

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Solid-state relays – Safety requirements

Relais statiques – Exigences de sécurité

IEC 62314:2022

<https://standards.iteh.ai/catalog/standards/sist/f40533cb-5d78-4ca4-81cb-76e6c3f6c638/iec-62314-2022>



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SOLID-STATE RELAYS – SAFETY REQUIREMENTS**FOREWORD**

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

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 categories for DC load;
- b) addition of load category for self-ballasted lamp load;
- c) addition of "sockets" terminal;
- d) update of references;
- e) introduction of the requirement of EMC;
- f) restructuring of the whole document.

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

Draft	Report on voting
94/670/FDIS	94/701/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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- withdrawn,
- replaced by a revised edition, or
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SOLID-STATE RELAYS – SAFETY REQUIREMENTS

1 Scope

This document 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 comply with the relevant product and/or application standard(s) to meet their intended application.

NOTE 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.

Solid state relay as apparatus:

Where the solid-state relay is specified as apparatus with a function to the end-user, requirements on EMC are given in this document.

Solid state relay as component:

There are no EMC requirements for solid-state relays intended for incorporation into the equipment by the equipment manufacturer, because the performance strongly depends on the application into the equipment.

The object of this document is to state:

- the characteristics of solid-state relays
- the requirements which apply to solid-state relays with reference to
 - a) electrical safety;
 - b) their operation and behaviour;
 - c) their dielectric properties;
 - d) EMC;

- 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 product documentation.

Solid-state switching devices with monolithic structures fall within the scope of IEC sub-committee 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.

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* (available at www.electropedia.org)

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

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

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

<https://standards.ieh.ai/catalog/standards/sist/f40533cb-5d78-4ca4-81cb-76e6c3f6c638/iec-60068-2-20-2021>, *Environmental testing – Part 2-20: Tests – Test Ta and Tb: Test methods for solderability and resistance to soldering heat of devices with leads*

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

IEC 60112:2020, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60664-1:2020, *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 60695-2-11:2021, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products (GWEPT)*

IEC 60695-2-12:2021, *Fire hazard testing – Part 2-12: Glowing/hot-wire based test methods – Glow-wire flammability index (GWFI) test method for materials*

IEC 60695-10-2:2014, *Fire hazard testing – Part 10-2: Abnormal heat – Ball pressure test method*

IEC 60747-5-5:2020, *Semiconductor 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 mm² up to 35 mm² (included)*

IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3:2020, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4:2012, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2014, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*
IEC 61000-4-5:2014/AMD1:2017

IEC 61000-4-6:2013, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:2009, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-11:2020, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase*

IEC 61000-4-34:2005, *Electromagnetic compatibility (EMC) – Part 4-34: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current more than 16 A per phase*
IEC 61000-4-34:2005/AMD1:2009

IEC 61180:2016, *High-voltage test techniques for low-voltage equipment – Definitions, test and procedure requirements, test equipment*

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

IEC 61760-1:2020, *Surface mounting technology – Part 1: Standard method for the specification of surface mounting components (SMDs)*

IEC 61810-1:2015, *Electromechanical elementary relays – Part 1: General and safety requirements*
IEC 61810-1:2015/AMD1:2019

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

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

IEC TS 62993:2017, *Guidance for determination of clearances, creepage distances and requirements for solid insulation for equipment with a rated voltage above 1 000 V AC and 1 500 V DC, and up to 2 000 V AC and 3 000 V DC*

CISPR 11:2015, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*
CISPR 11:2015/AMD1:2016
CISPR 11:2015/AMD2:2019

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

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 Terms and definitions related to relays

3.1.1

electrical relay

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

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

3.1.2

solid-state relay

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

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

3.1.3

rated operational voltage

U_e

value of voltage which determines the application of the solid-state relay and to which the 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 the output semiconductor is in the conducting state

3.1.7**OFF-state**

specified condition of the solid-state relay when the output semiconductor is in the isolating (non-conducting) state

3.1.8**normally open element**

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

3.1.9**normally closed element**

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

3.1.10**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

3.1.11**rated uninterrupted current** I_u

specified value of current, which the solid-state relay can carry in uninterrupted duty

3.1.12**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 can be assigned a number or a range of rated frequencies or be rated for both AC and DC.

3.1.13**overload current profile**

profile that gives the current/time coordinates for the controlled overload current

3.1.14**operating capability**

property that represents the combined capabilities of

- establishing and sustaining the ON-state and current carrying, and
- establishing and sustaining the OFF-state (blocking),

at maximum rated operational voltage under specified load and overload conditions in accordance with load category, overload current profile and specified duty cycles

3.1.15**rated conditional short-circuit current**

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

**3.1.16
leakage current** I_l

specified maximum current (peak or RMS value for AC), which flows through the output circuit in OFF-state condition

**3.1.17
ON-state voltage drop** U_d

specified maximum voltage (peak or RMS value for AC), between output terminals in the ON-state condition

**3.1.18
ON-state resistance** R_{on}

specified maximum value of resistance, between output terminals in the ON-state condition

**3.1.19
power consumption** P_s

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

**3.1.20
rated control circuit voltage** U_c

rated value of the control signal voltage

**3.1.21
rated control circuit current** I_c

rated value of the control circuit current

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**3.1.22
rated control circuit supply voltage** U_s

rated value of the supply circuit voltage

**3.1.23
operate**

change from the OFF-state condition to the ON-state condition (vice versa for normally closed element)

**3.1.24
release**

change from the ON-state condition to the OFF-state condition (vice versa for normally closed element)

**3.1.25
release voltage**

value of the control signal voltage at which a solid-state relay is switched off (switched on for normally closed element)

Note 1 to entry: The term "switch-off voltage" was used in previous edition.

**3.1.26
operate voltage**

value of the control signal voltage at which a solid-state relay is switched on (switched off for normally closed element)

Note 1 to entry: The term "switch-on voltage" was used in the previous edition.

**3.1.27
release current**

value of the control signal current at which a solid-state relay is switched off (switched on for normally closed element)

Note 1 to entry: The term "switch-off current" is used as the same meaning.

**3.1.28
operate current**

value of the control signal current at which a solid-state relay is switched on (switched off for normally closed element)

Note 1 to entry: The term "switch-on current" is used as the same meaning.

**3.1.29
marking**

identification of a solid-state relay which allows the unambiguous indication of its electrical, dimensional and functional parameters

**3.1.30
existing design**

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

**3.1.31
type test**

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

**3.1.32
routine test**

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

**3.1.33
sampling test**

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

**3.1.34
ambient temperature**

temperature prescribed for the air surrounding the solid-state relay under certain conditions, when the solid-state relay is mounted as specified

**3.1.35
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 – deletion of "of a component, device, equipment, or system" at the end of the definition.]