IEC 63522-39

Edition 1.0 2025-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrical relays – Tests and measurements –
Part 39: Insertion and withdrawal force

Relais électriques – Essais et mesurages –
Partie 39: Force d'insertion et de retrait

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ELECTRICAL RELAYS – TESTS AND MEASUREMENTS –

Part 39: Insertion and withdrawal force

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IEC 63522-39 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
94/1075/FDIS	94/1123/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.

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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 in the IEC 63522 series, published under the general title *Electrical relays – Tests and measurements*, can be found on the IEC website.

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

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ELECTRICAL RELAYS – TESTS AND MEASUREMENTS –

Part 39: Insertion and withdrawal force

1 Scope

This part of IEC 63522 is used for testing electromechanical elementary relays (electromechanical relays, reed relays, reed contacts, reed switches and technology combination of these) and shall evaluate their ability to perform under expected conditions of transportation, storage and all aspects of operational use.

This document defines standard test methods for:

1) measuring the insertion and withdrawal forces of the mating relay and socket;
2) measuring the insertion and withdrawal forces on relays with flat quickconnect terminations;
3) verifying the correct connection of flat terminals with eye lug connectors.

2 Normative references

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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 61210:2010, *Connecting devices – Flat quick-connect terminations for electric copper conductors – Safety requirements*

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IEC 61810-1:2015, *Electromechanical elementary relays – Part 1: General and safety requirements*
IEC 61810-1:2015/AMD1:2019

IEC 61984:2008, *Connectors – Safety requirements and tests*

IEC 63522-0, *Electrical relays –Tests and measurements – Part 0 Testing general*[1]

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

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[1] Under preparation. Stage at the time of publication: IEC CCDV 63522-0:2024.

[2] Under preparation. Stage at the time of publication: IEC RFDIS 63522-1:2025.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 63522-0[3] 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 Insertion and withdrawal force on mating relay and socket

4.1.1 Purpose

These tests are applicable to all elementary relays according to IEC 61810-1 used in conjunction with sockets according to IEC 61984. The specimen shall consist of a mating pair of relay and socket with all terminations in place.

This document defines a method to measure the insertion and withdrawal forces of the mating relay and socket, both in order to prevent damage to components during insertion or withdrawal and with the purpose to set or test minimum requirements for reliability for a mating set.

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4.1.2 Procedure

The insertion and withdrawal forces of the mating relay and socket shall be tested in the following way, in accordance with IEC 60512-13-2:

– Visual examination shall be done. There shall be no defects that would impair the validity of the test.

– The sockets shall be rigidly fixed in normal working position (e.g. on IEC 60715 mounting rail). The relays shall be fully inserted into the sockets and withdrawn from them, without the effect of any locking, latching, sealing, engaging, separating, or similar device, in a normal manner unless special instructions are given in the detail specification.

– The forces to fully insert and withdraw the relay into the socket shall be measured. This shall be done as many times as required by the detail specification. At a minimum, the forces for the first and last cycles shall be recorded.

– In order to determine the correct mating, an appropriate signalling method (like an LED) will be used.

4.1.3 Conditions

The conditions to be specified in the detail specification are the following:

a) maximum value of the insertion force;
b) maximum and minimum values of the withdrawal force;
c) difference from the forces for initial and final cycle, if different from 50 %
d) number of insertion and withdrawal cycles;
e) speed rate of insertion and withdrawal, if necessary;
f) description of test groups, if applicable;
g) description of test unit, if applicable;

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[3] Under preparation. Stage at the time of publication: IEC CCDV 63522-0:2024.

h) description of the lubricant and modality of its application, if applicable;

i) mounting position of sockets.

4.2 Insertion and withdrawal force on relays with flat quickconnect terminations

4.2.1 Purpose

These tests are applicable to all elementary relays with flat quickconnect terminations compliant with IEC 61210:2010.

This document defines a method to measure the insertion and withdrawal forces of standard female (male) connectors into relay male (female) terminations.

4.2.2 Procedure

Unless otherwise specified in the detail specification, a minimum of 3 relays, for a total of a minimum of 12 terminals, will be used. Each relay male (female) terminal will be tested with a new female (male) connector.

For each combination, the female (male) connector will be slowly and steadily inserted and withdrawn in the relay terminal 6 times at a rate of travel of approximately 1 mm/s.

Insertion and withdrawal force measurements shall be carried out with any suitable testing device providing accurate alignment and being capable of holding the reading. An example of a suitable device is shown in Annex B of IEC 61210:2010.

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4.2.3 Conditions

The conditions to be specified in the detail specification are the following:

a) tab size;

b) material and surface treatment of the connector

c) any deviation from IEC 61210 requirements on dimensions of flat terminations;

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d) maximum value of the insertion force, if different from Table 1;

e) minimum values of the withdrawal force, if different from Table 1;

f) number of insertion and withdrawal cycles, if different from 6;

g) speed rate of insertion and withdrawal, if necessary;

h) mounting position of relays and means of fixing (e.g. mounting flanges, IEC 60715 mounting rail connector).

4.3 Connection of relays with flat terminations for eye lug connectors

4.3.1 Purpose

These tests are applicable to all elementary relays with flat terminations with a hole, suitable for connections with eye lug connectors through nut and screw.

The purpose of this document is to verify that the connection with a wire terminated with an eye lug connector does not cause any modification on the relays (especially to the contact adjustment) due to the relevant tightening torque used for fixing the screw.

4.3.2 Procedure

Unless otherwise specified in the detail specification, a minimum of 3 relays, for a total of a minimum of 12 terminals, will be used.

With a suitable method, possibly the 4-wire method, the resistance of the connection shall be measured before, during and after the tightening of the screw.

4.3.3 Conditions

The conditions to be specified in the detail specification are the following:

a) screw diameter and thread;
b) material and surface treatment of the connector;
c) tightening torque;
d) mounting position of relays and means of fixing (e.g. mounting flanges, IEC 60715 mounting rail connector).

5 Evaluation

5.1 General

5.1.1 Insertion and withdrawal force on mating relay and socket

Visual examination shall be performed according to IEC 63522-1, with 10 × magnifications, at least at the beginning and at the end of the test. Any defects, which would impair the normal functioning of relay and socket connectors, shall be documented.

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NOTE X-ray or cutting image can be used for detailed evaluation.

The difference between the forces for the initial (I) and final (F) cycle shall be recorded. The force for the final cycle F shall be in the interval F = I ± 50 %, unless otherwise specified in the detail specification (see list item 4.3.3 c).

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5.1.2 Insertion and withdrawal force on relays with flat quickconnect terminations

Unless otherwise specified in the detail specification, the insertion and withdrawal forces shall be within the limits as specified in Table 1.

Table 1 – Insertion and withdrawal forces

Size	Insertion force	Sixth withdrawal force
mm	N	N
	Maximum	**Minimum**
2,8 mm	53	5
4,8 mm	67	9
6,3 mm	80	18
9,5 mm	100	20

5.1.3 Connection of relays with flat terminations for eye lug

The resistance of the connection shall not vary more than 10 % (unless otherwise specified in the detail specification), during all the procedure.