



SLOVENSKI STANDARD
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Electrical relays - Part 22-6: Electrical disturbance tests for measuring relays and protection equipment - Immunity to conducted disturbances induced by radio frequency fields

Electrical relays -- Part 22-6: Electrical disturbance tests for measuring relays and protection equipment - Immunity to conducted disturbances induced by radio frequency fields

Elektrische Relais -- Teil 22-6: Prüfungen der elektrischen Störfestigkeit von Meßrelais und Schutzeinrichtungen - Störfestigkeit gegen leitungsgeführte Störgrößen, induziert durch hochfrequente Felder

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Relais électriques -- Partie 22-6: Essais d'influence électrique concernant les relais de mesure et dispositifs de protection - Immunités aux perturbations conduites induites par des champs radioélectriques

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EUROPEAN STANDARD

EN 60255-22-6

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English version

Electrical relays
Part 22-6: Electrical disturbance tests for measuring relays
and protection equipment –
Immunity to conducted disturbances induced by radio frequency fields
(IEC 60255-22-6:2001)

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Elektrische Relais
 Teil 22-6: Prüfungen der elektrischen
 Störfestigkeit von Meßrelais und
 Schutzeinrichtungen –
 Störfestigkeit gegen leitungsgeführte
 Störgrößen, induziert durch hochfrequente
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This European Standard was approved by CENELEC on 2001-05-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
 Comité Européen de Normalisation Electrotechnique
 Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 95/112/FDIS, future edition 1 of IEC 60255-22-6, 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 60255-22-6 on 2001-05-01.

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) 2002-02-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2002-02-01

Annexes designated "normative" are part of the body of the standard.
In this standard, annex ZA is normative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60255-22-6:2001 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60255-22-3 NOTE: Harmonized as EN 60255-22-3:2000 (not modified).

IEC 61000-4-3 NOTE: Harmonized as EN 61000-4-3:1996 (modified).

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ELECTRICAL RELAYS –

Part 22-6: Electrical disturbance tests for measuring relays and protection equipment – Immunity to conducted disturbances induced by radio frequency fields

1 Scope and object

This part of IEC 60255 is based on IEC 61000-4-6, referring to that standard where applicable. It specifies the general requirements for conducted disturbances induced by electromagnetic fields for measuring relays and protection equipment for power system protection, including the control, monitoring and process interface equipment used with those systems.

The objective of the tests is to confirm that the equipment under test (EUT) will operate correctly when energized and subjected to conducted disturbances induced by radiofrequency fields within the frequency range 150 kHz to 80 MHz.

NOTE IEC 60255-22-3 (based on IEC 61000-4-3) will specify the immunity requirements of measuring relays and protection equipment over the frequency range of 80 MHz to 1 000 MHz.

The requirements specified in this standard are applicable to measuring relays and protection equipment in a new condition and all tests specified are type tests only.

The object of this standard is to establish

- terms used;
- test severity level;
- test equipment;
- test set-up;
- test procedures;
- criteria for acceptance;
- test report.

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 IEC and ISO maintain registers of currently valid International Standards.

IEC 60050(161), *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility*

IEC 60050(446), *International Electrotechnical Vocabulary (IEV) – Chapter 446: Electrical relays*

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

IEC 60255-6, *Electrical relays – Part 6: Measuring relays and protection equipment*

IEC 61000-4-6:1996, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 6: Immunity to conducted disturbances, induced by radio-frequency fields*

3 Definitions

For the purpose of this part of IEC 60255, the definitions contained in IEC 60050(161), IEC 60050(446) and IEC 60050(448) as well as the following definitions apply.

3.1

artificial hand

electrical network simulating the impedance of the human body under average operational conditions between a hand-held electrical appliance and earth

[IEV 161-04-27]

3.2

auxiliary equipment

equipment necessary to provide the EUT with the signals required for normal operation and equipment to verify the performance of the equipment under test

[IEC 61000-4-6:1996, definition 4.2]

3.3

coupling and decoupling devices (CDN)

devices which have been integrated into one box

[IEC 61000-4-6:1996, 6.2]

3.4

clamp injection

injection obtained by means of a clamp-on "current" injecting device on the cable

[IEC 61000-4-6:1996, definition 4.3, modified]

NOTE This can be either a current clamp or an EM-clamp.

3.5

coupling factor

ratio given by the open-circuit voltage (e.m.f.) obtained at the EUT port of the coupling (and decoupling) device divided by the open-circuit voltage obtained at the output of the test generator

[IEC 61000-4-6:1996, definition 4.5]

3.6

EUT

either a measuring relay or a protection equipment

3.7

port

particular interface of the EUT with the external electromagnetic environment

4 Test severity level

The voltage level, prior to modulation being applied, shall be 140 dB(μ V) or 10 V r.m.s., measured in accordance with 6.4.1 of IEC 61000-4-6.

NOTE This level of test voltage is applicable to equipment used in a severe electromagnetic radiation environment, e.g. levels typical of transceivers that can be operated close to the equipment, but not closer than 1 m.

5 Test equipment

Test equipment is described in clause 6 of IEC 61000-4-6. There are a number of different methods specified to inject the test voltage onto the cabling of the EUT. It is recommended that CDNs or clamp injection should be used to inject this disturbing signal (see 6.2.2 and 6.2.3 of IEC 61000-4-6).

6 Test set-up

All auxiliary equipment used to provide the EUT with signals for normal operation, and to verify the EUT's correct operation, shall be decoupled, so that the test voltage does not affect the auxiliary equipment.

