BRITISH STANDARD

BS EN 60898-2:2006
Including Corrigendum No. 1

Electrical accessories — Circuit-breakers for overcurrent protection for household and similar installations —

Part 2: Circuit-breakers for a.c and d.c. operation

The European Standard EN 60898-2:2006 has the status of a British Standard

ICS 29.120.50

British Standards

National foreword

This British Standard was published by BSI. It is the UK implementation of EN 60898-2:2006. It was derived by CENELEC from IEC 60898-2:2006. It supersedes BS EN 60898-2:2001 which will be withdrawn on 1 June 2010.

The UK participation in its preparation was entrusted by Technical Committee PEL/23, Electrical accessories, to Subcommittee PEL/23/1, Circuit breakers and similar equipment for household use.

A list of organizations represented on PEL/23/1 can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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EUROPEAN STANDARD

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Supersedes EN 60898-2:2001

English version

Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations Part 2: Circuit-breakers for a.c. and d.c. operation

(IEC 60898-2:2000 + A1:2003, modified)

Petit appareillage électrique –
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
(CEI 60898-2:2000 + A1:2003, modifiée)

Elektrisches Installationsmaterial –
Leitungsschutzschalter für Hausinstallationen und ähnliche Zwecke
Teil 2: Leitungsschutzschalter für Wechsel- und Gleichstrom (AC und DC)
(IEC 60898-2:2000 + A1:2003, modifiziert)

This European Standard was approved by CENELEC on 2005-06-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Ref. No. EN 60898-2:2006 E

Foreword

The text of the International Standard IEC 60898-2:2000 + A1:2003, together with common modifications prepared by the Technical Committee CENELEC TC 23E, Circuit breakers and similar devices for household and similar applications, was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 60898-2 on 2005-06-01.

This European Standard supersedes EN 60898-2:2001.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2007-03-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2010-06-01

In this European Standard the common modifications to the International Standard are indicated by a vertical line in the left margin of the text.

This Part 2 is to be used in conjunction with EN 60898-1:2003 + corrigendum February 2004 + A1:2004.

When 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", "modification" or "replacement", the relevant text of Part 1 is to be adapted accordingly.

In this standard, the following print types are used:

- requirements: roman type;
- *test specifications: italic type;*
- notes: smaller roman type.

1 Scope and object

This clause of Part 1 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 d.c. 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 d.c. short-circuit capacity not exceeding 10 000 A.

NOTE This standard applies to circuit-breakers able to make and break both a.c. current and d.c. current.

Delete the last two paragraphs.

2 Normative references

This clause of Part 1 applies.

3 Definitions

Clause 3 of Part 1 applies with the following modification:

Addition:

3.5.10.3
time constant
the rise time $T = L/R$ (ms) of a prospective direct current to reach a value of 0,63 times the maximum peak current

4 Classification

Clause 4 of Part 1 applies with the following modifications:

4.1 According to the number of poles

Replacement:

– single-pole circuit-breakers;

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

4.5 According to the instantaneous tripping current (see 3.5.17)

Delete D-Type.

Addition:

4.7 According to the time constant

– Circuit-breakers suitable for d.c. circuits with a time constant of $T \leq 4$ ms.

– Circuit-breakers suitable for d.c. 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 may occur, the time constant of $T = 4$ ms is considered sufficient.

5 Characteristics of circuit-breakers

Clause 5 of Part 1 applies with the following modification:

5.3.1 Standard values of rated voltage

Replacement:

The standard values of rated voltages are given in Table 1.

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

Table 1 – Standard values of rated voltage

Circuit-breakers	**AC**		**DC** [a]	
	AC circuit supplying the circuit-breaker	**Rated voltage a.c.**	**Rated voltage d.c.**	**DC wiring examples**
Single-pole	Single phase (phase to neutral or phase to phase)	230 V	220 V	Figure 18a
	Single phase (phase to neutral) or three-phase, using 3 single-pole circuit-breakers (3-wire or 4-wire)	(230/400) V	220 V	
Two-pole	Single phase (phase to phase)	400 V	(220/440) V	Figures 18b, 18c, 18d

Applicable for d.c. voltages:

[a] The rated voltage per pole shall not exceed 220 V d.c.

Applicable for a.c. voltages:

NOTE 1 In IEC 60038 the network voltage value of (230/400) V has been standardized. This value should progressively supersede 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 may be read as 220 V or 240 V, and 380 V or 415 V respectively.

