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Responsible committee: EPL/94 General purpose relays and reed contact units

Interested committees:

Title: Draft BS EN IEC 62314 Solid-state relays.

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- 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

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## 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 Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.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.                                       |                                                    |



**94/470/CD**

COMMITTEE DRAFT (CD)

PROJECT NUMBER:

**IEC 62314 ED2**

DATE OF CIRCULATION:

**2020-01-24**

CLOSING DATE FOR COMMENTS:

**2020-04-17**

SUPERSEDES DOCUMENTS:

**94/457/CD,94/465/CC**

IEC TC 94 : ALL-OR-NOTHING ELECTRICAL RELAYS

SECRETARIAT:

Austria

SECRETARY:

Mr Bernhard Spalt

OF INTEREST TO THE FOLLOWING COMMITTEES:

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.

TITLE:

**Solid-state relays**

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## CONTENTS

|    |                                                                                      |    |
|----|--------------------------------------------------------------------------------------|----|
| 1  |                                                                                      |    |
| 2  | FOREWORD.....                                                                        | 4  |
| 3  | 1 Scope.....                                                                         | 6  |
| 4  | 2 Normative references .....                                                         | 7  |
| 5  | 3 Terms and definitions .....                                                        | 8  |
| 6  | 3.1 Terms and definitions related to relays .....                                    | 8  |
| 7  | 3.2 Terms and definitions related to insulation coordination (see clause 12).....    | 12 |
| 8  | 4 Characteristics of solid-state relays .....                                        | 15 |
| 9  | 4.1 Type of solid-state relay .....                                                  | 15 |
| 10 | 5 Rated values .....                                                                 | 15 |
| 11 | 5.1 Rated and limiting values for load circuits and for insulation coordination..... | 15 |
| 12 | 5.2 Load category .....                                                              | 16 |
| 13 | 5.3 Rated and limiting values for control circuits.....                              | 17 |
| 14 | 5.4 Normal service, transport and storage conditions .....                           | 18 |
| 15 | 5.5 Normal mounting conditions .....                                                 | 18 |
| 16 | 6 Provisions for test.....                                                           | 18 |
| 17 | 6.1 Type test.....                                                                   | 18 |
| 18 | 6.2 Routine test.....                                                                | 19 |
| 19 | 7 Documentation and marking .....                                                    | 19 |
| 20 | 7.1 Data .....                                                                       | 19 |
| 21 | 7.2 Instructions for installation, operation and maintenance .....                   | 20 |
| 22 | 7.3 Marking.....                                                                     | 20 |
| 23 | 8 Temperature-rise.....                                                              | 21 |
| 24 | 8.1 General.....                                                                     | 21 |
| 25 | 8.2 Test conditions.....                                                             | 21 |
| 26 | 9 Basic operating Function .....                                                     | 22 |
| 27 | 9.1 OFF-state leakage current measurement.....                                       | 22 |
| 28 | 9.2 ON-state voltage drop measurement .....                                          | 22 |
| 29 | 10 Electrical endurance.....                                                         | 22 |
| 30 | 10.1 Overload test.....                                                              | 22 |
| 31 | 10.2 Endurance test.....                                                             | 24 |
| 32 | 11 Clearances and creepage distances .....                                           | 26 |
| 33 | 11.1 General.....                                                                    | 26 |
| 34 | 11.2 Basis for insulation coordination.....                                          | 26 |
| 35 | 11.3 Requirements and dimensioning rules .....                                       | 27 |
| 36 | 11.4 Tests and measurements .....                                                    | 30 |
| 37 | 11.5 Alternative test methods.....                                                   | 31 |
| 38 | 12 Terminations .....                                                                | 32 |
| 39 | 12.1 Quick-connect terminations .....                                                | 32 |
| 40 | 12.2 Screw-type and screwless-type clamping-units.....                               | 34 |
| 41 | 12.3 Solder terminals .....                                                          | 34 |
| 42 | 12.4 Sockets .....                                                                   | 34 |
| 43 | 13 Heat and fire resistance.....                                                     | 35 |
| 44 | 13.1 Materials .....                                                                 | 35 |
| 45 | 13.2 Ball pressure test .....                                                        | 36 |
| 46 | 14 Electromagnetic compatibility (EMC) .....                                         | 36 |

