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Low voltage electrical installations -- Part 6: Verification

Errichten von Niederspannungsanlagen -- Teil 6: Prüfungen

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Installations électriques a basse tension - Partie 6: Vérification

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HARMONIZATION DOCUMENT

DOCUMENT D'HARMONISATION

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HD 60364-6

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Supersedes HD 384.6.61 S2:2003

English version

Low voltage electrical installations - Part 6: Verification

(IEC 60364-6:2006, modified)

Installations électriques à basse tension - Partie 6: Vérification (CEI 60364-6:2006, modifiée)

Errichten von Niederspannungsanlagen - Teil 6: Prüfungen (IEC 60364-6:2006, modifiziert)

This Harmonization Document was approved by CENELEC on 2006-09-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for implementation of this Harmonization Document at national level.

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

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This Harmonization Document exists in three official versions (English, French, German).

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CENELEC

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

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FOREWORD

The text of document 64/1497/FDIS, future edition 1 of IEC 60364-6, prepared by IEC TC 64, Electrical installations and protection against electric shock, was submitted to the IEC-CENELEC parallel vote.

A draft amendment, prepared by SC 64A, Protection against electric shock, of Technical Committee CENELEC TC 64, Electrical installations and protection against electric shock, was submitted to the formal vote.

The combined texts were approved by CENELEC as HD 60364-6 on 2006-09-01.

This Harmonization Document supersedes HD 384.6.61 S2:2003.

The main changes with respect to HD 384.6.61 S2:2003 are:

– extension of the scope to cover, in addition to initial verification, also periodic verification of electrical installations;

– modification of verification requirements in the case of protection by automatic disconnection of the supply;

– requirements for verification of conditions for additional protection;

– requirements for reporting upon completion of initial and periodic verification;

– information concerning the measurement of earth loop impedance with current clamps;

– information concerning the evaluation of voltage drop;

– recommendations for electrical equipment which is being re-used;

– model forms of schedules that might be used for the description and for initial and periodic verification of electrical installations.

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The following dates were fixed:

– latest date by which the existence of the HD has to be announced at national level	(doa)	2007-03-01
– latest date by which the HD has to be implemented at national level by publication of a harmonized national standard or by endorsement	(dop)	2007-09-01
– latest date by which the national standards conflicting with the HD have to be withdrawn	(dow)	2009-09-01

Annexes ZA and ZB have been added by CENELEC.

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

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6.1 Scope

This Part of HD 60364 provides requirements for initial and periodic verification of an electrical installation.

Clause 61 provides requirements for initial verification, by inspection and testing, of an electrical installation to determine, as far as reasonably practicable, whether the requirements of the other parts of HD 60364 have been met and requirements for the reporting of the results of the initial verification. The initial verification takes place upon completion of a new installatioon or completion of additions or of alterations to existing installations.

Clause 62 provides requirements for periodic verification of an electrical installation to determine, as far as reasonably practicable, whether the installation and all its constituent equipment are in a satisfactory condition for use and requirements for the reporting of the results of the periodic verification.

6.2 Normative references

The following referenced documents are indispensable for the application 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.

HD 60364 (all parts), *Low voltage electrical installations* (IEC 60364, all parts)

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EN 60079-17, *Electrical apparatus for explosive atmospheres – Part 17: Inspection and maintenance of electrical installations in hazarduous areas (other than mines)* (IEC 60079-17)

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EN 61241-17, *Electrical apparatus for use in the presence of combustible dust – Part 17: Inspection and maintenance of electrical installations in hazarduous areas (other than mines)* (IEC 61241-17)

EN 61557 (all parts), *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. - Equipment for testing, measuring or monitoring of protective measures* (IEC 61557, all parts)

6.3 Definitions

For the purpose of clauses 61 and 62 the following definitions apply:

6.3.1
verification
all measures by means of which compliance of the electrical installation with the relevant requirements of HD 60364 is checked

NOTE It comprises inspection, testing and reporting.

6.3.2
inspection
Examination of an electrical installation using all the senses in order to ascertain correct selection and proper erection of electrical equipment.

