

MADALPINGELISED ELEKTRIPAIGALDISED. OSA 5-54:  
ELEKTRISEADMETE VALIK JA PAIGALDAMINE.  
MAANDAMINE JA KAITSEJUHID

Low-voltage electrical installations - Part 5-54:  
Selection and erection of electrical equipment -  
Earthing arrangements and protective conductors (IEC  
60364-5-54:2011)

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

Käesolev Eesti standard EVS-HD 60364-5-54:2011 sisaldab Euroopa standardi HD 60364-5-54:2011 ingliskeelset teksti.

Standard on kinnitatud Eesti Standardikeskuse 29.07.2011 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.

Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 22.07.2011.

Standard on kättesaadav Eesti standardiorganisatsioonist.

This Estonian standard EVS-HD 60364-5-54:2011 consists of the English text of the European standard HD 60364-5-54:2011.

This standard is ratified with the order of Estonian Centre for Standardisation dated 29.07.2011 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.

Date of Availability of the European standard text 22.07.2011.

The standard is available from Estonian standardisation organisation.

ICS 29.020, 91.140.50

Võtmesõnad: elektripaigaldised, juht, kaitse, maandussüsteem,

Inglisekeelsed võtmesõnad: protection,

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English version

**Low-voltage electrical installations -  
Part 5-54: Selection and erection of electrical equipment -  
Earthing arrangements and protective conductors  
(IEC 60364-5-54:2011)**

Installations électriques basse-tension -  
Partie 5-54: Choix et mise en oeuvre des  
matériels électriques -  
Installations de mise à la terre et  
conducteurs de protection  
(CEI 60364-5-54:2011)

Errichten von Niederspannungsanlagen -  
Teil 5-54: Auswahl und Errichtung  
elektrischer Betriebsmittel -  
Erdungsanlagen, Schutzleiter und  
Schutzpotentialausgleichsleiter  
(IEC 60364-5-54:2011)

This Harmonization Document was approved by CENELEC on 2011-04-27. 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.

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.

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

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

**CENELEC**

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

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**

## Foreword

The text of document 64/1755/FDIS, future edition 3 of IEC 60364-5-54, 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 the 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 60364-5-54 on 2011-04-27.

This European Standard supersedes HD 60364-5-54:2007.

The main changes with respect to HD 60364-5-54:2007 are listed below:

- clarification of the definition of protective conductor;
- improved specification of mechanical characteristics of the earth electrode;
- introduction of earth electrode for protection against electric shock and lighting protection;
- annexes describing concrete-embedded foundation earth electrodes and soil-embedded earth electrode.

The following dates were fixed:

- |   |       |            |
|---|-------|------------|
| – latest date by which the existence of the HD has to be announced at national level  | (doa) | 2011-10-27 |
| – latest date by which the HD has to be implemented at national level by publication of an harmonized national standard or by endorsement | (dop) | 2012-04-27 |
| – latest date by which the national standards conflicting with the HD have to be withdrawn  | (dow) | 2014-04-27 |

Annexes ZA, ZB and ZC have been added by CENELEC.

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## Endorsement notice

The text of the International Standard IEC 60364-5-54:2011 was approved by CENELEC as a Harmonization Document without any modification.

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

IEC 60079-0	NOTE Harmonized as EN 60079-0.
IEC 60079-14	NOTE Harmonized as EN 60079-14.
IEC 60364-4-43	NOTE Harmonized as HD 60364-4-43.
IEC 60364-5-52	NOTE Harmonized as HD 60364-5-52.
IEC 60364-6	NOTE Harmonized as HD 60364-6.
IEC 60364-7-701:2006	NOTE Harmonized as HD 60364-7-701:2007 (modified).

IEC 60702-1

NOTE Harmonized as EN 60702-1.

IEC 61643-12

NOTE Harmonized as CLC/TS 61643-12.

