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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrical relays – Tests and measurements – Part 17: Shock, acceleration and vibration

Relais électriques – Essais et mesurages – Partie 17: Chocs, accélération et vibrations

IEC 63522-17:2024-12(en-fr)

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ELECTRICAL RELAYS – TESTS AND MEASUREMENTS –

Part 17: Shock, acceleration and vibration

FOREWORD

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IEC 63522-17 has been prepared by IEC technical committee 94: Electrical relays. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
94/1053/FDIS	94/1082/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts of the IEC 63522 series, published under the general title *Electrical relays – Tests and measurements*, can be found on the IEC website.

The French version of this standard has not been voted upon.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

ELECTRICAL RELAYS – TESTS AND MEASUREMENTS –

Part 17: Shock, acceleration and vibration

1 Scope

This document is used for testing electromechanical elementary relays (electromechanical relays, reed relays, reed contacts, reed switches and technology combinations of these) and for evaluating their ability to perform under expected conditions of transportation, storage and all aspects of operational use.

This document defines a standard test method to simulate the mechanical stress on relays as it can occur in service, during handling or during transportation. This document comprises test procedures to simulate shock impacts, steady acceleration environments (such as moving vehicles, aircraft and projectiles) as well as vibration conditions.

The tests are generally intended to be carried out with devices under test (DUTs) without packaging. However, if the packaging is considered an essential part of the DUT, then the defined tests can be carried out with packaging as well.

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.

IEC 60068-2-6:2007, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-7:1983, *Basic environmental testing procedures – Part 2-7: Tests – Test Ga and guidance: Acceleration, steady state*
IEC 60068-2-7:1983/AMD1:1986

IEC 60068-2-27:2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-64:2008, *Environmental testing – Part 2-64: Tests – Test Fh: Vibration, broadband random and guidance*
IEC 60068-2-64:2008/AMD1:2019

IEC 63522-0:—, *Electrical relays – Tests and measurements – Part 0: Testing – General and guidance*[1]

IEC 63522-1, *Electrical relays – Tests and measurements – Part 1: Visual inspection and check of dimensions*[2]

IEC 63522-5, *Electrical relays – Tests and measurements – Part 5: Insulation resistance*

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[1] First edition under preparation. Stage at the time of publication: IEC CDV 63522-0:2024.

[2] First edition under preparation. Stage at the time of publication: IEC CDV 63522-1:2023.

IEC 63522-6, *Electrical relays – Tests and measurements – Part 6: Contact-circuit resistance (or voltage drop)*

IEC 63522-7, *Electrical relays – Tests and measurements – Part 7: Functional tests*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 63522-0 apply.

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

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

4 Test procedure

4.1 General

4.1.1 General purpose

This document defines three different test procedures, for:

- shock,
- acceleration, and
- vibration.

Those procedures provide evidence about the structural integrity of DUTs and their electromechanical design robustness. Based on the chosen test severity, the procedures may also be used to deliberately reveal mechanical weaknesses of DUTs and allow grouping of parts according to their stress resistance levels.

Shock tests may be used to characterize the robustness of the DUT with regard to transportation impacts (e.g. drop events, handling) or whenever the application is subject to rather infrequent shock impacts. Shocks create a wide-band excitation of the relays, not limited to specific frequencies. By that, the shock test also helps to understand the structural integrity of the DUT, if it is tested without packaging.

Acceleration tests may be used to characterise the robustness of the DUT with regard to continuous acceleration stress during its service life. Typical applications are aircrafts, rotating machinery as well as the automotive sector. The acceleration tests represent permanent steady forces to the DUT interior, giving insight into its structural integrity.

Vibration tests may be used to characterise the robustness of the DUT with regard to expected frequency ranges, by provoking particular resonance frequencies. This may be relevant for automotive applications as well as any kind of transportation stress. Further, environmental conditions like in off-shore installations may create significant vibrations in relays throughout life as well as rotating machines or any moving equipment near any relay installation. The vibration tests apply sine-wave forces to the DUT and its interior, creating a particular stress on any joints and connection elements between the structural components.

4.1.2 General conditions

The tests stated in this document shall be carried out with appropriate test conditions and severities, as well as suitable measurements conditions.

The DUT under test shall be in a new and clean condition, mounted as in service or as specified by the manufacturer. If agreed, the tests may be carried out also on DUTs that are or have been in service. The condition of the DUT is to be defined and stated in the report.

The test shall be performed under applicable reference conditions given in IEC 63522-0:—[3], 4.4.

The shaker orientation may be chosen based on the DUT properties to be vertical or horizontal. Due to the influence of gravity, the results can differ between vertical and horizontal excitation of the same DUT.

The energization of the test coil shall be at the lower limit of the operative range unless otherwise stated by the manufacturer or requested by the following procedures in 4.2, 4.3 and 4.4

Standard conditions of shock and vibration to which the DUT can be exposed to shall be specified in the product standard. Alternatively, they shall be subject to an agreement between the user and the manufacturer, when there are special requirements for other applications. Examples for conditions in dedicated applications and relay categories are:

- Reed relays: IEC 61810-4:2020, Annex Q;
- High-capacity relays: IEC 61810-10:2019, Annex T;
- Railway applications: IEC 61373;
- Conditions for road vehicles: ISO 16750-3.

4.2 Shock

4.2.1 Purpose

The purpose of this test is to prove the capability of the DUT to function during and/or after non-repetitive shocks encountered in service, during handling or during transportation.