6.3.3
testing
implementation of measures in an electrical installation by means of which its effectiveness is proved

NOTE It includes ascertaining values by means of appropriate measuring instruments, said values not being detectable by inspection.

6.3.4
reporting
recording of the results of inspection and testing

6.3.5
maintenance
combination of all technical and administrative actions, including supervision actions, intended to retain an item in, or restore it to, a state in which it can perform a required function

61 Initial verification

NOTE In Annex C a guidance on the application of the rules of this Clause 61 is given.

61.1 General

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

61.1.2 The information required by 514.5 of Part 5-51 and other information necessary for initial verification shall be made available to the person carrying out the initial verification.

61.1.3 Initial verification shall include comparison of the results with relevant criteria to confirm that the requirements of HD 60364 have been met.

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61.1.4 Precautions shall be taken to ensure that the verification shall not cause danger to persons or livestock and shall not cause damage to property and equipment even if the circuit is defective.

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61.1.5 For an addition or alteration to an existing installation, it shall be verified that the addition or alteration complies with HD 60364 and does not impair the safety of the existing installation.

NOTE For re-used equipment see Annex E

61.1.6 The initial verification shall be made by a skilled person, competent in verification.

NOTE Requirements concerning qualifications for enterprises and persons are a matter for national consideration.

61.2 Inspection

61.2.1 Inspection shall precede testing and shall normally be done prior to energizing the installation.

61.2.2 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 the manufacturers information, marking or certification

– correctly selected and erected according to HD 60364 and to the manufacturer's instructions;

– not visibly damaged so as to impair safety.

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

a) method of protection against electric shock (see Part 4-41);

b) presence of fire barriers and other precautions against propagation of fire and protection against thermal effects (see Part 4-42 and Clause 527 of Part 5-52);

c) selection of conductors for current-carrying capacity and voltage drop (see Part 4-43 and Clauses 523 and 525 of Part 5-52);

d) choice and setting of protective and monitoring devices (see Part 5-53);

e) presence and correct location of suitable isolating and switching devices (see Clause 536 of Part 5-53);

f) selection of equipment and protective measures appropriate to external influences (see Clauses 422 of Part 4-42, 512.2 of Part 5-51 and 522 of Part 5-52);

g) neutral and protective conductors correctly identified (see 514.3 of Part 5-51);

h) single-pole switching devices connected in the line conductors (see Clause 536 of Part 5-53)

i) presence of diagrams, warning notices or other similar information (see 514.5 of Part 5-51);

i) identification of circuits, overcurrent protective devices, switches, terminals, etc. (see Clause 514 of Part 5-51);

k) adequacy of connection of conductors (see Clause 526 of Part 5-52);

l) presence and adequacy of protective conductors, including protective equipotential bonding and supplementary equipotential bonding conductors (see Part 5-54);

m) accessibility of equipment for convenience of operation, identification and maintenance (see Clauses 513 and 514 of Part 5-51).

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Inspection shall include all particular requirements for special installations or locations.

61.3 Testing

61.3.1 General

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

Measuring instruments and monitoring equipment and methods shall be chosen in accordance with relevant parts of EN 61557. If other measuring equipment is used, it shall provide no less degree of performance and safety.

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

a) continuity of conductors (see 61.3.2);

b) insulation resistance of the electrical installation (see 61.3.3);

c) protection by SELV, PELV or by electrical separation (see 61.3.4);

d) floor and wall resistance/impedance (see 61.3.5);

e) automatic disconnection of supply (see 61.3.6);

f) additional protection (see 61.3.7);

g) polarity test (see 61.3.8);

h) test of the order of the phases (see 61.3.9);

i) functional and operational tests (see 61.3.10);

j) voltage drop (see 61.3.11) .

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

NOTE When testing in a potentially explosive atmosphere appropriate safety precautions in accordance with EN 60079-17 and EN 61241-17 are necessary.

61.3.2 Continuity of conductors

An electrical continuity test shall be made on:

a) protective conductors, including protective equipotential bonding and supplementary equipotential bonding conductors; and

b) in the case of ring final circuits, live conductors.

