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Road vehicles — Circuit breakers —

Part 1: Definitions and general test requirements

Véhicules routiers — Coupe-circuits —

Partie 1: Définitions et exigences générales d'essai

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 10924-1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

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

— *Part 1: Definitions and general test requirements*

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

The following part is under preparation:

— *Part 2: User's guide*

The following parts are planned:

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

— *Part 5: High current circuit breakers with tabs (Blade type), Form CB29*

— *Part 6: Circuit breakers with bolt-in contacts*

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 or 24 V.

This part of ISO 10924 is intended to be used in conjunction with other parts 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 referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6722, *Road vehicles — 60 V and 600 V single-core cables — Dimensions, test methods and requirements*

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*

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

NOTE The test fixture for the circuit breaker might 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.

3.2 Circuit breaker types

3.2.1
type I – automatic reset
mechanism that provides the reversal of an over-load condition after a cool-down period without any manual activity required by a user

3.2.2
type II – electrically reset
mechanism having a secondary heating circuit which, after an over-load condition occurs, creates heat internally upon the thermal element of the circuit breaker to keep it from reversing, as long as electrical system voltage and a small current flow (< 1,0 A) are available

NOTE The 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.

3.2.3
type III – manual reset
reset mechanism to enable the user by manual operation to reverse of a circuit interruption

3.2.4
type IV – switchable
mechanism for manual switch off for testing or maintenance

3.3 Circuit breaker components

3.3.1
housing
electrically non-conductive mechanical support for conductive and non-conductive parts of the circuit breaker

3.3.2
terminal
part of the circuit breaker that makes the electrical connection in the electrical circuit

3.3.3
thermal element
active part that monitors the current and causes the reversible interruption of the circuit in the case of an overcurrent

3.4 Circuit breaker features

3.4.1
snap-action mechanism
mechanism that ensures that the contact closing speed by mechanical reset is independent of the speed of operation of the reset mechanism

3.4.2
reset mechanism
mechanism that provides a user interface in a manual reset circuit breaker for resetting the device after an overcurrent condition

3.4.3
trip mechanism
mechanism that comprises a thermal actuator and mechanical components

3.4.4
switching mechanism
mechanism that provides the ability to switch off the circuit breaker by mechanical means

3.4.5
trip free mechanism
mechanism that prevents the switching mechanism from being defeated by forcibly holding the actuator in the "ON" position

NOTE In other words, it cannot be held closed against an overload.

3.4.5.1
cycling trip free mechanism
mechanism that cycles to open and close the contact(s) repeatedly if the actuator is maintained in the "ON" position in case of overcurrent

3.4.5.2
fully trip free mechanism
mechanism that enables 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
rated current
I_R
current used for identifying the circuit breaker, according to specified tests

NOTE 1 The continuous current is lower than the rated current.

NOTE 2 Adapted from ISO 8820-1:2008, definition 3.2.

3.6
prospective current
I_P
current that would flow in a circuit if the circuit breaker were replaced by a conductor with negligible impedance

NOTE See Figure 2.

3.7
nominal voltage
U_N
voltage value used to describe the electrical system of a vehicle

[ISO 16750-1:2006, definition 3.1]

3.8
supply voltage maximum
U_{Smax}
highest supply voltage in the specified supply voltage range of the DUT performing class A

[ISO 16750-1:2006, definition 3.4]

NOTE DUT: device under test.

3.9
voltage drop
U_D
voltage measured between specified measuring points at a specified current

[ISO 8820-1:2008, definition 3.4]

3.10
absolute breaking capacity
value of prospective breaking current a circuit breaker is capable of breaking at supply voltage maximum under prescribed conditions of use and behaviour

3.11
breaking capacity
value of prospective breaking current a circuit breaker is capable of breaking at rated voltage under prescribed conditions of use and behaviour

NOTE Adapted from ISO 8820-1:2008, definition 3.5.

3.12
time constant
time required for a physical quantity to rise from 0 to 1 – 1/e (i.e. 63,2 %) of its final steady value when it varies with time, t, as $1 - 1^{-kt}$

[ISO 8820-1:2008, definition 3.6]

3.13
operating time
time between the application of an over current and the moment when the current drops below a value, as specified in the appropriate part of ISO 8820

[ISO 8820-1:2008, definition 3.7]

3.14
resetting time
time elapsed between a circuit breaker tripping due to an overcurrent and subsequently reaching the ability of the circuit breaker to be reset

3.15
dielectric strength
strength measured between specified measuring points, as described in the appropriate parts of ISO 10924, at a specified voltage without flash-over

4 Marking, labelling and colour coding

The circuit breakers shall be permanently marked to be externally visible:

— rated current, I_R, expressed in amperes,

— supply voltage maximum, U_{Smax}, expressed in volts,

— colour coding,

— manufacturer's name, trademark or symbol.

The value of the nominal current without unit is accepted.

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 between 45 % and 75 % (standard condition).