NOTE 3 Circuit-breakers complying with the requirements of this standard may be used in IT systems.

Two-pole circuit breakers rated 230 V may have one or two protected poles.

Two-pole circuit breakers rated 400 V shall have two protected poles.

Three-pole circuit breakers shall have three protected poles.

Four-pole circuit breakers may have three or four protected poles.

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 of Table 2:

Table 2 – Ranges of instantaneous tripping

Type	Ranges for a.c.	Ranges for d.c.
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 Part 1 applies with the following modifications:

6.1 Standard marking

Replacement:

c) rated a.c. voltage with the symbol ~ and rated d.c. voltage with the symbol ⎓;

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 a.c. and d.c. in amperes in one rectangle, without the symbol A, if valid for both a.c. and d.c. (see example 1 below). If the rated short-circuit capacity is different for a.c. and d.c. this shall be indicated in two adjacent rectangles, without the symbol A, with the symbol ~ near the rectangle containing the a.c. value and with the symbol ⎓ near the rectangle containing the d.c. value (see example 2 below);

Addition:

l) time constant T15 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 after 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), c), f), g) and j) 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.

6.3 Guidance table for marking

Replacement:

		Markings may be on the circuit-breaker itself			Product information in catalogue
	Marking and other product information Each circuit-breaker shall be marked in a durable manner with all or, for small apparatus, part of the following data:	If, for small devices the space available does not allow all the above data to be marked, at least this information shall be marked and **visible** when the device is installed.	This information 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 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 **catalogues**.
a)	manufacturer's name or trademark		X		
b)	type designation, catalogue number or serial number		X		
c)	rated a.c. voltage with the symbol ~ and rated d.c. voltage with the symbol ⎓.	X			
d)	rated current without symbol "A" preceded by the symbol of overcurrent instantaneous tripping (B or C), for example B 16	X			
e)	rated frequency if the circuit-breaker is designed only for one frequency (see 5.3.3)				X
f)	rated short-circuit capacity for a.c. and d.c. in amperes in one rectangle, without the symbol A, if valid for both a.c. and d.c. (see example 1 in 6.1). If the rated short-circuit capacity is different for a.c. and d.c. this shall be indicated in two adjacent rectangles, without the symbol A, with the symbol ~ near the rectangle containing the a.c. value and with the symbol ⎓ near the rectangle containing the d.c. value (see example 2 in 6.1)		X [a]		
g)	wiring diagram, unless the correct mode of connection is evident		X	X	
h)	reference calibration temperature, if different from 30 °C				X
i)	the degree of protection (only if different from IP20)				X
j)	energy limiting class (e.g. 3) in a square in accordance with Annex ZA, if applied		X [a]		
k)	breaking capacity on one pole of multipole circuit-breakers in case of short-circuit to earth I_{cn1}				X
l)	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 in 6.1)				
	the position of use (symbol according to EN 60051), if necessary		X		
	indication of the terminal for the neutral with "N"		X		
	additional marking of performance to other standards		X		

[a] I_{cn} and the energy limiting class, if applied, shall be both on the device and combined together.

7 Standard conditions for operation in service

Clause 7 of Part 1 applies.

8 Requirements for construction and operation

Clause 8 of Part 1 applies with the following modifications:

8.1.3 Clearances and creepage distances (see annex B)

Addition of the following note 4 to Table 4:

NOTE 4 The values given for 230 V, 230/400)V and 400 V a.c., are also valid for 220 V and 440 V d.c.

8.6.1 Standard time-current zone

Replacement:

Table 7 – Time-current operating characteristics

Test	Type	Test current a.c.	Test current d.c.	Initial condition	Limits of tripping or non-tripping time	Result to be obtained	Remarks
a	B, C	1,13 I_n		Cold*	$t \geq 1$ 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*	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*	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*	t < 0,1 s	Tripping	Current established by closing an auxiliary switch

* 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 Part 1 applies with the following modifications:

9.1 Type tests and test sequences

Replacement of the second paragraph after "Table 8 (void)":

The test sequences and the number of samples to be submitted are stated in Annex C of this standard.

9.10.2 Test of instantaneous tripping and of correct opening of the contacts

Replacement:

9.10.2.2 For circuit-breakers of the B-type

An alternating current equal to 3 I_n is passed through all poles, starting from cold. The opening time shall be not less than 0,1 s and not more than:

– *45 s for rated currents up to and including 32 A;*
– *90 s for rated currents above 32 A.*

An alternating current equal to 5 I_n is then passed through all poles, starting from cold.

