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Electrical accessories - Circuit-breakers for overcurrent protection for household and similar installations - Part 1: Circuit-breakers for a.c. operation

EESTI STANDARDIKESKUS
ESTONIAN CENTRE FOR STANDARDISATION

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 60898-1:2019 sisaldab Euroopa standardi EN 60898-1:2019 ingliskeelset teksti.	This Estonian standard EVS-EN 60898-1:2019 consists of the English text of the European standard EN 60898-1:2019.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 18.01.2019.	Date of Availability of the European standard is 18.01.2019.
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Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

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English Version

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

Petit appareillage électrique - Disjoncteurs pour la protection contre les surintensités pour installations domestiques et analogues - Partie 1: Disjoncteurs pour le fonctionnement en courant alternatif (IEC 60898-1:2015 , modifiée)

Elektrisches Installationsmaterial - Leitungsschutzschalter für Hausinstallationen und ähnliche Zwecke - Teil 1: Leitungsschutzschalter für Wechselstrom (AC) (IEC 60898-1:2015 , modifiziert)

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

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European foreword

This document (EN 60898-1:2018) consists of the text of IEC 60898-1:2015 prepared by SC 23E “Circuit-breakers and similar equipment for household use” of IEC/TC 23 “Electrical accessories”, together with the common modifications prepared by CLC/TC 23E “Circuit breakers and similar devices for household and similar applications”.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2019-07-18
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2024-05-28

This document supersedes EN 60898-1:2003, EN 60898-1:2003/A1:2004, and EN 60898-1:2003/A12:2008.

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 60898-1:2015 are prefixed ”Z”.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

Endorsement notice

The text of the International Standard IEC 60898-1:2015 was approved by CENELEC as a European Standard with agreed common modifications.

1 Scope

Add *at the end of the 4th paragraph:*

…and overvoltage category III.

NOTE 1 Additional requirements are necessary for circuit-breakers used in locations having more severe overvoltage conditions.

Replace *the 6th paragraph by:*

Circuit-breakers of this standard are suitable for use in IT systems provided that the requirements of HD 60364-4-43 are complied with.

Add *after this 11th paragraph:*

Supplementary requirements may be necessary for circuit-breakers of the screw-in types.

Renumber *NOTE 1 as NOTE 2.*

After NOTE 1 renumbered as NOTE 2, ***add****:*

NOTE 3 Recommendations for the dimensional coordination between enclosures and circuit breakers for mounting on rails according to EN 60715 or equivalent means are given in the CENELEC report PD CLC/TR 50473.

2 Normative reference

Replace *the contents of the clause by:*

NOTE Normative references to international standards are given in Annex ZB.

3 Terms and definitions

Add *the following new definitions:*

3.2.15
type test
test of one or more devices made to a certain design to show that the design meets certain requirements

[SOURCE: IEC 60050-441:1984, 441-53-01, modified]

3.2.16
routine test
test to which each individual device is subjected during or after manufacture to ascertain whether it complies with certain criteria

[SOURCE: IEV 411-53-02, modified]

3.5.15
Replace *by:*

conventional non-tripping current
$\boldsymbol{I_{nt}}$
specified value of current which the circuit-breaker is capable of carrying for a specified time designated as conventional time, without tripping

[SOURCE: IEC 60050-442:1998, 442-05-54]

3.5.16
Add *at the end of the clause:*

[SOURCE: IEC 60050-441:1984, 442-05-55, modified]

3.6.11
Add *to the end of the reference of the source:*

“modified”

4 Classification

Replace *4.7 by:*

4.7 According to the I^2t characteristic

Circuit-breakers of B-type and C-type, having rated current up to and including 63 A and having short-circuit breaking capacity of 3 000 A, 4 500 A, 6 000 A and 10 000 A, are classified according to the limits within which their I^2t characteristics lie, measured according to 9.12.6 (see Annex ZA).

5 Characteristics of circuit-breakers

Replace *5.2.1.3 by:*

5.2.1.3 Rated impulse withstand voltage (U_{imp})

The rated impulse withstand voltage (U_{imp}) of a circuit-breaker is the value of voltage, assigned by the manufacturer, to which impulse test voltages and clearances are referred.

The rated impulse withstand voltage of a circuit-breaker shall be equal to or higher than the standard value of rated impulse withstand voltage given in 5.3.6.

