_{cn1}.

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

FDIS	Report on voting
23E/951A/FDIS	23E/976/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60898 series, published under the general title *Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations*, can be found on the IEC website.

This Part 2 is to be used in conjunction with IEC 60898-1.

Where a particular subclause of Part 1 is not mentioned in this Part 2, that subclause applies as far as is reasonable. Where this Part 2 states “addition”, “deletion” or “replacement”, the corresponding requirement, test specification or explanatory material in Part 1 should be adapted accordingly.

In this standard, the following print types are used:

– Requirements proper: in roman type.
– *Test specifications: in italic type.*
– Explanatory matter: in smaller roman type.

The committee has decided that the contents of this 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,
- withdrawn,
- replaced by a revised edition, or
- amended.

ELECTRICAL ACCESSORIES – CIRCUIT-BREAKERS FOR OVERCURRENT PROTECTION FOR HOUSEHOLD AND SIMILAR INSTALLATIONS –

Part 2: Circuit-breakers for AC and DC operation

1 Scope

Clause 1 of IEC 60898-1:2015 is applicable except as follows:

Addition at the end of the first paragraph:

This standard gives additional requirements for single- and two-pole circuit-breakers which, in addition to the above characteristics, are suitable for operation with direct current, and have a rated DC voltage not exceeding 220 V for single-pole and 440 V for two-pole circuit-breakers, a rated current not exceeding 125 A and a rated DC short-circuit capacity not exceeding 10 000 A.

NOTE This standard applies to circuit-breakers able to make and break both alternating current and direct current.

Delete the last two paragraphs.

2 Normative references

Clause 2 of IEC 60898-1:2015 is applicable except as follows:

Addition:

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

3 Terms and definitions

Clause 3 of IEC 60898-1:2015 is applicable except as follows:

Addition:

3.5.10.3
time constant
T
rise time of a prospective direct current to reach a value of 0,63 times the maximum peak current

$T = L/R$ (ms)

4 Classification

Clause 4 of IEC 60898-1:2015 is applicable except as follows:

4.2 According to the number of poles:

Replacement:

– single-pole circuit-breakers;
– two-pole circuit-breakers with two protected poles.

4.6 According to the instantaneous tripping current (see 3.5.17)

Delete D-Type.

Addition:

4.8 According to the time constant

– circuit-breakers suitable for DC circuits with a time constant of $T \leq 4$ ms;
– circuit-breakers suitable for DC circuits with a time constant of $T \leq 15$ ms.

NOTE It is assumed that short-circuit currents of 1 500 A are not exceeded in installations in which, due to the loads connected, time constants in normal service up to 15 ms can occur. Where higher short-circuit currents can occur, the time constant of $T = 4$ ms is considered sufficient.

5 Characteristics of circuit-breakers

Clause 5 of IEC 60898-1:2015 is applicable except as follows:

5.3.1 Preferred values of rated voltage

Replacement:

The preferred values of rated voltage are given in Table 1.

Examples of connections of circuit-breakers in DC systems are given in Figure 18.

Table 1 – Preferred values of rated voltage

Circuit-breakers	AC		DC [b]		
	AC circuit supplying the circuit-breaker	Rated AC voltage	DC circuit supplying the circuit-breaker	Rated DC voltage	DC wiring examples
Single-pole	Single-phase (phase to neutral)	230 V	Two wires (unearthed system)	125 V or 220 V	Figure 18a
	Single-phase (phase to earthed middle conductor, or phase to neutral)	120 V	–	–	
	Single-phase (phase to neutral) or three-phase (3 single-pole circuit-breakers) (3-wire or 4-wire)	230/400 V	–	–	
Two-pole	Single-phase (phase-to-phase)	400 V	Two wires (earthed system)	220/440 V	Figures 18b, 18c, 18d
	Single phase (phase-to-phase, 3-wire)	120/240 V [a]	Two wires (earthed system)	125/250 V [a]	

Applicable for DC voltages:

[a] Also for single-pole circuit-breakers to be used in pairs at 250 V DC (respectively 240 V AC) and individually at 125 V DC (respectively 120 V AC).

[b] The rated voltage per pole does not exceed 220 V DC.

Applicable for AC voltages:

NOTE 1 In IEC 60038 the network voltage value of 230/400 V has been standardized. This value progressively supersedes the values of 220/380 V and 240/415 V.

NOTE 2 Wherever in this standard there is a reference to 230 V or 400 V, it can be read as 220 V or 240 V, and 380 V or 415 V, respectively.

