

Electromechanical elementary relays —

Part 1: General requirements

ICS 29.120.70

National foreword

This British Standard is the UK implementation of EN 61810-1:2008. It is identical to IEC 61810-1:2008, incorporating corrigendum February 2010. It supersedes BS EN 61810-1:2004 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/94, General purpose relays and reed contact units.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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English version

**Electromechanical elementary relays -
Part 1: General requirements
(IEC 61810-1:2008)**

Relais électromécaniques élémentaires -
Partie 1: Exigences générales
(CEI 61810-1:2008)

Elektromechanische Elementarrelais -
Teil 1: Allgemeine Anforderungen
(IEC 61810-1:2008)

This European Standard was approved by CENELEC on 2008-05-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 94/267/FDIS, future edition 3 of IEC 61810-1, prepared by IEC TC 94, All-or-nothing electrical relays, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61810-1 on 2008-05-01.

This European Standard supersedes EN 61810-1:2004.

The relevant modifications compared to EN 61810-1:2004 are:

- update of references;
- renumbering of clauses to bring them into a more logical order;
- inclusion of contact load categories (same as in EN 61810-2 and EN 61810-7);
- clarifications concerning electrical endurance (Clause 11);
- inclusion of provisions for insulation coordination in accordance with the basic safety standards EN 60664-3, EN 60664-4 and EN 60664-5 (Clause 13);
- renumbering of all annexes in the order they are referenced in the body of the standard;
- inclusion of new Annex C (normative) for the test set-up, and new Annex D (informative) for special loads (based upon similar annexes in EN 61810-2 and EN 61810-7);
- improvement of Annex B covering inductive contact loads.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2009-02-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2011-05-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61810-1:2008 was approved by CENELEC as a European Standard without any modification.

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ELECTROMECHANICAL ELEMENTARY RELAYS –

Part 1: General requirements

1 Scope

This part of IEC 61810 applies to electromechanical elementary relays (non-specified time all-or-nothing relays) for incorporation into equipment. It defines the basic functional requirements and safety-related aspects for applications in all areas of electrical engineering or electronics, such as:

- general industrial equipment,
- electrical facilities,
- electrical machines,
- electrical appliances for household and similar use,
- information technology and business equipment,
- building automation equipment,
- automation equipment,
- electrical installation equipment,
- medical equipment,
- control equipment,
- telecommunications,
- vehicles,
- transportation (e.g. railways).

Compliance with the requirements of this standard is verified by the type tests indicated.

In case the application of a relay determines additional requirements exceeding those specified in this standard, the relay should be assessed in line with this application in accordance with the relevant IEC standard(s) (e.g. IEC 60730-1, IEC 60335-1, IEC 60950-1).

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.

IEC 60038:1983, *IEC standard voltages*
Amendment 1 (1994)
Amendment 2 (1997)

IEC 60050, *International Electrotechnical Vocabulary*

IEC 60068-2-2:2007, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-17:1994, *Basic environmental testing procedures – Part 2: Tests – Test Q: Sealing*

IEC 60068-2-20:1979, *Basic environmental testing procedures – Part 2: Tests – Test T: Soldering*
Amendment 2 (1987)

IEC 60085:2004, *Electrical insulation – Thermal classification*

IEC 60112:2003, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60364-4-44:2007, *Low voltage electrical installations – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances*

IEC 60417:2007, *Graphical symbols for use on equipment*

IEC 60664-1:2007, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60664-3:2003, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*

IEC 60664-4:2005, *Insulation coordination for equipment within low-voltage systems – Part 4: Consideration of high-frequency voltage stress*

IEC 60664-5:2007, *Insulation coordination for equipment within low-voltage systems – Part 5: Comprehensive method for determining clearances and creepage distances equal to or less than 2 mm*

IEC 60695-2-10:2000, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

IEC 60695-2-11:2000, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products*

IEC 60695-2-12:2000, *Fire hazard testing – Part 2-12: Glowing/hot-wire based test methods – Glow-wire flammability test method for materials*

IEC 60695-2-13:2000, *Fire hazard testing – Part 2-13: Glowing/hot-wire based test methods – Glow-wire ignitability test method for materials*