|    |                                                                                                 |    |
|----|-------------------------------------------------------------------------------------------------|----|
| 47 | Annex A (normative) Test for solid-state relays intended for self ballasted lamp loads .....    | 37 |
| 48 | Annex B (informative) Risk assessment .....                                                     | 40 |
| 49 | B.1 General .....                                                                               | 40 |
| 50 | B.2 Risk assessment procedure .....                                                             | 40 |
| 51 | Annex C (normative) Pollution degree .....                                                      | 47 |
| 52 | Annex D (normative) Rated impulse withstand voltages .....                                      | 48 |
| 53 | Annex E (informative) Electromagnetic compatibility (EMC) .....                                 | 50 |
| 54 | E.1 General .....                                                                               | 50 |
| 55 | E.2 EMC immunity .....                                                                          | 50 |
| 56 | E.3 EMC radiated and conducted emission .....                                                   | 53 |
| 57 |                                                                                                 |    |
| 58 | Figure A.1 – Circuit diagram for testing solid-state relay .....                                | 37 |
| 59 | Figure B.1 – Iterative process of risk assessment and risk reduction .....                      | 41 |
| 60 | Figure B.2 – Risk reduction .....                                                               | 43 |
| 61 |                                                                                                 |    |
| 62 | Table 1 – Load categories .....                                                                 | 17 |
| 63 | Table 2 – Type testing .....                                                                    | 18 |
| 64 | Table 3 – Routine tests .....                                                                   | 19 |
| 65 | Table 4 – Required data .....                                                                   | 20 |
| 66 | Table 5 – Minimum requirements for overload capability test conditions .....                    | 23 |
| 67 | Table 6 – Endurance test .....                                                                  | 25 |
| 68 | Table 7 – Minimum clearance .....                                                               | 28 |
| 69 | Table 8 – Minimum creepage distances for solid-state relays .....                               | 29 |
| 70 | Table 9 – Preconditioning .....                                                                 | 31 |
| 71 | Table 10 – Cross-sectional areas for conductors depending on the resistive current              |    |
| 72 | carried by the terminal .....                                                                   | 33 |
| 73 | Table 11 – Test conditions for test Tb .....                                                    | 34 |
| 74 | Table A.1 – Values for $I_{peak}$ and $I^2t$ depending on the type of distribution system ..... | 38 |
| 75 | Table A.2 – Calculated circuit parameters .....                                                 | 38 |
| 76 | Table A.3 – Number of operations for endurance test .....                                       | 38 |
| 77 | Table B.1 – Examples for the relation between failure mode, consequences and hazard .....       | 44 |
| 78 | Table B.2 – Severity of harm .....                                                              | 45 |
| 79 | Table B.3 – Probability of harm .....                                                           | 45 |
| 80 | Table B.4 – Risk category .....                                                                 | 45 |
| 81 | Table D.1 – Rated impulse withstand voltages (waveform: 1,2/50 µs) for solid-state              |    |
| 82 | relays connected directly to the mains .....                                                    | 48 |
| 83 | Table E.1 – Environmental conditions influencing EMC .....                                      | 50 |
| 84 | Table E.2 – Immunity tests for industrial environments .....                                    | 52 |
| 85 | Table E.3 – Immunity tests for residential, commercial and light-industrial                     |    |
| 86 | environments .....                                                                              | 53 |
| 87 |                                                                                                 |    |
| 88 |                                                                                                 |    |

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## SOLID-STATE RELAYS

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International Standard IEC 62314 has been prepared by technical committee 94: All-or-nothing electrical relays.

This second edition cancels and replaces the first edition published in 2006. This edition constitutes a technical revision.

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

- a) addition of load category LC N, LC O and LC P for DC load;
- b) addition of load category LC G for self-ballasted lamp load;
- c) addition of "sockets" terminal;
- d) requirement for degree of protection;
- e) update of references.

*Secretary note: this list is subject to being updated at the appropriate times in the project workflow and this note will be removed when having reached the FDIS stage.*

**Documents**

Document Sharing Hub

143

144 *Secretary note: clauses and/or subclauses which are titled as "Vacant" will be deleted and re-*  
145 *numbered during the next step.* The text of this International Standard is based on the  
146 following documents:

| 3CD       | CC        |
|-----------|-----------|
| 94/457/CD | 94/465/CC |

147

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

150 This publication has been drafted in accordance with the ISO/IEC Directives, Part 2. The  
151 committee has decided that the contents of this publication will remain unchanged until the  
152 stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related  
153 to the specific document. At this date, the publication will be

- 154 • reconfirmed;
- 155 • withdrawn;
- 156 • replaced by a revised edition, or
- 157 • amended.

158

159 A bilingual version of this publication may be issued at a later date.

160 The National Committees are requested to note that for this document the stability date  
161 is 20XX.

162 THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE  
163 DELETED AT THE PUBLICATION STAGE.

164

## SOLID-STATE RELAYS

### 1 Scope

This International Standard applies to particular all-or-nothing electrical relays denominated solid-state relays intended for performing electrical operations by single step function changes to the state of electric circuits between the OFF-state and the ON-state and vice versa.

