



DPC: 23 / 30455791 DC

## BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

Date: 07 June 2023

Origin: International

---

**Latest date for receipt of comments: 23 August 2023**

Project No. 2022/00921

Responsible committee: PEL/23 Electrical accessories

Interested committees:

---

Title: BS EN IEC 60669-2-1 Amendment 1. Switches for household and similar fixed electrical installations Part 2-1:  
Particular requirements - Electronic control devices

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

**WARNING: THIS IS A DRAFT AND MUST NOT BE REGARDED OR USED AS A BRITISH STANDARD.  
THIS DRAFT IS NOT CURRENT BEYOND 23 August 2023**

This draft is issued to allow comments from interested parties; all comments will be given consideration prior to publication. No acknowledgement will normally be sent. **See overleaf for information on the submission of comments.**

No copying is allowed, in any form, without prior written permission from BSI except as permitted under the Copyright, Designs and Patent Act 1988 or for circulation within a nominating organization for briefing purposes. Electronic circulation is limited to dissemination by e-mail within such an organization by committee members.

Further copies of this draft may be purchased from BSI Shop <http://shop.bsigroup.com> or from BSI Customer Services, Tel: +44(0) 20 8996 9001 or email [cservices@bsigroup.com](mailto:cservices@bsigroup.com). British, International and foreign standards are also available from BSI Customer Services.

Information on the co-operating organizations represented on the committees referenced above may be obtained from <http://standardsdevelopment.bsigroup.com>

---

Responsible Committee Secretary: **Mr Simon Bounds (BSI)**  
Direct tel: **0208 996 7281**  
E-mail: [simon.bounds@bsigroup.com](mailto:simon.bounds@bsigroup.com)

## Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

## UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

## Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

## Template for comments and secretariat observations

|                  |                        |
|------------------|------------------------|
| Date: xx/xx/20xx | Document: ISO/DIS xxxx |
|------------------|------------------------|

| 1  | 2                                          | (3)                          | 4               | 5                                                                                                                                  | (6)                                                                      | 7                                                  |
|----|--------------------------------------------|------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------|
| MB | Clause No./ Subclause No./Annex (e.g. 3.1) | Paragraph/Figure/ Table/Note | Type of comment | Commend (justification for change) by the MB                                                                                       | Proposed change by the MB                                                | Secretariat observations on each comment submitted |
|    | 3.1                                        | Definition 1                 | ed              | Definition is ambiguous and needs clarifying.                                                                                      | Amend to read '...so that the mains connector to which no connection...' |                                                    |
|    | 6.4                                        | Paragraph 2                  | te              | The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK. | Delete reference to UV photometer.                                       |                                                    |



## 23B/1466/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER:

**IEC 60669-2-1/AMD1 ED5**

DATE OF CIRCULATION:

**2023-06-02**

CLOSING DATE FOR COMMENTS:

**2023-09-22**

SUPERSEDES DOCUMENTS:

**23B/1387/RR**

IEC SC 23B : PLUGS, SOCKET-OUTLETS AND SWITCHES

SECRETARIAT:

Italy

SECRETARY:

Mr Cristiano Masini

OF INTEREST TO THE FOLLOWING COMMITTEES:

TC 34, TC 72

PROPOSED HORIZONTAL STANDARD:



Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.

FUNCTIONS CONCERNED:

☒ EMC

☐ ENVIRONMENT

☐ QUALITY ASSURANCE

☒ SAFETY

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Recipients of this document are invited to submit, with their comments, notification of any local regulations or technical reasons that may exist and should be considered should this proposal proceed, recognizing that failure to address such requirements could result in the need for new or existing "In Some Countries" clauses. (SEE [AC/22/2007](#) OR [NEW GUIDANCE DOC](#)).

TITLE:

**Amendment 1 - Switches for household and similar fixed electrical installations - Part 2-1: Particular requirements - Electronic control devices**

NOTE FROM TC/SC OFFICERS:

This document includes all modifications to IEC 60669-2-1 edition 5.0, agreed by MT6. The comments to the CD will be discussed by MT6 during its next meeting.

Please refer to 23B/1467/INF for the track changes version.

**Copyright © 2023 International Electrotechnical Commission, IEC.** All rights reserved. It is permitted to download this electronic file, to make a copy and to print out the content for the sole purpose of preparing National Committee positions. You may not copy or "mirror" the file or printed version of the document, or any part of it, for any other purpose without permission in writing from IEC.

**Draft CD IEC 60669-2-1 ED5 AMD1**

According to the MT 6 decisions a draft CD was created based on the IEC 60669-2-1 ED 5.0 and the following results from the work of the working groups and MT6 decisions:

AdHoc Inrush:

375 SC23B-MT6(sec)375 CC\_23B\_1350\_DC Inrush  
377 SC23B-MT6(sec)377 AHG Inrush observations on CC\_23B\_1350\_DC  
382 SC23B-MT6(sec)382 Minutes Zoom Meeting 18th October 2021

AdHoc MOV

23B/1282/DC: Requirements for products provided with a varistor 9 (MOV).  
23B/1287/INF  
362\_23B-MT6(sec)362 13 observations on 23B/1287/INF\_comments(MOV)  
367 SC23B(sec)367 MT6 Adhoc WG MOV 2021-02-25 RSS COMMENTS  
372 SC23B-MT6(sec)372 MOV-Draft\_CD  
374 SC23B-MT6(sec)374 Minutes of Zoom Meeting 12.+13th April 2021\_mod

AdHoc EU proposal

411/018 Draft CD based on 018 SC23B-MT6 AdHoc EU Proposals results\_2023\_02\_09  
429 SC23B-MT6(sec)429 MT6 decisions on 411 SC23B-MT6(sec)411

Other modifications (finalized in April 2023)

428 SC23B-MT6(sec) Proposal Overload MT6\_Singapore (+ modified drawing)  
418 SC23B-MT6 (Singapore\_French experts)-Table 101a  
417\_SC23B-MT6(sec)007-ADWG-ML-Draft-MultilayerProposal\_12\_2022  
405 23B-MT6(sec) Loads IT+DE proposal (398) modified by MT6  
406 SC23B-MT6(Haentjens\_2022-10)02 Ceiling mounted products modified by MT6  
410 SC23B-MT6(sec)-Basso\_Table116\_Singapore\_01

Work of the editing team 2023/05/25

411/018 comment 26: Implementation of the general decision to replace "manufacturer's instructions" or "defined by the manufacturer" to "instructions" based on 411/018 and 429 DE 13 in the whole document.

Embedding the figures in the main text.

Renumbering of tables, figures and annexes.

Formatting tables etc.

Changes vs IEC 60669-2-1 ED5:2021 are visible in Track Change Mode

The references to the comments decided in MT6 documents are listed in the comments.

# CONTENTS

|                                                                                                                                                                                                            |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| FOREWORD.....                                                                                                                                                                                              | 6  |
| 1 Scope.....                                                                                                                                                                                               | 8  |
| 2 Normative references.....                                                                                                                                                                                | 9  |
| 3 Terms and definitions .....                                                                                                                                                                              | 11 |
| 4 General requirements .....                                                                                                                                                                               | 16 |
| 5 General remarks on tests .....                                                                                                                                                                           | 16 |
| 6 Ratings.....                                                                                                                                                                                             | 18 |
| 7 Classification.....                                                                                                                                                                                      | 18 |
| 8 Marking .....                                                                                                                                                                                            | 20 |
| 9 Checking of dimensions .....                                                                                                                                                                             | 23 |
| 10 Protection against electrical shock .....                                                                                                                                                               | 23 |
| 11 Provision for earthing.....                                                                                                                                                                             | 26 |
| 12 Terminals .....                                                                                                                                                                                         | 27 |
| 13 Constructional requirements .....                                                                                                                                                                       | 27 |
| 14 Mechanism.....                                                                                                                                                                                          | 30 |
| 15 Resistance to ageing, protection provided by enclosures of switches and<br>resistance to humidity .....                                                                                                 | 30 |
| 16 Insulation resistance and electric strength.....                                                                                                                                                        | 30 |
| 17 Temperature rise .....                                                                                                                                                                                  | 32 |
| 18 Making and breaking capacity .....                                                                                                                                                                      | 37 |
| 19 Normal operation .....                                                                                                                                                                                  | 40 |
| 20 Mechanical strength.....                                                                                                                                                                                | 45 |
| 21 Resistance to heat.....                                                                                                                                                                                 | 46 |
| 22 Screws, current-carrying parts and connections.....                                                                                                                                                     | 47 |
| 23 Creepage distances, clearances and distances through sealing compound .....                                                                                                                             | 47 |
| 24 Resistance of insulating material to abnormal heat, to fire and to tracking .....                                                                                                                       | 58 |
| 25 Resistance to rusting .....                                                                                                                                                                             | 58 |
| 26 EMC requirements.....                                                                                                                                                                                   | 58 |
| 101 Abnormal conditions .....                                                                                                                                                                              | 68 |
| 102 Components .....                                                                                                                                                                                       | 74 |
| 103 Electromagnetic fields (EMF) .....                                                                                                                                                                     | 81 |
| Annex A (normative) <i>Replacement of title to Annex A as follows:</i> Additional<br>requirements for electronic control devices having facilities for the outlet and retention<br>of flexible cables..... | 82 |
| Annex B (informative) Changes planned for the future in order to align IEC 60669-1<br>with the requirements of IEC 60998 (all parts), IEC 60999 (all parts) and IEC 60228 .....                            | 83 |
| Annex C (informative) Circuit development (19.3) .....                                                                                                                                                     | 84 |
| Annex D (informative) Additional requirements for insulation-piercing terminals.....                                                                                                                       | 85 |
| Annex E (informative) Additional requirements and tests for switches intended to be<br>used at a temperature lower than -5 °C .....                                                                        | 86 |
| Annex AA (informative) Examples of types of electronic switches or HBES/BACS<br>switches and their functions .....                                                                                         | 91 |
| Annex BB (informative) Circuit development: 19.106 explained .....                                                                                                                                         | 92 |

|    |                                                                                           |     |
|----|-------------------------------------------------------------------------------------------|-----|
| 45 | Annex CC (normative) Additional requirements for electronic control devices using         |     |
| 46 | DLT-technology in accordance with IEC 62756-1 .....                                       | 98  |
| 47 | Annex DD (informative) Test set-ups .....                                                 | 100 |
| 48 | Annex EE (informative) Electrical interface specification for phase-cut dimmer in         |     |
| 49 | phase-cut dimmed lighting systems .....                                                   | 107 |
| 50 | Annex FF (normative) Requirements for electronic RCS and electronic TDS that              |     |
| 51 | provide the function, markings and connection configuration in accordance with            |     |
| 52 | IEC 60669-2-2 and IEC 60669-2-3 .....                                                     | 138 |
| 53 | Annex GG (informative) Flow-chart for the tests of subclause 101.2.4                      |     |
| 54 | Bibliography .....                                                                        | 144 |
| 55 |                                                                                           |     |
| 56 | Figure 101 – Test pin for checking the protection against electric shock.....             | 28  |
| 57 | Figure 102 – Current path tested in the looping through circuit.....                      | 39  |
| 58 | Figure 103 – Circuit diagram for testing electronic switches and HBES/BACS switches ..... | 40  |
| 59 | Figure 104 – Protective separation between circuits .....                                 | 54  |
| 60 | Figure 105 – Multilayer printed circuit board example.....                                | 59  |
| 61 | Figure 106 – Minimum creepage and clearances on printed circuit boards .....              | 73  |
| 62 | Figure 107 – Surge test .....                                                             | 81  |
| 63 | Figure BB.1 – 120 V 15 W (LT spice model) .....                                           | 93  |
| 64 | Figure BB.2 – 230 V 15 W (LT spice model) .....                                           | 94  |
| 65 | Figure BB.3 – Model for multiple lamp loads .....                                         | 95  |
| 66 | Figure BB.4 – $I_{peak}$ and $I^2t$ for multiple lamp loads .....                         | 95  |
| 67 | Figure DD.1 – Test setup for AC mains connection according to IEC 61000-4-4 .....         | 100 |
| 68 | Figure DD.2 – Test setup for bus and DC mains connection according to                     |     |
| 69 | IEC 61000-4-4 .....                                                                       | 101 |
| 70 | Figure DD.3 – Test setup for AC mains connection according to IEC 61000-4-5 .....         | 102 |
| 71 | Figure DD.4 – Test setup for bus and DC mains connection according to                     |     |
| 72 | IEC 61000-4-5 .....                                                                       | 103 |
| 73 | Figure DD.5 – Test setup for the ESD according to IEC 61000-4-2.....                      | 104 |
| 74 | Figure DD.6 – Test setup for AC mains connection according to IEC 61000-4-6 .....         | 105 |
| 75 | Figure DD.7 – Test setup for bus and DC mains connection according to                     |     |
| 76 | IEC 61000-4-6 .....                                                                       | 106 |
| 77 | Figure EE.1 – Example of wiring diagram .....                                             | 110 |
| 78 | Figure EE.2 – Timing leading edge dimming method.....                                     | 113 |
| 79 | Figure EE.3 – Timing trailing edge dimming method .....                                   | 118 |
| 80 | Figure EE.4 – Circuit to test the properties of the phase-cut dimmer during the non-      |     |
| 81 | conducting phase (Method 1) .....                                                         | 124 |
| 82 | Figure EE.5 – Circuit to test the properties of the phase-cut dimmer during the non-      |     |
| 83 | conducting phase (Method 2) .....                                                         | 125 |
| 84 | Figure EE.6 – Circuit to test the properties of the phase-cut dimmer during the           |     |
| 85 | transition from the non-conducting to the conducting phase .....                          | 126 |
| 86 | Figure EE.7 – Circuit to test the properties of the phase-cut dimmer during the           |     |
| 87 | electronic off-state .....                                                                | 128 |
| 88 | Figure EE.8 – Waveform of AC voltage source – Leading edge .....                          | 129 |
| 89 | Figure EE.9 – Waveform of AC voltage source – Trailing edge.....                          | 129 |

