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**Električne inštalacije zgradb – 6-61. del: Preverjanje – Prvo preverjanje (IEC 60364-6-61:1986 + A1:1993 + A2:1997, spremenjen)**

Electrical installations of buildings - Part 6-61: Verification - Initial verification (IEC 60364-6-61:1986 + A1:1993 + A2:1997, modified)

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## Foreword

The text of the International Standard IEC 60364-6-61:1986 + A1:1993 + A2:1997, prepared by IEC TC 64, Electrical installations and protection against electric shock, together with the common modifications prepared by SC 64A, Protection against electric shock, of Technical Committee CENELEC TC 64, Electrical installations of buildings, was submitted to the CENELEC formal vote and was approved by CENELEC as HD 384.6.61 S2 on 2002-09-24.

This Harmonization Document HD 384.6.1 S1:1992.

The following dates are proposed:

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|--|-------|------------|
| – latest date by which the existence of the HD has to be announced at national level   | (doa) | 2003-04-01 |
| – latest date by which the HD has to be implemented at national level by publication of a harmonized national standard or by endorsement | (dop) | 2004-04-01 |
| – latest date by which the national standards conflicting with the HD have to be withdrawn   | (dow) | 2005-10-01 |

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annex ZA is normative and annexes A, C, E and F are informative.

Annex ZA has been added by CENELEC.

In this Harmonization Document the common modifications to the International Standard are indicated by a vertical line in the left margin of the text.

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## 61.1 General

**61.1.1** Every installation shall be verified as far as reasonably practicable during erection and/or on completion before being put into service by the user.

**61.1.2** The information required by Clause 514.5 shall be made available to the persons carrying out the verification.

**61.1.3** Precautions shall be taken to avoid danger to persons and to avoid damage to property and installed equipment during inspection and testing.

**61.1.4** Where the installation is an extension or alteration of an existing installation, it shall be verified that the extension or alteration complies with HD 384 and does not impair the safety of the existing installation.

**61.1.5** The verification shall be made by a skilled person, competent in verification.

**61.1.6** On completion of the verification according to 61.1.1 and 61.1.4 a report shall be prepared.

NOTE Information on periodic verification is given in Annex F.

## 61.2 Normative references

See Annex ZA.

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## 61.3 Definitions

For the purpose of Chapter 61 the following definitions apply.

SIST HD:384.6.61-S2:2004  
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### 61.3.1 verification

all measures by means of which compliance of the complete electrical installation with the HD's of the HD 384 series is checked. Verification comprises inspection and testing

### 61.3.2 inspection

the examination of an electrical installation using all the senses in order to ascertain their proper selection and erection

### 61.3.3 testing

the implementation of measures in an electrical installation by means of which its effectiveness is proved. It includes ascertaining values by means of appropriate measuring instruments, these values not being detectable by inspection

## 611 Inspection

**611.1** Inspection shall precede testing and normally be done with the whole installation dead.

**611.2** The inspection shall be made to confirm that electrical equipment which is part of the fixed installation is

– in compliance with the safety requirements of the relevant equipment standards,

NOTE This may be ascertained by examination of marking or certification.

- correctly selected and erected according to HD 384 series and to the manufacturers instructions,
- not visibly damaged, so as to impair safety.

### 611.3 Inspection shall include at least the checking of the following, where relevant:

- method of protection against electric shock, including measurement of distances, with regard to, for example, protection by barriers or enclosures, by obstacles or by placing out of reach, (see Clauses 412.2, 412.3, 412.4, 413.3 and Section 471);

NOTE The requirement stated in Clause 413.3 "Protection by non-conducting location" is verifiable only where the installation includes only electrical equipment which is part of the fixed installation.

- presence of fire barriers and other precautions against propagation of fire and protection against thermal effects (see Chapters 42, 43 and Sections 482, 527);
- selection of conductors for current-carrying capacity and voltage drop (see Sections 523 and 525);
- choice and setting of protective and monitoring devices (see Chapter 53);
- presence of suitable isolating and switching devices correctly located (see Chapter 46 and Section 537);
- selection of equipment and protective measures appropriate to external influences (see Clause 512.2 and Sections 482 and 522);
- identification of neutral and protective conductors (see Clause 514.3);
- presence of diagrams, warning notices or other similar information (see Clause 514.5);
- identification of circuits, overcurrent protective devices, switches, terminals, etc. (see Section 514);
- adequacy of connections of conductors (see Section 526);
- accessibility for convenience of operation, identification and maintenance (see Sections 513 and 514).

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## 612 Testing

### 612.1 General

The following tests shall be carried out where relevant and should preferably be made in the following sequence:

- continuity of the protective conductors and of the main and supplementary equipotential bonding (see Clause 612.2);
- insulation resistance of the electrical installation (see Clause 612.3);
- protection by SELV and PELV or by electrical separation of circuits (see Clause 612.4);
- floor and wall resistance (see Clause 612.5);
- automatic disconnection of supply (see Clause 612.6);
- polarity test (see Clause 612.7);
- functional tests (see Clause 612.8);
- voltage drop (see Clause 612.9) (under consideration).