At the beginning of the electrical tests, a direct current shall be fixed at the nominal 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 in accordance with ISO 6722. 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 voltages to be used, see Table 1.

Table 1 — Supply voltage maximum, U_{Smax}

Nominal voltage U_N V	Supply voltage maximum U_{Smax} V
12	16
24	32

5.1.2 General performance requirements

The general performance requirements are as follows:

— marking and labelling shall remain legible;

— colour coding shall remain recognizable;

— after testing, the circuit breaker shall be removable from the test fixture by its intended method;

— manual and switchable circuit breakers shall provide for visible evidence of the electrical state.

5.2 Voltage drop

5.2.1 Purpose

The purpose of this test is to define and measure the energy consumption of the circuit breaker which creates a temperature rise.

5.2.2 Test

The circuit breaker shall be loaded with I_R. Measure the temperature at the hottest spot of the housing by using appropriate equipment. After a minimum of 15 min and once the temperature has been stabilized, record the maximum temperature.

5.2.3 Requirement

The maximum voltage drop shall not exceed the values specified in the applicable parts of ISO 10924.

5.3 Maximum housing temperature

5.3.1 Purpose

The purpose of this test is to evaluate the circuit breaker's maximum surface temperature during normal operation.

5.3.2 Test

Subject the circuit breaker to I_R and measure the housing temperature by using a thermocouple attached to the top of the housing. After the current has been flowing for a minimum of 15 min and once the measurement has been stabilized, record the maximum housing temperature.

5.3.3 Requirement

The maximum housing temperature shall be less than 95 °C.

5.4 Environmental conditions

5.4.1 Purpose

The purpose of these tests (mechanical and climatic loads) is to evaluate the ability of the circuit breaker to function under environmental stresses.

5.4.2 Mechanical loads

5.4.2.1 Test

If mechanical load tests are required, appropriate tests shall be chosen from ISO 16750-3, which shall be agreed between the circuit breaker manufacturer and vehicle manufacturer.

NOTE The rating values are taken into account.

5.4.2.2 Requirement

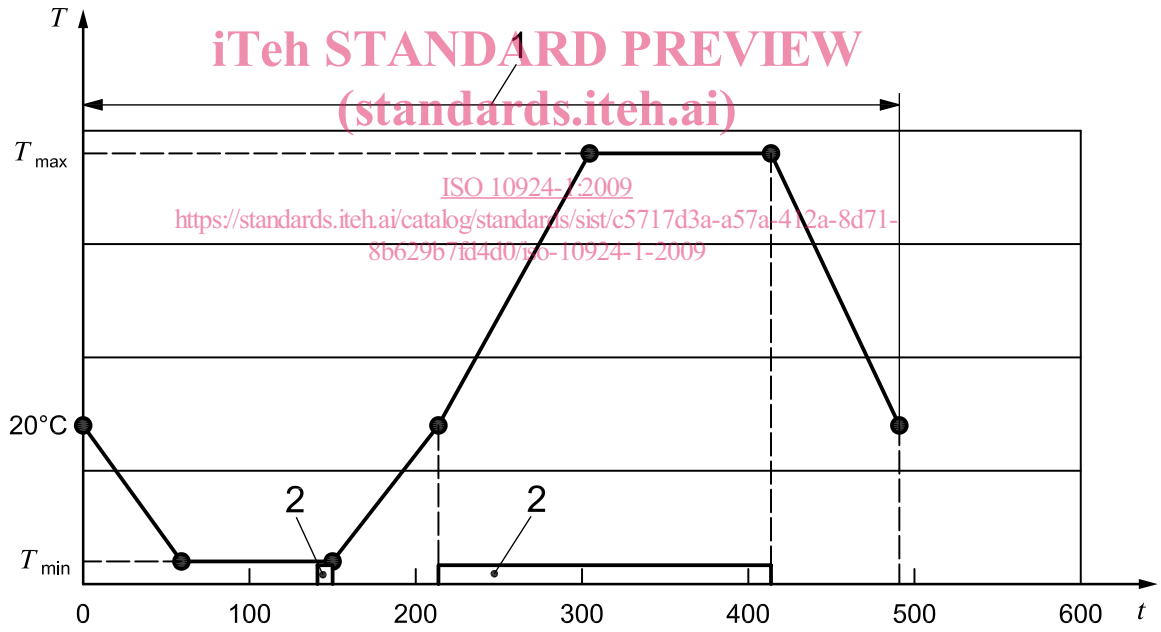
After the mechanical load tests, the circuit breaker shall meet the requirements specified in the applicable parts of ISO 10924.

5.4.3 Climatic loads

5.4.3.1 Test

See ISO 16750-4.

Subject the circuit breaker to a temperature/humidity cycling test as specified in Figure 1. The temperature range shall be in accordance with code G in ISO 16750-4.



Key

1 one cycle
2 operating mode 3.2, in accordance with ISO 16750-1
T temperature, in °C
t time, in min

NOTE See also ISO 16750-4.

Figure 1 — Temperature/humidity cycling