|     |                                                                                                 |     |
|-----|-------------------------------------------------------------------------------------------------|-----|
| 90  | Figure EE.10 – Equivalent circuit for controlgear in the on state to be used during             |     |
| 91  | dimmer tests.....                                                                               | 130 |
| 92  | Figure EE.11 – Equivalent circuit for controlgear being in off state .....                      | 131 |
| 93  | Figure EE.12 – Test enclosure .....                                                             | 134 |
| 94  | Figure EE.13 – Geometry of microphone placement in regard to device under test .....            | 134 |
| 95  | Figure EE.14 – Test circuit to test stability of phase angle .....                              | 135 |
| 96  | Figure EE.15 – Possibilities for proper triggering .....                                        | 136 |
| 97  | Figure EE.16 – Equivalent circuit EC_CG2 .....                                                  | 137 |
| 98  |                                                                                                 |     |
| 99  | Table 1 – Number of specimens needed for the tests (to be updated according the                 |     |
| 100 | changes confirmed) .....                                                                        | 16  |
| 101 | Table 15 – Test voltage, points of application and minimum values of insulating                 |     |
| 102 | resistance for the verification of electric strength .....                                      | 30  |
| 103 | Table 101 – Permissible temperature rise values .....                                           | 35  |
| 104 | Table 102 – Application of tests for making and breaking capacity and normal                    |     |
| 105 | operation for electronic switches and HBES/BACS switches according to 7.102.2 .....             | 38  |
| 106 | Table 103 – Values for $I_{peak}$ and $I^2t$ depending on the type of distribution system ..... | 43  |
| 107 | Table 104 – Calculated circuit parameters .....                                                 | 44  |
| 108 | Table 105 – Test loads for HBES/BACS switches for heating installations .....                   | 45  |
| 109 | Table 23 – Creepage distances, clearances and distances through insulating sealing              |     |
| 110 | compound.....                                                                                   | 47  |
| 111 | Table 106 – Relation between the rated voltage of the HBES/BACS switch, the rated               |     |
| 112 | insulation voltage and the rated impulse voltage.....                                           | 50  |
| 113 | Table 107 – Minimum clearances without verification test .....                                  | 51  |
| 114 | Table 108 – Test voltages and corresponding altitudes .....                                     | 52  |
| 115 | Table 109 – Minimum clearances with verification test .....                                     | 52  |
| 116 | Table 110 – Minimum creepage distances of basic, supplementary and reinforced                   |     |
| 117 | insulation without verification test for clearances .....                                       | 53  |
| 118 | Table 111 – Minimum creepage distances of basic, supplementary and reinforced                   |     |
| 119 | insulation with verification test for clearances .....                                          | 53  |
| 120 | Table 112 – Type of insulation .....                                                            | 55  |
| 121 | Table 113 – Immunity tests (overview) .....                                                     | 60  |
| 122 | Table 114 – Voltage dip and short-interruption test values .....                                | 60  |
| 123 | Table 115 – Surge immunity test voltages .....                                                  | 62  |
| 124 | Table 117 – Fast transient test values .....                                                    | 63  |
| 125 | Table 117 – Values for radiated electromagnetic field test of IEC 61000-4-3 <sup>a</sup> .....  | 65  |
| 126 | Table 118 – Measurement methods.....                                                            | 68  |
| 127 | Table 120 – Capacitors .....                                                                    | 75  |
| 128 | Table A.101 – Maximum current and minimum cross-sectional area .....                            | 82  |
| 129 | Table E.101 – Energy for impact tests.....                                                      | 89  |
| 130 | Table AA.1 – Functions overview .....                                                           | 91  |
| 131 | Table BB.1 – Lamp .....                                                                         | 92  |
| 132 | Table EE.1 – Nominal mains voltage 100 V – Frequency 50 Hz or 60 Hz.....                        | 114 |
| 133 | Table EE.2 – Nominal mains voltage 120 V – Frequency 50 Hz or 60 Hz.....                        | 114 |
| 134 | Table EE.3 – Nominal mains voltage 200 V – Frequency 50 Hz or 60 Hz.....                        | 114 |

|     |                                                                                           |     |
|-----|-------------------------------------------------------------------------------------------|-----|
| 135 | Table EE.4 – Nominal mains voltage 230 V – Frequency 50 Hz or 60 Hz.....                  | 114 |
| 136 | Table EE.5 – Nominal mains voltage 277 V – Frequency 50 Hz or 60 Hz.....                  | 114 |
| 137 | Table EE.6 – Slew rate for voltage decrease across the phase-cut dimmer .....             | 115 |
| 138 | Table EE.7 – Nominal mains voltage 100 V – Frequency 50 Hz or 60 Hz.....                  | 116 |
| 139 | Table EE.8 – Nominal mains voltage 120 V – Frequency 50 Hz or 60 Hz.....                  | 116 |
| 140 | Table EE.9 – Nominal mains voltage 200 V – Frequency 50 Hz or 60 Hz.....                  | 116 |
| 141 | Table EE.10 – Nominal mains voltage 230 V – Frequency 50 Hz or 60 Hz.....                 | 116 |
| 142 | Table EE.11 – Nominal mains voltage 277 V – Frequency 50 Hz or 60 Hz.....                 | 117 |
| 143 | Table EE.12 – Nominal mains voltage from 100 V to 277 V – Frequency 50 Hz or              |     |
| 144 | 60 Hz .....                                                                               | 119 |
| 145 | Table EE.13 – Nominal mains voltage 100 V – Frequency 50 Hz or 60 Hz.....                 | 120 |
| 146 | Table EE.14 – Nominal mains voltage 120 V – Frequency 50 Hz or 60 Hz.....                 | 120 |
| 147 | Table EE.15 – Nominal mains voltage 200 V – Frequency 50 Hz or 60 Hz.....                 | 120 |
| 148 | Table EE.16 – Nominal mains voltage 230 V – Frequency 50 Hz or 60 Hz.....                 | 121 |
| 149 | Table EE.17 – Nominal mains voltage 277 V – Frequency 50 Hz or 60 Hz.....                 | 121 |
| 150 | Table EE.18 – Currents and voltages for controlgear during the electronic off state ..... | 122 |
| 151 | Table EE.19 – Parameters for testing purposes .....                                       | 123 |
| 152 | Table EE.20 – Parameters for testing purposes .....                                       | 132 |

153

154

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SWITCHES FOR HOUSEHOLD AND  
SIMILAR FIXED ELECTRICAL INSTALLATIONS –****Part 2-1: Particular requirements – Electronic control devices****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.

International Standard IEC 60669-2-1 has been prepared by subcommittee 23B: Plugs, socket-outlets and switches, of IEC technical committee 23: Electrical accessories.

This fifth edition cancels and replaces the fourth edition published in 2002, Amendment 1:2008 and Amendment 2:2015. This edition constitutes a technical revision.

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

- a) incorporation of the requirements for HBES switches, previously included in IEC 60669-2-5;
- b) modification of 19.106, test and requirements for switches for LEDs;
- c) general indication to cover electronic control devices;
- d) test for looping through.

208 The text of this International Standard is based on the following documents:

| FDIS          | Report on voting |
|---------------|------------------|
| 23B/1326/FDIS | 23B/1342/RVD     |

209  
210 Full information on the voting for the approval of this International Standard can be found in the  
211 report on voting indicated in the above table.

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

213 This part of IEC 60669 is to be used in conjunction with IEC 60669-1:2017, hereinafter referred  
214 to as Part 1. It lists the changes necessary to convert that standard into a specific standard for  
215 electronic control devices.

216 In this document, the following print types are used:

- 217 – requirements proper: in roman type;
- 218 – *test specifications: in italic type;*
- 219 – notes: in smaller roman type.

220 Subclauses, figures, tables or notes which are additional to those in Part 1 are numbered  
221 starting from 101.

222 A list of all the parts in the IEC 60669 series, published under the general title *Switches for*  
223 *household and similar fixed electrical installations*, can be found on the IEC website.

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

- 227 • reconfirmed,
- 228 • withdrawn,
- 229 • replaced by a revised edition, or
- 230 • amended.

231

**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.**

232

233

## SWITCHES FOR HOUSEHOLD AND SIMILAR FIXED ELECTRICAL INSTALLATIONS –

### Part 2-1: Particular requirements – Electronic control devices

#### 1 Scope

This clause of Part 1 is replaced by:

This part of IEC 60669 applies to electronic control devices, a general term to cover electronic switches, home and building electronic systems (HBES) / building automation and control systems (BACS) switches and electronic extension units.

It applies to electronic switches and to HBES/BACS switches, for alternating current (AC) only with a rated switching voltage not exceeding 250 V and a rated current not exceeding 16 A, intended for household and similar fixed electrical installations, either indoors or outdoors.

It also applies to electronic extension units with a rated supply voltage not exceeding 250 V AC and 120 V DC, such as sensors and push buttons.

This document also applies to electronic remote control switches (RCS) and electronic time delay switches (TDS). Particular requirements are given in Annex FF.

Switches including only passive components such as resistors, capacitors, inductors, positive temperature coefficient (PTC) and negative temperature coefficient (NTC) components, varistors, printed wiring boards and connectors are not considered as electronic control devices.

This document also applies to electronic switches and HBES/BACS switches of which the control is realized by an electronic signal for the operation of lighting equipment circuits and the control of the brightness of lighting equipment (dimmers) as well as the control of the speed of motors (for example, those used in ventilating fans) and for other purposes (for example, heating controls).

The operation and/or control as mentioned above can be transmitted by an electronic signal via several media, for example, powerline (mains), twisted pair, optical fibre, radio frequency, infrared, etc. and are performed:

- intentionally by a person via an actuating member, a key, a card, etc., via a sensing surface or a sensing unit, by means of touch, proximity, turn, optical, acoustic, thermal;
- by physical means, for example, light, temperature, humidity, time, wind velocity, presence of people;
- by any other influence.

This document also applies to electronic control devices which include integrated radio receivers and transmitters.

This document also applies to specific boxes for switches. The specific boxes are considered as part of the enclosure.

NOTE 1 General purpose boxes for switches and other accessories are covered by IEC 60670-1.

276 Requirements for general purpose mounting boxes are given in the relevant part, if any, of  
277 IEC 60670.

278 This document applies to electronic control devices for use at ambient temperature not normally  
279 exceeding 25 °C but occasionally reaching 35 °C with a lower limit of the ambient air temperature of  
280 –5 °C.

281 NOTE 2 For lower temperatures, see Annex E.

282 Functional safety aspects are not covered by this document. Functional safety requirements  
283 are covered by the standards of the controlled devices.

284 In locations where special conditions prevail, such as in ships, vehicles and the like and in  
285 hazardous locations, for example where explosions are liable to occur, special construction  
286 and/or additional requirements may be required.

287 This document is not intended to cover devices which are designed to be incorporated in  
288 appliances or are intended to be delivered together with a specific appliance and which are  
289 within the scope of IEC 60730 (all parts) or IEC 61058-1.

290 Examples of designs of electronic switches and HBES/BACS switches and functions are shown  
291 in Annex AA.

292 Electrical interface specification for phase-cut dimmer used in phase-cut dimmed lighting  
293 systems are given for information only in Annex EE.

