
Lightning protection components (LPC) - Part 2: Requirements for conductors and earth electrodes

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Blitzschutzbauteile -- Teil 2: Anforderungen an Leitungen und Erder

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Composants de protection contre la foudre (CPF) -- Partie 2: Caractéristiques des conducteurs et des électrodes de terre

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Part 2: Requirements for conductors and earth electrodes**

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contre la foudre (CPF)
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et des électrodes
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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

Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 81X, Lightning protection.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 50164-2 on 2002-03-01.

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) 2003-03-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2005-03-01

Annexes designated "normative" are part of the body of the standard.
In this standard, annexes A, B, C and D are normative.

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Contents

	Page
1 Scope	4
2 Normative references	4
3 Definitions.....	4
4 Requirements	5
4.1 Documentation	5
4.2 Air termination conductors, air termination rods and down conductors.....	6
4.3 Earth electrodes	8
5 Tests.....	12
5.1 General condition for tests	12
5.2 Air termination conductors, air termination rods, earth lead-in rods, down conductors and earth conductors	12
5.3 Earth rods	13
5.4 Joints for earth rods	13
6 Electromagnetic compatibility (EMC)	14
Annex A (normative) Environmental test for conductors, air termination rods and earth lead-in rods	17
Annex B (normative) Environmental test for earth conductors, earth rods and earth lead-in rods	18
Annex C (normative) Requirements for minimum cross sectional area, mechanical and electrical characteristics, tests to be applied	19
Annex D (normative) Requirements for minimum dimensions, mechanical and electrical characteristics, tests to be applied	20
Figure 1 – Typical test arrangement for the compression test by manual means.....	15
Figure 2 – Typical test arrangement for the compression test by mechanical means	15
Figure 3 – Typical test arrangement for adhesion test	16
Table 1 – Material, configuration and minimum cross sectional area of air termination conductors, air termination rods, earth lead-in rods and down conductors	7
Table 2 – Mechanical and electrical characteristics of air termination conductors, air termination rods, earth lead-in rods and down conductors	8
Table 3 – Material, configuration and minimum dimensions of earth electrodes	10
Table 4 – Mechanical and electrical characteristics of earth electrodes	11
Table B.1 – Aqueous solution composition	18

1 Scope

This European Standard specifies the requirements and tests for

- metallic conductors (other than "natural" conductors) that form part of the air termination system and down conductors,
- metallic earth electrodes that form part of the earth termination system.

Lightning protection components (LPC) may also be suitable for use in hazardous atmospheres. Regard should then be taken of the extra requirements necessary for the components to be installed in such conditions.

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 (including amendments).

EN 50164-1	1999	Lightning protection components (LPC) - Part 1: Requirements for connection components
EN 60068-2-52	1996	Environmental testing - Part 2: Tests - Test Kb: Salt mist, cyclic (sodium chloride solution) (IEC 60068-2-52:1996)
EN ISO 6988	1994	Metallic and other non-organic coatings - Sulfur dioxide test with general condensation of moisture (ISO 6988:1985)
IEC 61024-1-2	1998	Protection of structures against lightning - Part 1-2: General Principles - Guide B - Design, installation, maintenance and inspection of lightning protection systems

3 Definitions

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

3.1

air termination system

part of an external lightning protection system which is intended to intercept and conduct lightning flashes

3.2

air termination rod or air termination conductor

part of the air termination system for intercepting and conducting direct lightning flashes to the structure

3.3

down conductor

part of an external lightning protection system which is intended to conduct lightning current from the air-termination system to the earth-termination system

3.4

earth termination system

part of an external lightning protection system which is intended to conduct and disperse lightning current to the earth

3.5

earth electrode

part or group of parts of the earth-termination system which provides direct electrical contact with and disperses the lightning current to the earth

NOTE Typical examples are earth rod, earth conductor and earth plate.

3.6

earth rod

earth electrode consisting of a metal rod driven into the ground
[IEC 60050 (604-04-06)]

3.7

earth conductor

earth electrode consisting of a conductor buried in the ground

3.8

earth plate

earth electrode consisting of a metal plate buried in the ground
[IEC 60050 (604-04-06)]

3.9

joint for earth rod

part of the earth termination system that facilitates the coupling of one section of an earth rod to another, for the purpose of deep driving

3.10

driving head

tool that is used in those applications where it is necessary to drive the earth rod

3.11

earth lead-in rod

rod which is installed between the down conductor/test joint and the earth electrode

NOTE Earth lead-in rods are used to improve mechanical stability.

4 Requirements

Conductors and earth electrodes shall be so designed and constructed that in normal use their performance is reliable and without danger to persons and the surrounding.

The choice of a material depends on its ability to match the particular application requirements.

4.1 Documentation

The manufacturer or supplier of the conductors and earth electrodes shall provide adequate information in his literature to ensure that the installer of the conductors and earth electrodes can select and install the materials in a suitable and safe manner, in accordance with IEC 61024-1-2.

Compliance is checked by inspection.

4.2 Air termination conductors, air termination rods and down conductors

The material, configuration and minimum cross sectional area of the conductors, shall be in accordance with Table 1. Their mechanical and electrical characteristics shall be in accordance with Table 2.

Other materials may be used if they possess equivalent mechanical and electrical characteristics and corrosion resistance properties for the intended application.

Other configurations may be used if the relevant dimensions are met.

The materials given in Table 1 may be covered with a coating of either plastic material such as ultra violet stabilized polyvinyl chloride (pvc), or equivalent material, depending on its application.

NOTE 1 Requirements and tests for ultra violet stabilized materials are under consideration.

Coated conductors shall be corrosion resistant and the coating shall exhibit good adherence to the base material.

