International Standard

ISO 10924-1

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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Foreword

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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 document 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).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 32, *Electrical and electronic components and general system aspects*.

This third edition cancels and replaces the second edition (ISO 10924-1:2016), which has been technically revised.

The main changes are as follows:

— in Clause 3 definition of insulation resistance was added;

— in Table 1 more details at the tolerances of measurement values were added;

— in Table 2 the test voltage of the DC power supply u_t was added;

— in 5.8.2 and 5.8.3 the test and requirements for absolute breaking capacity were clarified;

— in 5.9.2 and 5.9.3 the test and requirements for breaking capacity were clarified;

— in 5.11.3 the requirements for endurance were clarified;

— in Annex B Figure B.2 was added;

— Annex C the temperature rise test was added.

A list of all parts in the ISO 10924 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Road vehicles — Circuit breakers —

Part 1:
Definitions and general test requirements

1 Scope

This document defines terms and specifies general test requirements for circuit breakers for use in road vehicles with a nominal voltage of 12 V (DC), 24 V (DC), 48 V (DC) and 450 V (DC).

This document is intended to be used in conjunction with ISO 10924-2, ISO 10924-3, ISO 10924-4 and ISO 10924-5. The numbering of its clauses corresponds to that of the document whose requirements are applicable, except where modified by requirements particular to this document.

This document is not applicable to circuit breaker holders (electrical centres or fuse-holders) used in vehicles.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 6722-1[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 10924-2, *Road vehicles — Circuit breakers — Part 2: Guidance for users*

ISO 10924-3:2025, *Road vehicles — Circuit breakers — Part 3: Miniature circuit breakers with tabs (Blade type), Form CB11*

ISO 10924-4:2025, *Road vehicles — Circuit breakers — Part 4: Medium circuit breakers with tabs (Blade type), Form CB15*

ISO 10924-5:2025, *Road vehicles — Circuit breakers — Part 5: Circuit breakers with bolt with rated voltage of 450 V*

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*

1) Withdrawn standard.

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.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
absolute breaking capacity
value of prospective breaking current that a *circuit breaker* (3.3) 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* (3.3) 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 ISO 8820-3. However, some circuit breaker designs do not require a separate test fixture as the cables are directly connected to the circuit breaker *terminals* (3.4.2).

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

3.5.5
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

3.5.6
fully trip free
circuit breaker mechanism that causes the moving contact(s) to open and remain open, even if the actuator is maintained in the "ON" position in case of overcurrent

3.5.7
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
device that 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
device that is opened by overcurrent and remains open as long as a minimum voltage and current is available to the affected circuit

Note 1 to entry: The type II circuit breaker 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 the electrical system voltage and a small current flow (<1,0 A) is available, 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.

3.6.3
type III
manual reset
device that contains a *reset mechanism* (3.5.1) that the user is required to operate manually to reverse a circuit interruption

3.6.4
type IV
switchable
device that contains a mechanism like *type III* (3.6.3) and 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 ISO 10924-3, ISO 10924-4 and ISO 10924-5, at a specified voltage without disruptive discharge

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

[SOURCE: ISO 16750-1:2023, 3.13, modified — "12/24 V electrical system" has been replaced by "electrical system".]

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 the ISO 8820 series

[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 for the test circuit.

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* (3.3) is designed

3.14
rerating factor
correction factor of *rated current* (3.12) 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 the faulty section