## 294 **2 Normative references**

295 This clause of Part 1 applies except as follows.

296 *Addition:*

297 IEC 60050-845, *International Electrotechnical Vocabulary (IEV) – Part 845: Lighting* (available  
298 at [www.electropedia.org](http://www.electropedia.org))

299 IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

300 IEC 60127 (all parts), *Miniature fuses*

301 IEC 60317 (all parts), *Specifications for particular types of winding wires*

302 IEC 60317-0-1:2013, *Specifications for particular types of winding wires – Part 0-1: General*  
303 *requirements – Enamelled round copper wire*

304 IEC 60384-14:2013, *Fixed capacitors for use in electronic equipment – Part 14: Sectional*  
305 *specification – Fixed capacitors for electromagnetic interference suppression and connection*  
306 *to the supply mains*

307 IEC 60384-14:2013/AMD1:2016

308 IEC 60664-1:2020, *Insulation coordination for equipment within low-voltage supply systems –*  
309 *Part 1: Principles, requirements and tests*

310 IEC 60664-3:2016, *Insulation coordination for equipment within low-voltage systems – Part 3:*  
311 *Use of coating, potting or moulding for protection against pollution*

312 IEC 60669-1:2017, *Switches for household and similar fixed electrical installations – Part 1:*  
313 *General requirements*

- 314 IEC 60669-2-2:2006, *Switches for household and similar fixed electrical installations – Part 2-2:*  
315 *Particular requirements – Electromagnetic remote-control switches (RCS)*
- 316 IEC 60669-2-3:2006, *Switches for household and similar fixed electrical installations – Part 2-3:*  
317 *Particular requirements – Time-delay switches (TDS)*
- 318 IEC 60670 (all parts), *Boxes and enclosures for electrical accessories for household and similar*  
319 *fixed electrical installations*
- 320 IEC 60704-1, *Household and similar electrical appliances – Test code for the determination of*  
321 *airborne acoustical noise – Part 1: General requirements*
- 322 IEC 60715, *Dimensions of low-voltage switchgear and controlgear – Standardized mounting on*  
323 *rails for mechanical support of switchgear, controlgear and accessories*
- 324 IEC 60730 (all parts), *Automatic electrical controls*
- 325 IEC 60990, *Methods of measurement of touch current and protective conductor current*
- 326 IEC 60999-1, *Connecting devices – Electrical copper conductors – Safety requirements for*  
327 *screw-type and screwless-type clamping units – Part 1: General requirements and particular*  
328 *requirements for clamping units for conductors from 0,2 mm<sup>2</sup> up to 35 mm<sup>2</sup> (included)*
- 329 IEC 61000-2-2, *Electromagnetic compatibility (EMC) – Part 2-2: Environment – Compatibility*  
330 *levels for low-frequency conducted disturbances and signaling in public low-voltage power*  
331 *supply systems*
- 332 IEC 61000-3-2:2018, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for*  
333 *harmonic current emissions (equipment input current ≤ 16 A per phase)*
- 334 IEC 61000-3-3:2013, *Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of*  
335 *voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for*  
336 *equipment with rated current ≤ 16 A per phase and not subject to conditional connection*  
337 *IEC 61000-3-3:2013/AMD1:2017*
- 338 IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement*  
339 *techniques – Electrostatic discharge immunity test*
- 340 IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement*  
341 *techniques – Radiated, radio-frequency, electromagnetic field immunity test*
- 342 IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement*  
343 *techniques – Electrical fast transient/burst immunity test*
- 344 IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement*  
345 *techniques – Surge immunity test*
- 346 IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement*  
347 *techniques – Immunity to conducted disturbances, induced by radio-frequency fields*
- 348 IEC 61000-4-8, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement*  
349 *techniques – Power frequency magnetic field immunity test*
- 350 IEC 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement*  
351 *techniques – Voltage dips, short interruptions and voltage variations immunity tests for*  
352 *equipment with input current up to 16 A per phase*

IEC 61000-4-20:2010, *Electromagnetic compatibility (EMC) – Part 4-20: Testing and measurement techniques – Emission and immunity testing in transverse electromagnetic (TEM) waveguides*

IEC 61558-2-6, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers*

IEC 61558-2-16, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units*

IEC 62504, *General lighting – Light emitting diode (LED) products and related equipment – Terms and definitions*

IEC 62756-1, *Digital load side transmission lighting control (DLT) – Part 1: Basic requirements*

IEC/TR 63037:2019, *Electrical interface specifications for self ballasted lamps and controlgear in phase-cut dimmed lighting systems*

IEC 63044-3:2017, *Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) – Part 3: Electrical safety requirements*

CISPR 14-1:2016, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission*

CISPR 15:2018, *Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment*

CISPR 32:2015, *Electromagnetic compatibility of multimedia equipment – Emission requirements*  
CISPR 32:2015/AMD1:2019

ISO 306:2013, *Plastics – Thermoplastic materials – Determination of Vicat softening temperature (VST)*

ISO 3741, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Precision methods for reverberation test rooms*

ISO 3744, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane*

### **3 Terms and definitions**

This clause of Part 1 applies except as follows.

Add the terms and definitions in IEC 63044-3:2017 and the following:

#### **3.101**

##### **electronic switch**

stand-alone device designed to make or break and/or control directly the current in one or more electric circuits either through mechanical switching element(s) via an electronic control circuit, or through an electronic switching element via a mechanical/electronic control circuit

391 Note 1 to entry: A stand-alone device can still be controlled remotely via RF, IR or a dedicated electronic extension  
392 unit.

393 Note 2 to entry: To make or break and/or to control directly means that an actuator makes or breaks the current  
394 and/or controls the current.

### 395 **3.102**

#### 396 **HBES/BACS**

397 combination of HBES/BACS products (including their separate connected/detachable devices)  
398 linked together via one or more HBES/BACS networks

399 Note 1 to entry: Other names used such as "home control network", "home control systems", "home and building  
400 electronic systems", "building systems", "building automation system", etc. describe types of HBES/BACS system.

401 Note 2 to entry: HBES is the abbreviated term for "home and building electronic systems" and BACS is the  
402 abbreviated term for "building automation and control systems".

403 [SOURCE: IEC 63044-1:2017, 3.1.3, modified – Note 2 added.]

### 404 **3.103**

#### 405 **HBES/BACS switch**

406 network operated electronic device intended to be used in an HBES/BACS, using two-way  
407 communication and designed to make or break and/or to control directly the current in one or  
408 more electric circuits

409 Note 1 to entry: The communication can use different media, for example twisted pair (TP), power line (PL), infrared  
410 (IR) and radio frequency (RF).

411 Note 2 to entry: To make or break and/or to control directly means that an actuator makes or breaks the current  
412 and/or controls the current.

### 413 **3.104**

#### 414 **electronic extension unit**

415 device connected to an electronic switch, an HBES/BACS switch, and to lighting products used  
416 in lighting systems in the building environment in order to remotely control and/or to monitor the  
417 electronic switch, the HBES/BACS switch, and lighting products used in lighting systems in the  
418 building environment

419 Note 1 to entry: The electronic extension unit does not control directly the current in one or more circuits (e.g.  
420 sensors, HBES/BACS push buttons, status display).

### 421 **3.105**

#### 422 **ELV**

#### 423 **extra low voltage**

424 nominal voltage in the electrical installation of buildings according to the voltage band I  
425 specified in IEC 61140:2016

426 Note 1 to entry: Voltage band I according to IEC 61140 is a voltage below or equal to 50 V AC or 120 V DC.

427 [SOURCE: IEC 63044-3:2017, 3.1.7, modified – The publication IEC 61140 has been dated.]

### 428 **3.106**

#### 429 **FELV**

#### 430 **functional extra low voltage**

431 electrical circuit in which the nominal voltage cannot exceed ELV under normal conditions

432 Note 1 to entry: FELV has simple separation from mains.

433 Note 2 to entry: A FELV circuit is not safe to touch and may be connected to protective earth.

434 [SOURCE: IEC 63044-3:2017, 3.1.9, modified – The word "circuit" has been omitted from both  
435 terms.]

**3.107****SELV circuit****safety extra low voltage circuit**

electrical circuit in which the nominal voltage cannot exceed ELV

– under normal conditions,

– under single fault conditions, including earth fault in other circuits

Note 1 to entry: SELV has simple separation from PELV and other SELV systems, and earth and protective separation from all other circuits.

Note 2 to entry: Under normal conditions and single-fault conditions in a dry location inside a building, a SELV circuit with a voltage not higher than 25 V AC or 60 V DC is safe to touch.

[SOURCE: IEC 63044-3:2017, 3.1.10]

**3.108****PELV circuit****protective extra low voltage circuit**

electrical circuit in which the nominal voltage cannot exceed ELV

– under normal conditions,

– under single-fault conditions, except earth fault in other circuits

Note 1 to entry: PELV has protective separation from all circuits other than PELV, SELV or earth.

Note 2 to entry: PELV circuit is safe to touch within the same equipotential bonding area inside a building under the following conditions: under normal and single-fault conditions in dry locations and with no large contact area with a voltage not higher than 25 V AC or 60 V DC; otherwise not higher than 12 V AC or 30 V DC.

[SOURCE: IEC 63044-3:2017, 3.1.11]

**3.109****simple separation**

separation between circuits or between a circuit and earth by means of basic insulation

[SOURCE: IEC 63044-3:2017, 3.1.12]

**3.110****protective separation**

separation of one electric circuit from another by means of

– double insulation, or

– basic insulation and protective screening (shielding), or

– reinforced insulation

[SOURCE: IEC 63044-3:2017, 3.1.13]

**3.111****basic insulation**

insulation of hazardous-live-parts which provides basic protection

Note 1 to entry: This concept does not apply to insulation used exclusively for functional purposes.

[SOURCE: IEC 63044-3:2017, 3.1.14, modified – The note has been added.]

**3.112****supplementary insulation**

independent insulation applied in addition to basic insulation for fault protection

[SOURCE: IEC 63044-3:2017, 3.1.16]

**3.113****double insulation**

insulation comprising both basic insulation and supplementary insulation

[SOURCE: IEC 63044-3:2017, 3.1.15]

**3.114****reinforced insulation**

insulation of hazardous-live-parts which provides a degree of protection against electric shock equivalent to double insulation

Note 1 to entry: Reinforced insulation may comprise several layers which cannot be tested singly as basic insulation or supplementary insulation.

[SOURCE: IEC 63044-3:2017, 3.1.18, modified – The note has been added.]

**3.115****rated load**

load assigned in the instructions to the electronic switch, HBES/BACS switch, electronic TDS switch or electronic RCS switch

**3.116****minimum load**

lowest load at which the electronic switch, HBES/BACS switch, electronic TDS switch or electronic RCS switch still operates correctly

**3.117****minimum current**

lowest current at which the electronic switch, HBES/BACS switch, electronic TDS switch or electronic RCS switch still operates correctly

**3.118****electromechanically operated contact mechanism**

component which operates the parts used to open and close the circuit electromechanically

**3.119****semiconductor switching device**

switching device designed to make or break the current in an electric circuit by means of the controlled conductivity of a semiconductor in that circuit

Note 1 to entry: In a circuit where the current passes through zero (periodically or otherwise), the effect of "not making" the current following such a zero value is equivalent to breaking the current.

Note 2 to entry: Typical examples of semiconductor switching devices are:

- electronic switching devices using the phase-cut-on principle to control the load by electronic switching on the current at any phase angle at or after zero crossing in each half-wave, for example, by a thyristor;
- electronic switches or HBES/BACS switches using the phase-cut-off principle to control the load by switching off the current at any phase angle after zero crossing in each half-wave, for example, by a transistor in a diode bridge.

**3.120****phase-cut dimmer**

electronic switch or HBES/BACS switch that is connected in series with a load and changes the supply voltage waveform applied to the load from the pure mains voltage waveform to a leading edge (forward phase) or a trailing edge (reverse phase) AC voltage waveform or is capable of switching between both waveforms

Note 1 to entry: The output voltage waveform of a phase-cut dimmer is applied to one or more loads.

Note 2 to entry: The conduction angle of the voltage waveform is adjustable.

524 Note 3 to entry: Within this document, where the term "dimmer" is used the term "phase-cut dimmer" is meant.

525 **3.121**

526 **mechanical control unit**

527 unit directly adjustable by mechanical means (for example, potentiometer) which controls the  
528 output via electronic components

529 **3.122**

530 **electronic output control unit**

531 unit adjustable by other than mechanical means (for example, sensing unit), containing  
532 electronic components and controlling the output via electronic components

533 **3.123**

534 **protective impedance**

535 impedance connected between hazardous live parts and accessible conductive parts, of such  
536 value that the current, in normal use and under likely fault conditions in the electronic switch,  
537 is limited to a safe value, and which is so constructed that the reliability is maintained throughout  
538 the life of the electronic switch or HBES/BACS switch

539 **3.124**

540 **external flexible cable**

541 cable, a part of which is external to the electronic output control unit

542 Note 1 to entry: Such a cable may either be a supply cable or a connecting cable between separate parts of an  
543 accessory.

544 **3.125**

545 **live part**

546 conductive part intended to be energized in normal operation

547 **3.126**

548 **hazardous live part**

549 live part with a voltage higher than 25 V AC or 60 V DC ripple free in dry conditions or 12 V AC  
550 or 30 V DC in wet conditions

551 Note 1 to entry: Ripple free is conventionally an RMS ripple voltage not more than 10 % of the DC component.

552 **3.127**

553 **looping through function**

554 Function of the line or both line and neutral terminals to power other devices in the circuit of  
555 the installation

556 **3.128**

557 **lamp controlgear**

558 one or more components between the supply and one or more lamps which may serve to  
559 transform the supply voltage, limit the current of the lamp(s) to the required value, provide  
560 starting voltage and preheating current, prevent cold starting, correct power factor or reduce  
561 radio interference

562 Note 1 to entry: Independent dimmers are not considered to be lamp controlgear

563 Note 2 to entry: The lamp control gear can be included in the lamp or can be an independent device

564 [SOURCE: IEC 61347-1]

565 **3.129**

566 **Reference test voltage**

567  **$U_{REF}$**

568 r.m.s. value of voltage used for testing which depends on the mode of protection of the surge  
569 protective device (SPD), the nominal system voltage, the system configuration and the voltage  
570 regulation within the system

**3.130****maximum continuous operating voltage** **$U_c$** 

maximum r.m.s. voltage, which may be continuously applied to the SPD's mode of protection

Note 1 to entry: The  $U_c$  value covered by this standard may exceed 1 000 V.

**3.131****E.U.T.**

Equipment Under Test

**3.132****Surge protective device****SPD**

device that is intended to protect the electrical apparatus from transient overvoltages and to divert surge currents

Note 1 to entry: A surge protective device contains at least one non-linear component

[SOURCE: IEC 614-03-48]

**4 General requirements**

This clause of Part 1 applies, as far as applicable.