IEC 60695-10-2:2003, *Fire hazard testing – Part 10-2: Abnormal heat – Ball pressure test*

IEC 60721-3-3:2002, *Classification of environmental conditions – Part 3-3: Classification of groups of environmental parameters and their severities – Stationary use at weatherprotected locations*

Amendment 1 (1995)

Amendment 2 (1996)

IEC 60999-1:1999, *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm² up to 35 mm² (included)*

IEC 61210:1993, *Connecting devices – Flat quick-connect terminations for electrical copper conductors – Safety requirements*

IEC 61760-1:2006, *Surface mounting technology – Part 1: Standard method for the specification of surface mounting components (SMDs)*

IEC 61984:2001, *Connectors – Safety requirements and tests*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050, in particular IEC 60050-444 and the following apply.

An alphabetical list of terms can be found at the end of this standard.

NOTE In the text of this standard, the term *relay* is used instead of *elementary relay* to improve the readability.

3.1 Definitions related to general terms

3.1.1

marking

identification of a relay which, when completely given to the manufacturer of this relay, allows the unambiguous indication of its electrical, mechanical, dimensional and functional parameters

EXAMPLE Through the indication of the trade mark and the type designation on the relay, all relay-specific data can be derived from the type code.

3.1.2

intended use

use of a relay for the purpose for which it was made, and in the manner intended by the manufacturer

3.1.3

relay technology categories

categorization of relays, based upon environmental protection

NOTE Six categories are in use (RT 0 to RT V).

[IEV 444-01-11, modified]

3.1.4

pulse width modulation

PWM

pulse time modulation in which the pulse duration varies in accordance with a given function of the value of the modulating signal

[IEV 702-06-57]

3.2 Definitions of relay types

3.2.1

electrical relay

device designed to produce sudden and predetermined changes in one or more output circuits when certain conditions are fulfilled in the electric input circuits controlling the device

[IEV 444-01-01]

NOTE 1 For the purpose of this standard, output circuits are contact circuits.

NOTE 2 For the purpose of this standard, the term "coil" is used to denote "input circuit", although other types of input circuits are possible.

3.2.2

all-or-nothing relay

electrical relay, which is intended to be energized by a quantity, the value of which is either within its operative range or effectively zero

NOTE "All-or-nothing relays" include both "elementary relays" and "time relays".

[IEV 444-01-02]

3.2.3

elementary relay

all-or-nothing relay which operates and releases without any intentional time delay

[IEV 444-01-03, modified]

3.2.4

electromechanical relay

electrical relay in which the intended response results mainly from the movement of mechanical elements

[IEV 444-01-04]

3.2.5

electromagnetic relay

electromechanical relay in which the designed response is produced by means of electromagnetic forces

[IEV 444-01-05]

3.2.6

monostable relay

electrical relay which, having responded to an energizing quantity and having changed its condition, returns to its previous condition when that quantity is removed

[IEV 444-01-07]

3.2.7

bistable relay

electrical relay which, having responded to an energizing quantity and having changed its condition, remains in that condition after the quantity has been removed; a further appropriate energization is required to make it change its condition

[IEV 444-01-08]

NOTE Bistable relays are also called latching relays.

3.2.8

polarized relay

electrical relay, the change of condition of which depends upon the polarity of its DC energizing quantity

[IEV 444-01-09, modified]

3.2.9

non-polarized relay

electrical relay, the change of condition of which does not depend upon the polarity of its energizing quantity

[IEV 444-01-10]

3.3 Definitions related to conditions and operations

3.3.1

release condition

for a monostable relay, specified condition of the relay when it is not energized; for a bistable relay, one of the specified conditions, as declared by the manufacturer

[IEV 444-02-01]

NOTE See Figure A.1.

3.3.2

operate condition

for a monostable relay, specified condition of the relay when it is energized by the specified energizing quantity and has responded to that quantity; for a bistable relay, the condition other than the release condition as declared by the manufacturer

[IEV 444-02-02]

NOTE See Figure A.1.

3.3.3

operate (verb)

change from the release condition to the operate condition

[IEV 444-02-04]

NOTE See Figure A.1.