In the event of any test indicating failure to comply, that test and any preceding test, the results of which may have been influenced by the fault indicated, shall be repeated after the fault has been rectified.

The test methods described in this chapter are given as reference methods; other methods are not precluded provided they give no less valid results.

Measuring instruments and monitoring equipment shall comply with EN 61557. If other measuring equipment is used, it shall provide no less degree of performance and safety.

### 612.2 Continuity of the protective conductors, including the main and supplementary equipotential bonding

A continuity test shall be made. It is recommended that the test be carried out with a supply having a no-load voltage of 4 V to 24 V, d.c. or a.c., and with a minimum current of 0,2 A.

### 612.3 Insulation resistance of the electrical installation

The insulation resistance shall be measured between each live conductor and the protective conductor or earth.

NOTE 1 In TN-C systems, the PEN conductor is considered as part of the earth.

NOTE 2 In locations exposed to fire hazards the insulation resistance between the live conductors should be measured.

**Table 61A – Minimum value of the insulation resistance**

Nominal circuit voltage V	Test voltage d.c. to be applied V	Insulation resistance MΩ
SELV, PELV	250	≥ 0,25
Up to and including 500 V (including FELV), with the exception of the above cases	500	≥ 0,5
Above 500 V	1 000	≥ 1,0

The insulation resistance, measured with the test voltage values indicated in Table 61A is satisfactory if each circuit, with the appliances disconnected, has an insulation resistance not less than the appropriate value given in Table 61A.

Table 61A is applicable for verification of the insulation resistance between non-earthed protective conductors and earth.”

Measurements shall be carried out with direct current. The testing apparatus shall be capable of supplying the test voltage specified in Table 61A when loaded with 1 mA.

### 612.4 Protection by SELV, PELV or by electrical separation

The separation of circuits shall be confirmed in accordance with 612.4.1 in the case of protection by SELV, 612.4.2 in the case of protection by PELV, and 612.4.3 in the case of protection by electrical separation.

#### 612.4.1 Protection by SELV

The separation of live parts from those of other circuits and from earth, according to Section 411, shall be confirmed by a measurement of the insulation resistance. The resistance values obtained shall be in accordance with Table 61A.

#### 612.4.2 Protection by PELV

The separation of live parts from those of other circuits, according to Section 411, shall be confirmed by a measurement of the insulation resistance. The resistance values obtained shall be in accordance with Table 61A.

#### 612.4.3 Protection by electrical separation

The separation of live parts from those of other circuits and from earth, according to Clause 413.5, shall be confirmed by a measurement of the insulation resistance. The resistance values obtained shall be in accordance with Table 61A.

### 612.5 Floor and wall resistance

When it is necessary to comply with the requirements of Clause 413.3, at least three measurements shall be made in the same location, one of these measurements being approximately 1 m from any accessible extraneous conductive part in the location. The other two measurements shall be made at greater distances.

The above series of measurements shall be repeated for each relevant surface of the location.

In Annex A to this chapter methods for measuring the insulating resistance/impedance of floors and walls are given as examples.

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### 612.6 Verification of conditions for protection by automatic disconnection of the supply

#### 612.6.1 General

The verification of the efficacy of the measures for protection by automatic disconnection of supply is effected as follows:

##### a) For TN systems

Compliance with the rules of 413.1.3.3 and 413.1.3.5 shall be verified by

- 1) measurement of the fault loop impedance (see 612.6.3).

Alternatively where the calculations of the fault loop impedance or of the resistance of the protective conductors are available and when the arrangement of the installation permits the verification of the length and cross-sectional area of the conductors, the verification of the continuity of the protective conductors (see 612.2) is sufficient,

NOTE Compliance may be verified by measurement of the resistance of protective conductors under the conditions described in Annex E.

- 2) verification of either the characteristics or the effectiveness of the associated protective device, i.e. by inspection of the nominal current setting for circuit-breakers and the current rating for fuses and also by inspection and test for residual current devices.

The effectiveness of the automatic disconnection of supply by RCD's shall be verified by generating a residual current up to  $I_{dn}$  using suitable test equipment, without measurement of time.



In addition, it shall be ascertained that the earthing resistance  $R_B$  is designed where necessary according to 413.1.3.7.

b) *For TT systems*

Compliance with the rules of 413.1.4.2 shall be verified by

- 1) measurement of the resistance  $R_A$  of the earth electrode for exposed conductive parts of the installation (see 612.6.2),
- 2) verification of the characteristics and/or the effectiveness of the associated protective device. This verification shall be made
  - for RCD's: by inspection and by test.

