

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Electromechanical elementary relays –  
Part 3: Relays with forcibly guided (mechanically linked) contacts**

**Relais électromécaniques élémentaires –  
Partie 3: Relais à contacts guidés (liés mécaniquement)**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTROMECHANICAL ELEMENTARY RELAYS –****Part 3: Relays with forcibly guided (mechanically linked) contacts**

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International Standard IEC 61810-3 has been prepared by IEC technical committee 94: All-or-nothing electrical relays.

The content of this standard was already published in EN 50205:2002. The revisions in this standard only involve editorial changes and update of references.

The text of this standard is based on the following documents:

FDIS	Report on voting
94/378/FDIS	94/382/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of IEC 61810 series, published under the general title *Electromechanical elementary relays* can be found on the IEC website.

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

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## INTRODUCTION

This Standard applies to elementary relays in which special design and constructional measures are used to ensure that make (normally-open) contacts cannot assume the same state as break (normally-closed) contacts. These relays can be used in self-monitoring control systems, e.g. safety-related control systems.

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## ELECTROMECHANICAL ELEMENTARY RELAYS –

### Part 3: Relays with forcibly guided (mechanically linked) contacts

#### 1 Scope

This part of IEC 61810 specifies special requirements and tests for elementary relays with forcibly guided contacts, also known as mechanically linked contacts. These special requirements apply in addition to the general requirements of IEC 61810-1.

NOTE 1 This standard does not apply to electromechanical control circuit devices as described in IEC 60947-5-1.

NOTE 2 IEC 61810-2-1 provides guidelines for the assignment of reliability values.

NOTE 3 Contacts that are not mechanically linked (forcibly guided) are not considered in this standard.

#### 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.

IEC 60947-5-1, *Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices*

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

IEC 61810-7, *Electromechanical elementary relays – Part 7: Test and measurement procedures*

#### 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

##### 3.1

##### **elementary relay**

non-specified time all-or-nothing relay

Note 1 to entry: In this document the word “elementary” is sometimes omitted for clarity.

[SOURCE: IEC 60050-444:2002, 444-01-03, modified – modification of the definition]

##### 3.2

##### **failure to open**

fault condition when a contact does not open when expected to do so

##### 3.3

##### **failure criteria**

specified conditions to judge if a fault or malfunction is a failure



**3.4****fault****fault condition**

deviation of the existing condition from the expected condition

**3.5****failure**

termination of the ability of an item to perform a required function as defined in the failure criteria

**3.6****relay with mechanically linked contacts****relay with forcibly guided contacts**

elementary relay with at least one make contact and at least one break contact and including mechanical measures to prevent any make contact(s) and any break contact(s) being in the closed position simultaneously

**3.7****type A**

relay in which all contacts are mechanically linked

**3.8****type B**

relay containing contacts that are mechanically linked to each other as well as contacts that are not mechanically linked

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**4 Functional requirements**

IEC 61810-3:2015

**4.1 Forcibly guided (mechanically linked) operation**

The relay shall be designed such that if a make contact is closed, none of the mechanically linked break contacts can close and that if a break contact is closed, none of the mechanically linked make contacts can close. These requirements apply throughout the lifetime of the relay and under reasonably foreseeable failure conditions.

The effects of reasonably foreseeable breakage of and/or wear to parts of the elementary relay shall not nullify the function of forcibly guided (mechanically linked) operation.

Contact gaps of open contacts shall be greater than 0,5 mm for single break contacts and 0,3 mm each for double break contacts throughout the manufacturer's specified endurance of the relay.

Operation of forcibly guided (mechanically linked) contacts means that if any make contact fails to open when the relay is de-energized, none of the break contacts shall close. If any break contact fails to open when the relay is energized, no make contact shall close.

**4.2 Changeover contacts**

Only break contacts and make contacts are covered by this standard; in the case of relays that include changeover contacts, either the make circuit or the break circuit of a changeover contact can be considered to meet the requirements of this standard.

Changeover contacts shall be break-before-make. It shall be assured that the forcibly guided operation is maintained, as described under the fault conditions described in 5.1.

NOTE Special care is taken in the design of the application to ensure that the integrity of the safety-related circuit is maintained in the event of a failure.

### 4.3 Mechanical endurance

Elementary relays containing forcibly guided (mechanically linked) contacts shall have a mechanical endurance of at least  $10^7$  operating cycles.