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## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60364-4-41 (mod)	2005	Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock	HD 60364-4-41 + corr. July	2007 2007
IEC 60364-4-44 (mod) + corr. May	2007 2010	Low voltage electrical installations - Part 4-44: Protection for safety - Protection against voltage disturbances and electromagnetic disturbances	FprHD 60364-4-442	201X <sup>1)</sup>
IEC 60364-5-51 (mod)	2005	Electrical installations of building - Part 5-51: Selection and erection of electrical equipment - Common rules	HD 60364-5-51	2009
IEC 60439-2	-	Low-voltage switchgear and controlgear assemblies - Part 2: Particular requirements for busbar trunking systems (busways)	EN 60439-2	-
IEC 60724	-	Short-circuit temperature limits of electric cables- with rated voltages of 1 kV ( $U_m = 1,2$ kV) and 3 kV ( $U_m = 3,6$ kV)		-
IEC 60909-0	-	Short-circuit currents in three-phase a.c. systems - Part 0: Calculation of currents	EN 60909-0	-
IEC 60949	-	Calculation of thermally permissible short-circuit- currents, taking into account non-adiabatic heating effects		-
IEC 61140	2001	Protection against electric shock - Common aspects for installation and equipment	EN 61140	2002
IEC 61439-1	-	Low-voltage switchgear and controlgear assemblies - Part 1: General rules	EN 61439-1	-
IEC 61439-2	-	Low-voltage switchgear and controlgear assemblies - Part 2: Power switchgear and controlgear assemblies	EN 61439-2	-
IEC 61534-1	-	Powertrack systems - Part 1: General requirements	EN 61534-1	-

<sup>1)</sup> At draft stage.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 62305	Series	Protection against lightning	EN 62305	Series
IEC 62305-3 (mod)	2006	Protection against lightning - Part 3: Physical damage to structures and life hazard	EN 62305-3 <sup>2)</sup> + corr. November + corr. September + A11	2006 2006 2008 2009

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<sup>2)</sup> EN 62305-3 is superseded by EN 62305-3:2011, which is based on IEC 62305-3:2010.

## Annex ZB (normative)

### Special national conditions

**Special national condition:** National characteristic or practice that cannot be changed even over a long period, e.g. climatic conditions, electrical earthing conditions.

NOTE If it affects harmonization, it forms part of the Harmonization Document.

For the countries in which the relevant special national conditions apply these provisions are normative, for other countries they are informative.

Country	Clause N°	Wording
DE	542.1.1	Add the following text at the end of 542.1.1:  In Germany, there is an obligation to erect in every new building a foundation earth electrode according to National Standard DIN 18014.
IE	542.2.1	This note does not apply in Ireland
SI	542.2.1 542.3.1	In Slovenia the minimum cross sectional area for steel solid tape or strip as earth electrode or earthing conductor is 100 mm <sup>2</sup> .
CZ	542.2.1	In the Czech Republic, besides the steel electrodes which accord with Table ZB.54.1, the minimum size steel earth electrodes whose corrosion and mechanical strength, when embedded in the soil, has a resistivity higher than 50 Ωm, are as shown in to Table E.1.
CZ	542.2.1	In the Czech Republic, metal plates are only used as earth electrodes in certain cases.
NL	542.2.2	In the Netherlands, a single interruption in the earthing arrangement shall not lead to a touch voltage in the installation (connected to this earthing arrangement) that does not comply with Clause 411.
NL	542.2.2	In the Netherlands, the earth electrodes and associated conductors shall be installed at a depth of at least 60 cm. The conductors of an earthing arrangement laid in a loop, or having a circular shape, shall be installed with a distance between them of at least 1 m.
AT	542.2.3	In Austria, water pipes are not permitted as earth electrodes.
BE	542.2.3	In Belgium, water pipes are not permitted as earth electrodes.
CH	542.2.3	In Switzerland, water pipes are not permitted as earth electrodes.
DE	542.2.3	In Germany, water pipes are not permitted as earth electrodes.
FI	542.2.3	In Finland, water pipes are not permitted as earth electrodes.
HR	542.2.3	In Croatia, water pipes are not permitted as earth electrodes.
FI	542.2.3	In Iceland, water pipes are not permitted as earth electrodes.
IE	542.2.3	In Ireland, metal pipe systems of other services such as water, gas, fuel supply or central heating systems are not permitted for earth electrodes.
FR	542.2.3	In France, water pipes are not permitted as earth electrodes.
SE	542.2.3	In Sweden, water pipes are not permitted as earth electrodes.
UK	542.2.3	In the UK, a metallic pipe forming part of a water utility supply may not be used as an earth electrode.
IT	542.2.3	In Italy, it is permitted to use a water pipe system, but only with the consent of the water distributor.
IS	542.2.3	In Iceland, water pipes are not permitted as earth electrodes

