

Electrical relays

Part 5: Insulation coordination for measuring relays and protection equipment — Requirements and tests

The European Standard EN 60255-5:2001 has the status of a
British Standard

ICS 29.120.70

National foreword

This British Standard is the official English language version of EN 60255-5:2001. It supersedes BS 5992-3:1980 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PEL/95, Measuring relays and protection systems, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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Requirements and tests
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Relais électriques
Partie 5: Coordination de l'isolement
des relais de mesure et des dispositifs
de protection -
Prescriptions et essais
(CEI 60255-5:2000)

Elektrische Relais
Teil 5: Isolationskoordination für
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(IEC 60255-5:2000)

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European Committee for Electrotechnical Standardization
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Foreword

The text of document 95/98/FDIS, future edition 2 of IEC 60255-5, prepared by IEC TC 95, Measuring relays and protection equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60255-5 on 2001-03-01.

This standard should be read in conjunction with HD 625.1 S1:1996.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2001-12-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2004-03-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative and annexes A to D are informative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60255-5:2001 was approved by CENELEC as a European Standard without any modification.

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INTRODUCTION

The following points have been considered in the preparation of this standard.

- The application of the insulation coordination according to IEC 60664-1 leads to a graded range of rated impulse voltages dependent on the nominal voltage of the supply circuit and the applicable overvoltage category. Further, the impulse test voltages depend on the air pressure and therefore on the altitude of the test site. Consequently, a wide range of test voltages becomes necessary.

For an effective test practice, a rationalised test voltage of 5 kV has been specified in this standard. It is applicable for the normal case of relays directly energised via current and voltage transformers or directly connected to the station battery supply. It is applicable independent of the test site altitude, from sea level to 2 000 m.

The existing impulse test generators designed according to IEC 60060-1 remain applicable in this case.

For other test voltages, the IEC 60060-1 generator can also be used; however components of the generator must be modified depending on the required test voltage, as described in annex C. The modifications are necessary to retain the specified output energy of 0,5 J.

It is expected that suitable impulse test generators with variable output voltage and a fixed output energy of 0,5 J will become available on the market in the near future.

- Reduction of the source impedance of the impulse test generator to 50 Ω has been considered, because a value of this order would seem to correspond better to the characteristic impedance of the substation wiring (see also IEC 61000-4-5). However, considering the satisfactory experience with the current standard and in order to avoid the existing test generators from becoming obsolete, the 500 Ω value has been retained.
- Impulse withstand testing of circuits containing voltage suppression components may lead to heavy distortion of the impulse test waveform. This is acceptable, conditional upon the equipment being undamaged and fully functional after completion of the tests. Withstand surge testing of circuits is not part of insulation testing and not part of this standard.
- The inclusion of the pollution degree is based on IEC 60664-1 and is a new consideration.

ELECTRICAL RELAYS –

Part 5: Insulation coordination for measuring relays and protection equipment – Requirements and tests

1 Scope and object

This part of IEC 60255 gives general requirements for the insulation coordination of measuring relays and protection equipment.

NOTE 1 Unless otherwise stated, the term “relay(s)” is used as an abbreviation for the expression “measuring relays and protection equipment” in this standard.

In particular, this standard, specifies the following:

- definition of terms;
- guidance for the selection of clearances and creepage distances and other aspects related to the insulation of measuring relays and protection equipment;
- requirements for voltage tests and insulation resistance measurement.

This standard is applicable to the installation and use at altitudes up to 2 000 m of equipment having a rated a.c. voltage up to 1 000 V, with a rated frequency up to 65 Hz, or a d.c. voltage up to 1 500 V.

This standard also applies to associated auxiliary devices such as shunts, series resistors, transformers, etc., used and tested together with measuring relays and protection equipment as mentioned above, except where the devices are covered by other IEC publications, for example communication interfaces.

NOTE 2 Requirements for altitudes exceeding 2 000 m can be derived from table B.1.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60255. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 60255 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

IEC 60050(151):1978, *International Electrotechnical Vocabulary (IEV) – Chapter 151: Electrical and magnetic devices*

IEC 60050(448):1995, *International Electrotechnical Vocabulary – Chapter 448: Power system protection*

IEC 60060-1:1989, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60085:1984, *Thermal evaluation and classification of electrical insulation*

IEC 60112:1979, *Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions*

IEC 60255 (all parts), *Electrical relays*

IEC 60255-21-1:1988, *Electrical relays – Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment – Section 1: Vibration tests (sinusoidal)*

IEC 60255-21-2:1988, *Electrical relays – Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment – Section 2: Shock and bump tests*

IEC 60255-21-3:1993, *Electrical relays – Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment – Section 3: Seismic tests*

IEC 60664-1:1992, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 61000-4-5:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 5: Surge immunity test*

IEC 61180-1:1992, *High-voltage test techniques for low-voltage equipment – Part 1: Definitions and test procedure requirements*

IEC 61180-2:1994, *High-voltage test techniques for low-voltage equipment – Part 2: Test equipment*

3 Definitions

For the purpose of this part of IEC 60255, the following definitions together with those of IEC 60050(448), IEC 60664-1 and the relevant parts of IEC 60255 apply.

3.1

hazardous live part

part at a voltage in excess of 50 V r.m.s. or 75 V d.c.