The effectiveness of the automatic disconnection of supply by RCD's shall be verified by generating a residual current up to  $I_{dn}$  using suitable test equipment, without measurement of time,

- for overcurrent protective devices: by inspection (i.e. current setting for circuit-breakers, current rating for fuses).

c) *For IT systems*

Calculation or measurement of the first fault current

NOTE 1 This measurement is not necessary if all exposed conductive parts of the installation are connected to the power system earth (see 312.2.3) in the case where the system is connected to earth through an impedance (see 413.1.5.1).

NOTE 2 The measurement is made only if the calculation is not possible, because all the parameters are not known. Precautions are to be taken while making this measurement in order to avoid the danger due to a double fault.

Where conditions which are similar to conditions of TT systems occur in the event of a second fault (see 413.1.5.5a)), verification is made according to item b) of this clause.

Where conditions similar to conditions of TN systems occur in the event of a second fault (see 413.1.5.5b)), verification is made according to item a) of this clause.

NOTE 3 During the measurement of the fault loop impedance, it is necessary to establish a connection of negligible impedance between the neutral point of the system and the protective conductor at the origin of the installation.

**612.6.2 Measurement of the resistance of the earth electrode**

Measurement of the resistance of an earth electrode, where prescribed (see 413.1.4.2 for TT systems and 413.1.3.7 for TN systems and 413.1.5.3 for IT systems), is made by an appropriate method.

NOTE 1 Annex C gives, as an example, a description of a method of measurement using two auxiliary earth electrodes and the conditions to be fulfilled.

NOTE 2 Where, in a TT system, the location of the installation (e.g. in towns) is such that it is not possible in practice to provide the two auxiliary earth electrodes, measurement of the fault loop impedance (or resistance) will give an excess value.

**612.6.3 Measurement of the fault loop impedance**

Measurement of the fault loop impedance shall be effected at the same frequency as the nominal frequency of the circuit.

The measured fault loop impedance shall comply with 413.1.3.3 for TN systems and with 413.1.5.6 for IT systems.

NOTE The fault loop impedance value might be influenced by significant fault currents. This particularly applies to factory-built assemblies, including busbar trunking systems, metallic conduits and cables with metallic enclosures.

Where the requirements of this subclause are not satisfied or in case of doubt and where supplementary equipotential bonding according to 413.1.6 is applied, the effectiveness of that bonding shall be checked according to 413.1.6.2.

### 612.7 Polarity test

Where the rules forbid the installation of single pole switching devices in the neutral conductor, a test shall be made to verify that all such devices are connected in the line conductor only.

### 612.8 Functional tests

Assemblies, such as switchgear and controlgear assemblies, drives, controls and interlocks, shall be subjected to a functional test to show that they are properly mounted, adjusted and installed in accordance with the relevant requirements of the HD 384 series.

Protective devices shall be submitted to functional tests, if necessary, in order to check whether they are properly installed and adjusted.

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### 612.9 Verification of voltage drop

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Under consideration.

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## Annex A (informative)

### Method for measuring the insulation resistance/impedance of floors and walls to earth or protective conductors

Distinction is to be made between conductive floors and walls, floors and walls with leakage resistance and insulating floors and walls.

In case of insulating floors and walls the necessary resistance/impedance to earth or protective conductors shall be verified. This made be done in accordance with the following methods of measurement:

*For D.C.–systems:*

measurement by using an insulation resistance measuring instrument operating with a d.c. voltage of at least the nominal system voltage and with application of test electrode 1.

*For A.C.–systems:*

a) either measurement with a.c. voltage or at least the nominal system voltage and with additional safety provisions given by either the manufacturer of the measuring equipment or by an other competent person responsible for the measurement;

or

b) measurement by using an insulation resistance measuring instrument as for d.c. systems combined with an a.c. measurement with a voltage of at least 25 V and not exceeding 50 V.

For a.c. measurement test electrode 1 and test electrode 2 are applicable.

Measurement of the floor impedance  $Z_x$  is carried out by means of the current/voltage method.

Current is fed across ammeter I to the test electrode either from the line conductor L or from a separate a.c. safety voltage source.

The voltage at the test electrode is measured by means of a voltmeter  $U_x$  connected to PE.

The impedance of the floor insulation will then be:

$$Z_x = U_x / I$$

#### Description and application of test electrode 1

The test electrode comprises a metallic tripod of which the parts resting on the floor form the points of an equilateral triangle. Each supporting part is provided with a flexible base ensuring, when loaded, close contact with the surface being tested over an area of approximately 900 mm<sup>2</sup> and presenting a resistance of less than 5 000 Ω.

Before measurements are made, the surface being tested is moistened or covered with a damp cloth. While measurements are being made a force of approximately 750 N or of 250 N is applied to the tripod, in the case of floors or of walls respectively (see Figure A.1).