4.2.2 Procedure

4.2.2.1 General

The test shall be conducted in accordance with IEC 60068-2-27, according to test Ea of the basic environmental testing procedures.

Preferred severity levels are 3, 100, 500, 1 000 or 5 000 shocks in each direction, conducted with the half-sine pulse shape. If not defined otherwise by the application requirements, 3 shocks in each direction shall be the minimum. However, other test repetitions and shock profiles may be chosen in accordance with IEC 60068-2-27.

NOTE Previous editions of IEC 61810-7 included information on bump testing. This is now removed following the withdrawal of IEC 60068-2-29. Equivalent stresses can also be covered by definition of shock tests. In addition, specific transportation tests can be specified between manufacturer and customer. For example, in the America region, the ISTA (International Safe Transit Association) specifies several integrity tests like 1A, comprising a sequence of vibration and shock (by drop or other means).

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[3] First edition under preparation. Stage at the time of publication: IEC CDV 63522-0:2024.

4.2.2.2 Method 1: Capability to function during shocks

During this test, the DUT shall be subjected to one series of shocks while being in its operate condition and one further series while being in its release/reset condition. Both series of tests shall be performed in both directions of each of the three mutually perpendicular axes.

The DUTs shall be energized as defined in 4.2.3 i) unless otherwise specified by the manufacturer.

During the test, the contact state shall be electrically monitored in accordance with IEC 63522-0.

4.2.2.3 Method 2: Capability to function after shocks

During this test, the DUT shall be subjected to a series of shocks in both directions of each of the three mutually perpendicular axes. The DUT shall not be energized, and the contacts shall not be monitored.

4.2.3 Conditions

The conditions to be specified in addition to those of 4.1.2 are the following:

a) method 1 or 2 according to 4.2.2.2 or 4.2.2.3;

b) number of DUTs to be tested;

c) pulse shape, peak acceleration and duration shall be chosen from Table 1 of IEC 60068-2-27:2008, with a half-sine wave of 11 ms as a preferred pulse shape. IEC 60068-2-27:2008, Table 1 provides recommendations for degrees of test severity;

d) number of shocks, preferred values are 3, 100, 500, 1 000 or 5 000 shocks;

e) coordinate system for the test. The axis shall be aligned with the DUT body edges and create a cartesian coordinate system, following the right-hand rule. An example is shown in Annex A;

f) shaker orientation;

g) method of mounting of the DUT to the shaker, as agreed with the manufacturer. Change of DUT orientation between tests of different shock axis shall avoid any impacts to test sample conditions;

h) permitted duration of opening or closing and details of monitoring device, preferred duration is 10 µs (alternative recommended values are 100 µs, 1 ms, and 10 ms). The contact action shall be monitored in accordance with IEC 63522-0 (e.g., by a measuring and indicating device as described in IEC 63522-0:—[4], A.2.4, for open DUTs to detect making contact and for closed DUTs to detect micro-interruptions);

i) for method 1 according to 4.2.2.2:

- energization value, preferably the lower limit of the operative range (for monostable and bistable DUTs),
- contact load, if required.

4.3 Acceleration

4.3.1 Purpose

The purpose of this test is to prove the capability of the DUT to function during and/or after being subjected to forces produced by steady acceleration environments (such as moving vehicles, aircraft, and projectiles).

4 First edition under preparation. Stage at the time of publication: IEC CDV 63522-0:2024.

4.3.2 Procedure

4.3.2.1 General

This test shall be carried out in accordance with IEC 60068-2-7, test Ga of the basic environmental testing procedures.

4.3.2.2 Method 1: Capability to function during acceleration

During this test, the DUT shall be in its operate condition for 50 % of the time of exposure. During the remaining 50 % of the time of exposure, the DUT shall be in its release/reset condition. Both exposures shall be performed in both directions of each of the three mutually perpendicular axes.

The DUTs shall be energized as defined in 4.3.3 i) unless otherwise specified by the manufacturer.

During the test, the contact state shall be electrically monitored in accordance with IEC 63522-0.

4.3.2.3 Method 2: Capability to function after acceleration

During this test, the DUT shall be subjected to the required acceleration in both directions of each of the three mutually perpendicular axes. The DUT shall not be energized, and the contacts shall not be monitored.

4.3.3 Conditions

The conditions to be specified in addition to those of 4.1.2 are the following:

a) method 1 or 2;

b) number of DUTs to be tested;

c) acceleration level;

d) duration, if other than 10 s;

e) other characteristics given in IEC 60068-2-7:1983, Clause 8;

f) coordinate system for the test. The axis shall be aligned with the DUT body edges and create a cartesian coordinate system, following the right-hand rule. An example is shown in Annex A;

g) shaker orientation;

h) method of mounting of the DUT directly on the shaker plate as prescribed by the manufacturer, an easy changeover for orientation should be targeted (to avoid DUT manipulation during changeover);

i) for method 1 only:

- energization value, preferably the lower limit of the operative range (for monostable and bistable DUTs),
- contact load, if required;

j) permitted duration of opening or closing and details of monitoring device, preferred duration is 10 µs (alternative recommended values are 100 µs, 1 ms and 10 ms). The contact action shall be monitored in accordance with IEC 63522-0 (e.g., by a measuring and indicating device as described in IEC 63522-0:—[5], A.2.4, for open DUTs to detect making contact and for closed DUTs to detect micro-interruptions).

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5 First edition under preparation. Stage at the time of publication: IEC CDV 63522-0:2024.