3.3.4**release (verb)**

for a monostable relay, change from the operate condition to the release condition

[IEV 444-02-05]

NOTE See Figure A.1.

3.3.5**reset (verb)**

for a bistable relay, change from the operate condition to the release condition

[IEV 444-02-06]

3.3.6**cycle**

operation and subsequent release/reset

[IEV 444-02-11]

3.3.7**frequency of operation**

number of cycles per unit of time

[IEV 444-02-12]

3.3.8**continuous duty**

duty in which the relay remains energized for a period long enough to reach thermal equilibrium

[IEV 444-02-13]

3.3.9**intermittent duty**

duty in which the relay performs a series of identical cycles, the durations in the energized and unenergized conditions being specified; the duration of energization of the relay is such as will not permit the relay to reach thermal equilibrium

[IEV 444-02-14, modified]

3.3.10**temporary duty**

duty in which the relay remains energized for insufficient duration to reach thermal equilibrium, the time intervals of energization being separated by unenergized time intervals of duration sufficient to restore equality of temperature between the relay and the surrounding medium

[IEV 444-02-16]

3.3.11**duty factor**

ratio of the duration of energization to the total period in which intermittent or continuous or temporary duty takes place

NOTE The duty factor can be expressed as a percentage of the total period.

[IEV 444-02-15]

3.3.12**thermal resistance (of the coil)**

quotient of the temperature rise of the relay coil by the input power, measured after a period long enough to reach thermal equilibrium

NOTE The thermal resistance usually is given in K/W.

[IEV 444-02-17]

3.3.13

ambient temperature

temperature(s) prescribed for the air surrounding the relay under certain conditions, when the relay is mounted as indicated by the manufacturer

3.3.14

limiting continuous thermal withstand power

highest steady state value of the applied electric power that a relay can withstand continuously, and under specified conditions, while satisfying specified temperature rise requirements

[IEV 444-03-18, modified]

NOTE Comprises both the applied power at the coil(s) and the contact(s).

3.3.15

thermal equilibrium

variation of less than 1 K between any two out of three consecutive measurements made at an interval of 5 min

3.3.16

rated value

value of a quantity used for specification purposes, established for a specific set of operating conditions

[IEV 444-02-18, modified]

3.3.17

test value

value of a quantity for which the relay shall comply with a specified action during a test

[IEV 444-02-20]

3.3.18

actual value

value of a quantity determined by measurement on a specific relay, during performance of a specified function

[IEV 444-02-21]

3.3.19

mechanical endurance

number of cycles under specified conditions with unloaded contact(s)

[IEV 444-07-10, modified]

3.4 Definitions of operating values

3.4.1

energizing quantity

electrical quantity which, when applied to the coil(s) of a relay under specified conditions, enables it to fulfil its purpose

NOTE For relays, the energizing quantity is usually a voltage. Therefore, the input voltage as energizing quantity is used in the definitions given in 3.4. Where a relay is energized by a given current instead, the respective terms and definitions apply with "current" used instead of "voltage".

[IEV 444-03-01, modified]

3.4.2

operate voltage

set voltage (for bistable relays only)

value of the coil voltage at which a relay operates

[IEV 444-03-06, modified]

3.4.3
operate voltage

U_1

value of the coil voltage at which a relay operates, having previously been energized at that same voltage

NOTE Thermal equilibrium has to be achieved.

3.4.4
limiting voltage

U_2

value of the coil voltage, taking into account the effect of heating due to the power dissipated by the coil(s), which when exceeded may result in a relay failure caused by thermal overload

NOTE Thermal equilibrium has to be achieved.

3.4.5
operative range

range of values of coil voltage for which a relay is able to perform its specified function

[IEV 444-03-05, modified]

3.4.6
release voltage

value of the coil voltage at which a monostable relay releases

[IEV 444-03-08, modified]

3.4.7
reset voltage

value of the coil voltage at which a bistable relay resets

[IEV 444-03-10, modified]

3.5 Definitions related to contacts

For a.c., r.m.s. values for voltage and current are specified, unless otherwise indicated.