**5 General remarks on tests**

This clause of Part 1 applies, as far as applicable, except as follows.

*Replace Table 1 by the following Table 1:*

**Table 1 – Number of specimens needed for the tests (to be updated according the changes confirmed)**

|    | Clauses and subclauses                                                                          | Specimens | Notes   |
|----|-------------------------------------------------------------------------------------------------|-----------|---------|
| 6  | Ratings                                                                                         | A         |         |
| 7  | Classification                                                                                  | A         |         |
| 8  | Marking                                                                                         | A         |         |
| 9  | Checking of dimensions                                                                          | ABC       |         |
| 10 | Protection against electric shock                                                               | ABC       | a       |
| 11 | Provision for earthing                                                                          | ABC       | b       |
| 12 | Terminals                                                                                       | ABC       | c, d, e |
| 13 | Constructional requirements                                                                     | ABC       | f, g    |
| 14 | Mechanism                                                                                       | ABC       |         |
| 15 | Resistance to ageing, protection provided by enclosures of switches, and resistance to humidity | ABC       | t       |
| 16 | Insulation resistance and electric strength                                                     | ABC       | h       |
| 17 | Temperature rise                                                                                | ABC       |         |
| 18 | Making and breaking capacity                                                                    | ABC       | i, j    |
| 19 | Normal operation                                                                                | ABC       | i, j    |
| 20 | Mechanical strength                                                                             | ABC       | k, l    |
| 21 | Resistance to heat                                                                              | ABC       | m       |
| 22 | Screws, current-carrying parts and connections                                                  | ABC       |         |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                             |     |         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----|---------|
| 23                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Creepage distances, clearances and distances through sealing compound       | ABC |         |
| 24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Resistance of insulating material to abnormal heat, to fire and to tracking | DEF | n, o    |
| 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Resistance to rusting                                                       | DEF |         |
| 26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | EMC requirements                                                            | G   |         |
| 101                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Abnormal conditions                                                         | HIJ | p, q, r |
| 102                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Components                                                                  | HIJ | s       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | TOTAL                                                                       | 10  |         |
| <p>a) One extra set of specimens of touch sensitive electronic control devices with a protective impedance may be used for the tests of 10.2.</p> <p>b) One extra set of specimens of electronic control devices with printed conductors used to provide protective earthing continuity is needed for the tests of 11.101.</p> <p>c) Two extra sets of specimens of terminals suitable for rigid and flexible conductors are required for 12.2.5, 12.2.6 and 12.2.7.</p> <p>d) Five extra screwless terminals are used for the test of 12.3.11 and one extra set of specimens is used for the test of 12.3.12</p> <p>e) Number of specimens required for insulation-piercing terminals (IPTs) are shown in Table D.1.</p> <p>f) An extra set of membranes are needed for each of the tests of 13.15.1 and 13.15.2.</p> <p>g) For switches with pilot light units if the electronic circuitry is so enclosed that the short-circuiting or disconnecting of components is impossible or difficult, the manufacturer shall provide additional prepared test specimens.</p> <p>h) One extra set of specimens of switches fitted with pilot light may be used for the tests of Clause 16.</p> <p>i) Only the complete contact mechanism may be submitted.</p> <p>j) For electronic switches and HBES/BACS switches with mechanical and electromechanical switching devices, one extra set of specimens is needed for each additional type of load (see also Table 102).</p> <p>k) Extra sets of specimens are needed for the tests of 20.5.2 and 20.5.3.</p> <p>l) One extra set of specimens of cord-operated switches is needed for the test of 20.10</p> <p>m) One extra set of specimens may be used for the tests of 21.2 and 21.3. In this case the specimens shall be subjected first to the tests of 15.1.</p> <p>n) The test is made on one specimen (D). In case of doubt, the test shall be repeated on two further specimens (E and F).</p> <p>o) For electronic control devices with an IP code higher than IPX0, one extra set of specimens may be used for the test of 24.2.</p> <p>p) It may be necessary to provide 3 additional specimens for the test of 101.2.4</p> <p>q) It may be necessary to provide 6 additional sets of 3 specimens for the test of 101.4.</p> <p>r) It may be necessary to provide 3 additional specimens for the test of 101.5.</p> <p>s) For electronic control devices and HBES/BACS switches with a cut-out, one extra set of specimens may be used for the tests of 102.5.2.2 or 102.5.2.3.</p> <p>t) Two extra sets of specimens may be used for IP test IP &gt; 20 according to 15.2.2 and 15.2.3. The specimens shall be preliminarily submitted to the ageing test of 15.1.</p> |                                                                             |     |         |

593

594 **5.101 Particular requirements**

595 *Applied voltage and current measuring instruments shall indicate true RMS values and shall*  
596 *not be affected by factors such as waveform*

597 *If the electronic circuitry is so enclosed that the short-circuiting or disconnecting of components*  
598 *is impossible or difficult, the manufacturer shall provide one additional test specimen with leads*  
599 *connected for measurements, short-circuiting, etc.*

600 *It is not necessary to connect leads to the interior of hybrid and monolith integrated circuits.*

601 *It may be necessary to disconnect electronic components for tests.*

602 *In this document the term instructions is understood to mean manufacturer's instructions.*

## 603 **6 Ratings**

604 This clause of Part 1 applies, as far as applicable, except as follows.

### 605 **6.1 Rated voltage**

606 *Replace the first paragraph by:*

607 Preferred rated voltages of the load circuits are 110 V, 120 V, 130 V, 220 V, 230 V and 240 V.

608 NOTE For electronic extension units, other AC or DC voltages are common for the power supply and  
609 communication.

### 610 **6.2 Rated current**

611 *Replace the entire text of Subclause 6.2 by:*

612 There are no preferred values.

### 613 **6.3 Preferred combinations of number of poles and ratings**

614 *Replace the entire text of Subclause 6.3 by:*

615 There are no preferred combinations of number of poles and ratings.

#### 616 **6.101 Preferred rated supply frequency**

617 The preferred rated supply frequencies are 50 Hz and/or 60 Hz.

## 618 **7 Classification**

619 This clause of Part 1 applies, as far as applicable, except as follows.

620 **7.5** according to the method of actuating the switch:

621 *Addition:*

- 622 – touch;
- 623 – proximity;
- 624 – optical;
- 625 – acoustic;
- 626 – other external influences.

627 **7.7** according to the method of installation, as a consequence of the design of the switch:

628 *Addition:*

629 NOTE This classification is not applicable for SELV electronic control devices

630 **7.8** according to the type of terminal:

631 *Addition:*

- 632 – electronic control devices without terminals equipped with connecting leads.

633 **7.9** according to the suitability to accept conductors:

634 *Add the following note at the end:*

635 NOTE 101 This classification does not apply to terminals used for communication purpose only.

636 **7.101** according to the type of product:

- 637 – electronic control devices classified as an electronic switch;
- 638 – electronic control devices classified as an HBES/BACS switch;
- 639 – electronic control devices classified as an electronic extension unit.

640 **7.102** according to the kind of load intended to be controlled by the electronic switch or  
641 HBES/BACS switch:

642 **7.102.1** for general purpose use according to Part 1 up to and including 16 A;

643 **7.102.2** for dedicated loads:

- 644 – incandescent lamps;
- 645 – iron core transformers lamp controlgear for extra-low voltage incandescent lamps;
- 646 – electronic step-down converters lamp controlgear for extra-low voltage incandescent lamps;
- 647 – other lamp controlgear
- 648 – motors;
- 649 – heating installations (a combination of resistive load and a motor load with a power factor  
650 not less than 0,6);
- 651 – specific load, defined in the instructions

652 NOTE: Specific loads are loads which are not listed above

653 **7.103** according to the presence of SELV, PELV or FELV parts:

- 654 – electronic control devices with SELV, PELV or FELV parts only;
- 655 – electronic control devices without SELV, PELV or FELV parts;
- 656 – electronic control devices having a combination of parts connected to the mains and SELV,  
657 PELV or FELV parts.

658 **7.104** according to the installation environment:

- 659 – electronic control devices intended to be used in a SELV/PELV environment only;
- 660 – electronic control devices intended to be used in a FELV environment only;
- 661 – electronic control devices intended to be used in a SELV/PELV, FELV and/or mains  
662 environment.

663 **7.105** according to the connection to the network port based on SELV/PELV:

- 664 – a) connected to a network which is installed wholly within the same equipotential earthing  
665 system;
- 666 – b) connected to a network which is not installed wholly within the same equipotential  
667 earthing system.

668 **7.106** according to the mounting area

- 669 – electronic control devices intended for floor installation
- 670 – electronic control devices intended for wall installation
- 671 – electronic control devices intended for ceiling installation

## 8 Marking

This clause of Part 1 applies except as follows.

### 8.1 General

#### *Replacement:*

Electronic switches and HBES/BACS switches shall be marked with:

- rated voltage(s) in volts;
- for switches classified according to 7.102.1, the rated current(s)
  - in amperes (A) if the switch is tested according to 19.1 of Part 1 only, or
  - in amperes (A) if the switch is tested according to 19.1 and 19.3 of Part 1 only, or
  - in amperes (AX) if the switch is tested according to 19.1, 19.2 and 19.3 of Part 1 when the rated currents in amperes (A) and (AX) are equal, or
  - in amperes (A and AX) if the switch is tested according to 19.1, 19.2 and 19.3 of Part 1 when the rated currents in amperes (A) and (AX) are not equal;
- for switches classified according to 7.102.2, the rated current(s) in amperes or rated load(s) in volt-amperes or watts;
- symbol for nature of supply;
- manufacturer's or responsible vendor's name, trade mark or identification mark;
- type reference, which may be a catalogue number;
- symbol for mini-gap construction, if applicable;
- symbol for micro-gap construction, if applicable;
- symbol for semiconductor switching device, if applicable;
- first characteristic numeral for the degree of protection against access to hazardous live parts and against harmful effects due to ingress of solid objects, if declared higher than 4, in which case the second characteristic numeral shall also be marked;
- second characteristic numeral for the degree of protection against harmful effects due to ingress of water, if declared higher than 2, in which case the first characteristic numeral shall also be marked;
- length of insulation to be removed before the insertion of the conductor into the screwless type terminal.

NOTE 1 For electronic switches and HBES/BACS switches suitable for more than one type of rated load, see 8.3.

NOTE 2 In the following country, the marking of the type reference is not used: UK.

NOTE 3 In the following countries, the symbol that electrotechnical expertise is required (see IEC 60417-6182:2013-09) is to be placed on the packaging: DE.

In addition, electronic switches and HBES/BACS switches shall be marked with

- rated frequency in hertz, unless the electronic switch and HBES/BACS switch is designed for both 50 Hz and 60 Hz;
- rating and type of any fuse incorporated in the electronic switch and HBES/BACS switch, if intended to be replaceable;
- symbols for the kind of load (see 8.2); except for electronic switches and HBES/BACS switches classified according to 7.102.1 for general purpose use for which Part 1 applies;
- the minimum height for mounting the electronic switch and the HBES/BACS switch shall be indicated in the instructions if there is a restriction (see 10.1).

In addition, electronic switches and HBES/BACS switches with screwless terminals shall be marked with an indication of the suitability to accept rigid conductors only, for those electronic switches and

716 HBES/BACS switches having this restriction. This information may be put on the electronic switch  
717 and/or on the packaging unit.

718 For electronic switches and HBES/BACS switches with included automatic function if the declared  
719 number of operations in the instructions is higher than that indicated in 19.101, 19.102, 19.104, 19.106  
720 and 19.107 then this shall be stated in the accompanying instruction sheet.

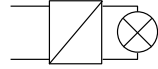
721 Electronic extension units are marked as for electronic switches and HBES/BACS switches but  
722 electronic extension units which are supplied by the network do not need to be marked with:

- 723 – rated voltage in volts;
- 724 – rated current in amperes or rated load in volt-amperes or watts;
- 725 – symbol for nature of supply.

726 The method for the correct installation of the product shall be provided in the instructions.

## 727 8.2 Symbols

728 *Addition:*

|                                                                                                |                                                                                       |
|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Volt-ampere                                                                                    | VA                                                                                    |
| Hertz                                                                                          | Hz                                                                                    |
| Terminal for regulated load (IEC 60417-6165:2012-06)                                           |   |
| Type of load:                                                                                  |                                                                                       |
| LED light sources                                                                              | LED                                                                                   |
| Incandescent lamps (IEC 60417-5012:2002-10)                                                    |  |
| Fluorescent lamps (IEC 60417-6153:2012-04)                                                     |  |
| Motors (ISO 7000-0147:2004-01)                                                                 |  |
| Electronic step-down converter for extra-low-voltage incandescent lamps (for example, halogen) |  |
| Iron core transformer for extra-low-voltage incandescent lamps (for example, halogen)          |                                                                                       |

729 Note: LED light sources and fluorescent light sources are always connected to a lamp controlgear. The electronic  
730 switch and the HBES/BACS switch will switch the lamp controlgear. A dedicated symbol for lamp controlgear is not  
731 available. The marking is needed for the end user.

732 For electronic switches or HBES/BACS switches intended for heating installations suitable for  
733 resistive load and for motor load, the rated current for motor load is placed between round  
734 brackets and immediately follows the rated current for resistive load.