### 4.4 Electrical endurance

The electrical endurance shall be as specified by the manufacturer in accordance with IEC 61810-1.

### 4.5 Operating conditions

#### 4.5.1 Ambient temperature

Elementary relays with forcibly guided (mechanically linked) contacts shall function correctly over an ambient temperature range of at least  $-10\text{ °C}$  to  $+55\text{ °C}$ .

#### 4.5.2 Energizing quantity

Unless otherwise stated by the manufacturer, elementary relays with forcibly guided (mechanically linked) contacts shall at least correspond to class '2' in the operative range of their rated coil voltage (see 5.3.1 of IEC 61810-1:2015).

### 4.6 Characteristic values and marking

#### 4.6.1 Characteristic values

The manufacturer shall state in his documentation the following:

- whether the relay is type A or type B. In the case of type B relays, which contacts are mechanically linked and which contacts are not mechanically linked;
- the vibration resistance over the frequency range at least from  $f = 10\text{ Hz}$  to  $200\text{ Hz}$  (see IEC 61810-7);
- the shock resistance of the relay in accordance with IEC 61810-7;
- the contact load(s) according to IEC 61810-1:2015, Annex B or the utilization category(ies) in accordance with IEC 60947-5-1;

NOTE Commonly utilisation categories AC15 and DC13 are applied.

- the limits of the operative range.

#### 4.6.2 Marking

Relays with forcibly guided (mechanically linked) contacts shall be marked to indicate whether they are type A or type B. If a contact schematic is marked on the relay then the following marking shall be placed adjacent to the schematic.

Type A relays with forcibly guided (mechanically linked) contacts shall be marked either with the words "type A" or with the symbol given in the Figure 1 below:

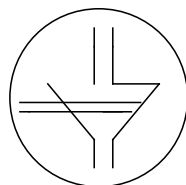


Figure 1 – Symbol for a forcibly guided (mechanically linked) contact set, type A

Type B relays with forcibly guided (mechanically linked) contacts shall be marked either with the words “type B” or with the symbols given in the Figure 2 (Source ISO 7000:2014/Figure 0434) below:

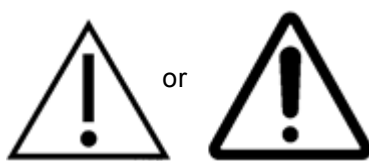


Figure 2 – Symbols for use on type B relays

## 5 Verification and type tests

### 5.1 Design verification

A failure mode and effect analysis shall be performed considering all parts that are involved in the forcibly guided (mechanically linked) operation. The analysis shall consider the breakage and wear of these parts as well as failure to open.

All reasonably foreseeable single faults shall be assumed and their effects considered. If the fault of a part leads directly to a second fault then the two faults shall be considered. If the fault of a part is excluded as a failure criteria, the manufacturer shall justify the exclusion, for example by design calculations or measurements showing over-dimensioning. The failure criteria “spring broken” shall not be excluded.

It shall be considered whether, in case any electrically conductive parts break or come loose, the construction of the elementary relay prevents any short-circuits or conductive connections from occurring which would nullify the function of forcibly guided (mechanically linked) operation.

NOTE 1 Bridging by conductive parts can be prevented by such means as, for example, insulation or other appropriate methods applied between the conducting parts.

NOTE 2 Examples of conductive parts are contacts, contact springs and return springs.

The failure of movable functional parts as a result of, for example, breakage or wear shall be considered and the result expected shall be evaluated.

NOTE 3 An example of a movable functional part is the actuator of the contact set.

### 5.2 Type tests

Type tests shall be performed to verify the function of forcibly guided (mechanically linked) operation.

The tests shall be performed on new relays and also on relays that have been subjected to the electrical and mechanical endurance tests.

The test shall be conducted by simulating the welding of a contact of the elementary relay. The simulated welding shall be performed under worst case conditions using a separate sample for each make contact and each break contact. A separate sample shall be used for each simulated contact welding unless it can be demonstrated by analysis that a reduced number of samples will give an equivalent test result.

Welding of the contacts shall be simulated by such means as, for example, soldering the contacts together or using an appropriate glue. The thickness of the contact tips shall not change by more than 0,02 mm as a result of having been soldered or glued. Break contacts