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Second edition
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Road vehicles — Circuit breakers —

Part 1: Definitions and general test requirements

Véhicules routiers — Coupe-circuits —

Partie 1: Définitions et exigences d'essais générales

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Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information.

The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 32, *Electrical and electronic components and general system aspects*.

This second edition cancels and replaces the first edition (ISO 10924-1:2009), which has been technically revised.

ISO 10924 consists of the following parts, under the general title *Road vehicles — Circuit breakers*:

— *Part 1: Definitions and general test requirements*

— *Part 2: User's guide*

— *Part 3: Miniature circuit breakers with tabs (Blade type), Form CB11*

— *Part 4: Medium circuit breakers with tabs (Blade type), Form CB15*

— *Part 5: Circuit breakers with bolt with rated voltage of 450 V*

Road vehicles — Circuit breakers —

Part 1: Definitions and general test requirements

1 Scope

This part of ISO 10924 defines terms and specifies general test requirements for circuit breakers for use in road vehicles with a nominal voltage of 12 V d.c., 24 V d.c, 48 V d.c. and 450 V d.c.

This part of ISO 10924 is intended to be used in conjunction with other parts of ISO 10924. The numbering of its clauses corresponds to that of this part of ISO 10924 whose requirements are applicable, except where modified by requirements particular to this part of ISO 10924.

This part of ISO 10924 is not applicable to circuit breaker holders (electrical centres or fuse-holders) used in vehicles.

2 Normative references

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

ISO 6722–1, *Road vehicles — 60 V and 600 V single-core cables — Part 1: Dimensions, test methods and requirements for copper conductor cables*

ISO 8820–1, *Road vehicles — Fuse-links — Part 1: Definitions and general test requirements*

ISO 8820–3, *Road vehicles — Fuse-links — Part 3: Fuse-links with tabs (blade type) Type C (medium), Type E (high current) and Type F (miniature)*

ISO 16750–1, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 1: General*

ISO 16750–3, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 3: Mechanical loads*

ISO 16750–4, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 4: Climatic loads*

ISO 16750–5, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 5: Chemical loads*

IEC 60068–2–70, *Environmental testing — Part 2: Tests — Test Xb: Abrasion of markings and letterings caused by rubbing of fingers and hands*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16750-1, ISO 8820-1 and the following apply.

3.1
absolute breaking capacity
value of prospective breaking current that a circuit breaker is capable of breaking at least once at U_{Smax} under prescribed conditions of use and behaviour

3.2
breaking capacity
I_B
value of prospective breaking current a circuit breaker is capable of breaking several times at U_{Smax} under prescribed conditions of use and behaviour

3.3
circuit breaker
overcurrent protection device that mechanically interrupts the circuit reversibly, responsive to electric current

Note 1 to entry: The test fixture for the circuit breaker may be identical to the test fixture as described in the appropriate part of ISO 8820; however, some circuit breaker designs do not require a separate test fixture as the cables are directly connected to the circuit breaker terminals.

3.4 Circuit breaker components

3.4.1
housing
electrically non-conductive mechanical support for conductive and non-conductive parts of the *circuit breaker* (3.3)

3.4.2
terminal
part of the *circuit breaker* (3.3) which makes the electrical connection in the electrical circuit

3.4.3
time delayed element
active part that acts depending on the current and causes the reversible interruption of the circuit in the case of an overcurrent

3.5 Circuit breaker features

3.5.1
reset mechanism
provides a user interface in a manual reset *circuit breaker* (3.3) for resetting the device after an overcurrent condition

3.5.2
snap-action mechanism
ensures that the contact closing speed by mechanical reset is independent of the speed of operation of the *reset mechanism* (3.5.1)

3.5.3
switching mechanism
provides the ability to switch off the *circuit breaker* (3.3) by mechanical means

3.5.4
trip mechanism
comprises a time delayed actuator and mechanical components

3.5.4.1
cycling trip free
circuit breaker mechanism that cycles to open and close the contact(s) repeatedly if the actuator is maintained in the "*ON*" position in case of overcurrent

3.5.4.2
fully trip free
circuit breaker mechanism that will cause the moving contact(s) to open and remain open, even if the actuator is maintained in the "*ON*" position in case of overcurrent

3.5.5
trip free mechanism
prevents the *switching mechanism* (3.5.3) from being defeated by forcibly holding the actuator "*ON*" position, i.e. cannot be held closed against an overload

3.6 Circuit breaker types

3.6.1
type I – automatic reset
provides the reversal of an overcurrent condition after a cool-down period without any manual activity required by a user

3.6.2
type II – electrically reset
has a secondary heating circuit which, after an overcurrent condition occurs, creates heat internally upon the *time delayed element* (3.4.3) of the *circuit breaker* (3.3) to keep it from reversing as long as electrical system voltage and a small current flow (<1,0 A) is available, reset function is accomplished by removing all electrical power supplied to the circuit breaker until the internal thermal element cools down and returns to its conductive position

3.6.3
type III – manual reset

contains a *reset mechanism* (3.5.1) that the user is required to operate manually for reversal of a circuit interruption

3.6.4
type IV – switchable
mechanism like type III additionally capable of being switched off manually for user testing or maintenance

3.7
dielectric strength
strength measured between specified measuring points, as shown in the appropriate parts of ISO 10924, at a specified voltage without flash-over

3.8
nominal voltage
U_N
voltage value used to describe the electrical system of a vehicle

[SOURCE: ISO 16750-1:2006, 3.1]

3.9
operating time
time between the application of an overcurrent and the moment when the current drops below a value as specified in the appropriate part of ISO 8820

[SOURCE: ISO 8820-1:2014, 3.7]

3.10
operating time rating
operating time (3.9), as a function of the current under defined test conditions

[SOURCE: ISO 8820-1:2014, 3.8]

3.11
prospective current
I_P
current, which would flow in a circuit, if the *circuit breaker* (3.3) would be replaced by a conductor with negligible impedance

Note 1 to entry: See Figure B.1.

3.12
rated current
I_R
current used for identifying the *circuit breaker* (3.3), according to specified tests

Note 1 to entry: The continuous current can be lower than the rated current.

3.13
rated voltage
U_R
maximum supply voltage for which the circuit breaker is designed

[SOURCE: ISO 8820-1:2014, 3.10]

3.14
rerating factor
correction factor of *rated current* (3.14) that consider fluctuations in ambient temperature

3.15
resetting time
time elapsed between a *circuit breaker* (3.3) tripping due to an overcurrent and subsequently reaching the ability of the circuit breaker to be reset

3.16
selectivity
primary interruption of the *circuit breaker* (3.3) placed closest to faulty section

3.17
supply voltage maximum
U_{Smax}
highest supply voltage in the specified supply voltage range of the DUT performing class A

[SOURCE: ISO 16750-1:2006, 3.4]

3.18
time constant
time required for a physical quantity to rise from 0 to 1 – 1/*e* (that id 63,2 %) of its final steady value when it varies with time, *t*, as $1 - 1^{-kt}$

Note 1 to entry: The continuous current is lower than the *rated current* (3.14).

[SOURCE: ISO 8820-1:2014, 3.13]

3.19
test voltage
voltage(s) applied to the DUT during a test

[SOURCE: ISO 16750-1:2006, 3.7]

3.20
voltage drop
U_D
voltage measured between specified measuring points at a specified current

[SOURCE: ISO 8820-1:2014, 3.14]

4 Marking, labelling and colour coding

The circuit breakers shall be permanently marked with the following to be externally visible:

— rated current (I_R) in Ampere (A), the value of the rated current (I_R) without unit is accepted;

— supply voltage maximum (U_{Smax}) in (V);

— colour coding;

— manufacturer's name, trademark and/or symbol;

— part no. or identification.

5 Tests and requirements

5.1 General

5.1.1 General test conditions

If not otherwise specified, all tests shall be performed at room temperature (RT) (23 ± 5) °C at a relative humidity (RH) of 45 % to 75 % (standard condition).

At the beginning of the electrical tests, a direct current shall be fixed at the rated value. This current shall be measured with an appropriate method. If not otherwise specified, no further adjustments during the tests are allowed.

All electrical measurement equipment shall have a tolerance of less than ±2 %.

Mount the circuit breaker in a test fixture (holder) as specified in the applicable part of ISO 10924.

For appropriate cable sizes, see the applicable part of ISO 10924.

Temperature measurements shall be performed at no forced air flow.

Connections shall be made to the circuit breaker with copper cables according to ISO 6722-1. The cable length between the test fixture and the rest of the test set-up shall be (500 ± 50) mm, if not otherwise specified.

Measure the connection resistance using a dummy with dimensions as specified in the appropriate part of ISO 10924. Use a current as specified in the appropriate part of ISO 10924 for this measurement. For the used voltages, see Table 1.