

FINAL VERSION

VERSION FINALE



**Electromechanical elementary relays –
Part 1: General and safety requirements**

**Relais électromécaniques élémentaires –
Partie 1: Exigences générales et de sécurité**

CONTENTS

FOREWORD.....	7
1 Scope.....	9
2 Normative references	9
3 Terms and definitions	11
3.1 Terms and definitions related to general terms.....	11
3.2 Terms and definitions of relay types.....	12
3.3 Terms and definitions related to conditions and operations	13
3.4 Terms and definitions of operating values	15
3.5 Terms and definitions related to contacts	16
3.6 Terms and definitions related to accessories.....	19
3.7 Terms and definitions related to insulation	19
4 Influence quantities	21
5 Rated values	22
5.1 General.....	22
5.2 Rated coil voltage/rated coil voltage range.....	22
5.3 Operative range	22
5.4 Release	23
5.5 Reset.....	23
5.6 Electrical endurance	23
5.7 Frequency of operation	23
5.8 Contact loads.....	23
5.9 Ambient temperature	24
5.10 Categories of environmental protection	24
5.11 Duty factor	24
6 General provisions for testing	24
7 Documentation and marking	27
7.1 Data.....	27
7.2 Additional data.....	28
7.3 Marking.....	28
7.4 Symbols.....	29
8 Heating.....	30
8.1 Requirements	30
8.2 Test set-up	30
8.3 Test procedure.....	31
8.4 Terminals.....	32
8.4.1 General	32
8.4.2 Solder terminals	32
8.4.3 Flat quick-connect terminations	33
8.4.4 Screw and screwless type terminals	33
8.4.5 Alternative termination types	33
8.4.6 Sockets	33
9 Basic operating function	34
9.1 General test conditions	34
9.2 Operate (monostable relays).....	34
9.2.1 Operate with (constant) coil voltage.....	34

9.2.2	Operate with PWM and/or other operating methods	35
9.3	Operate/reset (bistable relays).....	35
10	Dielectric strength	36
10.1	Preconditioning.....	36
10.2	Dielectric strength.....	36
10.3	Special cases for test procedure B.....	38
11	Electrical endurance	38
11.1	General.....	38
11.2	Overload and endurance test.....	39
11.3	Failure and malfunction criteria	39
11.4	Final dielectric test.....	39
12	Mechanical endurance.....	41
13	Clearances, creepage distances and solid insulation	42
13.1	General provisions.....	42
13.2	Clearances and creepage distances.....	43
13.3	Solid insulation	46
13.4	Accessible surfaces	47
13.5	Solid insulation in the coil assembly as part of the insulation coordination	47
14	Terminations	47
14.1	General.....	47
14.2	Screw terminals and screwless terminals	47
14.3	Flat quick-connect terminations.....	47
14.4	Solder terminals.....	48
14.4.1	Resistance to soldering heat.....	48
14.4.2	Solder pins	48
14.4.3	Terminals for surface mounting (SMD).....	48
14.4.4	Other solder terminations (e.g. soldering lugs).....	48
14.5	Sockets.....	48
14.6	Alternative termination types.....	49
15	Sealing.....	49
16	Heat and fire resistance.....	49
Annex A (normative)	Explanations regarding relays	50
Annex B (informative)	Inductive contact loads.....	53
Annex C (normative)	Test set-up	57
C.1	Test circuit.....	57
C.2	Description and requirements	59
C.2.1	Power source for coil energization	59
C.2.2	Switching (coil control) device	59
C.2.3	Power source for contact loads.....	59
C.2.4	Control device	59
C.2.5	Measuring and indicating device.....	60
C.3	Test schematic.....	60
C.4	Contact load categories (CC).....	60
C.5	Special loads	60
Annex D (informative)	Special loads	61
D.1	Dedicated device application tests and test sequences	61
D.2	Special loads for telecom and signal relays.....	67

D.3	Special loads with inrush current	68
Annex E (normative)	Heating test arrangement.....	71
Annex F (normative)	Measurement of clearances and creepage distances.....	72
Annex G (normative)	Relation between rated impulse voltage, nominal voltage and overvoltage category	77
Annex H (normative)	Pollution degrees	79
Annex I (normative)	Proof tracking test	80
Annex J (informative)	Schematic diagram of families of terminations	81
Annex K (normative)	Glow-wire test	82
Annex L (normative)	Ball pressure test	83
Annex M (informative)	Needle flame test.....	85
Annex N (informative)	Resistance for standard soldering processes	86
N.1	General.....	86
N.2	Double wave soldering process.....	86
N.2.1	Profile.....	86
N.2.2	Conditions	86
N.3	SMT and through hole reflow (THR) soldering process.....	87
N.3.1	Profile.....	87
N.3.2	Conditions	87
N.4	Evaluation.....	87
Annex O (informative)	Risk assessment.....	88
O.1	General.....	88
O.2	Risk assessment procedure	88
O.3	Achieving tolerable risk	89
O.4	An application of risk assessment procedures (proposal for the user)	90
	Alphabetical list of terms	92
	Bibliography.....	93
Figure A.1	– Diagram explaining terms related to monostable relays	50
Figure A.2	– Example explaining terms relating to contacts.....	51
Figure A.3	– Explanations regarding the operative range of the coil voltage.....	51
Figure A.4	– Explanation regarding the preconditioning and testing of the operate voltage according to 5.3.1 (Class 1) and 9.2	52
Figure A.5	– Explanation regarding the preconditioning and testing of the operate voltage according to 5.3.2 and 9.2	52
Figure C.1	– Standard test circuit.....	57
Figure C.2	– Functional block diagram	58
Figure C.3	– Contact load categories	60
Figure D.1	– Typical test circuit diagram	66
Figure D.2	– Waveform per synthetic measurement of pulse width and peak current.....	67
Figure D.3	– Circuit for cable load.....	67
Figure D.4	– Test circuit for inrush current loads (e.g. capacitive loads and simulated tungsten filament lamp loads) – AC circuits.....	68
Figure D.5	– Example for a tungsten filament lamp test for relays rated 10/100 A/250 V~/2,5 ms	69

Figure D.6 – Test circuit for inrush current loads (e.g. capacitive loads and simulated lamp loads) – DC circuits	69
Figure D.7 – Test circuit for inrush current loads (e.g. simulated fluorescent lamp loads) with power-factor correction	70
Figure E.1 – Test arrangement	71
Figure F.1 – Example 1	72
Figure F.2 – Example 2	72
Figure F.3 – Example 3	73
Figure F.4 – Example 4	73
Figure F.5 – Example 5a and 5b	73
Figure F.6 – Example 6a and 6b	74
Figure F.7 – Example 7a and 7b	74
Figure F.8 – Example 8a and 8b	75
Figure F.9 – Example 9	75
Figure F.10 – Example 10	76
Figure F.11 – Example 11	76
Figure J.1 – Schematic diagram of families of terminations	81
Figure L.1 – Ball pressure test apparatus	84
Figure N.1 – Double wave soldering profile	86
Figure N.2 – SMT and through hole soldering profile	87
Figure O.1 – Iterative process of risk assessment and risk reduction	88
Figure O.2 – Risk reduction	89
Table 1 – Reference values of influence quantities	22
Table 2 – Categories of protection	24
Table 3 – Type testing	26
Table 4 – Routine tests	26
Table 5 – Number of test samples	27
Table 6 – Required relay data (1 of 2)	27
Table 7 – Symbols	29
Table 8 – Examples for indication of rated values	29
Table 9 – Thermal classification	30
Table 10 – Cross-sectional areas and lengths of conductors dependent on the current carried by the terminal	32
Table 11 – Operate and release with constant coil voltages	34
Table 12 – Operate and release with PWM and/or other operating methods	35
Table 13 – Dielectric strength – AC	36
Table 14 – Dielectric strength – DC	37
Table 15 – Electrical endurance test procedures	39
Table 16 – Schematics for contact loading	40
Table 17 – Provisions for the dimensioning of clearances and creepage distances	43
Table 18 – Minimum clearances in air for insulation coordination	44
Table 19 – Material groups	45
Table 20 – Minimum creepage distances for equipment subject to long-term stresses	45

Table 21 – Rated insulation voltage according to supply system voltage	46
Table 22 – Test conditions for test Tb	48
Table B.1 – Verification of the making and breaking capacity (abnormal conditions)	54
Table B.2 – Verification of the making and breaking capacity (normal conditions)	55
Table B.3 – Electrical endurance test.....	55
Table B.4 – Contact rating designations and equivalency to utilization categories	56
Table C.1 – Characteristics of power sources for contact loads	58
Table C.2 – Standard contact load characteristics	59
Table D.1 – Overload test values	61
Table D.2 – Endurance test values	62
Table D.3 – Horsepower-rated equipment full-load currents (AC).....	63
Table D.4 – Horsepower-rated equipment currents (DC).....	63
Table D.5 – Overload and endurance test voltages	63
Table D.6 – Bulk energy capacitances	65
Table D.7 – Peak current requirements	65
Table G.1 – Correspondence between the nominal voltage of the supply system and the equipment rated impulse withstand voltage, in case of overvoltage protection by surge-arresters according to IEC 60099-1	77
Table O.1 – Examples for the relation between failure mode, consequences and hazard	90
Table O.2 – Severity of harm	91
Table O.3 – Probability of harm	91
Table O.4 – Risk category.....	91

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROMECHANICAL ELEMENTARY RELAYS –

Part 1: General and safety requirements

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

DISCLAIMER

This Consolidated version is not an official IEC Standard and has been prepared for user convenience. Only the current versions of the standard and its amendment(s) are to be considered the official documents.

This Consolidated version of IEC 61810-1 bears the edition number 4.1. It consists of the fourth edition (2015-02) [documents 94/380/FDIS and 94/384RVD], its corrigenda 1 (2017-06) and 2 (2018-02), and its amendment 1 (2012-02) [documents 94/450/CDV and 94/460/RVC]. The technical content is identical to the base edition and its amendment.

This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.

International Standard IEC 61810-1 has been prepared by IEC technical committee 94: All-or-nothing electrical relays.

This fourth edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- two main test procedures were introduced: procedure A, reflecting the procedure known from Edition 3 of this standard and procedure B, reflecting the assessment according to North American requirements;
- inclusion of dedicated device application tests especially relevant for applications in the North American Market (see Clause D.1);
- introduction of testing under single mounting condition;
- clarification of insulation requirements after endurance testing;
- inclusion of provisions for basic safety requirements;
- update of references.

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 the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

ELECTROMECHANICAL ELEMENTARY RELAYS –

Part 1: General and safety requirements

1 Scope

This part of IEC 61810 applies to electromechanical elementary relays (non-specified time all-or-nothing relays) for incorporation into low voltage equipment (circuits up to 1 000 V alternate current or 1 500 V direct current). It defines the basic functional and safety 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 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 60038:2009, *IEC standard voltages*

IEC 60050 (all parts), *International Electrotechnical Vocabulary* (available at <http://www.electropedia.org>)

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 2-17: Tests – Test Q: Sealing*