735 Example: 16(3), where 16 A is the rated current for resistive load and 3 A is the rated current  
736 for motor load.

737 NOTE 101 The rating and type of any fuse can be marked with symbols (see IEC 60127 (all parts)).

738 If other symbols are used, they shall be explained in the installation instructions.

In the case of specific load, it shall be defined in the instructions. This includes the number of switching cycles.

Additional markings according to IEC 61140 can only be used if the protection class is not dependent on the installation conditions.

### 8.3 Visibility of markings

*Replacement of the second paragraph with the following:*

The following marking shall be placed on the main part of the electronic switch and HBES/BACS switch:

- the rated current or rated load, rated voltage, symbol for nature of supply, rated frequency (if required by 8.1), at least one type of load if the electronic switch and HBES/BACS switch is classified in 7.102.2, the rating and type of any incorporated fuse (this shall be marked on the fuse-holder or in the proximity of the fuse),
- either the name, trade mark or identification mark of the manufacturer or of the responsible vendor,
- length of insulation to be removed before the insertion of the conductor into the screwless terminal, if any,
- symbol for mini-gap construction, micro-gap construction or semiconductor device, if applicable,
- the type reference.

NOTE The type reference can be the series reference only.

Where an electronic switch or HBES/BACS switch classified in 7.102.2 is suitable for more than one type of load if not already marked on the electronic switch or HBES/BACS switch, the information concerning these shall be stated in the accompanying instruction sheet. In addition, the minimum, if any, and the maximum current or the minimum, if any, and the maximum load in volt-ampere or watt shall be stated for each type of load.

If a phase-cut dimmer is intended to be used together with an iron core transformer, information shall be given in the instructions that only a transformer intended to be used with a phase-cut dimmer shall be used.

### 8.4 Marking on terminals for phase conductors

*Addition:*

If there are more than two terminals, the load terminal shall be marked with an arrow pointing away from the terminal or with one of the symbols mentioned in 8.2 and any other terminals shall be marked in accordance with the installation instructions.

Unless the installation of the electronic control device is made clear by the markings of the terminals, a wiring diagram shall be provided with each electronic control device.

If switched circuits cannot be used in SELV/PELV circuits, the relevant information shall be provided in the instructions.

If a product is classified according to 7.105 a), this shall be stated in the instructions.

## 8.6 Marking of the switch position

*Addition:*

The off-state shall not be marked with an "O" if the circuit on the load side is considered as live, in accordance with Clause 10.

### 8.6.101

## 8.7 Additional requirements for marking

*Addition after the second paragraph:*

If an electronic control device containing a viewing window (lens) for a sensing device is intended to be mounted at a height greater than 1,7 m, this information shall be stated in the instruction sheet.

If the electronic control device provides a looping through function on the input terminals through other components inside the electronic switch, such as PCBs, then the maximum rated current of the upstream fuse/circuit breaker to be installed shall be declared in the instructions.

If an wall mounted electronic control device containing a viewing window (lens) for a sensing device is intended to be mounted at a height greater than 1,7 m, this information shall be stated in the instruction sheet.

*Addition to NOTE 2:*

- Information concerning external, directly associated fuses/current limiting devices, where applicable.

### 8.101 Other markings

It is recommended that the actual state of the electronic switch and HBES/BACS switch intended to control the brightness of lighting products be indicated when used as intended. This can be achieved by one of the following:

- with marking of the on-/off-state position, or
- with an indicator lamp, or
- by adjusting the lamp dimmer so that at the lowest control state and at rated voltage minus 10 %, the light is still visible.

Adjustment is to be made by the installer using an appropriate load specified in the instructions.

## 9 Checking of dimensions

This clause of Part 1 applies except as follows.

*Addition:*

Electronic control devices may be of dimensions other than those specified in the standard sheets (if any) provided they are supplied with specific boxes.

## 10 Protection against electrical shock

This clause of Part 1 applies except as follows.

## 10.1 Prevention of access to live parts

*Addition after the second paragraph:*

For the purpose of this document, metal sensing surfaces which are connected to hazardous live parts by means of protective impedances (see 10.2) shall not be considered to be hazardous live parts.

Electronic switches and HBES/BACS switches without a mechanical switch in the main circuit do not provide a "full off-state". Therefore, the circuit on the load side shall be considered to be live.

*Add before the last paragraph:*

*Viewing windows or the like on wall mounted electronic control devices intended to be mounted at a height greater than 1,7 m and ceiling mounted electronic control devices are subjected to a force of 30 N.*

## 10.2 Requirements for operating parts

*Addition:*

For touch sensitive electronic control devices, the associated protective impedance does not have to comply with the requirements of Clause 16 and Clause 23.

For electronic control devices with a protection degree of IPX0, accessible parts which are needed for the operation of electronic control devices (for example, sensing surfaces) may be connected to hazardous live parts. If they are connected to hazardous live parts, it shall be by means of a protective impedance.

The protective impedance shall consist of at least two resistors or independent capacitors in series, of the same nominal value or a combination of both. The resistors shall comply with the requirements given in 10.2.4, and the capacitors shall comply with the requirements given in 10.2.3.

The removal of protective impedance shall only be possible by destruction of the electronic control device or by rendering it unusable.

*Compliance is checked by inspection and by the following test.*

*The measurements are carried out between either a single accessible metal part or any combination of accessible metal parts and earth, through a non-inductive resistor of 2 kΩ at rated voltage (and rated load in on-state), in on- and off-state, and/or at lowest and highest setting values. During the measurements, each one of the resistors and all other components, if any, in the protective impedance, are alternatively short-circuited.*

*The current shall not exceed, in any measurement, 0,7 mA (peak value) for AC up to 1 kHz or 2 mA for DC.*

*For frequencies above 1 kHz, the limit of 0,7 mA is multiplied by the value of the frequency in kilohertz but shall not exceed 70 mA.*

### 10.101 Requirements for fuse replacement or adjustment of control setting

During the replacement of fuses or adjustment of control setting there shall be no risk of electric shock for the user.

If a cover or cover-plate or a fuse can be removed without the use of a tool, or if the instructions indicate that for the purpose of maintenance, fuse replacement or adjustment of control settings, covers and cover-plates fastened by means of a tool have to be removed, the protection against

contact with hazardous live parts shall be assured even after removal of the covers or cover-plates.

This requirement does not apply when the electronic control device is to be dismantled from its supporting means for the replacement of the fuse-link and adjustment.

The conditions for the safe replacement of the fuse and the safe adjustment of the setting(s) shall be specified in the instructions, if relevant.

*Compliance is checked by applying test probe B according to IEC 61032:1997 with a force not exceeding 10 N. The test probe shall not touch hazardous live parts.*

If an electronic control device is provided with a hole for adjusting the setting of the electronic control device and this hole is indicated as such, there shall be no risk of electric shock for the user.

*Compliance is checked by applying a test pin according to Figure 101 through that hole only. The pin shall not touch hazardous live parts.*

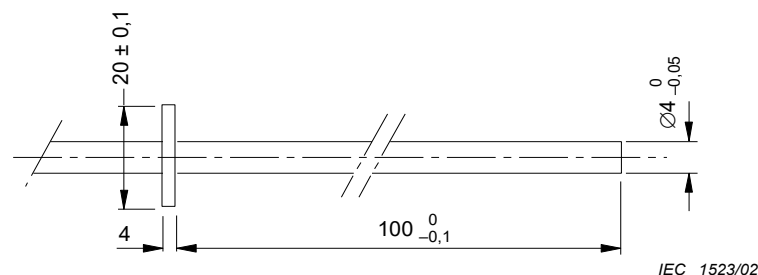


**Figure 101 – Test pin for checking the protection against electric shock**

### 10.102 Ventilation openings

Ventilation openings over hazardous live parts shall be so designed that a foreign body introduced into these openings shall not come into contact with any hazardous live parts with the electronic control device installed as in normal use.

*Compliance is checked by applying the test probe 13 of IEC 61032:1997 through the openings. The pin of the test probe shall not touch hazardous live parts.*

### 10.103 SELV, PELV or FELV circuits

Live parts of SELV, PELV or FELV circuits shall be electrically separated from each other and from other circuits by simple or protective separation as given in Clause 23.

If the SELV / PELV is higher than 25 V AC or 60 V DC in dry conditions or 12 V AC or 30 V DC in wet conditions, protection against direct contact shall be provided by:

- barriers or enclosures giving at least the degree of protection IP2X or IPXXB, or
- insulation capable of withstanding a test voltage of 500 V AC for 1 min.

*Compliance is checked by inspection and the tests of Clause 16 and Clause 23.*

## 10.104 Protection from touch current

### 10.104.1 General

For an explanation on touch current, see IEC 63044-3.

### 10.104.2 Permissible touch current when touching accessible parts of HBES/BACS switches

The touch current of HBES/BACS switches shall not be higher than 0,5 mA RMS (0,7 mA peak) even during single fault condition.

*Compliance is checked by inspection and, if necessary, by tests in accordance with IEC 60990.*

### 10.104.3 Limitation of the touch current from the device to the dedicated HBES/BACS network

The touch current to the HBES/BACS network from HBES/BACS switches supplied from the mains supply, or from interfaces to other networks, shall be limited to 0,25 mA RMS.

*Compliance is checked by measurement in accordance with IEC 60990.*

*This test does not apply to HBES/BACS switches where the circuit to be connected to the HBES/BACS network is connected to the protective or functional earthing terminal in the HBES/BACS switch. In this case the touch current from the HBES/BACS switch to the network is considered to be zero.*

NOTE When it is possible to touch the HBES/BACS network during maintenance, the limitation of the summation of touch current can be considered to be in accordance with IEC 63044-3.

## 11 Provision for earthing

This clause of Part 1 applies except as follows.

Clause 11 does not apply to SELV electronic switches or to SELV HBES/BACS switches.

### 11.101 Protective earthing continuity via printed circuit boards

The printed conductors of printed circuit boards may be used to provide protective earthing continuity under the following conditions only:

- at least two tracks are used each having independent soldering points which will withstand a single short circuit test according to 101.4 ensuring that the current goes through the track and immediately after the switch shall fulfil the requirements of 11.4, or
- a single track is used with two independent means of connection on each end which will withstand a single short circuit test according to 101.4 ensuring that the current goes through the track and immediately after the switch shall fulfil the requirements of 11.4.

In addition,

- the material of the printed circuit board shall consist of epoxide woven glass fabric copper-clad laminated sheet and
- the printed circuit board shall comply with the overload test according to 101.2.4.

*Three new specimens are submitted to the test.*

## 12 Terminals

This clause of Part 1 applies except as follows.

### 12.1 General

*Addition after the last paragraph:*

*Terminals having screw clamping complying with IEC 60998-2-1 are considered to be in compliance with the requirements and tests of 12.2, except those of 12.2.6 and 12.2.7 and 12.2.8, provided they are chosen according to Table 4.*

*Terminals for other than the main circuit (load circuit) may have different connecting capability in relation to this circuit. This means that these terminals need not necessarily have the same connecting capability as the mains terminals. Terminals for conductors smaller than 0,5 mm<sup>2</sup> shall fulfil the requirements of IEC 60999-1.*

*Terminals having screwless clamping complying with IEC 60998-2-2 are considered to be in compliance with the requirements and tests of 12.3 provided they are chosen according to Table 8, except for the requirements of 12.3.7 and 12.3.9. The tests of 12.3.7 and 12.3.9 shall be carried out in addition.*

### 12.2 Terminals with screw clamping for external copper conductors

*Addition to footnote b) of Table 4:*

This requirement may be achieved using terminal(s) with two separate clamping units.

## 13 Constructional requirements

This clause of Part 1 applies except as follows.

### 13.1.1

*Addition before the last paragraph*

Cover and cover plates of ceiling mounted electronic control devices are allowed to be fixed by means of a rotating movement.

*Replace the last paragraph by*

Compliance is checked according to 13.3.2, 13.3.3, 13.3.4 or 13.3.101

### 13.3.3

*Replacement of the text in Table 12 of the last row of the first column with "To insulating parts, earthed metal parts, the live parts of SELV or metal parts separated from hazardous live parts by creepage distances and by clearances twice those according to 23.1".*

*Addition*

**13.3.101** For covers and cover plates of ceiling mounted electronic control devices, which are intended to ensure protection against electric shock, whose fixing is not dependent on screws and whose removal is obtained by applying a torque by the test of 20.101

**13.4 Openings in normal use**

*Addition after the first paragraph:*

Free openings according to 10.101 and 10.102 are accepted.

**13.5 Attachment of knobs**

*Replacement:*

Knobs of electronic control devices shall be securely fixed in a reliable manner so that they will not work loose in normal use, if loosening may result in a hazard.

If knobs are used to indicate the position of electronic control devices, it shall not be possible to fix them in a wrong position, if this may result in a hazard.

*Compliance is checked by inspection and by the following tests.*

*Where it is possible to apply an axial pull in normal use, an axial pull shall be applied for 1 min to try to pull off the knob.*

*The pull force to be applied is normally 15 N, but if the knob is intended to be pulled in normal use this is increased to 30 N.*

*An axial push of 30 N for 1 min is then applied to all knobs.*

*During and after these tests, the electronic control device shall show no damage, nor shall a knob have moved so as to impair compliance with this document.*

NOTE Sealing compound and the like, other than self-hardening resins are not considered to be adequate to prevent loosening.