This document deals with solid-state relays which are intended for incorporation in other products or equipment. As such, solid-state relays are considered to be components and this document defines the basic safety-related and functional requirements for solid-state relays as stand-alone components.

Such solid-state relays are incorporated in products or equipment which themselves have to comply with the relevant product and/or application standard(s) to meet their intended application. The following are examples of such applications:

- general industrial equipment;
- electrical facilities;
- electrical machines;
- electrical appliances;
- office communications;
- building automation and environmental control;
- automation and process control;
- electrical installation engineering;
- medical engineering;
- telecommunications;
- vehicle engineering;
- transportation engineering;
- lighting control.

Where the application of a solid-state relay determines additional requirements such as EMC and overcurrent protection, the solid-state relay shall be assessed in accordance with the relevant IEC standard(s) and for EMC see clause 14 and Annex E.

Solid-state switching devices with monolithic structures fall within the scope of IEC subcommittee 47E and are not covered in this document.

Semiconductor controllers and contactors fall within the scope of the IEC 60947 series of standards – *Low-voltage switchgear and controlgear* – developed by IEC subcommittee 121A and are not covered in this document.

Compliance with the requirements of this document is verified by the type tests and routine tests indicated.

The object of this document is to state:

- the characteristics of solid-state relays;
- the requirements which solid-state relays shall comply with reference to
  - a) their operation and behaviour;
  - b) their dielectric properties;

- c) the degrees of protection provided by their enclosures, where applicable;
- the tests verifying that the requirements have been met, and the test methods to be adopted;
- the information to be given with the solid-state relay or in the manufacturer's documentation.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60038:2009, *IEC standard voltages*

IEC 60050-444:2002, *International Electrotechnical Vocabulary (IEV) – Part 444: Elementary relays*

IEC 60068-2-1:2007, *Environmental testing – Part 2: Tests. Tests A: Cold*

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

IEC 60068-2-14:2009, *Environmental testing – Part 2: Tests. Test N: Change of temperature*

IEC 60068-2-20:2008, *Environmental testing – Part 2: Tests. Test T: Soldering*

IEC 60068-2-78:2012, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60112:2003/AMD1:2009, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

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

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

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

IEC 60695-2-10:2013, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

IEC 60747-5-5:2007, *Semiconductor devices - Discrete devices – Part 5-5: Optoelectronic devices - Photocouplers*

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

IEC 61000-4 (all parts), *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques*

244 IEC 61210:2010, *Connecting devices – Flat quick-connect terminations for electrical copper*  
245 *conductors – Safety requirements*

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

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

250 IEC 61984:2008, *Connectors – Safety requirements and tests*

251 IEC 62368-1:2018, *Audio/video, information and communication technology equipment –*  
252 *Part 1: Safety requirements*

253 IEC TS 62993:2018, *Guidance for determination of clearances, creepage distances and*  
254 *requirements for solid insulation for equipment with a rated voltage above 1 000 V AC and 1*  
255 *500 V DC, and up to 2 000 V AC and 3 000 V DC*

256 CISPR 11:2015+AMD1:2016+AMD2:2019, *Industrial, scientific and medical equipment –*  
257 *Radio-frequency disturbance characteristics – Limits and methods of measurement*  
258 *Amendment 1 (2010)*

259 CISPR 32:2015, *Electromagnetic compatibility of multimedia equipment – Emission*  
260 *requirements*

261 **Secretary note: all normative references will be checked and updated in a later stage.**

## 262 **3 Terms and definitions**

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

### 265 **3.1 Terms and definitions related to relays**

#### 266 **3.1.1**

##### 267 **electrical relay**

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

270 [SOURCE: IEC 60050-444:2002, 444-01-01]

#### 271 **3.1.2**

##### 272 **solid-state relay**

273 electrical relay in which the intended response is produced by electronic, magnetic, optical or  
274 other components without mechanical motion

275 [SOURCE: IEC 60050-444:2002, 444-01-06]

#### 276 **3.1.3**

##### 277 **rated operational voltage**

278  $U_e$

279 value of voltage which determines the application of the solid-state relay and to which the  
280 relevant tests and the load categories are referred

**3.1.4****rated insulation voltage** $U_i$ 

value of voltage to which dielectric tests and creepage distances are referred

**3.1.5****rated impulse withstand voltage** $U_{imp}$ 

peak value of an impulse voltage of prescribed form and polarity which the solid-state relay is capable of withstanding without failure under specified conditions of test and to which the values of the clearances are referred

