

CONSOLIDATED VERSION

VERSION CONSOLIDÉE



**Automatic electrical controls –
Part 1: General requirements**

**Dispositifs de commande électrique automatiques –
Partie 1: Exigences générales**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2015 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 60 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 15 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

Plus de 60 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

CONSOLIDATED VERSION

VERSION CONSOLIDÉE



**Automatic electrical controls –
Part 1: General requirements**

**Dispositifs de commande électrique automatiques –
Partie 1: Exigences générales**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 97.120

ISBN 978-2-8322-3088-6

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

REDLINE VERSION

VERSION REDLINE



**Automatic electrical controls –
Part 1: General requirements**

**Dispositifs de commande électrique automatiques –
Partie 1: Exigences générales**

CONTENTS

FOREWORD	7
1 Scope and normative references	10
2 Terms and definitions	15
3 General requirements	37
4 General notes on tests	37
5 Rating.....	41
6 Classification.....	41
7 Information	49
8 Protection against electric shock	58
9 Provision for protective earthing	61
10 Terminals and terminations.....	64
11 Constructional requirements.....	72
12 Moisture and dust resistance.....	90
13 Electric strength and insulation resistance.....	92
14 Heating.....	95
15 Manufacturing deviation and drift.....	101
16 Environmental stress	102
17 Endurance.....	103
18 Mechanical strength	112
19 Threaded parts and connections.....	119
20 Creepage distances, clearances and distances through solid insulation.....	122
21 Resistance to heat, fire and tracking.....	131
22 Resistance to corrosion	133
23 Electromagnetic compatibility (EMC) requirements – Emission	134
24 Components	135
25 Normal operation	137
26 Electromagnetic compatibility (EMC) requirements – Immunity.....	137
27 Abnormal operation	137
28 Guidance on the use of electronic disconnection	140
Annex A (normative) Indelibility of markings.....	160
Annex B (normative) Measurement of creepage distances and clearances in air.....	162
Annex C (normative) Cotton used for mercury switch test (not applicable in the countries members of CENELEC)	167
Annex D (informative) Heat, fire and tracking.....	168
Annex E (normative) Circuit for measuring leakage current.....	169
Annex F (informative) Fire hazard testing.....	170
Annex G (normative) Heat and fire resistance tests.....	171
Annex H (normative) Requirements for electronic controls	173
Annex J (normative) Requirements for thermistor elements and controls using thermistors.....	237
Annex K (informative) Nominal voltages of supply systems for different modes of overvoltage control	255

Annex L (normative) Overvoltage categories	257
Annex M (informative) Typical usage	258
Annex N (normative) Pollution degrees	259
Annex P (normative) Printed circuit board coating performance test.....	260
Annex Q (normative) Printed circuit board coating performance test	262
Annex R (informative) Explanatory notes for surge immunity test	265
Annex S (informative) Guidance for applying Clause 20	270
Annex T (normative) Requirements for SELV and PELV.....	272
Annex U (normative) Requirements for relays when used as controls in IEC 60335 appliances	275
Annex V (normative) Requirements for controls powered by secondary batteries (rechargeable)	278
Bibliography.....	280
Figure 1 – Test pin.....	140
Figure 2 – Standard test finger.....	141
Figure 3 – Test nail	142
Figure 4 – Impact test for free-standing controls	143
Figure 5 – Tumbling barrel	143
Figure 6 – Ball-pressure apparatus	144
Figure 7 – Void	144
Figure 8 – Apparatus for testing durability of markings on rating labels	144
Figure 9 – Apparatus for flexing test	145
Figure 10 – Screw terminals and stud terminals (1 of 2).....	146
Figure 11 – Pillar terminals	148
Figure 12 – Mantle terminals.....	149
Figure 13 – Saddle and lug terminals	150
Figure 14 – Tabs.....	151
Figure 15 – Tabs for non-reversible connectors	152
Figure 16 – Receptacles	153
Figure 17 – Measurement of creepage distance and clearance	154
Figures 18 to 24 Void.....	155
Figure 25 – Diagram for leakage current measurement at operating temperature for single-phase connection of class II controls	155
Figure 26 – Diagram for leakage current measurement at operating temperature for single-phase connection of controls other than class II	156
Figure 27 – Diagram for leakage current measurement at operating temperature for three-phase connection of class II controls	157
Figure 28 – Diagram for leakage current measurement at operating temperature for three-phase connection of controls other than class II.....	158
Figure 29 – Diagram for leakage current measurement at operating temperature for single-phase connection of controls other than class II	158
Figure 30 – Diagram for leakage current measurement at operating temperature for two-phase connection of controls to three-wire, ground neutral supply other than class II	159
Figure B.1 – Narrow groove	163