3.5.1
contact

arrangement of contact members, with their insulation, which close or open their contact circuit by their relative movement (see Figure A.2)

[IEV 444-04-03]

3.5.2
contact set

combination of contacts within a relay, separated by their insulation (see Figure A.2)

[IEV 444-04-04]

3.5.3
contact gap

gap between the contact points when the contact circuit is open

[IEV 444-04-09]

3.5.4
make contact

contact which is closed when the relay is in its operate condition and which is open when the relay is in its release condition

[IEV 444-04-17]

3.5.5

break contact

contact which is open when the relay is in its operate condition and which is closed when the relay is in its release condition

[IEV 444-04-18]

3.5.6

change-over contact

combination of two contact circuits with three contact members, one of which is common to the two contact circuits; such that when one of these contact circuits is open, the other is closed

[IEV 444-04-19]

3.5.7

switching power

power which a relay contact makes and/or breaks

NOTE The switching power is usually specified in W for d.c. and in VA for a.c.

[IEV 444-04-24]

3.5.8

switching voltage

voltage between the contact members before closing or after opening of a relay contact

NOTE The term “contact voltage” (see IEV 444-04-25) has been replaced by “switching voltage”. The definition remains unchanged, however.

3.5.9

contact current

electric current which a relay contact carries before opening or after closing

[IEV 444-04-26]

3.5.10

switching current

electric current which a relay contact makes and/or breaks

[IEV 444-04-27]

3.5.11

limiting continuous current

greatest value of electric current which a closed contact is capable of carrying continuously under specified conditions

[IEV 444-04-28, modified]

3.5.12

limiting short-time current

greatest value of electric current which a closed contact is capable of carrying for a specified short period under specified conditions

[IEV 444-04-29, modified]

3.5.13

limiting making capacity

greatest value of electric current which a contact is capable of making under specified conditions such as switching voltage, number of makes, power factor, time constant

[IEV 444-04-30, modified]

3.5.14**limiting breaking capacity**

greatest value of electric current which a contact is capable of breaking under specified conditions such as switching voltage, number of breaks, power factor, time constant

[IEV 444-04-31, modified]

3.5.15**limiting cycling capacity**

greatest value of electric current which a contact is capable of making and breaking successively under specified conditions such as switching voltage, number of breaks, power factor, time constant

[IEV 444-04-32, modified]

3.5.16**micro-interruption**

interruption of a circuit by contact separation which does not provide full-disconnection or micro-disconnection

NOTE There are no dielectric strength or dimensional requirements for the contact gap.

[IEC 60730-1, 2.4.4, modified]

3.5.17**micro-disconnection**

adequate contact separation in at least one contact so as to provide functional security

NOTE There is a requirement for the dielectric strength of the contact gap but no dimensional requirement.

[IEC 60730-1, 2.4.3, modified]

3.5.18**full-disconnection**

contact separation for the disconnection of conductors so as to provide the equivalent of basic insulation between those parts intended to be disconnected

NOTE There are dielectric strength and dimensional requirements.

[IEC 60730-1, 2.4.2, modified]

3.5.19**all-pole disconnection**

full-disconnection of all conductors by a single switching action

3.5.20**failure**

termination of the ability of an item to perform a required function

[IEV 191-04-01]

NOTE For the purpose of this standard, items are elementary relays.

3.5.21**malfunction**

single event when an item does not perform a required function

3.5.22**contact failure**

occurrence of break and/or make malfunctions of a contact under test, exceeding a specified number

3.5.23**electrical endurance**

number of cycles without contact failure under specified conditions, with loaded contacts

3.6 Definitions related to accessories

3.6.1

manual operation

manual movement of the actuating member of the relay

3.6.2

actuating member

part which is pulled, pushed, turned or otherwise operated in order to initiate a function

3.6.3

switching position indicator

part of a relay for visual indication of the switching position

3.7 Definitions related to insulation

3.7.1

functional insulation

insulation between conductive parts which is necessary only for the proper functioning of the relay

[IEC 60664-1, 1.3.17.1, modified]

3.7.2

basic insulation

insulation applied to live parts to provide basic protection against electric shock

NOTE Basic insulation does not necessarily include insulation used exclusively for functional purposes.