NOTE A ring final circuit is a final circuit arranged in a form of a ring connected to a single point of supply.

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61.3.3 Insulation resistance of the electrical installation

The insulation resistance shall be measured between live conductors and the protective conductor connected to the earthing arrangement. For the purposes of this test, live conductors may be connected together.

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Table 6.A Minimum values of insulation resistance

Nominal circuit voltage (V)	Test voltage d.c. (V)	Insulation resistance (MΩ)
SELV and PELV	250	≥ 0,5
Up to and including 500 V, including FELV	500	≥ 1,0
Above 500 V	1 000	≥ 1,0

The insulation resistance, measured with the test voltage indicated in table 6A, is satisfactory if each circuit, with the appliances disconnected, has an insulation resistance not less than the appropriate value given in Table 6A.

Table 6A shall be applied for a verification of the insulation resistance between non-earthed protective conductors and earth.

Where surge protective devices (SPDs) or other equipment are likely to influence the verification test or be damaged, such equipment shall be disconnected before carrying out the insulation resistance test.

Where it is not reasonably practicable to disconnect such equipment (e.g. in case of fixed socket-outlets incorporating an SPD), the test voltage for the particular circuit may be reduced to 250 V d.c., but the insulation resistance must have a value of at least 1 MΩ.

NOTE 1 For measurement purposes, the neutral conductor is disconnected from the protective conductor.

NOTE 2 In TN-C systems, the measurement is made between the live conductors and the PEN conductor.

NOTE 3 In locations exposed to fire hazard a measurement of the insulation resistance between the live conductors should be applied. In practice, it may be necessary to carry out this measurement during erection of the installation before the connection of the equipment.

NOTE 4 Insulation resistance values are usually much higher than those of Table 6A. When such values show evident differences, further investigation is needed to identify the reasons.

61.3.4 Protection by SELV, PELV or by electrical separation

The separation of circuits shall be confirmed in accordance with 61.3.4.1 in the case of protection by SELV, 61.3.4.2 in the case of protection by PELV and 61.3.4.3 in the case of protection by electrical separation.

The resistance value obtained in 61.3.4.1, 61.3.4.2 and 61.3.4.3 shall be at least that of the circuit with the highest voltage present in accordance with Table 6A.

61.3.4.1 Protection by SELV

The separation of the live parts from those of other circuits and from earth, according to Clause 414 of Part 4-41, shall be confirmed by a measurement of the insulation resistance. The resistance values obtained shall be in accordance with table 6A.

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61.3.4.2 Protection by PELV

The separation of the live parts from those of other circuits, according to Clause 414 of Part 4-41, shall be confirmed by a measurement of the insulation resistance. The resistance values obtained shall be in accordance with table 6A.

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61.3.4.3 Protection by electrical separation

The separation of the live parts from those of other circuits and from earth, according to Clause 413 of Part 4-41, shall be confirmed by a measurement of the insulation resistance. The resistance values obtained shall be in accordance with table 6A.

In case of electrical separation with more than one item of current-using equipment, either by measurement or by calculation it shall be verified that in case of two coincidental faults with negligible impedance between different line conductors and either the protective bonding conductor or exposed-conductive-parts connected to it, at least one of the faulty circuits shall be disconnected. The disconnection time shall be in accordance with that for the protective measure automatic disconnection in a TN-system.

61.3.5 Insulation resistance/impedance of floors and walls

When it is necessary to comply with the requirements of Clause C.1 of Part 4-41, 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 measurement of resistance/impedance of insulating floors and walls is carried out with the system voltage to earth at nominal frequency.

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

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

61.3.6 Protection by automatic disconnection of the supply

NOTE Where RCDs are applied also for protection against fire, the verification of the conditions for protection by automatic disconnection of the supply may be considered as covering the aspects of Part 4-42.

61.3.6.1 General

The verification of the efficacy of the measures for fault protection (protection against indirect contact) by automatic disconnection of supply is effected as follows

a) For TN systems

Compliance with the rules of 411.4.4 and 411.3.2 of Part 4-41 shall be verified by:

1) measurement of the fault loop impedance (see 61.3.6.3).