**3.1.6****ON-state**

specified condition of the solid-state relay when it is energized by the specified energizing quantity and has responded to that quantity

**3.1.7****OFF-state**

specified condition of the solid-state relay when it is not energized

**3.1.8****normally open element**

switching element which is closed when the solid-state relay is in its operate condition and which is open when the solid-state relay is in its release condition

**normally closed element**

switching element which is open when the solid-state relay is in its operate condition and which is closed when the solid-state relay is in its release condition

**3.1.9****rated operational current** $I_e$ 

normal operating current when the solid-state relay is in the ON-state and takes into account the rated frequency (see 5.1), the load category (see 5.2) and the overload characteristics at 40 °C ambient temperature unless otherwise specified

**3.1.10****rated uninterrupted current** $I_u$ 

value of current, stated by the manufacturer, which the solid-state relay can carry in uninterrupted duty

**3.1.11****rated frequency**

supply frequency for which a solid-state relay is designed and to which the other characteristic values correspond

Note 1 to entry: The same solid-state relay may be assigned a number or a range of rated frequencies or be rated for both AC and DC

**3.1.12****overload current profile**

gives the current/time coordinates for the controlled overload current

**3.1.13****operating capability**

represents the combined capabilities of

– establishing and sustaining the ON-state and current carrying, and

329 – establishing and sustaining the OFF-state (blocking),  
330 at maximum rated voltage under specified load and overload conditions in accordance with  
331 load category, overload current profile and specified duty cycles

### 332 3.1.14

#### 333 **rated conditional short-circuit current**

334 value of prospective current, stated by the manufacturer, which the solid-state relay,  
335 protected by a short-circuit protective device specified by the manufacturer, can withstand  
336 satisfactorily for the operating time of this device under the test conditions specified in the  
337 relevant product standard

### 338 3.1.15

#### 339 **leakage current**

340  $I_l$

341 maximum current (peak or RMS value for AC), stated by the manufacturer, flows through the  
342 output circuit in OFF-state condition

### 343 3.1.16

#### 344 **ON-state voltage drop**

345  $U_d$

346 maximum voltage (peak or RMS value for AC), stated by the manufacturer, between output  
347 terminals in the ON-state condition

### 348 3.1.17

#### 349 **ON-state resistance**

350  $R_{on}$

351 maximum value of resistance, stated by the manufacturer, between output terminals in the  
352 ON-state condition

### 353 3.1.18

#### 354 **power consumption**

355  $P_s$

356 value of total power consumed of the control circuit and/or the supply circuit, if any

### 357 3.1.19

#### 358 **rated control circuit voltage**

359  $U_c$

360 rated value of the control signal voltage

### 361 3.1.20

#### 362 **rated control circuit current**

363  $I_c$

364 rated value of the control circuit current

### 365 3.1.21

#### 366 **rated control circuit supply voltage**

367  $U_s$

368 rated value of the supply circuit voltage

### 369 3.1.22

#### 370 **release voltage**

371 value of the control signal voltage at which a solid-state relay switched off; the term “switch-  
372 off voltage” was used in previous edition

### 373 3.1.23

#### 374 **operate voltage**

375 value of the control signal voltage at which a solid-state relay switched on; the term “switch-  
376 on voltage” was used in previous edition

**3.1.24****release current**

value of the control signal current at which a solid-state relay switched off; the term “switch-off current” is used as the same meaning

**3.1.25****operate current**

value of the control signal current at which a solid-state relay switched on, the term “switch-on current” is used as the same meaning

**3.1.26****marking**

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

**3.1.27****existing design**

design which was already approved by the preceding Edition of this document

**3.1.28****type test**

test of one or more devices made to a certain design to show that the design meets certain specifications

**3.1.29****routine test**

test to which each individual device is subjected during and/or after manufacture to ascertain whether it complies with certain criteria

**3.1.30****sampling test**

test on a number of devices taken at random from a batch

**3.1.31****operate**

change from the OFF-state condition to the ON-state condition

**3.1.32****release**

change from the ON-state condition to the OFF-state condition

**3.1.33****ambient temperature**

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

**3.1.34****rated value**

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

[SOURCE: IEC 60050-444:2002, 444-02-18, modified – modification of the definition]

**3.1.35****test value**

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

## **3.2 Terms and definitions related to insulation coordination (see clause 12)**

### **3.2.1**

#### **clearance**

shortest distance in air between two conductive parts

[SOURCE: IEC 60664-1:2007, 3.2]

### **3.2.2**

#### **creepage distance**

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

[SOURCE: IEC 60664-1:2007, 3.3, modified – modification of the definition]

### **3.2.3**

#### **functional insulation**

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

[SOURCE: IEC 60664-1:2007, 3.17.1]

### **3.2.4**

#### **solid insulation**

solid insulating material interposed between two conductive parts

[SOURCE: IEC 60664-1:2007, 3.4]

### **3.2.5**

#### **basic insulation**

insulation of hazardous-live-parts which provides basic protection against electric shock

Note 1 to entry: Basic insulation does not necessarily include insulation used exclusively for functional purposes.