Figure B.2 – Wide groove	163
Figure B.3 – V-shaped groove.....	163
Figure B.4 – Rib.....	164
Figure B.5 – Uncemented joint with narrow groove	164
Figure B.6 – Uncemented joint with wide groove	164
Figure B.7 – Uncemented joint with narrow and wide grooves	165
Figure B.8 – Diverging side walls	165
Figure B.9 – Narrow recess.....	166
Figure B.10 – Wide recess	166
Figure B.11 – Conductive floating part	166
Figure E.1 – Circuit for measuring leakage currents	169
Figure H.1 – V-Model for the software life cycle	199
Figure H.2 – Voltage variation test	215
Figure H.3 – Ring wave characteristics (open-circuit voltage)	220
Figure H.4 – Schematic of a ring wave generator 0,5 μs /100 kHz.....	220
Figure H.5 – Example of an electronic circuit with low power points	225
Figure J.1 – Test circuit for inrush-current limiting thermistor endurance test	253
Figure P.1 – Test sample	261
Figure Q.1 – Test sample.....	263
Figure Q.2 – Examples of land configurations (see also Figure Q.1)	264
Figure R.1 – Example of surge protection by shielding in buildings with common earth reference systems.....	268
Figure R.2 – Example of secondary surge protection in buildings with separate common earth reference systems	268
Figure R.3 – Example of primary and secondary surge protection of indoor/outdoor equipment.....	269
Figure S.1 – Guidance flowchart for application of requirements of Clause 20	270
Table 1 (7.2 of edition 3) – Required information and methods of providing information (1 of 4).....	52
Table 2 (9.3.2 of edition 3) – Quick connect terminal dimensions (Canada and USA).....	63
Table 3 (10.1.4 of edition 3) – Minimum cross-sectional area of conductors	65
Table 4 (10.1.8 of edition 3) – Terminal conductors.....	67
Table 5 (10.1.9 of edition 3) – Conductor pull test values	68
Table 6 (10.2.1 of edition 3) – Nominal cross-sectional areas of conductors	70
Table 7 (10.2.4.2 of edition 3) – Material and plating for tabs	71
Table 8 (10.2.4.3 of edition 3) – Axial force values for tab insertion and withdrawal	71
Table 9 (11.7.2 of edition 3) – Pull and torque values	82
Table 10 (11.8.2 of edition 3) – Minimum cord conductor sizes	83
Table 11 (13.1 of edition 3) – Minimum insulation resistance	93
Table 12 (13.2 of edition 3) – Insulation or disconnection test voltages ^a (1 of 2).....	93
Table 13 (14.1 of edition 3) – Maximum heating temperatures (1 of 3)	98
Table 14 (17.2.1 of edition 3) – Electrical conditions for the overvoltage test (this table applies in all countries except Canada, and the USA)	105

Table 15 (17.2.2 of edition 3) – Electrical conditions for the overload tests of 17.7 and 17.10 (this table applies in Canada, USA, and all countries which use an overload test)	106
Table 16 (17.2.3 of edition 3) – Electrical conditions for the overload tests of 17.8, 17.9, 17.11, 17.12 and 17.13 (this table applies in Canada, USA, and all countries which use an overload test)	107
Table 17 (18.4.1 of edition 3) – Minimum thickness of sheet metal for enclosures made of carbon steel or stainless steel	115
Table 18 (18.4.2 of edition 3) – Minimum thickness of sheet metal for enclosures of aluminium, copper or brass	116
Table 19 (18.7 of edition 3) – Pull-cord force test values	118
Table 20 (19.1 of edition 3) – Threaded parts torque test values	120
Table 21 (20.1 of edition 3) – Rated impulse voltage for equipment energized directly from the supply mains (from IEC 60664-1:2007, Table F.1)	123
Table 22 (20.2 of edition 3) – Clearances for insulation co-ordination (from IEC 60664-1:2007, Table F.2)	124
Table 23 (20.3 of edition 3) – Minimum creepage distances for basic insulation	128
Table 24 (20.4 of edition 3) – Minimum creepage distances for functional insulation	129
Table 25 (21.4 of edition 3) – Mercury switch short-circuit conditions	133
Table 26 (27.2.3 of edition 3) – Maximum winding temperature (for test of mechanical blocked output conditions)	138
Table B.1 – Value of X	162
Table H.1 (H.11.12.7 of edition 3) – Acceptable measures to address fault/errors ^a (1 of 6)	192
Table H.2 – Semi-formal methods	199
Table H.3 – Software architecture specification	200
Table H.4 – Module design specification	201
Table H.5 – Design and coding standards	201
Table H.6 – Software module testing	202
Table H.7 – Software integration testing	203
Table H.8 – Software safety validation	203
Table H.9 (H.11.12.6 of edition 3) – Combinations of analytical measures during hardware development	204
Table H.10 – Data exchange	205
Table H.11 – Examples of defences against unauthorised access and transmission failure modes	206
Table H.12 (H.23 of edition 3) – Emission	211
Table H.13 (H.26.2.1 of edition 3) – Applicable test levels	212
Table H.14 – Voltage dips, short interruptions and voltage variations	214
Table H.15 (H.26.5.4.2 of edition 3) – Test values for voltage variations	215
Table H.16 (H.26.8.2 of edition 3) – Test voltages for test level 2 (depending on the installation class conditions)	217
Table H.17 – Test level for electrical fast transient burst test	218
Table H.18 (H.26.10.4 of edition 3) – Peak voltages	219
Table H.19 (H.26.12.2.1 of edition 3) – Test levels for conducted disturbances on mains and I/O lines	221
Table H.20 (H.26.12.3.1 of edition 3) – Test level for immunity to radiated electromagnetic fields	222

Table H.21 – Increased test level for radiated immunity (ISM, GSM, DECT bands)	222
Table H.22 (H.26.13.2 of edition 3) – Test level for supply frequency variations	223
Table H.23 (H.26.14.2 of edition 3) – Test level for continuous fields	224
Table H.24 (H.27.1 of edition 3) – Electrical/electronic component fault modes table (1 of 3)	228
Table J.1 – Maximum current	239
Table J.2 (J.7, 7.2 of edition 3) – Normal operating conditions	240
Table J.3 – Samples for the test (clause reference)	241
Table J.4 – Electrical and thermal ratings of a thermistor	242
Table J.5 – Additional items to Table 1	244
Table J.6 – Sequence of calibration and conditioning tests for PTC thermistors	246
Table J.7 – Classes for PTC sensing thermistors	247
Table J.8 – Sequence of calibration and conditioning tests for NTC thermistors	248
Table J.9 – Classes for NTC sensing thermistors	248
Table J.10 – Number of cycles for endurance test	251
Table J.11 – Ageing test temperature	252
Table J.12 – Number of cycles for endurance test	253
Table K.1 – Inherent control or equivalent protective control	255
Table K.2 – Cases where protective control is necessary and control is provided by surge arresters having a ratio of clamping voltage to rated voltage not smaller than that specified by IEC 60099-1	256
Table M.1 – Typical usage	258
Table P.1 – Environmental cycling conditions	260
Table Q.1 – IEC 60664-3 test levels or conditions	262
Table S.1 – Example A – Using Annex S guidance for applying Clause 20	271
Table S.2 – Example B – Using Annex S guidance for applying Clause 20	271

Generated by EVS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

AUTOMATIC ELECTRICAL CONTROLS –

Part 1: General 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 60730-1 bears the edition number 5.1. It consists of the fifth edition (2013-11) [documents 72/899/FDIS and 72/928/RVD] and its corrigendum 1 (september 2014), and its amendment 1 (2015-12) [documents 72/1017/FDIS and 72/1026/RVD]. The technical content is identical to the base edition and its amendment.

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 60730-1 has been prepared by IEC technical committee 72: Automatic electrical controls.

This edition constitutes a technical revision. The major changes with respect to the previous edition are as follows.

- modification of the title and scope;
- revisions to Clause H.26 based on changes in technology, applications, and to improve consistency and layout;
- modification to Table H.12 to align with CISPR 22;
- revisions to Annex J to correlate the fault modes of thermistors and to exempt thermistors used in conjunction with type 1 controls in SELV low power circuits from the tests specified in Annex J;
- new requirements covering battery-powered controls, and the use of batteries in controls;
- revision addressing the exclusion of relay faults;
- new/updated requirements in Clause 24, for switch mode power supplies;
- revisions covering the allowance of screwless-type clamping units complying with IEC 60999-1;
- new requirements addressing remotely actuated control functions;
- addition of a new/updated leakage current diagram to align the Annex E diagram with the diagram in IEC 60990;
- updated requirements for temperature sensing controls.

A list of all parts of the IEC 60730 series, under the general title: *Automatic electrical controls*, can be found on the IEC website.

In the development of a fully international standard to cover automatic controls for household and similar use, it has been necessary to take into consideration the differing requirements resulting from practical experience in various parts of the world and to recognize the variation in national electrical systems and wiring rules.

The “in some countries” notes regarding differing national practices are contained in the following subclauses:

2.1.5	11.11.1.2	17.10.4
2.7.2	11.11.1.3	17.12.5
2.7.3	11.11.1.4	18.1.6
2.14.2	12.1.6	18.1.6.1
4.2.1	12.3	18.1.6.2
6.6.1	Table 12 (13.2.1), footnote a	18.1.6.3
Table 1 (7.2), footnote d	13.3.4	18.4
7.4.3	14.4	19.2.4.1
7.4.3.2	Table 13 (14.7.4), footnote f	19.2.5.1
8.1.1.1	15.1	21.1
8.4	16.2.1	21.4
9.3.2	17.1.3.1	27.2.3.1
9.3.4	17.2.2	Annex C
9.5.2	17.2.3	Annex D
Table 3 (10.1.4), footnote b	17.2.3.1	H.26.10
10.1.4.1	Table 14 (17.2.5)	Table H.18 (H.26.10.4)
10.1.14	Table 15 (17.2.5)	H.27.1.1.3
10.1.16	Table 16 (17.2.5)	Table K.1, footnote b
10.1.16.1	17.5.1	Table K.2, footnote b

Table 6 (10.2.1), footnote b	17.7.7	T.3.2
11.5	17.8.4.1	
Table 10 (11.8.2), footnote b	17.10	

It is envisaged that in the next edition of this standard it will be found possible to remove those differences that are covered by new IEC standards now being prepared by other technical committees.

This part 1 is to be used in conjunction with the appropriate part 2 for a particular type of control, or for controls for particular applications. This part 1 may also be applied, so far as reasonable, to controls not mentioned in a part 2, and to controls designed on new principles, in which cases additional requirements may be considered to be necessary.

Where, for a particular clause or subclause, the text of part 2 indicates:

Addition: the part 1 text applies with the additional requirement indicated in a part 2;

Modification: the part 1 text applies with a minor change as indicated in a part 2;

Replacement: the part 2 text contains a change which replaces the part 1 text in its entirety.

Where no change is necessary, the part 2 indicates that the relevant clause or subclause applies.

NOTE In this standard the following print types are used:

- Requirements proper: in roman type;
- *Test specifications: in italic type;*
- Explanatory matter: in smaller roman type;
- Defined terms: **bold type**.

Some table titles contain reference in brackets to table numbers in IEC 60730-1, edition 3 for ease of correlation between parts 2 and the Part 1.

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

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.

AUTOMATIC ELECTRICAL CONTROLS –

Part 1: General requirements

1 Scope and normative references

1.1 Scope

In general, this part of IEC 60730 applies to automatic **electrical controls** for use in, on, or in association with equipment for household and similar use. The equipment may use electricity, gas, oil, solid fuel, solar thermal energy, etc., or a combination thereof.

NOTE 1 Throughout this standard the word "equipment" means "appliance and equipment."

EXAMPLE 1 **Controls** for appliances within the scope of IEC 60335.

This International Standard is applicable to **controls** for building automation within the scope of ISO 16484.

This standard also applies to automatic **electrical controls** for equipment that may be used by the public, such as equipment intended to be used in shops, offices, hospitals, farms and commercial and industrial applications.

EXAMPLE 2 **Controls** for commercial catering, heating and air-conditioning equipment.

This standard is also applicable to individual **controls** utilized as part of a **control** system or **controls** which are mechanically integral with multifunctional **controls** having non-electrical outputs.

EXAMPLE 3 Independently mounted water valves, **controls** in smart grid systems and **controls** for building automation systems within the scope of ISO 16484-2.

This standard is also applicable to relays when used as **controls** for IEC 60335 appliances. Additional requirements for the safety and **operating values** of relays when used as **controls** for IEC 60335 appliances are contained in Annex U.

NOTE 2 These requirements are referred to in the scope of IEC 61810-1.

NOTE 3 This standard is intended to be used for the testing of any stand-alone relay which is intended to be used as a **control** of an appliance according to IEC 60335-1. It is not intended to be used for any other stand-alone relay, or to replace the IEC 61810 series of standards.

This standard does not apply to automatic **electrical controls** intended exclusively for industrial process applications unless explicitly mentioned in the relevant part 2 or the equipment standard.

This standard applies to **controls** powered by primary or secondary batteries, requirements for which are contained within the standard, including Annex V.

1.1.1 This International Standard applies to the inherent safety, to the **operating values**, **operating times**, and **operating sequences** where such are associated with equipment safety, and to the testing of automatic **electrical control** devices used in, or in association with, equipment.

This standard applies to **controls** using **thermistors**, see also Annex J.

This standard is also applicable to the **functional safety of low complexity safety related systems and controls**.

1.1.2 This standard applies to automatic **electrical controls**, mechanically or electrically operated, responsive to or controlling such characteristics as temperature, pressure, passage of time, humidity, light, electrostatic effects, flow, or liquid level, current, voltage, acceleration, or combinations thereof.

1.1.3 This standard applies to starting relays, which are a specific type of automatic **electrical control**, intended to switch the starting winding of a motor. Such **controls** may be built into, or be separate from, the motor.

1.1.4 This standard applies to **manual controls** when such are electrically and/or mechanically integral with **automatic controls**.

NOTE Requirements for manual switches not forming part of an **automatic control** are contained in IEC 61058-1.

1.1.5 This standard applies to a.c. or d.c. powered **controls** with a rated voltage not exceeding 690 V a.c. or 600 V d.c.

1.1.6 This standard does not take into account the **response value** of an **automatic action** of a **control**, if such a **response value** is dependent upon the method of mounting the **control** in the equipment. Where a **response value** is of significant purpose for the protection of the **user**, or surroundings, the value defined in the appropriate household equipment standard or as determined by the manufacturer shall apply.

1.1.7 This standard applies also to **controls** incorporating **electronic devices**, requirements for which are contained in Annex H.

1.1.8 This standard applies also to **controls** using NTC or PTC **thermistors**, requirements for which are contained in Annex J.

1.1.9 This standard applies to the electrical and **functional safety of controls** capable of receiving and responding to communications signals, including signals for power billing rate and demand response.

The signals may be transmitted to or received from external units being part of the **control** (wired), or to and from external units which are not part of the **control** (wireless) under test.

1.1.10 This standard does not address the integrity of the output signal to the network devices, such as interoperability with other devices unless it has been evaluated as part of the **control system**.

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, *IEC standard voltages*

IEC 60065:2001, *Audio, video and similar electronic apparatus – Safety requirements*¹
Amendment 1:2005
Amendment 2:2010

¹ There exists a consolidated edition 7.2:2011 including IEC 60065:2001 and its Amendments 1:2005 and 2:2010.

IEC 60068-2-75, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC 60085, *Electrical insulation – Thermal evaluation and designation*

IEC 60099-1, *Surge arresters – Part 1: Non-linear resistor type gapped arresters for a.c. systems*²

IEC 60112:2003, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*³
Amendment 1:2009

IEC 60127-1, *Miniature fuses – Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links*

IEC 60227-1, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 1: General requirements*

IEC 60245-1, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 1: General requirements*

IEC 60269-1, *Low-voltage fuses – Part 1: General requirements*

IEC 60335-1:2010, *Household and similar electrical appliances – Safety – Part 1: General requirements*

IEC 60364 (all parts), *Low-voltage electrical installations*

IEC 60384-14, *Fixed capacitors for use in electronic equipment – Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains*

IEC 60384-16, *Fixed capacitors for use in electronic equipment – Part 16: Sectional specification: Fixed metallized polypropylene film dielectric d.c. capacitors*

IEC 60384-17, *Fixed capacitors for use in electronic equipment – Part 17: Sectional specification: Fixed metallized polypropylene film dielectric a.c. and pulse capacitors*

IEC 60417 (all parts), *Graphical symbols for use on equipment*

IEC 60423, *Conduit systems for cable management – Outside diameters of conduits for electrical installations and threads for conduits and fittings*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP code)*⁴
Amendment 1:1999

IEC 60539 (all parts), *Directly heated negative temperature coefficient thermistors*

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

² Withdrawn.

³ There exists a consolidated edition 4.1:2009 including IEC 60112:2003 and its Amendment 1:2009.

⁴ There exists a consolidated edition 2.1:2001 including IEC 60529:1989 and its Amendment 1:1999.