3.2

exposed conductive part

conductive part which can be readily touched and is normally not hazardous live but may be at hazardous live voltage under a single fault condition

NOTE 1 For relays which are not enclosed, the frame, the fixing devices, etc., form the exposed conductive parts.

NOTE 2 For relays which are enclosed, the conductive parts which are accessible when the relay is mounted in its normal position of use, including those of its fixing surface, form the exposed conductive parts. Small parts such as inscription plates, screws and rivets which are isolated from the circuits are not taken into consideration.

3.3

clearance

shortest distance in air between two conductive parts

[IEC 60664-1]

3.4

solid insulation

solid insulating material interposed between any two conductive parts

[IEC 60664-1]

3.5**creepage distance**

shortest distance along the surface of the insulating material between two conductive parts [IEV 151-03-37]

3.6**rated voltage**

value of voltage assigned by the manufacturer to a component, device or equipment and to which operation and performance characteristics are referred
[IEC 60664-1]

3.7**rated insulation voltage**

r.m.s. withstand voltage value assigned by the manufacturer to the relay or to a part of it, characterising the specified (long term) withstand capability of its insulation and to which dielectric tests and creepage distances are referred

NOTE The rated insulation voltage is not necessarily equal to the rated voltage of equipment which is primarily related to functional performance.

3.8**rated impulse voltage**

impulse withstand voltage value assigned by the manufacturer to the relay or to a part of it, characterising the specified withstand capability of its insulation against transient overvoltages and to which clearances are referred

3.9**overvoltage**

any voltage having a peak value exceeding the corresponding peak value of the maximum steady-state voltage at normal operating conditions
[IEC 60664-1]

3.10**overvoltage category**

numeral defining a transient overvoltage condition
[IEC 60664-1]

NOTE Overvoltage categories I, II, III, IV are used, see 4.2.2.1.

3.11**macro-environment**

environment of the room or other location in which the relay is installed or used
[IEC 60664-1]

3.12**micro-environment**

immediate environment of the insulation which particularly influences the dimensioning of the creepage distances
[IEC 60664-1]

3.13**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
[IEC 60664-1]

3.14**pollution degree**

numeral characterising the expected pollution of the micro-environment
[IEC 60664-1]

NOTE Degrees 1 to 4 are defined in 4.4.

3.15

tracking

progressive formation of conductive paths which are produced on the surface of solid insulating material due to the combined effects of electric stress and electrolytic contamination on the surface

3.16

comparative tracking index

figure that characterises the relative tracking performance of insulating materials

3.17

type test

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

[IEV 151-04-15]

3.18

routine test

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

[IEV 151-04-16]

3.19

dielectric test

test of short duration which consists in applying a specified voltage to the insulation to prove that it is in accordance with the rated insulation voltage of the circuit, as stated by the manufacturer

3.20

impulse voltage withstand test

test which consists in applying a specified impulse voltage to the insulation to prove the ability of the measuring relay or protection equipment to withstand without damage overvoltages of very high values and very short duration

3.21

functional insulation

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

[IEC 60664-1]

3.22

basic insulation

insulation applied to live parts to provide basic protection against electric shock

[IEC 60664-1]

NOTE Basic insulation does not necessarily include insulation used exclusively for functional purposes.

3.23

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

[IEC 60664-1]

3.24

double insulation

insulation comprising both basic insulation and supplementary insulation

[IEC 60664-1]

3.25**reinforced insulation**

single insulation system applied to live parts, which provides a degree of protection against electric shock equivalent to double insulation under conditions specified in the relevant IEC standard [IEC 60664-1]

NOTE A single insulation system does not imply that the insulation must be one homogeneous piece. It may comprise several layers which cannot be tested singly as basic or supplementary insulation.

4 Insulation coordination**4.1 Basic principles**

The basic principles of insulation coordination are stated in IEC 60664-1 which provides guidance for the specification and testing of clearances, creepage distances and solid insulation.

NOTE The standard insulation for relays is basic insulation. However, there are cases of application in which a higher level of insulation (e.g. supplementary, reinforced or double insulation) is required. For example, a communication port connected to a modem may require double insulation.

Clearances shall be dimensioned according to expected overvoltages at the place of installation.

The following design parameters shall be considered:

- overvoltage category;
- pollution degree;
- geometry of clearances;
- nominal voltage from which the rated insulation voltage is derived.

The overvoltage category takes into account the fact that transient overvoltages, originating from the supply system, can intrude into the equipment through its terminals. In addition, the equipment itself may generate overvoltages.

Overvoltage categories are specified that describe the different probabilities of transient overvoltages occurring to which the equipment will be subjected during operation.

The geometry of clearances plays an important part for flashover, whereby inhomogeneous fields are to be assumed in the normal case for measuring relays and protection equipment.

The pollution degree is only relevant for small clearances.

Creepage distances shall be dimensioned from the view point of avoiding breakdown as a consequence of tracking. The following parameters shall therefore be taken into consideration:

- nominal voltage from which the rated insulation voltage is derived;
- tracking withstand of insulation material;
- pollution degree.

The rated voltage depends on the nominal voltage of the supply system or the maximum operating voltage. The pollution degree specified for the equipment depends on its environment and may be altered within the equipment.

The voltage test for clearances is carried out with transient high-voltage (impulse voltage withstand test) derived from voltages occurring in practice in low-voltage supply circuits.