**13.9 Surface-type switches having an IP code higher than IP20**

*Replace the second paragraph by:*

Wall mounted surface-type switches that have degrees of protection IPX4, IPX5 and IPX6 shall have provisions for opening a drain hole.

**13.15 Requirements for membranes in inlet openings**

*Replace the title by:*

**13.15 Requirements for membranes in inlet opening and lenses****13.15.1**

*Replacement:*

Membranes, lenses and the like shall be reliably fixed and shall not be displaced by the mechanical and thermal stresses occurring in normal use.

*Compliance is checked by the following tests.*

*Membranes, lenses and the like are tested when assembled in the electronic control devices.*

*First, the electronic control devices are fitted with the membranes, lenses and the like which have been subjected to the treatment specified in 15.1.*

985 *The electronic control devices are then placed for 2 h in a heating cabinet as described in 15.1,*  
986 *the temperature being maintained at  $(40 \pm 2)$  °C.*

987 *Immediately after this period, a force of 30 N is applied for 5 s to various parts of the*  
988 *membranes, lenses and the like, by means of the tip of test probe 11 according to IEC 61032.*

989 *During these tests, the membranes, lenses and the like shall not deform to such an extent that*  
990 *hazardous live parts become accessible.*

991 *For membranes, lenses and the like likely to be subjected to an axial pull in normal use, an*  
992 *axial pull of 30 N is applied for 5 s.*

993 *During this test, the membranes, lenses and the like shall not come out.*

994 *The test is then repeated with membranes, lenses and the like which have not been subjected*  
995 *to any treatment.*

#### 996 **13.101 Cut-outs**

997 Cut-outs in electronic switches and HBES/BACS switches for motor control circuits shall be  
998 non-self-resetting.

999 *Compliance is checked by inspection.*

#### 1000 **13.102 Electronic switches and HBES/BACS switches for the control of the voltage of** 1001 **iron core transformers for extra-low-voltage incandescent lamps**

1002 Electronic switches and HBES/BACS switches for the control of the voltage of iron core  
1003 transformers for extra-low-voltage incandescent lamps (for example, halogen) shall have a  
1004 maximum tolerance of the phase-control angle between the positive and negative half-wave of  
1005  $\pm 2^\circ$ .

1006 NOTE 1 Higher tolerances will generate a DC current influencing the temperature rise in the windings of the iron  
1007 core transformer.

1008 NOTE 2 The maximum tolerance between the phase-control angle of the positive and negative half-wave can be  
1009 measured directly or as DC voltage as a percentage of the rated voltage. This corresponds at  $90^\circ$  to 1,1 % of the  
1010 peak value of the rated voltage.

1011 *Compliance is checked by measurement.*

#### 1012 **13.103 Free ends of leads**

1013 Free ends of leads of electronic switches and HBES/BACS switches, if any, may be prepared  
1014 but pre-soldering shall not be used.

1015 *Compliance is checked by inspection.*

#### 1016 **13.105 Conductors used in the electronic switch and HBES/BACS switch**

1017 Internal wiring that is accessible during and/or after installation, if any, shall be secured in such a way  
1018 that it cannot become loose or detached and impair the safety of the electronic switch and  
1019 HBES/BACS switch.

1020 Conductor terminations using solder shall be mechanically secured. Hooking the conductor through a  
1021 hole of the conductive termination and affixing conductors in thermal tubing, sealing compound or glue  
1022 are examples of acceptable securement.

1023 This requirement is not applicable to internal wiring that cannot be so displaced such that clearances  
1024 or creepage distances are reduced below the specified values or such that, if it becomes loose, it  
1025 cannot create hazardous connections between different circuits such as primary and secondary.

1026 Compliance is checked by inspection.

1027 The insulation of conductors shall provide sufficient resistance to the foreseeable temperatures inside  
1028 the device and/or the enclosure when installed in normal use. In addition, the insulation of conductors  
1029 running between circuits of different voltage bands shall meet the insulation requirement of the highest  
1030 voltage present.

1031 Means used for the method to secure the conductor in place shall be selected according to the  
1032 foreseeable temperature conditions present inside the device/enclosure.

1033 Means used to secure the conductor shall not reduce the clearances and creepage distances.

1034 Compliance is checked by the tests of Clause 21 Resistance to heat and Clause 23 Creepage  
1035 distances, clearances and distances through sealing compound.

## 1036 14 Mechanism

1037 This clause of Part 1 only applies to electronic switches and HBES/BACS switches provided  
1038 with mechanical switching devices.

## 1039 15 Resistance to ageing, protection provided by enclosures of switches and 1040 resistance to humidity

1041 This clause of Part 1 applies.

## 1042 16 Insulation resistance and electric strength

1043 This clause of Part 1 applies except as follows.

### 1044 16.1 General

1045 *Addition after the first paragraph:*

1046 *Insulation resistance and electric strength are measured with the protective impedances*  
1047 *disconnected as described in 10.2.*

### 1048 16.3 Electric strength test

1049 *Replace Table 15 by the following new Table 15:*

1050 **Table 15 – Test voltage, points of application and minimum values of insulating**  
1051 **resistance for the verification of electric strength**

| Insulation to be tested |                                                                                                            | Minimum value<br>of insulation<br>resistance<br><br>MΩ | Test voltage<br>V                                            |                                                          |
|-------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------------|----------------------------------------------------------|
|                         |                                                                                                            |                                                        | Switches having<br>a rated voltage<br>not exceeding<br>130 V | Switches having<br>a rated voltage<br>exceeding<br>130 V |
| 1                       | Between all poles connected together and the body, with the switch in the "on" position.                   | 5                                                      | 1 250                                                        | 2 000                                                    |
| 2                       | Between each pole in turn and all other poles connected to the body, with the switch in the "on" position. | 2                                                      | 1 250                                                        | 2 000                                                    |

| Insulation to be tested                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Minimum value<br>of insulation<br>resistance<br><br>MΩ | Test voltage<br>V                                            |                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------------|----------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                        | Switches having<br>a rated voltage<br>not exceeding<br>130 V | Switches having<br>a rated voltage<br>exceeding<br>130 V |
| 3 Between the terminals which are electrically connected together when the switch is in the "on" position, the switch being in the "off" position:<br>– normal/mini-gap construction;<br>– micro-gap construction;                                                                                                                                                                                                                                                                                                                 | 2<br>2                                                 | 1 250<br>500 <sup>a</sup>                                    | 2 000<br>1 250 (NOTE 1)                                  |
| 4 Between metal parts of the mechanism, when insulated from hazardous live parts, and<br>– hazardous live parts;<br>– metal foil in contact with the surface of the knob or a similar actuating member;<br>– the key of key-operated switches, if insulation is required (see 10.6);<br>– the point of anchorage of the cord, chain or rod of switches operated by such means, if insulation is required (see 10.6);<br>– accessible metal parts, including fixing screws, of the main part, if insulation is required (see 10.5). | 5<br>5<br>5<br>5<br>5                                  | 1 250<br>1 250<br>1 250<br>1 250<br>1 250                    | 2 000<br>2 000<br>2 000<br>2 000<br>2 000                |
| 5 Between any metal enclosure and metal foil in contact with the inner surface of its insulating linings, if any (Note 3).                                                                                                                                                                                                                                                                                                                                                                                                         | 5                                                      | 1 250                                                        | 2 000                                                    |
| 6 Between hazardous live parts and accessible metal parts, if the metal parts of the mechanism are not insulated from hazardous live parts.                                                                                                                                                                                                                                                                                                                                                                                        | –                                                      | 2 000                                                        | 3 000                                                    |
| 7 Between hazardous live parts and parts of the mechanism<br>– if the latter parts are not insulated from accessible metal parts (see 10.5);<br>– if the latter parts are not insulated from the point of contact with a removable key or operating cord, chain or rod (see 10.6).                                                                                                                                                                                                                                                 | –<br>–                                                 | 2 000<br>2 000                                               | 3 000<br>3 000                                           |
| 8 Between hazardous live parts and metal knobs, push-buttons and the like (see 10.2).                                                                                                                                                                                                                                                                                                                                                                                                                                              | –                                                      | 2 500                                                        | 4 000                                                    |
| 9 Between LV (mains) circuit(s) and FELV circuit(s)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5                                                      | 1 500                                                        | 1 500                                                    |
| 10 Between SELV/PELV circuits and other circuit(s) having a higher voltage than SELV/PELV                                                                                                                                                                                                                                                                                                                                                                                                                                          | 7                                                      | 3 000                                                        | 3 750                                                    |
| 11 Between a SELV or PELV circuit below 25 V AC or 60 V DC and a SELV or PELV circuit above 25 V AC or 60 V DC                                                                                                                                                                                                                                                                                                                                                                                                                     | 5                                                      | 500                                                          | 500                                                      |
| 12 Between a SELV or PELV circuit above 25 V AC or 60 V DC and accessible surfaces (see Clause 10)                                                                                                                                                                                                                                                                                                                                                                                                                                 | 5                                                      | 500                                                          | 500                                                      |
| 13 Between a SELV and PELV circuits or between different SELV or different PELV circuits from different sources                                                                                                                                                                                                                                                                                                                                                                                                                    | 5                                                      | 500                                                          | 500                                                      |
| 14 Between switching circuit(s) and control circuit(s) if they are electrically separated                                                                                                                                                                                                                                                                                                                                                                                                                                          | 5                                                      | 2 000                                                        | 3 000                                                    |

| Insulation to be tested                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Minimum value<br>of insulation<br>resistance<br><br>MΩ | Test voltage<br>V                                            |                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------------|----------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                        | Switches having<br>a rated voltage<br>not exceeding<br>130 V | Switches having<br>a rated voltage<br>exceeding<br>130 V |
| <p><sup>a</sup> This value also applies for the electric strength test after normal operation.</p> <p>NOTE 1 For switches having a rated voltage up to and including 250 V, this value is reduced to</p> <ul style="list-style-type: none"><li>– 750 V for the electric strength test after resistance to humidity;</li><li>– 500 V for the electric strength test after normal operation.</li></ul> <p>NOTE 2 This test is carried out only if any insulation is necessary.</p> <p>NOTE 3 In the following country the test of item 8 is conducted between hazardous live parts and metal knobs, push-buttons and metal foil in contact with the outer surface of accessible external parts and operating keys of insulating material. The test voltage for switches with a rating voltage exceeding 130 V is to be 3000 V: AU.</p> <p>NOTE 101 The test according to item 3 is carried out only on electronic switches and HBES/BACS switches combined with mechanical switches.</p> <p>NOTE 102 Only items 10, 11, 12 and 13 are applicable to SELV or PELV parts of electronic control devices.</p> <p>NOTE 103 Items 1 to 9 are not applicable to SELV or PELV parts of electronic control devices.</p> |                                                        |                                                              |                                                          |

1052

1053 **17 Temperature rise**

1054 This clause of Part 1 is completely replaced by the following:

1055 **17.1 General**

1056 Electronic switches and HBES/BACS switches shall be so constructed that the temperature rise  
1057 in normal use is not excessive.

1058 The metal and the design of the contacts, if any, shall be such that the operation of the  
1059 electronic switches and HBES/BACS switches is not adversely affected by oxidation or any  
1060 other deterioration.

1061 The design and the material of the electronic switch and HBES/BACS switch shall be such that  
1062 the material and the components in the electronic switch and HBES/BACS switch are not  
1063 adversely affected by the temperature rise in normal use.