NOTE For dimensioning of clearances, for rated impulse withstand voltages higher than the standard value of rated impulse withstand voltage given in 5.3.6, see EN 60664 series.

5.2.2

Delete *the note*

5.2.4

Replace *in the note "Table 17" by "Table 18"*

5.3.1

Replace *by:*

5.3.1 Standard values of rated voltage

Standard values of rated voltage are given in Table 1.

Replace *Table 1 and title by the following:*

Table 1 — Standard values of rated voltage

Circuit-breakers	Circuit supplying the circuit-breaker	Rated voltage of circuit-breakers for use in systems 230 V, 230/400 V, 400 V
Single pole	Single phase (phase to neutral or phase to phase)	230 V
	Three-phase 4-wire	230 V
	Single phase (phase to neutral) or three-phase, using 3 single-pole circuit-breakers (3-wire or 4-wire)	230/400 V
Two-pole	Single phase (phase to neutral or phase to phase)	230 V
	Single phase (phase to phase)	400 V
	Three phase (4-wire)	230 V
Three-pole	Three phase (3-wire or 4-wire)	400 V
Four-pole	Three phase (4-wire)	400 V
NOTE Wherever in this standard there is a reference to 230 V or 400 V, they may be read as 220 V or 240 V, 380 V or 415 V, respectively.		

***Add** after the table:*

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.

5.3.4.1

***Add** an asterisk "(*)" after 1 500 A.*

***Replace** the note by:*

(*) Only for circuit-breakers incorporated or associated with and in the immediate vicinity of socket-outlets or switches for household and similar applications.

5.3.4.2

***Replace** by:*

5.3.4.2 Standard values above 10 000 A up to and including 25 000 A

For values above 10 000 A up to and including 25 000 A the standard values are:

15 000 A, 20 000 A and 25 000 A.

The corresponding power factor range is given in 9.12.5.

5.3.5

Table 2

***Delete** [a] after 20 In.*

***Delete** the note "[a] For special cases values up to …"*

5.3.6

Replace *the title and the contents of Table 3 by:*

Table 3 (void)

Replace *the first sentence by*

The standard value of the rated impulse withstand voltage (U_{imp}) is 4 kV.

Replace *in the title "Standard values" by "Standard value".*

6 Marking and other product information

The text of Clause 6 becomes 6.1 with the following modifications:

6.1 Standard marking

Replace *the text of f) by:*

f) rated short-circuit capacity, in A, within a rectangle, without symbol "A";

In h) replace "ambient air" by "calibration".

Replace *the text of j) by*

j) Void

Replace *the text of k) by:*

k) (void)

Add *a new line m)*

m) energy limiting class in a square in accordance with Annex ZA, if applied. I_{cn} and the energy limiting class, when applied, shall be both on the device and combined;

In the first paragraph after l), ***replace*** *"a), b), c), e), f), h), i), j) and l)" by "a), b), c), f), g), l) and m)".*

In the second sentence of this paragraph ***replace*** *"marking g) may be" by "Marking g) alternatively may be".*

Delete *Notes 1 and 2.*

Replace *the 5th and 6th paragraphs by:*

Irrespective of type (B, C or D), the manufacturer shall publish in his literature the I^2t characteristic (see 3.5.13).

Renumber NOTE 3 in note.

After NOTE 3, add a new paragraph

For rail mounting circuit-breakers, appropriate rail(s) shall be indicated in manufacturer's documentation.

Add *the new subclauses 6.2 and 6.3:*

6.2 Additional marking

Additional marking to other standards (EN or IEC or other) is allowed under the following conditions:

— the circuit-breaker shall comply with all the requirements of the additional standard;

— the relevant standard to which the additional marking refers shall be indicated adjacent to this marking and shall be clearly differentiated or separated from the standard marking according to 6.1.

Compliance is checked by inspection and by carrying out all the test sequences required by the relevant standard. Equivalent or less severe test sequences need not be repeated.

6.3 Guidance table for marking

Marking and other product information Each MCB shall be marked in a durable manner with all or, for small apparatus, part of the following data:		**Markings may be on the MCB itself**			**Product information in catalogue**
		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 voltage, with the symbol ~		**X**		
d)	rated current without symbol "A" preceded by the symbol of overcurrent instantaneous tripping (B, C or D), 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 in a rectangle, in amperes, without symbol "A"		**X(*)**		
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)	Void				
k)	Void				
l)	breaking capacity on one pole of multipole MCBs in case of short-circuit to earth I_{cn1}		**X**		
m)	energy limiting class (e.g. 3) in a square in accordance with Annex ZA, as applicable		**X(*)**		**X(**)**
	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**		

(*) I_{cn} and the energy limiting class, as applicable, shall be both on the device and combined together.