NOTE 3 Circuit-breakers complying with this standard can be used in IT systems.

The manufacturer shall declare in his literature the minimum voltage for which the circuit-breaker is designed.

Relevant tests are under consideration.

5.3.5 Standard ranges of instantaneous tripping

Replacement:

Table 2 – Ranges of instantaneous tripping

Type	Ranges for alternating current	Ranges for direct current
B	Above 3 I_n up to and including 5 I_n	Above 4 I_n up to and including 7 I_n
C	Above 5 I_n up to and including 10 I_n	Above 7 I_n up to and including 15 I_n

6 Marking and other product information

Clause 6 of IEC 60898-1:2015 is applicable except as follows:

Replacement:

c) rated AC voltage with the symbol ∼ (IEC 60417-5032:2002-10) and rated DC voltage with the symbol ⎓ (IEC 60417-5031:2002-10).

d) rated current without symbol "A", preceded by the symbol of instantaneous tripping (B or C), for example B 16;

f) rated short-circuit capacity for AC and DC in amperes in one rectangle, without the symbol A, if valid for both AC and DC (see Example 1 below). If the rated short-circuit capacity is different for AC and DC this shall be indicated in two adjacent rectangles, without the symbol A, with the symbol ∼ (IEC 60417-5032:2002-10) near the rectangle containing the AC value and with the symbol ⎓ (IEC 60417-5031:2002-10) near the rectangle containing the DC value (see Example 2 below).

Delete j).

Addition:

m) time constant *T*15 within a rectangle, if applicable, associated with the marking for the short-circuit capacity at the time constant of 15 ms (see Example 3 below).

Replacement of the first paragraph following l):

If, for small devices, the space available does not allow all the above data to be marked, at least the information under c) and d) shall be marked and visible when the circuit-breaker is installed.

The information under a), b), e), f), g), h), i), l) and m) may be marked on the side or on the back of the device and be visible only before the device is installed.

Alternatively, the information under g) may be on the inside of any cover which has to be removed in order to connect the supply wires. Any remaining information not marked shall be given in the manufacturer's literature.

EXAMPLE 1 [6 000]

EXAMPLE 2 [10 000] ∼

[6 000] ⎓

EXAMPLE 3 [1 500 | *T*15]

The terminals shall be marked with + or – if necessary. Additionally, arrows indicating the direction of the current are allowed.

Indications on the possible connection diagrams according to Figure 18 shall be given in the manufacturer's documentation

7 Standard conditions for operation in service

Clause 7 of IEC 60898-1:2015 applies.

8 Requirements for construction and operation

Clause 8 of IEC 60898-1:2015 is applicable except as follows:

8.6.1 Standard time-current zone

Replacement:

Table 7 – Time-current operating characteristics

Test	Type	Test current AC	Test current DC	Initial condition	Limits of tripping or non-tripping time	Result to be obtained	Remarks
a	B, C	1,13 I_n		Cold [a]	$t \geq 1$ h ($I_n \leq 63$ A) $t \geq 2$ h ($I_n > 63$ A)	No tripping	
b	B, C	1,45 I_n		Immediately following test a	$t < 1$ h ($I_n \leq 63$ A) $t < 2$ h ($I_n > 63$ A)	Tripping	Current steadily increased within 5 s
c	B, C	2,55 I_n		Cold [a]	1 s < t < 60 s ($I_n \leq 32$ A) 1 s < t < 120 s ($I_n > 32$ A)	Tripping	
d	B C	3 I_n 5 I_n	4 I_n 7 I_n	Cold [a]	0,1 < t < 45 s ($I_n \leq 32$ A) 0,1 < t < 90 s ($I_n > 32$ A) 0,1 < t < 15 s ($I_n \leq 32$ A) 0,1 < t < 30 s ($I_n > 32$ A)	Tripping	Current established by closing an auxiliary switch
e	B C	5 I_n 10 I_n	7 I_n 15 I_n	Cold [a]	t < 0,1 s	Tripping	Current established by closing an auxiliary switch

[a] The term "cold" means without previous loading, at the reference calibration temperature.

8.8 Performance at short-circuit currents

Replacement of the third paragraph:

It is required that circuit-breakers be able to make and to break any value of current up to and including the value corresponding to the rated short-circuit capacity at rated frequency, at a power-frequency recovery voltage equal to 105 % (±5 %) of the rated operational voltage and at any power factor not less or any time constant not greater than the appropriate limit of the range stated in 9.12.5. It is also required that the corresponding values of I^2t lie below the I^2t characteristic (see 3.5.13).

9 Tests

Clause 9 of IEC 60898-1:2015 is applicable except as follows:

9.2 Test conditions

Addition after the fourth paragraph:

For direct current, the test voltage (current) shall have a ripple of ω ≤ 5 % or have the minimum instantaneous value of the voltage (current) no lower than the required test voltage (current) −5 %

9.10.3.1 General test conditions

Replacement of second paragraph:

For the upper values of the test current, the test is made on each protected pole:

– *for alternating current, at rated voltage between phase to neutral with a power factor between 0,95 and 1;*

– *for direct current, a time constant of T = 4 ms or, for circuit-breakers marked with T15, a time constant of T = 15 ms.*

9.10.3.2 For circuit-breakers of the B-type

Replacement:

An alternating current equal to 3 I_n is passed through all poles connected in series, starting from cold. The opening time shall comply with Table 7.

An alternating current equal to 5 I_n is then passed through each pole separately, starting from cold. The opening time shall comply with Table 7.

A direct current equal to 4 I_n is passed through all poles connected in series, starting from cold. The opening time shall comply with Table 7.

A direct current equal to 7 I_n is then passed through each pole separately, starting from cold. The opening time shall comply with Table 7.

9.10.3.3 For circuit-breakers of the C-type

Replacement:

An alternating current equal to 5 I_n is passed through all poles connected in series, starting from cold. The opening time shall comply with Table 7.

An alternating current equal to 10 I_n is then passed through each pole separately, starting from cold. The opening time shall comply with Table 7.

A direct current equal to 7 I_n is passed through all poles connected in series, starting from cold. The opening time shall comply with Table 7.

A direct current equal to 15 I_n is then passed through each pole separately, starting from cold. The opening time shall comply with Table 7.

9.11.1 General test conditions

Addition after the fourth paragraph:

The direct current shall have a ripple of $\omega \leq 5$ % and a time constant of T = 4 ms (with a tolerance of $^{0}_{-10}$ %) or, for circuit-breakers marked with T15, a time constant of T = 15 ms (with a tolerance of $^{0}_{-10}$ %).

9.11.2 Test procedure

Replacement of the first paragraph:

One set of circuit-breakers is submitted to 4 000 operating cycles at alternating current, and another set to 1 000 operating cycles at direct current, both at their rated current.

9.12.3 Tolerances and test quantities

Addition:

– *ripple* ≤ 5 %

– *time constant* $^{0}_{-10}$ %.

9.12.5 Power factor of the test circuits

Replacement:

9.12.5 Power factor and time constant of the test circuits

Addition:

For DC test currents up to and including 1 500 A, one of the following time constants shall be used:

$T = L / R = 4$ ms *for devices not marked T15*

$T = L / R = 15$ ms *for devices marked T15.*

For DC tests currents above 1 500 A and less than or equal to 10 000 A, the tests for all samples are made at the time constant of T = 4 ms.

NOTE It is assumed that short-circuit currents of 1 500 A are not exceeded in installations in which, due to the loads connected, time constants in normal service up to 15 ms can occur. Where higher short-circuit currents can occur, the time constant of T = 4 ms is considered sufficient.

9.12.8 Interpretation of records

Replacement:

9.12.8.1 Interpretation of records in case of AC voltage

a) Determination of the applied and power frequency recovery voltages.

The applied and power frequency recovery voltages are determined from the record corresponding to the opening operation O, (see 9.12.11.1) made with the apparatus under test and estimated as indicated in Figure 6a. The voltage on the supply side shall be measured during the first cycle after arc extinction in all poles and after high frequency phenomena have subsided.

b) Determination of the prospective short-circuit current.

The AC component of the prospective current is taken as being equal to the r.m.s. value of the AC component of the calibration current (values corresponding to A_2 of Figure 6a). Where applicable, the prospective short-circuit current shall be the average of the prospective currents in all the phases.

9.12.8.2 Interpretation of records in case of DC voltage

a) Determination of the applied voltage and the recovery voltage.

The applied voltage and the recovery voltage are determined from the record taken during the break test. The voltage on the supply side shall be measured after arc extinction and after high frequency phenomena have subsided.

b) Determination of the prospective short-circuit current.

NOTE The value of the prospective current is taken as being equal to the maximum value A_2 as determined from the calibration curve because circuit-breakers according to this standard break the current before it has reached its maximum value.

The maximum value of the prospective current is indicated as A_2 in Figure 6b.