Country	Clause N°	Wording
PL	542.2.3	In Poland, it is permitted to use a water pipe system as earth electrodes, but only with the consent of the water distributor.
NL	542.2.3	In the Netherlands, water pipes are not permitted as earth electrodes.
SL	542.2.3	In Slovenia, water pipes are not permitted as earth electrodes.
NO	542.2.3	In Norway, metallic pipelines are not permitted as earth electrodes.
DK	542.2.3	In Denmark, waterpipes are not permitted as earth electrodes.
DE	542.2.3	In Germany the first dash together with the note is deleted and replaced by: concrete-embedded foundation earth electrode according to the National Standard DIN 18014;
DK	542.2.4	In Denmark where possible the earth electrode shall be installed at a depth of at least 2 m.
DE	542.2.5	In Germany, for external conductors (e.g. LPS down conductors) which are connected to the foundation earth, these connections made of hot galvanized steels shall not be buried in soil, except joints with plastic-cover or of stainless steel according No: 1.4571 are used for durable insulation (according to European certified reference material CRM 284-2 EN 10020)
CH	542.3.1	In Switzerland, the minimal cross-section of the earthing conductor shall be not less than 16 mm <sup>2</sup> .
IE	542.3.1	In Ireland, the minimum cross-sectional area is 10 mm <sup>2</sup>
DK	542.3.1	In Denmark, earthing conductors buried in the soil shall be at a depth of at least 0,35 m.
NL	542.3.1	In the Netherlands, a single interruption in a protective conductor used for more than one installation shall not lead to a touch voltage that does not comply with Clause 411.
NO	542.3.1	In Norway, earthing conductors laid in the ground shall be at least 25 mm <sup>2</sup> Cu or 50 mm <sup>2</sup> corrosion protected Fe. Joints and/or connections shall be protected against corrosion.
SL	542.3.2	In Slovenia the connection of an earthing conductor to an earth electrode shall be soundly made also with screws, not smaller than M10.
NL	542.3.2	In the Netherlands, earthing conductors embedded in the soil shall be installed at a depth of at least 60 cm.
CZ	542.2.5 (after the 1 <sup>st</sup> para.)	In the Czech Republic, copper or copper-sheathed earth electrodes in densely inhabited regions are permitted, provided that the corrosive influence of the copper on steel, zinc coated steel, etc. is controlled and that sacrificial protection for the elimination of macro-cell is applied.
CZ	542.2.5 (at the end of the subclause)	In the Czech Republic, the contacts of steel earth electrodes and earthing conductors, and crossovers of steel earth electrodes and earthing conductors between two different medias, are protected no matter whether they are protected in a general sense (e.g. by zinc layer) or not. The crossovers are protected by passive protection (e.g. by asphalt sealing compound, pouring resin, anticorrosive band, etc.) up to these distances: <ul style="list-style-type: none"> <li>– earthing conductors when crossing into the soil at least 30 cm below the surface and 20 cm above the surface;</li> <li>– earthing conductors from foundation earth electrodes;</li> <li>– on the crossing from concrete to the soil at least 30 cm in concrete and 100 cm in the soil;</li> <li>– on the crossing from concrete to the surface at least 10 cm in concrete and 20 cm above the surface;</li> <li>– at arching over the dilatation joints – arching waist in the joint and at least 20 cm in concrete on both sides of the joint.</li> </ul>
IE	542.3.1	In Ireland, for circuits for lighting, the minimum cross-sectional area is 1.5mm <sup>2</sup> .
FI	542.3.1	In Finland, the minimum cross-sectional area for earthing conductors not protected against corrosion is 16 mm <sup>2</sup> copper or 50 mm <sup>2</sup> steel.
AT	543.1.1	In Austria replace the first and second paragraph by: The cross-sectional area of every protective conductor shall be capable of withstanding mechanical and thermal stresses caused by the prospective fault current for the expected duration.