1064 *Compliance is checked by the following test, where applicable.*

1065 *The electronic switches and HBES/BACS switches shall be connected as for normal use with*  
1066 *the fuses, circuit breakers or other current-limiting means, if any, specified in the instruction*  
1067 *sheets.*

1068 *The electronic switches and HBES/BACS switches are fitted with the conductors as specified*  
1069 *in Table 16, the cross-sectional area being not less than 1,5 mm<sup>2</sup>; the terminal screws or nuts,*  
1070 *if any, are tightened with a torque equal to two-thirds of that specified in Table 5 of Part 1.*

1071 *Electronic switches and HBES/BACS switches with mechanical switching mechanism, e.g.*  
1072 *relays, shall be loaded with the maximum rated current or rated power that results in the*  
1073 *maximum temperature rise.*

1074 *For other electronic switches and other HBES/BACS switches e.g dimmers which can be loaded*  
1075 *with incandescent lamps (lamps rated for the supply voltage, including halogen lamps) the*  
1076 *following applies:*

- 1077 • *If the rated power of some of the loads is expressed in W and is higher or equal to the rated*  
1078 *power of other loads expressed in VA, electronic switches and HBES/BACS switches shall*  
1079 *be loaded with halogen lamps or tungsten filament lamps so that, at the rated voltage of the*  
1080 *load, the rated load will be obtained. As the characteristics of halogen lamps of different*  
1081 *power are equivalent, lamps of any power can be used to reach the rated load.*
- 1082 • *If the rated power of some of the loads is expressed in W and is lower than the rated power*  
1083 *of other loads expressed in VA, electronic switches and HBES/BACS switches shall be*  
1084 *loaded with all types of load in accordance with the instructions.*
- 1085 • *If the rated power for lamp controlgear, expressed in W is higher than 25 % of the rated*  
1086 *power of the incandescent lamps the test shall be done with all types of load.*

1087 *For electronic switches and HBES/BACS switches which are designed for lamps other than*  
1088 *incandescent lamps the following applies*

- 1089 • *Electronic switches and HBES/BACS switches for lamp controlgear are loaded with one type*  
1090 *of load as specified in the instructions for this test so that, at the rated voltage of the load,*  
1091 *the rated load will be obtained. Dimmers shall be loaded with dimmable lamp controlgear*  
1092 *as specified in the instructions for this test. If for these types of electronic switches and*  
1093 *HBES/BACS switches, the maximum number of lamp controlgear and the rating of the lamp*  
1094 *are given in the instructions, the electronic switch and HBES/BACS switch is loaded*  
1095 *accordingly.*
- 1096 • *Electronic switches and HBES/BACS switches for other types of lamps are tested in*  
1097 *accordance with the instructions.*

1098 *Other electronic switches and HBES/BACS switches shall be loaded with the type of load as*  
1099 *stated in the instructions.*

1100 NOTE 2 The rated loads are verified with the electronic switch or HBES/BACS switch short-circuited.

1101 *If the electronic switch provides a looping through function to power other devices in the circuit*  
1102 *via the input terminals and where the circuit current is transferred not only via the terminals but*  
1103 *through other components inside the electronic switch, then this looping through circuit is*  
1104 *loaded in addition to the rated current of the upstream fuse/circuit breaker declared in the*  
1105 *instructions minus the rated load already connected to the switch.*

1106 *The electronic switches and HBES/BACS switches are loaded until steady-state temperature is*  
1107 *reached or for 4 h, whichever is the shorter time, at a voltage between 0,9 and 1,1 times rated*  
1108 *voltage, whichever is the more unfavourable. Steady-state value is reached when the variation*  
1109 *of the temperature rise does not exceed 1 K/h.*

1110 *Phase-cut dimmers operating with leading and trailing edge shall be tested in both modes with*  
1111 *the relevant load.*

1112 *In lamp phase-cut dimmers and speed controllers, the setting is adjusted such that the highest*  
1113 *temperature rise will occur.*

1114 *Flush-mounted electronic switches and HBES/BACS switches are mounted in flush-mounted*  
1115 *boxes. The box is placed in a block of wood filled around the box with plaster, so that the front*  
1116 *edge of the box does not protrude and is not more than 5 mm below the front surface of the*  
1117 *wood block.*

1118 *The test assembly shall be allowed to dry for not less than seven days when first made.*

1119 *The size of the pinewood block, which may be fabricated from more than one piece, shall be*  
1120 *such that there is at least 25 mm of wood surrounding the plaster, the plaster having a thickness*  
1121 *between 10 mm and 15 mm around the maximum dimensions of the sides and rear of the box.*

1122 NOTE 3 The sides of the cavity in the pinewood block can have a cylindrical shape.

1123 *The cables connected to the electronic switch shall enter through the top of the box, the point(s)*  
1124 *of entry being sealed to prevent the circulation of air. The length of each conductor within the*  
1125 *box shall be  $(80 \pm 10)$  mm.*

1126 *Surface-type electronic switches and HBES/BACS switches shall be mounted as in normal use,*  
1127 *centrally on the surface of a wooden block, which shall be at least 20 mm thick, 500 mm wide*  
1128 *and 500 mm high.*

1129 *The other types of electronic switches and HBES/BACS switches shall be mounted according*  
1130 *to the instructions or, in the absence of such instructions, in the position of normal use*  
1131 *considered to give the most onerous conditions.*

1132 *The test assembly shall be placed in a draught-free environment for the test.*

1133 *The temperature is determined by thermocouples, so chosen and positioned that they have*  
1134 *negligible effect on the temperature being determined.*

1135 *During the test, the state of the electronic switches and HBES/BACS switches shall not change,*  
1136 *fuses and other protective devices shall not operate, and the permissible temperature rises*  
1137 *determined in Table 101, column concerning Clause 17, shall not be exceeded and the*  
1138 *components shall operate within their operating range*

1139 *After this test, the electronic switches and HBES/BACS switches shall be in operating condition.*

1140 *If sealing compounds are used, they shall not have flowed to such an extent that hazardous live*  
1141 *parts are exposed.*

1142 *Compliance is checked by inspection.*

1143 NOTE 4 For the purpose of the test of 21.4, the temperature rise of external parts of insulating material not  
1144 necessary to retain current-carrying parts and parts of the earthing circuit in position, even though they are in contact  
1145 with them, is also determined.

1146 NOTE 5 Undue oxidation of contacts can be prevented by sliding action or by the use of silver or silver-faced  
1147 contacts.

1148 NOTE 6 In the case of combination of electronic switches, the test is carried out separately on each electronic  
1149 switch.

1150 *For the purposes of the tests of 102.3, 102.4 and 102.5.2, the reference temperature*  
1151 *surrounding a component in an electronic switch and HBES/BACS switch is the maximum*  
1152 *temperature rise measured on the component during the test plus 25 °C.*

1153 *The temperature rise test shall be performed after the tests of clause 19.*

1154 NOTE 7 Due to the contact degradation temperature rise test may be more critical after the normal operation test.

1155

**Table 101 – Permissible temperature rise values**

| Parts of the electronic switch                                                                                                                                                        | Permissible temperature rise<br>K |                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|------------------|
|                                                                                                                                                                                       | Clause 17                         | Clause 101       |
| External accessible parts when installed during normal use                                                                                                                            |                                   |                  |
| Metal parts      Knobs, handles, sensing surfaces, etc.                                                                                                                               | 40                                | 75               |
| Enclosure <sup>a</sup>                                                                                                                                                                | 50                                | 75               |
| Non-metallic parts      Knobs, handles, sensing surfaces, etc. <sup>b</sup>                                                                                                           | 60                                | 75               |
| Enclosure <sup>a,b</sup>                                                                                                                                                              | 70                                | 75               |
| Windings of transformers and core laminations in contact therewith <sup>c</sup>                                                                                                       |                                   |                  |
| Class A                                                                                                                                                                               | 75                                | 115              |
| Class E                                                                                                                                                                               | 90                                | 130              |
| Class B                                                                                                                                                                               | 95                                | 140              |
| Class F                                                                                                                                                                               | 115                               | 155              |
| Class H                                                                                                                                                                               | 140                               | 175              |
| Class N                                                                                                                                                                               | 160                               | 195              |
| Class R                                                                                                                                                                               | 180                               | 215              |
| Class 250                                                                                                                                                                             | 210                               | 245              |
| Other insulations ( <sup>c, g</sup> ) except thermoplastic:                                                                                                                           |                                   |                  |
| Non-impregnated paper                                                                                                                                                                 | 65                                | -                |
| Non-impregnated cardboard                                                                                                                                                             | 70                                | -                |
| Impregnated cotton, silk, paper and textile,                                                                                                                                          | 80                                | -                |
| urea resins                                                                                                                                                                           | 80                                | -                |
| Laminates bonded with phenol-formaldehyde resins                                                                                                                                      | 95                                | -                |
| Phenol-formaldehyde mouldings with cellulose fillers                                                                                                                                  | 95                                | -                |
| Phenol-formaldehyde mouldings with mineral fillers                                                                                                                                    | 105                               | -                |
| Printed Circuit Board on the area subject to heat                                                                                                                                     | 130 <sup>g</sup>                  | 160 <sup>f</sup> |
| Natural rubber                                                                                                                                                                        | 55                                | -                |
| Silicone rubber                                                                                                                                                                       | 135                               | -                |
| Thermoplastic materials on the area subject to heat, with the exception of thermoplastic materials supporting live part, and accessible when installed during normal use <sup>d</sup> | e                                 | -                |
| Terminals and parts which may come into contact with cable insulation when installed                                                                                                  | 55                                | 110              |

The values of the permissible temperature rises are based on an ambient temperature of 25 °C, but the measurements are made under normal conditions.

<sup>a</sup> For areas not exceeding 5 cm<sup>2</sup> and which are not likely to be touched in normal use, temperature rises up to 75 K are allowed under normal operating conditions.

<sup>b</sup> If these temperature rises are higher than those allowed by the class of the assessed insulating material, the nature of the material is the governing factor.

<sup>c</sup> For the purpose of this document, the permissible temperature rises are based on the recommendations in IEC 60085. The materials quoted above are shown only as examples. If materials other than those listed in IEC 60085 are used, the maximum temperatures shall not exceed those which have been proved to be satisfactory.

<sup>d</sup> Natural and synthetic rubbers are not considered as being thermoplastic materials.

<sup>e</sup> The temperature, if any, is measured in relation with Clause 21.4 "Ball-pressure test on parts of insulating material not necessary to retain current carrying parts and parts of the earthing circuit in position" of IEC 60669-1.

<sup>f</sup> The temperature rise may exceed the above value (160 K, for Clause 101)) by not more than 100 K for a maximum period of 1 min.

<sup>g</sup> For the test of Clause 17 the temperature rise shall not exceed the typical value of the maximum operational temperature (MOT) of the printed circuit board as given in the data sheets.

### 17.101 Looping through circuit

Electronic control devices connected to the mains providing means for the continuation of the circuit current, and where the circuit current is transferred not only via the terminals but through other components inside the electronic switch, such as PCBs, shall be submitted to the following test.

*The electronic switch and the HBES/BACS switch are mounted according to Clause 17 and connected with conductors with the maximum accepted cross-sectional area being not less than 1,5 mm<sup>2</sup>.*

*The looping through function of the electronic switch is loaded for 1 h with the rated current of the upstream fuse/circuit breaker declared in the instructions.*

*During this test no current is transferred through the switch contacts as given in Figure 102.*

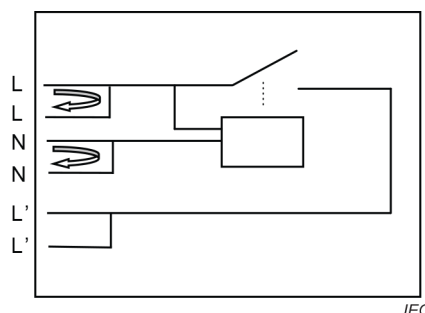


**Figure 102 – Current path tested in the looping through circuit**

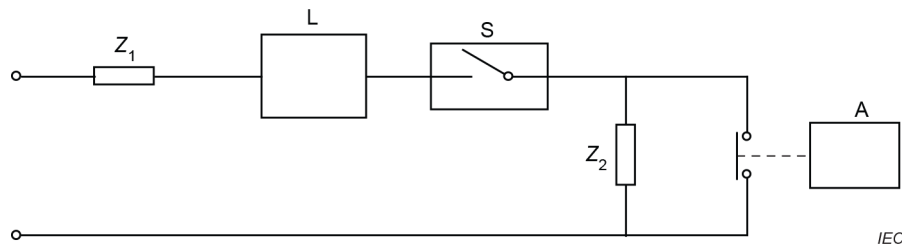
*The temperature is determined by means of thermocouples, so chosen and positioned that they have negligible effect on the temperature being determined.*

*The temperature rise of the terminals shall not exceed 55 K.*

*The temperature rise of the PCB shall not exceed the maximum operational temperature (MOT) of the printed circuit board as given in the data sheets of this component.*

*After the test the looping through circuit shall in addition be tested according to 101.4 with the following modifications:*

1176 *The short circuit is applied one time by the auxiliary switch A without any synchronization with*  
 1177 *respect to the voltage as given in Figure 103.*



1178

#### 1179 **Components**

1180  $Z_1$  impedance for adjusting the prospective short-circuit current (non-inductive)

1181  $Z_2$  impedance for adjusting the load current (non-inductive)

1182 L limiting device for the prospective let-through  $I^2t$

1183 S specimen

1184 A auxiliary switch for causing the short circuit

1185 **Figure 103 – Circuit diagram for testing electronic switches**  
 1186 **and HBES/BACS switches**

## 1187 **18 Making and breaking capacity**

1188 This clause of Part 1 applies except as follows.

### 1189 *Replacement:*

#### 1190 **18.1 General**

1191 Electronic switches and HBES/BACS switches shall have adequate making and breaking  
 1192 capacity.

1193 In the case of electronic switches and HBES/BACS switches using relays, the relay shall be operated  
 1194 at the specified rate of operation with the appropriate load(s) as in normal use.

1195 *This test is carried out only on electronic switches and HBES/BACS switches provided with*  
 1196 *mechanically or electro-mechanically operated contact mechanisms in the load circuit.*

1197 Electronic switches and HBES/BACS switches classified for general purpose use according  
 1198 to 7.102.1, shall be tested according to Clause 18 of Part 1.

1199 Electronic switches and HBES/BACS switches classified for dedicated loads according to  
 1200 7.102.2 shall be tested according to Part 1 except as follows.