NOTE 1 When RCDs with Idn ≤ 500 mA are used as disconnecting devices, measurement of the fault loop impedance is normally not necessary.

Alternatively, where the calculation of the fault loop impedance or of the resistance of the protective conductors are available and where the arrangement of the installation permits the verification of the length and cross-sectional area of the conductors, the verification of the electrical continuity of the protective conductors (see 61.3.2) is sufficient.

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NOTE 2 Compliance may be verified by measurement of the resistance of protective conductors.

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2) verification of the characteristics and/or the effectiveness of the associated protective device. This verification shall be made:

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– for overcurrent protective devices, by visual inspection (i.e. short time or instantaneous tripping setting for circuit-breakers, current rating and type for fuses);

– for RCDs, by visual inspection and test.

The effectiveness of automatic disconnection of supply by RCDs shall be verified using suitable test equipment according to EN 61557-6 (see 61.3.1) confirming that the relevant requirements in Part 4-41 are met.

It is recommended that the disconnecting times required by Part 4-41 be verified. However, the requirements for disconnecting times shall be verified in case of:

– re-used RCDs;

– additions or alterations to an existing installation where existing RCDs are also to be used as disconnecting devices for such additions or alterations.

NOTE Where the effectiveness of the protective measure has been confirmed at a point located downstream of an RCD, the protection of the installation downstream from this point may be proved by confirmation of the continuity of the protective conductors.

In addition, it shall be confirmed by mutual agreement between the contractor and the electricity supplier that the requirement of 411.4.1 of Part 4-41 is complied with.

b) For TT systems

Compliance with the rules of 411.5.3 of Part 4-41 shall be verified by:

1) measurement of the resistance R_A of the earth electrode for exposed- conductive-parts of the installation (see 61.3.6.2);

NOTE Where the measurement of R_A is not possible, it may be possible to replace it by the measure of the fault loop impedance as in a)1).

2) verification of the characteristics and/or effectiveness of the associated protective device. This verification shall be made:

– for overcurrent protective devices, by visual inspection (i.e. short time or instantaneous tripping setting for circuit-breakers, current rating and type for fuses);

– for RCDs, by visual inspection and by test.

The effectiveness of automatic disconnection of supply by RCDs shall be verified using suitable test equipment according to EN 61557-6 (see 61.3.1) confirming that the relevant requirements in Part 4-41 are met.

It is recommended that the disconnecting times required by Part 4-41 be verified. However, the requirements for disconnecting times shall be verified in case of:

– re-used RCDs;

– additions or alterations to an existing installation where existing RCDs are also to be used as disconnecting devices for such additions or alterations.

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NOTE Where the effectiveness of the protective measure has been confirmed at a point located downstream of an RCD, the protection of the installation downstream this point may be proved by confirmation of the continuity of the protective conductors.

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c) For IT systems

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Compliance with the rules of 411.6.2 of Part 4-41 shall be verified by calculation or measurement of the current I_d in case of a first fault at the line conductor or at the neutral.

NOTE 1 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 the measurement in order to avoid the danger due to a double fault.

Where conditions that are similar to conditions of TT systems occur, in the event of a second fault in another circuit (see point a) of 411.6.4 of Part 4-41), verification is made as for TT systems (see point b) of this clause).

Where conditions that are similar to conditions of TN systems occur, in the event of a second fault in another circuit (see point b) of 411.6.4 of Part 4-41), verification is made as for TN systems (see point a) of this clause).

NOTE 2 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 preferably at the origin of the installation or, where this is not acceptable, at the point of measurement.

61.3.6.2 Measurement of the resistance of the earth electrode

Measurement of the resistance of an earth electrode, where prescribed (see s 411.5.3, for TT systems, 411.4.1, for TN systems, and 411.6.2, for IT systems, of Part 4-41), is made by an appropriate method.

NOTE 1 Annex B, Method B1, gives, as an example, a description of a method of measurement using two auxiliary earth electrodes and the conditions to be fulfilled.