Country	Clause N°	Wording
		<p>Where automatic disconnection of supply according to 411.3.2 is used, the cross-sectional area of the protective conductor shall be</p> <ul style="list-style-type: none"> <li>- either calculated in accordance with 543.1.2,</li> <li>- or selected in accordance with table 54.2. For protective conductors protecting exposed conductive parts of sources (e.g. generators or transformers), a cross-sectional area of the half value of the line conductors could be not enough. In such special cases, it shall be ensured that the requirements of the first paragraph are met.</li> </ul> <p>In either case, the requirements of 543.1.3 shall be met.</p>
AT	543.1.1, Table 54.2, Fifth line	In Austria, for the time before relevant changing the standards for cables, it is allowed to use standardized cables with cross-sectional area of 150/70 mm <sup>2</sup> and of 400/185 mm <sup>2</sup> without calculation according to 543.1.2, nevertheless the cross-sectional area of the protective conductor is a little less than 0,5 times the cross-sectional area of the line conductor as here required within Table 54.2.
DK	543.1.1	<p>In Denmark, for circuits protected by RCDs it is normally allowed to use copper protective conductors with a cross-sectional area of at least 2,5 mm<sup>2</sup>, independent of the cross-sectional area of the line conductor and without calculation.</p> <p>Only when RCDs are used in TN-systems and the protective conductor is connected to the PEN conductor upstream of the RCD, with less cross-sectional area than the line conductor and shorter than 10 m is it necessary to calculate the cross-sectional area of the protective conductor from the formula.</p>
IE	543.1.3	In Ireland, for circuits for lighting, the minimum cross-sectional area is 1.5mm <sup>2</sup> .
NL	543.1.4	In the Netherlands, where an earthing arrangement is used for more than one installation, the earthing conductor shall be installed in such a way that a single interruption of the conductor does not impair the protective function of the arrangement.
IT	543.2.1	In Italy, cable tray and cable ladder are permitted as protective conductors in accordance with local or national regulations or standards.
UK	543.2.1	In the UK, cable tray and cable ladder are permitted as protective conductors in accordance with local or national regulations or standards.
UK	543.2.3	In the UK cable tray and cable ladder are permitted as protective conductors in accordance with local or national regulations or standards.
CH	543.2.3	In Switzerland, metallic water pipes may be used as equipotential bonding conductors.
UK	544.1	In the UK, particular requirements exist regarding the minimum acceptable cross-sectional areas for protective bonding conductors where Protective Multiple Earthing (PME) conditions apply.
CZ	543.4.1	<p>In the Czech Republic, the use of PEN conductors in parts of installations which are not metered, is permitted provided that:</p> <ul style="list-style-type: none"> <li>- the cross-sectional areas of all conductors of branches to electrometers, and from electrometers to the point of separation, are identical and not lower than 6 mm<sup>2</sup> Cu or 10 mm<sup>2</sup> Al;</li> <li>- separation of the PEN conductor into the neutral conductor N and protective conductor PE is carried out at the closest suitable point in the wiring system behind the electrometer (e.g. in the dwelling switchboard) and in compliance with the rest of the requirements of this subclause.</li> </ul>
SE	543.4.3 b)	In Sweden the example in item b) is not permitted.
DE	544.1	<p>In Germany, replace the first paragraph as follows:</p> <p>The protective bonding conductor for the connection to the main earthing terminal shall have a cross-sectional area not less than :</p>
IE	544.1 1st indent	In Ireland, the minimum value is 10mm. In addition, a permanent label inscribed "Safety Electrical Connection- do not remove" shall be permanently affixed at each main bonding connection

Country	Clause N°	Wording
IE	544.1 2nd paragraph	In Ireland, the value for main bonding conductors need not exceed 70mm <sup>2</sup>
IE	544.2.3	In Ireland, the minimum cross-sectional area for supplementary bonding conductors is 2.5mm <sup>2</sup> where mechanical protection is provided, and 4mm <sup>2</sup> where mechanical protection is not provided. In addition, a permanent label inscribed "Safety Electrical Connection- do not remove" shall be permanently affixed at the bonding connection to a pipe

**Table ZB.54.1 – Minimum size of steel earth electrodes in soil with resistivity higher than 50 Ω**

Type of earth electrode	Shape	Minimum dimensions	
		Zinc coated steel	Bare steel (without coating)
Strip or round wire earth electrode	Strip	According to table 54.1	Cross-sectional area 150 mm <sup>2</sup> , thickness 4 mm
	Steel wire	Ø 8 mm	Ø 10 mm
Rod with vertical extension	Round rod	Ø 8 mm	Ø 10 mm
	Pipe	Ø 15 mm, pipe wall thickness 3 mm	Ø 15 mm, pipe wall thickness 4 mm
	Steel angle etc.	Cross-sectional area 100 mm <sup>2</sup> angle wall thickness 3 mm	Cross-sectional area 150 mm <sup>2</sup> angle wall thickness 4 mm