The circuit-breaker shall trip in a time less than 0,1 s.

A direct current equal to 4 I_n is passed through all poles, starting from cold.

The opening time shall be not less than 0,1 s and not more than:

– *45 s for rated currents up to and including 32 A;*
– *90 s for rated currents above 32 A.*

A direct current equal to 7 I_n is then passed through all poles, starting from cold.

The circuit-breaker shall trip in a time less than 0,1 s.

Moreover the circuit-breaker shall perform the test of 9.10.1.2.

9.10.2.3 For circuit-breakers of the C-type

An alternating current equal to 5 I_n is passed through all poles, starting from cold.

The opening time shall be not less than 0,1 s and not more than:

– *15 s for rated currents up to and including 32 A;*
– *30 s for rated currents above 32 A.*

An alternating current equal to 10 I_n is then passed through all poles, starting from cold.

The circuit-breaker shall trip in a time less than 0,1 s.

Moreover the circuit-breaker shall perform the test of 9.10.1.2.

A direct current equal to 7 I_n is passed through all poles, starting from cold.

The opening time shall be not less than 0,1 s and not more than:

– *15 s for rated currents up to and including 32 A;*

– *30 s for rated currents above 32 A.*

A direct current equal to 15 I_n *is then passed through all poles, starting from cold.*

The circuit-breaker shall trip in a time less than 0,1 s.

9.11 Test of mechanical and electrical endurance

9.11.1 General test conditions

Replacement of the fourth paragraph:

The alternating current shall have a substantially sine-wave form and the power factor shall be between 0,85 and 0,9.

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* $\leq$*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 d.c. 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 d.c. 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 may occur, the time constant of *T* = 4 ms is considered sufficient.

9.12.8 Interpretation of records

Replacement of the title of 9.12.8.1 by:

9.12.8.1 Interpretation of records in case of a.c. voltage

Addition:

9.12.8.3 Interpretation of records in case of d.c. 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 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 7b.*

9.12.11 Test procedure

Replacement of the title of 9.12.11.2 by:

9.12.11.2 Tests at reduced short-circuit currents and at small direct currents

Replacement of the title of 9.12.11.2.1 by:

9.12.11.2.1 Tests at reduced a.c. short-circuit currents

Addition:

9.12.11.2.3 Tests at reduced d.c. short-circuit currents

At direct currents the test circuit is adjusted so as to obtain a current of 500 A or $10 \times I_n$ *whichever is the higher, at a time constant corresponding to the assigned time constant.*

Each of the protected poles of the circuit-breaker is subjected separately to a test in a circuit, of which the connections are shown in Figure 3.

The circuit-breaker is caused to open automatically three times, the circuit being closed once by the auxiliary switch A and twice by the circuit-breaker itself.

The sequence of operations shall be:

$$O – t – CO – t – CO$$

After arc extinction, the recovery voltage shall be maintained for a duration not less than 0,1 s.

9.12.11.2.4 Test at small direct currents up to and including 150 A

The circuit-breaker shall be closed three times on to each of the test currents listed below; during the tests the operating means is actuated as in normal use. If the circuit-breaker does not trip, it shall be switched off manually.

Test currents: 1 A, 2 A, 4 A, 8 A, 16 A, 32 A, 63 A, 150 A

The time between each operating cycle CO shall be at least 10 s, the closing time shall not be longer than 2 s. The time between the various test currents shall be at least 2 min.

The time of the arc extinction during the test shall not exceed 1 s.

9.12.11.3 Test at 1 500 A

Replacement of the first paragraph:

For circuit-breakers having rated short-circuit capacity of 1 500 A, the test circuit is calibrated according to 9.12.7.1 and 9.12.7.2, to obtain a current of 1 500 A at a power factor corresponding to this current according to Table 17.

For direct current the time constant is calibrated corresponding to the assigned time constant.

Replacement of the second paragraph:

For circuit-breakers having rated short-circuit capacity exceeding 1 500 A, the test circuit is calibrated according to 9.12.7.1 and 9.12.7.3, at a power factor corresponding to 1 500 A, according to Table 17.

For direct current the time constant is calibrated corresponding to the assigned time constant.

Replace the eleventh paragraph:

The sequence of operations shall be as specified in 9.12.11.2.1 and 9.12.11.2.3.

For single-pole circuit-breakers of rated voltage 230/400 V the operations for a.c. are as follows:

Subsequent to the six O operations only two CO operations are performed. In addition, these circuit-breakers are then tested by performing simultaneously one O operation, with one circuit-breaker being inserted in each phase of the test circuit for three-pole circuit-breakers (see Figure 5). For this test the auxiliary switch establishing the short-circuit is not synchronized.

For the tests at d.c.

- *single-pole circuit-breakers of rated voltage 220 V are tested in a circuit according to Figure 3;*
- *two-pole circuit-breakers of rated voltage 440 V are tested in a circuit according to Figure 4b.*

9.12.11.4.2 Test at service short-circuit capacity (I_{cs})

Replacement of the first paragraph of a):

a) *The test circuit is calibrated according to 9.12.7.1 and 9.12.7.3, on a.c. with a power factor according to Table 17, or on d.c. with a time constant according to 9.12.5.*

Addition:

e) *In the case of direct current, the test sequence for single- and two-pole circuit-breakers is:*

O – t – CO – t – CO

Three operations are made, the circuit being closed once by the auxiliary switch A and twice by the circuit-breaker.

Single-pole circuit-breakers of rated voltage 220 V are tested in a circuit according to Figure 3.

Two-pole circuit-breakers of rated voltage 440 V are tested in a circuit according to Figure 4b.

9.12.11.4.3 Test at rated short-circuit capacity (I_{cn})

Replacement of the first paragraph:

a) *The test circuit is calibrated according to 9.12.7.1 and 9.12.7.2, on a.c. with a power factor according to Table 17, on d.c. with a time constant according to 9.12.5.*

Addition:

c) *In the case of direct current, the test sequence for single- and two-pole circuit-breakers is:*

O – t – CO

Two operations are made, the circuit being closed once by the auxiliary switch A and once by the circuit-breaker.

Single-pole circuit-breakers of rated voltage 220 V are tested in a circuit according to Figure 3.

Two-pole circuit-breakers of rated voltage 440 V are tested in a circuit according to Figure 4b.

9.12.12 Verification of the circuit-breaker after short-circuit tests

Addition at the end of 9.12.12.2:

The test of 9.12.11.2.4 is repeated but the test currents 63 A and 150 A are omitted.

Figures

The figures of Part 1 apply with the following modifications:

Renumber Figure 7 as Figure 7a and replace the title by:

Figure 7a – Calibration of the test circuit

Addition:

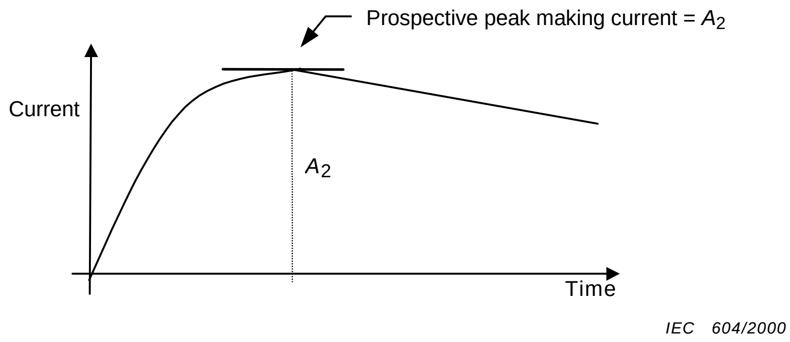
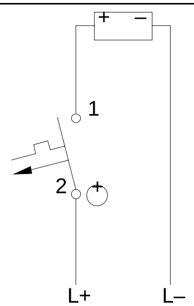
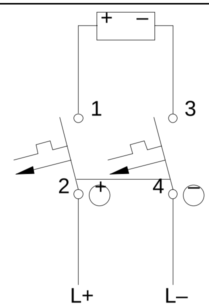
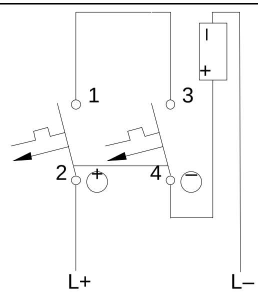
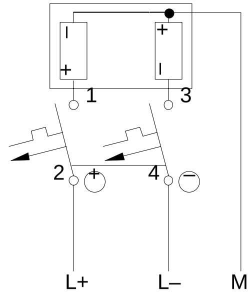


Figure 7b – Calibration of the test circuit in case of direct currents

Addition:

	a	**b**	**c**	**d**
Circuit-breaker rated voltage	220 V	220/440 V	220/440 V	220/440 V
Maximum voltage between the conductors	220 V	440 V	440 V	440 V
Maximum voltage between conductor and earth	220 V	220 V	440 V [a]	220 V
Circuit breaker	Single-pole	Two-pole	Two-pole	Two-pole
Circuit				

[a] For applications with an earthed negative pole, where the voltage to earth is higher than the rated voltage of a single-pole circuit-breaker.

IEC 773/03

Figure 18 – Examples of connections of the circuit-breakers in different d.c. systems

Annexes

The annexes of Part 1 are applicable, except as follows:

Annex C

Annex C of Part 1 applies with the following modifications:

Replacement:

Table C.1 – Test sequences and number of samples necessary to prove compliance with the standard

Test sequence		Clause or subclause	Test performed at		Test (or inspection)
A		6			Marking
		8.1.1			General
		8.1.2			Mechanism
		9.3			Indelibility of marking
		8.1.3			Clearances and creepage distances (external parts only)
		8.1.6			Non-interchangeability
		9.4			Reliability of screws, current-carrying parts and connections
		9.5			Reliability of screw-type terminals for external copper conductors
		9.6			Protection against electric shock
		8.1.3			Clearances and creepage distances (internal parts only)
		9.14			Resistance to heat
		9.15			Resistance to abnormal heat and to fire
		9.16			Resistance to rusting
B		9.7			Dielectric properties and isolating capability
		9.8			Temperature rise and power loss
		9.9			28-day test
C	C_1	9.11	a.c.		Mechanical and electrical endurance
		9.12.11.2.1			Test at reduced a.c. short-circuit currents
		9.12.12			Verification of circuit-breaker after short-circuit tests
		9.11		d.c.	Mechanical and electrical endurance
		9.12.11.2.3			Test at reduced d.c. short-circuit currents
		9.12.11.2.4			Test at small direct currents up to and including 150 A
		9.12.12			Verification of circuit-breaker after short-circuit tests
	C_2	9.12.11.2.2	a.c.		Short-circuit test for verifying the suitability of circuit-breakers for use in IT systems
		9.12.12			Verification of circuit-breaker after short-circuit tests
D	D_0	9.10	a.c.	d.c.	Tripping characteristic
	D_1	9.13	a.c.	d.c.	Mechanical stresses
		9.12.11.3			Short-circuit performance at 1 500 A
		9.12.12			Verification of circuit-breaker after short-circuit tests
E	E_1	9.12.11.4.2	a.c.	d.c.	Service short-circuit capacity (I_{cs})
		9.12.12			Verification of circuit-breaker after short-circuit tests
	E_2	9.12.11.4.3	a.c.	d.c.	Performance at rated short-circuit capacity (I_{cn})
		9.12.12			Verification of circuit-breaker after short-circuit tests
	E_3	9.12.11.4.4	a.c.		Performance at rated making and breaking capacity (I_{cn1}) on an individual pole of multipole circuit-breakers
		9.12.12			

NOTE With the agreement of the manufacturer the same samples may be used for more than one sequence.

Replacement:

Table C.2 – Number of samples for full test procedure

Test sequence		Number of samples		Minimum number of samples which shall pass the tests [a, b]		Number of samples for repeated tests [c]	
		AC ~	DC —	AC ~	DC —	AC ~	DC —
A		1		1			
B		3		2		3	
C	C_1	3	3	2 [e]	2 [e]	3	3
	C_2	3	3	2 [e]	2 [e]	3	3
D		3	3	2 [e]	2 [e]	3	3
E_1		3 + 3 [d]	3	2 [e] + 2 [d, e]	2 [e]	3 + 3 [d]	3
E_2		3 + 4 [d]	3	2 [e] + 3 [d, e]	2 [e]	3 + 4 [d]	3
E_3		3		2 [e]		3	

[a] In total, a maximum of two test sequences may be repeated.

[b] It is assumed that a sample which has not passed a test has not met the requirements due to workmanship or assembly defects which are not representative of the design.

[c] In the case of repeated tests, all results shall be acceptable.

[d] Supplementary samples in the case of single-pole circuit-breakers of rated voltage 230/400 V.

[e] All samples shall meet the test requirements of 9.12.10, 9.12.11.2, 9.12.11.3 and 9.12.11.4 as appropriate.

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