(**) The manufacturer shall publish in his literature the I^2t characteristic.

7 Standard conditions for operating in service

Replace *the whole clause by:*

7 Standard conditions for operation in service and for installation

7.1 Standard conditions

Circuit breakers complying with this standard shall be capable of operating under the standard conditions shown in Table Z.1.

Table Z.1 – Standard conditions for operation in service

Influencing quantity	Standard range of application	Reference value	Test tolerances [f]
Ambient temperature [a g]	–5 °C to +40 °C [b]	see 9.2	
Altitude	Not exceeding 2 000 m		
Relative humidity maximum value 40 °C	50 % [c]		
External magnetic field	Not exceeding 5 times the earth's magnetic field in any direction	Earth's magnetic field	[d]
Position	As stated by the manufacturer, with a tolerance of 2° in any direction [e]	As stated by the manufacturer	2° in any direction
Frequency	Reference value ± 5 % [f]	Rated value	± 5 %
Sinusoidal wave distortion	Not exceeding 5 %	Zero	5 %

[a] The maximum value of the mean daily temperature is +35 °C.

[b] Values outside the range are admissible where more severe climatic conditions prevail, subject to agreement between manufacturer and user.

[c] Higher relative humidities are admitted at lower temperature (for example 90 % at 20 °C).

[d] When a circuit breaker is installed in proximity of a strong magnetic field, supplementary requirements may be necessary.

[e] The device shall be fixed without causing deformation liable to impair its functions.

[f] The tolerances given apply unless otherwise specified in the relevant test.

[g] Extreme limits of –20 °C and +60 °C are admissible during storage and transportation, and should be taken into account in the design of the device.

7.2 Conditions of installation

Circuit breakers shall be installed in accordance with the manufacturer's instructions.

8 Requirements for construction and operation

8.1.2

Delete *in paragraph 7, 2nd sentence "without operating handle"*

Delete *Note 1 and* ***replace*** *"NOTE 2 "by "NOTE".*

8.1.3 Clearances and creepage distances

Replace *the whole subclause 8.1.3 by:*

8.1.3 Clearances and creepage distances

8.1.3.1 General

The minimum required clearances and creepage distances are given in Table 4 that is based on the circuit-breaker being designed for operating in an environment with pollution degree 2.

The insulating materials are classified into material groups on the basis of their comparative tracking index (CTI) according to EN 60664-1.

NOTE 1 The comparative tracking index (CTI) is declared by the manufacturer on the basis of tests carried out on the insulating material.

NOTE 2 Information on the requirements for design of solid insulation is provided in EN 60664-1.

Table 4 — Minimum clearances and creepage distances

	Minimum clearances **mm**	Minimum creepage distances[e, f] **mm**											
		Group IIIa [h] (175 V ≤ CTI < 400 V)[d]				**Group II (400 V ≤ CTI < 600 V)[d]**				**Group I (600 V ≤ CTI)[d]**			
	Rated voltage **V**	Working voltage [e] **V**											
	U_{imp}												
	4 kV												
Item/Description	**230/400 230 400**	**> 25 ≤ 50 [i]**	**120**	**250**	**400**	**> 25 ≤ 50[i]**	**120**	**250**	**400**	**> 25 ≤ 50 [i]**	**120**	**250**	**400**
1. between live parts which are separated when the main contacts are in the open position [a,j]	**4,0**	**1,2**	**2,0**	**4,0**	**4,0**	**0,9**	**2,0**	**4,0**	**4,0**	**0,6**	**2,0**	**4,0**	**4,0**
2. between live parts of different polarity [a,j, k]	**3,0**	**1,2**	**1,5**	**3,0**	**4,0**	**0,9**	**1,5**	**3,0**	**3,0**	**0,6**	**1,5**	**3,0**	**3,0**
3. between circuits supplied from different sources, one of which being PELV or SELV [g]	**8,0**		**3,0**	**6,0**	**8,0**		**3,0**	**6,0**	**8,0**		**3,0**	**6,0**	**8,0**

		Rated voltage V		
		230 / 400	**230 / 400**	**230 / 400**
4. between live parts and **– accessible surfaces of operating means** **– screws or other means for fixing covers which have to be removed when mounting the circuit–breaker** **– surface on which the circuit-breaker is mounted [b]** **– screws or other means for fixing the circuit-breaker [b]** **– metal covers or boxes [b]** **– other accessible metal parts [c]** **– metal frames supporting flush-type circuit-breakers**	**3,0**	**4,0**	**3,0**	**3,0**

NOTE 1 The values given for 400 V are also valid for 440 V.

NOTE 2 The parts of the neutral path, if any, are considered to be live parts.

a For auxiliary and control contacts the values are given in the relevant standard.

b The values are doubled if clearances and creepage distances between live parts of the device and the metallic screen or the surface on which the circuit-breaker is mounted are not dependent on the design of the circuit-breaker only, so that they can be reduced when the circuit-breaker is mounted in the most unfavourable condition.

c Including a metal foil in contact with the surfaces of insulating material which are accessible after installation for normal use. The foil is pushed into corners, grooves, etc., by means of a straight unjointed test finger according to 9.6 (see Figure 8).

d See EN 60112.

e Interpolation is allowed in determining creepage distances corresponding to voltage values intermediate to those listed as working voltage. When interpolating, linear interpolation shall be used and values shall be rounded to the same number of digits as the values picked up from the tables. For determination of creepage distances, see Annex B.

f Creepage distances cannot be less than the associated clearances.

g To cover all different voltages including ELV in an auxiliary contact.

h For material group IIIb (100 V ≤ CTI < 175 V) the values for material group IIIa multiplied by 1,6 apply.

i For working voltages up to and including 25 V reference may be made to EN 60664-1.

j The clearance distances between the metal parts within the arc chamber may be less than 1mm, provided that the sum of distances is greater than prescribed in item 1 of Table 4.

k This applies also to clearance and creepage distances between live parts of different polarity of circuit breakers mounted close to one another.

8.1.3.2 Clearances

Compliance for item 1 in Table 4 is checked by measurement and by the tests of 9.7.5.4.

Compliance for item 2 and 4 in Table 4 is checked by measurement or by the tests of 9.7.5.2.

The clearances of items 2 and 4 (except accessible surface after installation, see Note) may be reduced provided that the measured clearances are not shorter than the minimum allowed in IEC 60664-1 for homogenous field conditions. In this case, compliance for items 2 and 4 is always checked by the test of 9.7.5.2.

NOTE Accessible surface after installation means any surface accessible by the user when the circuit-breaker is installed according to the manufacturer's instructions. The test finger can be applied to determine whether a surface is accessible or not.

Compliance for item 3 in Table 4 is checked by measurement.

8.1.3.3 Creepage distances

Compliance for item 1, 2, 3 and 4 is checked by measurement

NOTE All measurements required in 8.1.3 are carried out in Test sequence A on one sample. Tests according to 9.7.2 to 9.7.5 are carried out in Test sequence B on three samples.

8.1.3.4 Solid insulation

Compliance is checked by the tests according to 9.7.2, 9.7.3, 9.7.4 and 9.7.5 as applicable.

8.1.4.4

Replace *in the last paragraph "parts of electronic devices" by "electronic parts, including circuit boards,"*

Add *a new paragraph at the end of the subclause:*

Compliance is checked by inspection in accordance with manufacturer's declaration.

8.1.5.2

Delete *the note after Table 5.*

8.1.5.12

Add *a new paragraph at the end of the subclause:*

Compliance is checked by inspection.

8.1.7.1

Delete *from the first paragraph ", the holding in position of which does not depend solely on their plug-in connection(s),»*

8.6.1

Table 7

Replace *the row for test d by:*

d	B	3 I_n	Cold [a]	0,1 s < t < 45 s (for In ≤ 32 A) 0,1 s < t < 90 s (for In > 32 A)	Tripping	Current established by closing an auxiliary switch
	C	5 I_n		0,1 s < t < 15 s (for In ≤ 32 A) 0,1 s < t < 30 s (for In > 32 A)		
	D	10 I_n		0,1 s < t < 4 s[b] (for In ≤ 32 A) 0,1 s < t < 8 s (for In > 32 A)		

In the row for test e ***delete*** *"[b]" after "20 I_n".*

Delete *the note in Table 7.*

Replace *the text of* [b] *by:*

[b] For $I_n \leq 10$ A, $t < 8$ s is permissible.