1201 *Contact mechanisms shall have adequate making and breaking capacity.*

1202 *The test is made on three new specimens of the complete contact mechanism for each type of*  
 1203 *load.*

1204 *Compliance is checked by the relevant tests, as reported in Table 102:*

1205 **Table 102 – Application of tests for making and breaking capacity and normal operation**  
 1206 **for electronic switches and HBES/BACS switches according to 7.102.2**

| Electronic switches and HBES/BACS switches for the control of:                                                                                                                                                                                                                                                                                                                                                                   | Tests of Clause 18                   |                          |                 |        | Tests of Clause 19                                                                       |                |                                   |                                         |                  |                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|--------------------------|-----------------|--------|------------------------------------------------------------------------------------------|----------------|-----------------------------------|-----------------------------------------|------------------|-----------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                  | 18.2<br>of<br>part-<br>1 and<br>-2-1 | 18.3<br>of<br>part-<br>1 | 18.101          | 18.102 | 19.101<br>Incandescent<br>lamp circuits<br>with or<br>without step<br>down<br>converters | 19.102<br>void | 19.106<br>Lamp<br>control<br>gear | 19.107<br>Heating<br>installa-<br>tions | 19.108<br>Motors | 19.109<br>Specific<br>loads |
| Incandescent lamps                                                                                                                                                                                                                                                                                                                                                                                                               | X                                    | X                        |                 |        | X                                                                                        |                |                                   |                                         |                  |                             |
| Iron core transformer lamp controlgear for extra low voltage incandescent lamps                                                                                                                                                                                                                                                                                                                                                  | X                                    | x                        |                 | X      | X                                                                                        |                |                                   |                                         |                  |                             |
| Electronic step-down converter lamp controlgear for extra low-voltage incandescent lamps                                                                                                                                                                                                                                                                                                                                         |                                      | X                        |                 |        | X                                                                                        |                |                                   |                                         |                  |                             |
| Other lamp controlgear                                                                                                                                                                                                                                                                                                                                                                                                           | X                                    |                          |                 |        |                                                                                          |                | X                                 |                                         |                  |                             |
| Motors                                                                                                                                                                                                                                                                                                                                                                                                                           | X                                    |                          | X               |        |                                                                                          |                |                                   |                                         | X                |                             |
| Heating installations                                                                                                                                                                                                                                                                                                                                                                                                            | X                                    |                          | X <sup>b)</sup> |        |                                                                                          |                |                                   | X                                       |                  |                             |
| Specific loads                                                                                                                                                                                                                                                                                                                                                                                                                   |                                      |                          |                 |        |                                                                                          |                |                                   |                                         |                  | X <sup>a)</sup>             |
| X = applicable<br>a) The test load consists of the specific load according to the instructions<br>b) Only if a motor is part of the load.<br>NOTE 1 For each type of load, a new set of three specimens is used.<br>NOTE 2 For electronic switches and HBES/BACS switches whose rate of operation is limited by their application (for heat or light sensors), the rate of operation is set to the shortest possible cycle time. |                                      |                          |                 |        |                                                                                          |                |                                   |                                         |                  |                             |

1207 *The tests are made by means of an apparatus which is arranged to simulate normal operation.*

1208 *The connections are as shown in Figure 11.*

1209 *For electronic and HBES/BACS switches of pattern number 7, one side is tested as pattern*  
 1210 *number 6. The test is repeated on the other side of a new set of specimens if the other side is*  
 1211 *not identical.*

1212 *For electronic and HBES/BACS switches of pattern numbers 6, 6/2 and 7, the selector switch*  
 1213 *S shown in Figure 11 is moved after the fraction of the total number of operations indicated in*  
 1214 *Table 17.*

1215 *Electronic switches and HBES/BACS switches are fitted with conductors as for the test of*  
 1216 *Clause 17.*

**18.2 Overload**

*Addition after the second paragraph:*

*For electronic switches and HBES/BACS switches whose rate of operation is limited by their application (for example, heat or light sensors), the rate of operation is as follows. The electronic switch is set to the shortest cycle time possible. The electronic switch and HBES/BACS switches are re-activated at the end of each cycle within a time of  $(2 \pm 0,5)$  s.*

**18.3 Overload test with filament lamps**

*Addition after the 1<sup>st</sup> paragraph:*

*The rate of operation is as specified in 18.2. There shall be no forced actuation. The on-period shall be  $25 \left(\frac{+5}{0}\right)$  % of the total cycle and the off-period  $75 \left(\frac{0}{-5}\right)$  %.*

**18.101 Contact mechanism for motors**

*The contact mechanism is subjected to tests of 50 cycles of operation, each at rated voltage and at the rate of operations specified in 18.1:*

- a) the contact mechanism closes a circuit through which a current of  $9 I_n$  ( $\cos \varphi = 0,8 \pm 0,05$ ) passes, this current being interrupted by means of an auxiliary switch 50 ms to 100 ms after each closure;*
- b) the circuit through which a current of  $6 I_n$  ( $\cos \varphi = 0,6 \pm 0,05$ ) passes is closed by an auxiliary switch and opened by the contact mechanism 300 ms to 500 ms after each closure.*

NOTE 101  $I_n$  is the rated current of the electronic switch.

*If the electronic switch and HBES/BACS switch has a rated load instead of a rated current,  $I_n$  is calculated under the assumption that the power factor ( $\cos \varphi$ ) of the motor load is 0,6.*

*During the tests, no sustained arcing shall occur.*

*After the test, the electronic control device shall operate as intended*

**18.102 Electronic switches and HBES/BACS switches for control of the voltage of iron core transformers for extra-low-voltage incandescent lamps**

*Electronic switches and HBES/BACS switches for control of the voltage of iron core transformers for extra-low-voltage incandescent lamps (for example, halogen) shall be subjected to the following test.*

*The test is made on three specimens.*

*The contact mechanism is subjected to 50 making operations, each at rated voltage and at the rate of operation as specified in 18.1.*

*The test circuit shall be adjusted to a test current 10 times the rated current of the electronic switch for one half-cycle of the power supply frequency.*

*During the tests, no sustained arcing shall occur.*

*After the tests, the specimens shall show no damage impairing their further use.*

## 19 Normal operation

This clause of Part 1 applies except as follows.

*Replacement:*

### 19.1 General

Electronic switches and HBES/BACS switches classified for general purpose use according to 7.102.1, shall be tested according to Clause 19 of Part 1.

Electronic switches and HBES/BACS switches classified for dedicated loads according to 7.102.2 shall be tested as follows.

*Electronic switches and HBES/BACS switches shall withstand, without excessive wear or other harmful effect, the mechanical, electrical and thermal stresses occurring in normal use.*

*Compliance is checked by the tests of 19.101, 19.103, 19.104, 19.105, 19.106, 19.107, 19.108 and 19.109 according to the classification of the electronic switches and HBES/BACS switches as far as applicable according to Table 102. During these tests the electronic switches and HBES/BACS switches are tested at their rated voltage and loaded as specified in Clause 17, unless otherwise specified.*

*For HBES/BACS switches, the tests according to 19.101, 19.106, 19.107, 19.108 and 19.109 are conducted on the complete HBES/BACS switch which shall be controlled by the electronic extension units*

*The electronic extension units are tested when installed according to the accompanying instructions so as to verify that they are capable of controlling the electronic switch or the HBES/BACS switch in accordance with this Clause 19.*

*For electronic switches and HBES/BACS switches with included automatic function the number of operations for tests of 19.101, 19.104, 19.106, 19.108 and 19.109 is that specified in the relevant subclause. If the declared number of operations is higher than those indicated in the relevant subclause, the tests shall be made according to the declared value.*

Sticking of the contacts, which does not prevent the next operation of the switch, is not regarded as welding.

*Electronic switches and HBES/BACS switches including electronic circuits which close the contact of the contact mechanism always at zero-crossing  $\pm 20^\circ$  phase angle, shall be tested together with their electronic circuit.*

NOTE 1 For the purpose of this test, the manufacturer can provide the specimens with a special circuit that simulates the automatic operations.

NOTE 2 For electronic switches and HBES/BACS switches whose cycle of operation is limited by their applications (for example, passive infrared, time delay electronic switches, etc.), the rate of operation during the tests can be specified in the instructions.

*During the test, the specimens shall function correctly.*

*After the tests, except for 19.103, 19.104 and 19.105 the specimen shall withstand the following:*

- an electric strength test as specified in Clause 16, the test voltage of 4 000 V being, however, reduced by 1 000 V and the other test voltages except for 10, 11, 12 and 13 by 500 V;*
- a temperature rise test as specified in Clause 17 but loaded with the same load used for the relevant normal operation test.*

1294 *The specimens shall then not show:*

- 1295 – *wear impairing their further use;*
- 1296 – *discrepancy between the position of the actuating member and that of the moving contacts,*  
1297 *if any, if the position of the actuating member is indicated;*
- 1298 – *deterioration of enclosures, insulating linings or barriers to such an extent that the electronic*  
1299 *switch cannot be further operated or that the requirements of Clause 10 are no longer*  
1300 *complied with;*
- 1301 – *loosening of electrical or mechanical connections;*
- 1302 – *seepage of sealing compound;*
- 1303 – *relative displacement of the moving contacts of electronic switches of pattern number 2.*

1304 *The humidity treatment according to 15.3 is not repeated before the electric strength test of this*  
1305 *Subclause 19.1.*

1306 *During the test, the specimens are not lubricated.*

1307 **19.101 Contact mechanisms incorporated in electronic switches and HBES/BACS**  
1308 **switches intended for incandescent lamp circuits**

1309 Contact mechanisms incorporated in electronic switches and HBES/BACS switches intended  
1310 for incandescent lamp circuits with or without step-down converters are subjected to the  
1311 following test.

1312 *The test is made on three new specimens of the complete contact mechanism.*

1313 *The circuit details and the manner of operation of the selector switch S are as described in*  
1314 *18.1, unless otherwise specified.*

1315 *The number of operations is 40 000.*

1316 *The rate of operation is as specified in 18.2 There shall be no forced actuation. The on-period*  
1317 *shall be  $25 \left( \frac{+5}{0} \right)$  % of the total cycle and the off-period  $75 \left( \frac{0}{-5} \right)$  %.*

1318 *For rotary electronic switches and HBES/BACS switches intended to be operated in either*  
1319 *direction, the actuating member is turned in one direction for half the total number of operations*  
1320 *and in the reverse direction for the remainder.*

1321 *While testing one part, the other part is in the "off" position. The test is followed by the test of*  
1322 *14.3, if applicable.*

1323 **19.102 Void**

1324 **19.103 Semiconductor switching devices and/or electronic regulating units**  
1325 **incorporated in electronic switches and HBES/BACS switches**

1326 *Semiconductor switching devices and/or electronic regulating units incorporated in electronic*  
1327 *switches and HBES/BACS switches are subjected to the following tests.*

1328 NOTE Examples of electronic regulating units are controls used for the adjustment of time, light level, sensitivity,  
1329 etc., of the device.

1330 *The electronic switches and HBES/BACS switches are loaded with rated load until steady-state*  
1331 *temperature at 1,1 times rated voltage is reached.*

1332 *The switch state of the electronic switches and HBES/BACS switches is changed 10 times,*  
1333 *and/or the setting value is altered 10 times over the whole range from minimum to maximum*  
1334 *and back to minimum by means of the sensing surface or unit.*

1335 *Additionally, where appropriate, the switch state of the electronic switches and HBES/BACS*  
1336 *switches is changed 10 times, and/or the setting value is altered 10 times over the whole range*  
1337 *from minimum to maximum and back to minimum by means of an electronic extension unit.*

1338 **19.104 Mechanical control units incorporated in electronic switches and HBES/BACS**  
1339 **switches**

1340 Mechanical control units are push buttons, potentiometers, etc, requiring a manual operation.

1341 *Mechanical control units incorporated in electronic switches and HBES/BACS switches are*  
1342 *subjected to the following test.*

1343 *The electronic switches and HBES/BACS switches are loaded with their rated load and the*  
1344 *voltage is then increased to 1,1 times the rated voltage, the setting is altered 10 000 times over*  
1345 *the whole range from minimum to maximum and back to minimum by means of its control unit,*  
1346 *the rate of operation being between 10 and 15 operations per minute.*

1347 **19.105 Electronic switches and HBES/BACS switches for which a minimum load or**  
1348 **current is specified**

1349 *For electronic switches and HBES/BACS switches for which a minimum load or current is*  
1350 *specified in the instructions, the characteristic is additionally tested with the specified minimum*  
1351 *load or current at 0,9 times rated voltage.*

1352 *The switch state of the electronic switches and HBES/BACS switches is changed 10 times,*  
1353 *and/or the setting value is altered 10 times over the whole range from minimum to maximum*  
1354 *and back to minimum.*

1355 *In addition, where appropriate, the switch state of the electronic switch and HBES/BACS switch*  
1356 *is changed 10 times, and/or the setting value is altered 10 times over the whole range from*  
1357 *minimum to maximum and back to minimum by means of an electronic extension unit.*

1358 **19.106 Contact mechanisms incorporated in electronic switches and HBES/BACS**  
1359 **switches intended for lamp controlgear**

1360 Contact mechanisms incorporated in electronic switches and HBES/BACS switches intended  
1361 for lamp controlgear shall withstand, without excessive wear or other harmful effect, the  
1362 electrical and thermal stresses that can occur.

1363 *The test is made on three new specimens of the complete contact mechanism.*

1364 *Compliance is checked by connecting the test circuit, including Load B, as given in Figure 12b*  
1365 *via the electronic switches and HBES/BACS switches under test to a power supply with the*  
1366 *following test conditions.*

1367 *The test circuit, including the cables for connecting the test specimen and the Load B, shall be*  
1368 *adjusted to reach, downstream the switch under test, the  $I_{peak}$  and  $I^2t$  values of Table 103.*

1369 *Indicative values for C and  $R_2$  of Load B are given in Table 104 which is given for information*  
1370 *only.*

1371 NOTE 101 The values for C and  $R_2$  in Table 104 are calculated to have the required values for inrush current and  
1372  $I^2t$  and considering: