SLOVENSKI STANDARD
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Erection and operation of electrical test equipment

Erection and operation of electrical test equipment

Errichten und Betreiben elektrischer Prüfanlagen

Installation et exploitation des équipements électriques d'essais

Ta slovenski standard je istoveten z: **EN 50191:2000**

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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

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Foreword

The text of this European Standard, prepared by CENELEC BTTF 85-1, Erection and operation of electrical test equipment, was submitted to the formal vote and was approved by CENELEC as EN 50191 on 1999-10-01.

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) 2001-03-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2002-10-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex A is normative and annex B is informative.

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Introduction

With reference to clause 5, the user of this EN, prepared in the field of application of Article 118 A of the EC Treaty, should be aware that standards have no formal legal relationship with Directives which may have been made under Article 118 A of the Treaty. In addition, national legislation in the Member states may contain more stringent requirements than the minimum requirements of a Directive based on Article 118 A. Information on the relationship between the national legislation implementing Directives based on Article 118 A and this EN may be given in a national foreword of the national standard implementing this EN.

1 Scope

1.1 This standard is applicable to the erection and operation of fixed and temporary electrical test installations.

1.2 Compliance with this standard is not necessary, if contact with live parts presents no danger. This is the case when one of the following conditions is satisfied at live exposed points:

a) The voltage at frequencies above 500 Hz does not exceed 25 V a.c. or 60 V d.c. and complies with the requirements for SELV or for PELV in accordance with HD 384.4.41.

b) In case of voltages at frequencies up to 500 Hz exceeding 25 V a.c.or 60 V d.c., the resultant current through a non-inductive resistance of 2 kΩ does not exceed 3 mA a.c. (r.m.s.). or 12 mA d.c.

c) At frequencies above 500 Hz no hazardous body currents or contact voltages occur. In these cases the national determined current and voltage values should be applied. If there are no national requirements determined reference values for permissible body currents and contact voltages can be taken from Table A.1 in Annex A.

d) The discharge energy does not exceed 350 mJ.

Even though compliance with this standard is not necessary if one of the above-mentioned conditions is satisfied, other potential risks shall be considered and appropriate measures put into place to obviate the risks.

1.3 This standard does not apply to the power supply to the test installations. In this case, the standards of the HD 384 series (for nominal voltages up to 1000 V) or HD 637 S1 (for nominal voltages exceeding 1 kV) are applicable to erection and EN 50110-1 is applicable to operation.

1.4 Where no requirements are given in this standard, the standards of the HD 384 series (for nominal voltages up to 1000 V) or HD 637 S1 (for nominal voltages exceeding 1 kV) apply to the erection of electrical test installations and EN 50110-1 applies to the operation of electrical test installations.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 294	Safety of machinery - Safety distance to prevent danger zones being reached by the upper limbs
EN 418	Safety of machinery - Emergency stop equipment, functional aspects - Principles for design
EN 574	Safety of machinery - Two-hand control devices - Functional aspects - Principles for design
EN 50110-1	Operation of electrical installations
EN 60529	Degrees of protection provided by enclosures (IP Code) (IEC 60529)
EN 61219	Live working - Earthing or earthing and short-circuiting equipment using lances as short-circuiting device - Lance earthing (IEC 61219)
EN 61310-1	Safety of machinery - Indication, marking and actuation -- Part 1: Requirements for visual, auditory and tactile signals (IEC 61310-1)

EN 61558	Safety of power transformers, power supply units and similar (IEC 61558 series)
HD 366	Classification of electrical and electronic equipment with regard to protection against electric shock (IEC 60536)
HD 384 series	Electrical installations of buildings (IEC 60364 series, modified)
HD 637 S1	Power installations exceeding 1 kV a.c.
IEC 60050-826	International Electrotechnical Vocabulary -- Chapter 826: Electrical installations of buildings

3 Definitions

For the purpose of this standard, the following definitions apply:

3.1
electrical test installations
(referred to in the following as **test installations**)
the entirety of all the test appliances and devices combined for test purposes, by means of which electrical tests are performed on test objects

Test installations may be designed and erected or installed as:

- test station;
- test laboratory or experimental station;
- temporary test installations.

3.2
test station

appropriately identified test installations within a defined area in which only one or two persons are generally employed on test work, e.g. in the line of series production or in electric workshops, repair and service shops

In test stations a distinction is made between those with and those without automatic protection against direct contact.

3.2.1
test station with automatic protection against direct contact
a test station in which the test object and all live parts of the test apparatus have automatically activated full protection against direct contact in an energized condition

NOTE Automatic protection means that voltages can only occur when the safety devices are effective, e.g. when the cover or door of the test station is closed.

3.2.2
test station without automatic protection against direct contact
a test station in which parts of the test object or live parts of the test apparatus are not fully protected against direct contact during testing. This includes, for instance, test areas in electric workshops, laboratories, measurement and experimental areas

3.3
test laboratory
test installations in a securely enclosed space or within an area separated from adjacent work areas, in which several persons are generally employed on test work on larger test objects remaining there for a longer period of time

A test laboratory may be subdivided into test areas in which mutually independent tests are performed.

3.4
experimental station
test installations for performing experiments or tests within the scope of research and development work. In general, no routine tests are performed in experimental stations. A variety of test assemblies as well as different hazards shall therefore be anticipated

An experimental station may be subdivided into sections in which mutually independent experiments or tests are carried out.

3.5
temporary test installations
test installations erected for a short time in order to perform tests on individual test objects

3.6
prohibition zone
a volume around live parts which should not be breached if full protection against direct contact with these parts is not provided

3.7
test area
the area around the test assembly which is separated from the surrounding area

3.8
signal lights
lights which are clearly visible from outside the boundaries of the test area giving red or green signals to indicate the operational status inside the test area

3.9
indicator lights
serve to indicate the switching status on the control panels. They are not an alternative to required signal lights

3.10
risk
a combination of the probability and the degree of the possible injury or damage to health of a person exposed to a hazard or to hazards

3.11
electrical hazard
a source of possible injury or damage to health in presence of electrical energy from an electrical installation

3.12
skilled person
a person with relevant education and experience to enable him or her to avoid dangers which electricity may create. (IEV 826-09-01, modified)

3.13
instructed person
a person adequately advised by skilled persons to enable him or her to avoid dangers which electricity may create (IEV 826-09-02, modified)

3.14
nominated person in control of a work activity
that person who has been nominated to be the person with direct management responsibility for the work activity. parts of this responsibility may be delegated to others as required

3.15 Operational status

3.15.1
out of operation
status when
a) all power supplies, signalling and control circuits are switched off and secured against unauthorized switching-on,
b) all safety precautions necessary before entering the test area (for voltages exceeding 1 kV, e.g. earthing, short-circuiting) have been taken

3.15.2
ready for operation
status when
a) the power supplies for the switchgear signalling and control circuits of the test installations are switched on,
b) the green signal lights, where these are required in accordance with the provisions in clause 4, are on,
c) all power supplies for the test voltage are switched off and secured against unintentional switching,
d) the safety precautions specified in 3.16.1 b ("out of operation") are in force

3.15.3
ready to switch on
status when

a) all power supplies for the test voltage are switched off,
b) all entries to the test area are closed,
c) the red signal lights are switched on,
d) the safety precautions specified in 3.16.1 b ("Out of operation") are no longer in force

3.15.4
in operation
status when

a) all entries to the test area are closed,
b) the red signal lights are switched on,
c) one or more power supplies for the test voltage are switched on

NOTE In clauses 4 and 5, the technical devices for setting up the operational status **ready for operation** and **ready to switch on** are only required for certain test installations with voltages exceeding 1 kV.

4 Erection of test installations

4.1 General

4.1.1 Protection against electric shock

4.1.1.1 Test assembly

The test assembly shall be so arranged and designed that the protection against direct contact is secured by insulation of live parts, covers, enclosures, obstacles or safe distances. A safe distance is ensured, when the person carrying out the tests cannot reach the prohibition zone with parts of his / her body or tools. Safety can also be satisfied by means of a two-hand control device or the use of two safety test probes to apply the test voltage. Test leads with full protection against direct contact shall be used. Two-hand control devices shall comply with EN 574, Type II or IIIB. Where several persons are involved in a test, a two-hand control device shall be provided for each person of the test personnel and which are so connected that all the two hand controls are required to be operated before the test supplies can be energised.

Safety test probes shall have the adequate insulation level for the applied test voltage. No clamping devices shall be permitted for this purpose.

In case of measuring instruments and auxiliary appliances of protection Class I HD 366 (e.g. cathode ray oscilloscope, sine wave generator), where the protective conductor is interrupted to facilitate testing, e.g. because the enclosure has to be isolated from earth potential, the appliance shall be supplied from an isolating transformer in accordance with EN 61558.

If a circuit and/or the enclosure of a measuring instrument or an auxiliary appliance designed for mains connection is connected to live parts of the test assembly which can carry voltage to earth, then the internal insulation of the supplying isolating transformer shall be rated at least for this voltage.

An effective protective measure for protection in case of a fault (protection against indirect contact) shall be provided.

The test assembly shall be so designed and arranged in order to prevent the transfer of voltage to extraneous conductive parts.

4.1.1.2 Prohibition zone

The boundary of the prohibition zone shall be determined in accordance with Table A.2 and is dependent on the test voltage.

In case of voltages up to 1000 V, the surface of the live part is considered to be the boundary of the prohibition zone. In case of voltages exceeding 1 kV, reaching the prohibition zone is considered equal to touching live parts.

4.1.1.3 Barriers, test area

Test areas shall be separated from work areas and passageways. The barriers shall be so designed as to

- prevent access to the test area by persons other than the test persons
- prevent persons other than the test persons reaching the prohibition zone
- prevent persons outside the barrier reaching the operating devices of test installations which are located inside the barrier

The minimum distance between the barrier enclosing the test area and the boundary of the prohibition zone or operation devices shall be determined in accordance with Figure A.2 and Table A.3. In case of grid barriers, the minimum distance between the barrier and the prohibition zone shall comply with Table A.4 at any opening, where it is possible to reach through the barrier.

Barriers made of conductive materials shall be earthed or other measures shall be taken to prevent indirect electric shock in case of a fault.

4.1.2 Indicator lights and signs

4.1.2.1 The test installations controls and test circuits shall be clearly identified.

4.1.2.2 Test installations shall have devices which indicate the operational status, e.g. indicator lights.

4.1.2.3 Test installations and test areas shall be clearly and visibly indicated by means of warning signs.

4.1.3 Emergency switching off

Test installations shall be provided with means for emergency switching off in order to cut off all electrical energy which could result in danger. The devices or equipment shall be in accordance with the requirements of EN 418. An adequate number of manual controls shall be provided inside and outside the test area as appropriate to the size of the area and complexity of layout. Connection points, e.g. outlets of the general power supply within the test area, shall be identified accordingly, if they are not interrupted by the emergency switching off equipment.

4.1.4 Preventing unauthorized and unintentional switching-on

Test installations shall be secured against unauthorized and unintentional switching-on of test circuits. Manual controls shall be clearly correlated to the respective test circuits.

4.1.5 Preventing automatic energizing

Automatic energizing of test circuits shall be prevented when mains voltage recovers after a power failure.

4.1.6 Protection against residual voltages and transfer of voltages

4.1.6.1 If there is a likelihood of danger due to residual voltages after switching-off test circuits, suitable devices or equipment shall be provided for a safe discharge of energy.

4.1.6.2 Transfer of voltage to accessible conductive parts outside the test area shall be prevented by adequate measures - e.g. earthing, shielding, appropriate cable routing - or these conductive parts shall be protected against direct contact.

4.1.7 Protective measures against other hazards

Appropriate means of protection shall be provided, in cases where in addition to dangers due to voltages other hazards are to be expected, e.g. due to arcs, noise, explosion, radiation, flying parts, formation of gas, fire, dangerous substances.

4.2 Test stations with automatic protection against direct contact

4.2.1 The protection against direct contact in accordance with 4.1.1.1 must be satisfied by insulation of live parts, covers or enclosures. The means of protection against direct contact shall guarantee at least the defined degree of protection IP3X.. in accordance with EN 60529 and include all parts of the test object.

It shall not be possible to switch on the test voltages until the means of protection are fully operational and functioning correctly. Opening the means of protection must disconnect the test voltage automatically. Residual voltages shall be automatically reduced to a non-hazardous level before live parts can be touched.

Single fault conditions shall not prevent the test voltages from being switched off when the means of protection are opened. The occurrence of the fault shall ensure that it is impossible to switch the test voltages on again. It must not be possible to bypass the means of protection in an easy way.

4.2.2 Mechanical means of protection shall be adequately strong.

4.2.3 The degree of protection against direct contact IP3X.. may be omitted if the enclosure complies with the following requirements:

- means of protection for the automatic protection against direct contact shall be solid walls or barrier grids (side length or diameter of the openings not exceeding 40 mm) at least 1800 mm high;
- the test enclosure must be equipped with devices which do not permit doors to the test area to be opened until the test voltage has been switched off and secured against being switched on again and - if necessary - earthed and short-circuited. It shall not be possible to disable these protective measures until the doors have been closed.

4.2.4 The degree of protection, required in 4.2.1, may be omitted in exceptional cases, if the test object and all live parts are fully protected against direct contact and a measure for protection in case of a fault (protection against indirect contact) is efficient for the test object and the test apparatus during the test.

4.2.5 In the case of test stations with automatic protection against direct contact, barriers in accordance with 4.1.1.3 and emergency switching off devices in accordance with 4.1.3 may be omitted.

4.3 Test stations without automatic protection against direct contact

4.3.1 Test stations without automatic protection against direct contact shall only be installed if the erection of test stations with automatic protection against direct contact is not practicable, e.g.

- due to frequently changing test duties;
- in case of varying types of test objects;
- in case of serious difficulties in performing the work;
- when test duties occur only occasionally.

4.3.2 The barriers in accordance with 4.1.1.3 may be e.g. walls, grids, ropes, chains or bars subject to national regulations. They shall be so designed that visual contact with the operator can be maintained from outside at all times.

4.3.3 At least one emergency switching device shall be installed outside the test areas.

4.3.4 An adequate number of red signal lights, indicating the operational status, shall be installed.

4.3.5 If test circuits are electrically connected to the general power supply system, additional protection shall be provided by means of a RCD with a rated difference current ≤ 30 mA. If the residual current includes d.c. components, an appropriate RCD shall be used.

4.3.6 Test workbench tops shall be made of insulating materials.

4.3.7 Electrical equipment, e.g. measuring instruments, variable resistors, shall be incorporated in an effective protective measure for protection in case of a fault (protection against indirect contact). This also applies to the exposed conductive parts of test objects unless these parts of the test object are also included in the test (e.g. insulation test, leakage current test, see Figure 1). Electrical equipment with protective insulation or supplied by means of isolating transformers shall preferably be used.

4.3.8 The working area of test stations shall be such that movement of test personnel is not impeded. National regulations shall be taken into consideration.

4.3.9 When safety test probes are used with voltages exceeding 1 kV, the high voltage side of the test apparatus shall be electrically isolated from the supply mains and insulated from earth, same applying to test probes and their leads. The test object shall also be isolated from earth where practicable.

The r.m.s. value of the leakage current (see IEC 60050-826) on the high voltage side of the test apparatus shall not exceed 3 mA. This value shall not be exceeded even when a highly resistive connection is made between the high voltage side and earth, e.g. for adjustment of potential of a measuring instrument (see Figure 1).