It is recommended that the CDN, as defined in clause D.2 of IEC 61000-4-6, or clamp injection, as defined in clause A.2 of IEC 61000-4-6, be used to test the ports of the EUT.

Normally the EUT shall be individually tested with the EUT placed on an insulating support 0,1 m above the ground reference plane, and all parts of the EUT shall be at least 0,5 m from any metallic obstacles. All non-excited input ports of the CDN shall be terminated by 50 Ω T loads. If the EUT is to be tested on a non-conducting table, normally 0,8 m high, the ground reference plane may be placed on the table.

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On all cables to be tested, CDNs or clamp injection shall be used. The CDNs shall be placed on the ground reference plane, making direct contact with it at about 0,1 m to 0,3 m from the EUT. The cables between the CDNs or clamp injection and the EUT shall be as short as possible and shall not be bundled nor wrapped. The cables above the ground reference plane shall be between 30 mm and 50 mm.

If the EUT is provided with other earth terminals, they shall, when allowed, be connected to the ground reference plane through the coupling and decoupling network CDN-M1 terminated by a 50 Ω T load.

If the EUT is provided with a keyboard or hand-held accessory, then the artificial hand shall be placed on this keyboard or wrapped around the accessory and connected to the ground reference plane.

Auxiliary equipment required for the defined operation of the EUT according to the specifications, e.g. communication equipment, as well as auxiliary equipment necessary for ensuring any data transfer and assessment of the functions, shall be connected to the EUT through CDNs or clamp injection. However, as far as possible, the number of cables to be tested should be limited to the representative functions.

Where the EUT is exclusively mounted in a cubicle, the tests may be conducted with the EUT in the cubicle. The cubicle should be placed on a insulating support, 0,1 m above the ground reference plane. If there are several EUTs within the cubicle, no conducted immunity test shall be performed on their interconnecting cables, these being regarded as internal cables of the system.

Typical EUT set-ups for measuring relays and protection equipment are shown in figures 1 and 2, which are based on figures 10 and 9 of IEC 61000-4-6.

7 Test procedure

The tests shall be carried out using the reference conditions given in IEC 60255-6.

In order to simulate actual operating conditions, the test voltage should be applied to all of the wiring connected to the port under test. Each port of the EUT shall be tested individually in turn, if this is practical; e.g. earth, current transformer inputs, voltage transformer inputs, auxiliary supply, output contacts, status inputs and communication links. All ports of the EUT not being tested should be connected to CDNs which shall be terminated by 50 Ω T loads.

NOTE No test is recommended on the earth port if the wiring connected to this port is always less than 3 m in length.

If a CDN is used to test identical circuits, e.g. status inputs or output contacts, they should, for practical reasons, be connected to a single CDN.

Also for practical reasons, the effect of this disturbance on the relay in its transitional or operate state is only considered at certain spot frequencies as specified in 7.2.

The following tests shall be performed to confirm that

- a) the EUT will have normal performance within the specification limits when energized and subjected to a conducted disturbance within the swept frequency range 150 kHz to 80 MHz;
- b) the EUT is capable of correct operation and reset in the presence of a conducted disturbance at given spot frequencies within the range 150 kHz to 80 MHz.

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7.1 Frequency sweep

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Time delay settings of the EUT shall be set to their minimum practical values as defined by their intended application.

The tests shall be carried out with auxiliary energizing quantities applied to the appropriate circuits, using input energizing quantities equal to rated values. The values of the input energizing quantities shall be within twice the assigned error of the transitional state.

If the rated conditions of the EUT mean that the input energizing quantity is much lower than the relay operate value, the tests shall be performed at the continuous thermal withstand value.

The frequency range is swept from 150 kHz to 80 MHz, with the signal 80 % amplitude modulated with a 1 kHz sinewave, pausing to adjust the radio frequency signal level or to switch oscillators as necessary. The rate of sweep shall not exceed $1,5 \times 10^{-3}$ decades per second.

Where the frequency range is swept incrementally, the step size shall not exceed 1 % of fundamental, with linear interpolation between calibrated points. The dwell time at each frequency shall be 0,5 s. In those cases where the EUT operate time is greater than 0,5 s, the dwell time shall be increased until operation of the EUT is possible.

NOTE The expression "not exceed 1 % of fundamental" means that the frequency of each step is less than, or equal to, the frequency of the previous step after multiplication by a factor of 1,01 (for a 1 % step size).

7.2 Spot frequencies

The tests shall be carried out with auxiliary energizing quantities applied to the appropriate circuits with values equal to rated conditions.

Table 1 specifies the spot frequencies which shall be used. The signals shall be amplitude modulated with a 1 kHz sinewave.

Table 1 – Spot frequencies

Spot frequency MHz	Tolerance	Modulation	Duty cycle
27	±0,5 %	80 %	100 %
68	±0,5 %	80 %	100 %

During each spot frequency test, the input energizing quantities shall be adjusted to cause the EUT to change from the normal energized state to the operated state and held until the EUT operates correctly. The input energizing quantities shall then be readjusted to cause the EUT to reset.

The testing time at each spot frequency should be not less than 10 s.

8 Criteria for acceptance

The test result is positive if the EUT shows its immunity for all the period of the application of the tests.

Table 2 lists the important functions which could apply to a measuring relay or protection equipment. These should be monitored during both sweep and spot frequency testing.

Table 2 – Criteria for acceptance

Function	Criterion for acceptance
Protection	Normal performance within the specification limits
Command and control	
Measurement	
Integral human machine interface and visual alarms	
Data communication	