[SOURCE: IEC 60664-1:2007, 3.17.2, modified – modification of the definition]

### **3.2.6**

#### **supplementary insulation**

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

[SOURCE: IEC 60664-1:2007, 3.17.3, modified – modification of the definition]

### **3.2.7**

#### **double insulation**

insulation comprising both basic insulation and supplementary insulation

[SOURCE: IEC 60664-1, 3.17.4]

### **3.2.8**

#### **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 or supplementary insulation.

[SOURCE: IEC 60664-1:2007, 3.17.5]

**3.2.9****overvoltage**

any voltage having a peak value exceeding the corresponding peak value of maximum steady-state voltage at normal operating conditions

[SOURCE: IEC 60664-1:2007, 3.7]

**3.2.10****overvoltage category**

numeral defining a transient overvoltage condition

Note 1 to entry: Overvoltage categories I, II, III and IV are used, see 4.3.3.2 of IEC 60664-1.

[SOURCE: IEC 60664-1:2007, 3.10]

**3.2.11****pollution**

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

[SOURCE: IEC 60664-1:2007, 3.11]

**3.2.12****micro-environment**

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

[SOURCE: IEC 60664-1:2007, 3.12.2]

**3.2.13****macro-environment**

environment of the room or other location in which the equipment is installed or used

[SOURCE: IEC 60664-1:2007, 3.12.1]

**3.2.14****pollution degree**

numeral characterizing the expected pollution of the micro-environment

Note 1 to entry: Pollution degrees 1, 2 and 3 are used, see Annex C.

[SOURCE: IEC 60664-1:2007, 3.13]

**3.2.15****type 1 protection**

protection against pollution by the use of coating, potting or moulding assuming Pollution degree 1 under the protection

Note 1 to entry: Requirements and tests are given in IEC 60664-3.

Note 2 to entry: Pollution degree 1 is specified in Annex C.

**3.2.16****conductive part**

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

**3.2.17****live part**

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

Note 1 to entry: A PEN conductor combines the functions of both a protective earthing conductor and a neutral conductor.

[SOURCE: IEC 60050-195:1998, 195-02-19, modified – modification of the definition]

**3.2.18****tracking**

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

Note 1 to entry: Tracking usually occurs due to surface contamination.

[SOURCE: IEC 60050-212:2010, 212-11-56, modified – modification of the definition]

**3.2.19****comparative tracking index****CTI**

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

[SOURCE: IEC 60050-212:2010, 212-11-59, modified – modification of the definition]

## 4 Characteristics of solid-state relays

### 4.1 Type of solid-state relay

Typically solid-state relays according to this standards are classified by:

- number of poles;
- type of poles;
- type of switching element;
- type of control circuit.
- rated and limiting values for load circuits (see 5.1);
- load category (see 5.2);
- rated and limiting values for control circuits (see 5.3).

Note. 'Type of poles' is intended to specify normally-open or normally-closed.

## 5 Rated values

### 5.1 Rated and limiting values for load circuits and for insulation coordination

The rated and limiting values established for solid-state relays shall be stated in accordance with the following, but only where required in this document the applicable values shall be verified by tests.

#### *Rated voltages*

- rated operational voltage ( $U_e$ );
- ON-state voltage drop ( $U_d$ );
- rated insulation voltage ( $U_i$ ).

In no case shall the maximum value of the rated operational voltage exceed that of the rated insulation voltage.

NOTE Where no rated insulation voltage is specified for a solid-state relay, the highest value of the rated operational voltage is considered to be the rated insulation voltage.

- rated impulse withstand voltage ( $U_{imp}$ ).

The rated impulse withstand voltage of a solid-state relay shall be equal to or higher than the values stated for the transient overvoltages occurring in the circuit in which the solid-state relay is incorporated.

- minimum operating voltage or rated operating voltage range, if applicable.

#### *Rated currents*

- rated operational current ( $I_e$ );
- rated uninterrupted current ( $I_u$ );
- leakage current ( $I_l$ ).
- minimum operating current or rated operating current range, if applicable.

#### *Rated frequency*

#### *Normal load and overload characteristics*

- overload current profile