8.6.3.3

In 8.6.3.3, ***add*** *in the first line, after the word "ambient" the word "air".*

8.11

Delete *the word "External" in the first line.*

Replace *the last line by:*

Compliance is checked

— for external parts made of insulating material, by the test of 9.15;

— for all other parts made of insulating material, by the test sequences, no additional test being required.

Add *the new subclauses 8.14 and 8.15:*

8.14 Electromagnetic immunity

Circuit-breakers for overcurrent protection for household and similar installations are not sensitive to normal electromagnetic disturbances and therefore no immunity tests are required.

8.15 Electromagnetic emission

Electromagnetic disturbances can only be generated by circuit breakers for overcurrent protection for household and similar installations during occasional switching or automatic breaking operations. The duration of the disturbances is of the order of milliseconds.

The frequency, the level and the consequences of these emissions are considered as part of the normal electromagnetic environment of low voltage installations. Therefore the requirements for electromagnetic emissions are deemed to be satisfied and no verification is necessary.

9 Tests

9.1

Add *the following new note:*

NOTE Test to verify compliance of additional marking to 6.2, if any, are carried out according to the relevant standard.

9.2

Delete *the note after Table 10.*

9.6

Replace *the second sentence of the 7th paragraph by:*

This finger is applied to all places where yielding of insulating material could impair the safety of the circuit-breaker; in the case of knockouts it is applied with a force of 10 N.

9.7

Replace *the whole Clause 9.7 by.*

9.7 Test of dielectric properties

9.7.1 Resistance to humidity

9.7.1.1 Preparation of the circuit-breaker for test

Parts which can be removed without the aid of a tool are removed and subjected to the humidity treatment with the main part; spring lids are kept open during this treatment.

Inlet openings, if any, are left open; if knockouts are provided, one of them is opened.

9.7.1.2 Test conditions

The humidity treatment is carried out in a humidity cabinet containing air with a relative humidity maintained between 91 % and 95 %.

The temperature of the air in which the sample is placed is maintained within ± 1 °C of any convenient value T between 20 °C and 30 °C.

Before being placed in the humidity cabinet, the sample is brought to a temperature between T and T +4 °C.

9.7.1.3 Test procedure

The sample is kept in the cabinet for 48 h.

NOTE 1 A relative humidity between 91 % and 95 % can be obtained by placing in the humidity cabinet a saturated solution of sodium sulphate (Na_2SO_4) or potassium nitrate (KNO_3) in water having a sufficiently large contact surface with the air.

NOTE 2 In order to achieve the specified conditions within the cabinet it is necessary to ensure constant circulation of the air within and, in general, to use a cabinet which is thermally insulated.

9.7.1.4 Condition of the circuit-breaker after the test

After this treatment, the sample shall show no damage within the meaning of this standard and shall withstand the tests of 9.7.2, 9.7.3, 9.7.4, and 9.7.5.2.

9.7.2 Insulation resistance of the main circuit

The circuit-breaker having been treated as specified in 9.7.1 is then removed from the cabinet.

After an interval between 30 min and 60 min following this treatment, the insulation resistance is measured 5 s after application of a d.c. voltage of approximately 500 V, in the following order:

a) with the circuit-breaker in the open position, between each pair of the terminals which are electrically connected together when the circuit-breaker is in the closed position, in turn on each pole;

b) with the circuit-breaker in the closed position, between each pole and the others connected together;

c) with the circuit-breaker in the closed position, between all poles connected together and the frame, including a metal foil or part in contact with the outer surface of the housing of insulating material but with the terminal areas kept completely free to avoid flashover between terminals and the metal foil;

d) for circuit-breakers with a metal enclosure having an internal lining of insulating material, between the frame and a metal foil in contact with the inner surface of the lining of insulating material, including bushings and similar devices.

The measurements a), b) and c) are carried out after having connected all auxiliary circuits to the frame.

The term “frame” includes:

— all accessible metal parts and a metal foil in contact with the surfaces of insulating material which are accessible after installation as for normal use;

— the surface on which the base of the circuit-breaker is mounted, covered, if necessary, with a metal foil;

— screws and other devices for fixing the base to its support;

— screws for fixing covers which have to be removed when mounting the circuit-breaker,

— metal parts of operating means referred to in 8.2.

If the circuit-breaker is provided with a terminal intended for the interconnection of protective conductors, this terminal is connected to the frame.

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.

The insulation resistance shall be not less than

— 2 MΩ for the measurements according to items a) and b);

— 5 MΩ for the other measurements.

9.7.3 Dielectric strength of the main circuit

After the circuit-breaker has passed the tests of 9.7.2 the test voltage specified is applied for 1 min between the parts indicated in 9.7.2.

The test voltage shall have practically sinusoidal waveform, and a frequency between 45 Hz and 65 Hz.

The source of the test voltage shall be capable of supplying a short-circuit current of at least 0,2 A.

No overcurrent tripping device of the transformer shall operate when the current in the output circuit is lower than 100 mA.

The values of the test voltage shall be as follows:

— 2 000 V for items a) to c) of 9.7.2;

— 2 500 V for item d) of 9.7.2;

Initially, not more than half the prescribed voltage is applied, then it is raised to the full value within 5 s.

No flashover or breakdown shall occur during the test.

Glow discharges without drop in the voltage are neglected.

9.7.4 Insulation resistance and dielectric strength of auxiliary circuits

Insulation resistance and dielectric strength shall be verified according to a, b and c.

a) The measurement of the insulation resistance and the dielectric strength tests for the auxiliary circuits are carried out immediately after the measurement of the insulation resistance and the dielectric strength tests for the main circuit, under the conditions given in b) and c) below.

b) The measurements of the insulation resistance are carried out:

   — between the auxiliary circuits connected to each other and to the frame;

   — between each of the parts of the auxiliary circuits which might be isolated from the other parts in normal service and the whole of the other parts connected together, at a voltage of approximately 500 V d.c., after this voltage has been applied for 1 min.

   The insulation resistance shall be not less than 2 MΩ.

c) A substantially sinusoidal voltage at rated frequency is applied for 1 min between the parts listed under b).

   The voltage values to be applied are specified in Table 13

Table 13 – Test voltage of auxiliary circuits

Rated voltage of auxiliary circuits (a.c. or d.c.) V		Test voltage V
Greater than	**Up to and including**	
0	***30***	***600***
30	***50***	***1 000***
50	***110***	***1 500***
110	***250***	***2 000***
250	***500***	***2 500***

At the beginning of the test the voltage shall not exceed half the value specified. It is then increased steadily to the full value in not less than 5 s, but not more than 20 s.

During the test, there shall be no flashover or perforation.

NOTE 1 Discharges which do not correspond to a voltage drop are disregarded.

NOTE 2 In the case of circuit breakers in which the auxiliary circuit is not accessible for verification of the requirements given in b), the tests can be made on samples specially prepared by the manufacturer or according to his instructions.

NOTE 3 Auxiliary circuits do not include the control circuit of circuit breakers functionally dependent on line voltage.

NOTE 4 Control circuits other than those of secondary circuit of detection transformers and control circuits connected to the main circuit are submitted to the same tests as the auxiliary circuits.

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

9.7.5.1 General testing procedure for the impulse withstand voltage tests

The impulses are given by a generator producing positive and negative impulses having a front time of 1,2 µs, and a time to half-value of 50 µs, the tolerances being as follow:

— ± 5 % for the peak value;

— ± 30 % for the front time;

— ± 20 % for the time to half-value.

For each test, five positive impulses and five negative impulses are applied. The interval between consecutive impulses being at least 1 s for impulses of the same polarity and being at least 10 s for impulses of the opposite polarity

When performing the impulse voltage test on complete circuit-breaker, the attenuation or amplification of the test voltage shall be taken into account. It needs to be ensured that the required value of the test voltage is applied across the terminals of the equipment under test.

The surge impedance of the test apparatus shall have a nominal value of 500 Ω.

In 9.7.5.2, for the verification of clearances within the basic insulation, on complete circuit-breaker, a very low impedance of the generator is needed for the test. For this purpose, a hybrid generator with a virtual impedance of 2 ohm is appropriate if internal components are not disconnected before testing. However, in any case, a measurement of the correct test voltage directly at the clearance is required.

The shape of the impulses is adjusted with the circuit-breaker under test connected to the impulse generator. For this purpose appropriate voltage dividers and voltage sensors shall be used.