[IEC 60664-1, 1.3.17.2]

3.7.3

supplementary insulation

independent insulation applied in addition to basic insulation, in order to provide protection against electric shock in the event of a failure of basic insulation

[IEC 60664-1, 1.3.17.3]

3.7.4

double insulation

insulation comprising both basic insulation and supplementary insulation

[IEC 60664-1, 1.3.17.4]

3.7.5

reinforced insulation

a single insulation system applied to live parts, which provides a degree of protection against electric shock equivalent to double insulation

[IEC 60664-1, 1.3.17.5, modified]

3.7.6

conductive part

part which is capable of conducting electric current, although it may not necessarily be used for this purpose

3.7.7

live part

conductor or conductive part intended to be energized in normal operation, including a neutral conductor, but by convention not a PEN conductor

[IEV 195-02-19, modified]

NOTE A PEN conductor combines the functions of both a protective earthing conductor and a neutral conductor.

3.7.8**clearance**

shortest distance in air between two conductive parts, or between a conductive part and the accessible surface of a relay

[IEC 60664-1, 1.3.2, modified]

NOTE An example for an accessible surface is the actuating member of a relay used for manual operation.

3.7.9**solid insulation**

solid insulating material interposed between two conductive parts

[IEC 60664-1, 1.3.4]

3.7.10**supporting material**

solid insulating material keeping live parts in their position

3.7.11**creepage distance**

shortest distance along the surface of the insulating material between two conductive parts

[IEC 60664-1, 1.3.3]

3.7.12**tracking**

progressive degradation of a solid insulating material by local discharges to form conducting or partially conducting paths

NOTE Tracking usually occurs due to surface contamination.

[IEV 212-01-42, modified]

3.7.13**proof tracking index****PTI**

numerical value of the proof voltage expressed in volts which a material can withstand without tracking under specified test conditions

[IEV 212-01-45, modified]

3.7.14**comparative tracking index****CTI**

numerical value of the maximum voltage in volts which a material can withstand without tracking under specified test conditions

[IEV 212-01-44]

3.7.15**pollution**

any addition of foreign matter, solid, liquid, or gaseous that can result in a reduction of electric strength or surface resistivity of the insulation

[IEC 60664-1, 1.3.11]

3.7.16**pollution degree**

number characterizing the expected pollution of the micro-environment

NOTE Pollution degrees 1, 2 and 3 are used, see Annex H.

[IEC 60664-1, 1.3.13, modified]

3.7.17

micro-environment

the immediate environment of the insulation which particularly influences the dimensioning of the creepage distances

[IEC 60664-1, 1.3.12.2]

4 Influence quantities

The specified performance of a relay shall be given with respect to the reference conditions, i.e. the set of reference values of all influence quantities.

Unless otherwise explicitly stated by the manufacturer, the reference values and tolerance ranges listed in Table 1 apply.

Table 1 – Reference values of influence quantities

Influence quantity	Reference value	Tolerance range and conditions for testing ^a
Ambient temperature	23 °C	±5 K
Atmospheric pressure	96 kPa	86 kPa to 106 kPa
Relative humidity	50 %	25 % to 75 %
External magnetic induction	0	$0 \pm 5 \times 10^{-4}$ T in any direction
Position	As indicated by the manufacturer	According to 8.2 a)
Voltage/current (for coil and load)	As indicated by the manufacturer	±5 % for steady-state conditions
Frequency	16 $\frac{2}{3}$ Hz or 50 Hz or 60 Hz or 400 Hz	Same as reference value with tolerance ±2 %
Waveform	Sinusoidal	Sinusoidal; maximum distortion factor 5 % ^b
Alternating component in d.c. (ripple)	0	Maximum 6 % ^c
Direct component in a.c.	0	Maximum 2 % of peak value
Shock and vibration	0	Maximum 1 m/s ²
Industrial and other atmospheres	Clean air	Clean air (pollution not exceeding class 3C2 of IEC 60721-3-3)

^a The test may be carried out with other values of the influence quantities, provided the quantitative relationship between one or more influence quantities and the value of the considered characteristic is known.

^b Distortion factor: ratio of the harmonic content obtained by subtracting the fundamental wave from a non-sinusoidal harmonic quantity and the r.m.s. value of the non-sinusoidal quantity. It is usually expressed as a percentage.

^c The alternating component (ripple content) of a d.c. supply, expressed as a percentage, is defined as follows:

$$\frac{\text{maximum value} - \text{minimum value}}{\text{d.c. component}} \times 100$$

5 Rated values

The recommended values listed below do not comprise all technical possibilities and other values may be adopted according to conditions of operation and use.

5.1 Rated coil voltage/rated coil voltage range

a) AC voltage, recommended r.m.s. values:

6 V; 12 V; 24 V; 48 V; $100/\sqrt{3}$ V; $110/\sqrt{3}$ V; $120/\sqrt{3}$ V; 100 V; 110 V; 115 V; 120 V; 127 V; 200 V; 230 V; 277 V; 400 V; 480 V; 500 V.

b) DC voltage, recommended values:

1,5 V; 3 V; 4,5 V; 5 V; 9 V; 12 V; 24 V; 28 V; 48 V; 60 V; 110 V; 125 V; 220 V; 250 V; 440 V; 500 V.

- c) Rated voltage range (for example 220 V to 240 V) and corresponding frequencies (e.g. 50 Hz/60 Hz) shall be specified by the manufacturer.

5.2 Operative range

The operative range of a relay coil can be specified either according to 5.2.1 or 5.2.2 or 5.2.3.

5.2.1 The recommended operative range is to be specified according to one of two classes:

- Class 1: 80 % to 110 % of the rated coil voltage (or range).
- Class 2: 85 % to 110 % of the rated coil voltage (or range).

NOTE Where a rated coil voltage range applies, the operative range is from 80 % (or 85 %) of the lower limit to 110 % of the upper limit of the rated coil voltage range.

The above values apply over the full ambient temperature range as declared by the manufacturer.

Where the manufacturer deviates from the recommended classes, he shall specify both the rated coil voltage (or range) and the corresponding operative range, see Figure A.3.

5.2.2 As an alternative to the operative range specified in 5.2.1, the manufacturer may graphically represent the operative range against ambient temperature. This is achieved by describing the upper limit (U_2 = limiting coil voltage) and the lower limit (U_1 = operate voltage) of the operative range, as illustrated by Figure A.3.

5.2.3 Where relays are operated with pulse width modulation (PWM) and/or other methods of coil power reduction the coil energization shall be as stated by the manufacturer.

5.3 Release

The release values indicated below apply over the full ambient temperature range as declared by the manufacturer.

a) DC relay

Where the operative range is specified according to 5.2.1, the release voltage of monostable relays shall be not lower than 5 % of the rated coil voltage (or the upper limit of the rated coil voltage range), see Figure A.3.

Where the operative range is specified according to 5.2.2, the release voltage of monostable relays shall be not lower than 10 % of the lower limit U_1 of the operative range, see Figure A.3.

b) AC relay

The same conditions as for d.c. relays apply, except that a value of 15 % shall be used in place of 5 % or 10 %, respectively.

5.4 Reset

The recommended values shall be the same as those specified in 5.2, unless otherwise specified by the manufacturer (for instance for single coil bistable remanence relays).

5.5 Electrical endurance

Recommended number of cycles: 5 000; 10 000; 20 000; 30 000; 50 000; 100 000; 200 000; 300 000; 500 000; etc.

5.6 Frequency of operation

Recommended frequencies: 360/h; 720/h; 900/h and multiples thereof.

0,1 Hz; 0,2 Hz; 0,5 Hz and multiples thereof.

5.7 Contact loads

a) Resistive loads, recommended values

Current: 0,1 A; 0,5 A; 1 A; 2 A; 3 A; 5 A; 6 A; 8 A; 10 A; 12 A; 16 A; 25 A; 35 A; 60 A; 100 A.

Voltage: 4,5 V; 5 V; 12 V; 24 V; 36 V; 42 V; 48 V; 110 V; 125 V; 230 V; 250 V; 400 V (AC/DC).

b) Recommended inductive loads, see Annex B.

5.8 Ambient temperature

Unless otherwise stated, the preferred ambient temperature range is $-10\text{ }^{\circ}\text{C}$ to $+55\text{ }^{\circ}\text{C}$ for the operation of relays.

Other recommended values for the upper limit are:

+200 °C	+175 °C	+155 °C	+125 °C	+100 °C	+85 °C
+70 °C	+40 °C	+30 °C			

Other recommended values for the lower limit are:

$-65\text{ }^{\circ}\text{C}$	$-55\text{ }^{\circ}\text{C}$	$-40\text{ }^{\circ}\text{C}$	$-25\text{ }^{\circ}\text{C}$	$-5\text{ }^{\circ}\text{C}$	$+5\text{ }^{\circ}\text{C}$
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5.9 Categories of environmental protection

The relay technology categories describing the degree of sealing of the relay case or its contact unit are given in Table 2 below.

Table 2 – Categories of protection

Relay technology category	Protection
RT 0: Unenclosed relay	Relay not provided with a protective case
RT I: Dust protected relay	Relay provided with a case which protects its mechanism from dust
RT II: Flux proof relay	Relay capable of being automatically soldered without allowing the migration of solder fluxes beyond the intended areas
RT III: Wash tight relay	Relay capable of being automatically soldered and subsequently undergoing a washing process to remove flux residues without allowing the ingress of flux or washing solvents. NOTE In service, this type of relay is sometimes vented to the atmosphere after the soldering or washing process; in this case the requirements with respect to clearances and creepage distances can change
RT IV: Sealed relay	Relay provided with a case which has no venting to the outside atmosphere, and having a time constant better than $2 \times 10^4\text{ s}$ in accordance with IEC 60068-2-17
RT V: Hermetically sealed relay	Sealed relay having an enhanced level of sealing, assuring a time constant better than $2 \times 10^6\text{ s}$ in accordance with IEC 60068-2-17

5.10 Duty factor

Recommended values:

15 %; 25 %; 33 %; 40 %; 50 %; 60 %.

NOTE In addition, the frequency of operation stated by the manufacturer is to be maintained.

6 General provisions for testing

In the subsequent clauses, the requirements to be checked as well as the related tests are specified.

The tests according to this standard are type tests.

NOTE Tests according to this standard can be applied to routine and sampling tests as appropriate.

The specimens shall be grouped in seven inspection lots of three specimens each, and the related tests shall be taken from Table 3.

For each inspection lot, the tests shall be carried out in the given order.

If one or more specimen(s) of an inspection lot do(es) not pass a test, this test as well as every other one that may have influenced the result of this test shall be repeated once with an additional set of specimens of the same design. In case the manufacturer modifies the relays, all tests technically influenced by this modification shall also be repeated.

Unless otherwise stated in this standard, the tests and measurements shall be carried out in accordance with the reference values and tolerance ranges of the influence quantities given in Table 1.

In special cases, the use of deviating values may be justified. These values shall be as given by the manufacturer and shall be indicated in the test report. The same applies to special test conditions deviating from the conditions specified in this standard (e.g. mounting position for heating tests).

Table 3 – Type testing

Inspection lot	Tests	Clause	Additional references
1	Marking and documentation	7	IEC 60417
1	Heating (all coil voltages)	8	IEC 60085
1	Basic operating function (all coil voltages)	9	
2	Insulation resistance and dielectric strength	10	
3	Electrical endurance (per contact load and contact material)	11	
4	Mechanical endurance	12	
5	Clearances, creepage distances and distances through solid insulation	13	IEC 60664-1
6	Screw type terminals and screwless terminals (if applicable)	14.1	IEC 60999-1
6	Flat quick-connect terminations (if applicable)	14.2	IEC 61210
6	Solder terminals (if applicable)	14.3	IEC 60068-2-20
6	Sockets (if applicable)	14.4	IEC 61984
6	Alternative termination types (if applicable)	14.5	
6	Sealing (if applicable)	15	IEC 60068-2-17
7	Heat and fire resistance	16	IEC 60695-2-10