Compliance is checked by the test of 5.2.

NOTE 2 A summary of requirements for minimum cross sectional area, mechanical and electrical characteristics as well as tests is given in Annex C.

Table 1 - Material, configuration and minimum cross sectional area of air termination conductors, air termination rods, earth lead-in rods and down conductors

Material	Configuration	Minimum cross sectional area ^a	Comments
Copper	Solid tape	50 mm ²	2 mm min. thickness
	Solid round ^e	50 mm ²	8 mm diameter
	Stranded	50 mm ²	1,7 mm min. diameter of each strand
	Solid round ^{f,g}	200 mm ²	16 mm diameter
Tin plated copper ^b	Solid tape	50 mm ²	2 mm min. thickness
	Solid round ^e	50 mm ²	8 mm diameter
	Stranded	50 mm ²	1,7 mm min. diameter of each strand
	Solid round ^{f,g}	200 mm ²	16 mm diameter
Aluminium	Solid tape	70 mm ²	3 mm min. thickness
	Solid round	50 mm ²	8 mm diameter
	Stranded	50 mm ²	1,7 mm min. diameter of each strand
Aluminium alloy	Solid tape	50 mm ²	2,5 mm min. thickness
	Solid round	50 mm ²	8 mm diameter
	Stranded	50 mm ²	1,7 mm min. diameter of each strand
	Solid round ^f	200 mm ²	16 mm diameter
Galvanized steel ^c	Solid tape	50 mm ²	2,5 mm min. thickness
	Solid round	50 mm ²	8 mm diameter
	Stranded	50 mm ²	1,7 mm min. diameter of each strand
	Solid round ^{f,g}	200 mm ²	16 mm diameter
Stainless steel ^d	Solid tape ^h	50 mm ²	2 mm min. thickness
	Solid round ^h	50 mm ²	8 mm diameter
	Stranded	70 mm ²	1,7 mm min. diameter of each strand
	Solid round ^{f,g}	200 mm ²	16 mm diameter

^a Allowable tolerance: - 3 %.

^b Hot dipped or electroplated; minimum thickness coating of 1 micron.

^c The coating should be smooth, continuous and free from flux stains with a minimum thickness coating of 50 microns.

^d Chromium ≥ 16 %; Nickel ≥ 8 %; Carbon ≤ 0,07 %.

^e 50 mm² (8 mm diameter) may be reduced to 28 mm² (6 mm diameter) in certain applications where mechanical strength is not an essential requirement. Consideration should in this case, be given to reducing the spacing of the fasteners.

^f Applicable for air termination rods only. For applications where mechanical stress such as wind loading is not critical, a 10 mm diameter, 1 m long maximum air termination rod may be used.

^g Applicable for earth lead-in rods only.

^h If thermal and mechanical considerations are important then these values should be increased to 78 mm² (10 mm diameter) for solid round and 75 mm² (3 mm minimum thickness) for solid tape.

Table 2 - Mechanical and electrical characteristics of air termination conductors, air termination rods, earth lead-in rods and down conductors

Material	Configuration	Maximum electrical resistivity $\mu\Omega\text{m}$	Hardness	Minimum elongation
			HB	%
Copper and tin plated copper	Solid	0,025	40 – 110	7
	Stranded		N/A	N/A
Aluminium	Solid	0,028	≤ 30	15
	Stranded		N/A	N/A
Aluminium alloy	Solid	0,036	45 - 90	10
	Stranded		N/A	N/A
Hot dip galvanized steel	Solid	0,25	65 – 180	7
	Stranded		N/A	N/A
Stainless steel	Solid	0,80	120 - 210	35
	Stranded		N/A	N/A

N/A = not applicable.

4.3 Earth electrodes

The minimum cross sectional area of earth electrodes, its material and its configuration shall be in accordance with Table 3. Its mechanical and electrical characteristics shall be in accordance with Table 4.

Other materials may be used if they possess equivalent mechanical and electrical characteristics and corrosion resistance properties for the intended application.

Other configurations may be used if the relevant dimensions are met.

NOTE 1 Aluminium/aluminium alloy should not be buried in the ground.

NOTE 2 A summary of requirements for minimum dimensions, mechanical and electrical characteristics as well as tests is given in Annex D.

4.3.1 Earth rods

Earth rods shall be mechanically robust to ensure correct installation. The choice of material shall be sufficiently malleable to ensure no cracking of the rod takes place during installation.

The threads on the rods if any shall be smooth and fully formed. For coated rods, the coating shall extend over the threads. A lead in chamfer or point is recommended to facilitate driving.

NOTE For electroplated rods such as copper coated rods, it is desirable to thread roll the thread profile to ensure no copper is removed from the steel.

Compliance is checked by inspection and by the test according to 5.3.

4.3.2 Joints for earth rods

Earth rods can be extended to drive deeper into the ground. This can be achieved by means of a joint/coupling device.

The choice of material shall be compatible with that of the earth rod being joined.

It shall be mechanically robust, sufficient to withstand the driving forces generated during installation.

It shall also exhibit good corrosion resistance.

Threaded external joints/couplers shall be of a sufficient length to ensure no threads on the earth rod are exposed when installed.

Threaded internal joints/couplers shall ensure that the mating faces of the earth rods come in contact after assembly.

Furthermore, joints for earth rods shall meet the requirements of EN 50164-1.

Compliance is checked by inspection, the test according to 5.3.2 but with a specimen as specified in 5.4 and the tests according to 5.4.

4.3.3 Driving in of earth rods

The manufacturer shall provide adequate instructions in his literature to ensure that the mechanical driving forces are transferred directly without causing damage to the earth rod and the coupler.

Compliance is checked in conjunction with 4.1.

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