

Lightning protection components (LPC) —

Part 2: Requirements for conductors and earth electrodes

The European Standard EN 50164-2:2002, with the incorporation of amendment A1:2006, has the status of a British Standard

ICS 91.120.40

National foreword

This British Standard is the official English language version of EN 50164-2:2002, incorporating amendment A1:2006.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by **A1** **A1**.

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A list of organizations represented on GEL/81 can be obtained on request to its secretary.

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

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

Blitzschutzbauteile
Teil 2: Anforderungen an Leitungen
und Erder

This European Standard was approved by CENELEC on 2002-03-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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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

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

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- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2005-03-01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

Foreword to amendment A1

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

The text of the draft was submitted to the formal vote and was approved by CENELEC as amendment A1 to EN 50164-2:2002 on 2006-03-01.

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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 1460	1994	Metallic coatings - Hot dip galvanized coatings on ferrous materials - Gravimetric determination of the mass per unit area (ISO 1460:1992)
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 **A1** The coating should be smooth continuous and free from flux stains with a minimum weight of 350 g/m² for solid round material and 500 g/m² for solid tape material. The coating can be measured in accordance with EN ISO 1460 with a sample length of approximately 200 mm. **A1**

^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 $\mu\Omega\text{m}$	Tensile strength	Minimum elongation
			N/mm ²	%
Copper and tin plated copper	Solid	0,019	200 - 450	7
	Stranded		N/A	N/A
Aluminium	Solid	0,028	≤ 150	15
	Stranded		N/A	N/A
Aluminium alloy	Solid	0,036	120 - 280	10
	Stranded		N/A	N/A
Hot dip galvanized steel	Solid	0,15	290 - 510	7
	Stranded		N/A	N/A
Stainless steel	Solid	0,80	400 - 730	35
	Stranded		N/A	N/A

N/A=not applicable.

NOTE Minimum length of conductor for testing shall be 250 mm. ∇

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.

Table 3 - Material, configuration and minimum dimensions of earth electrodes

Material	Configuration	Minimum dimensions ^a			Comments
		Earth rod	Earth conductor	Earth plate	
Copper	Stranded ^b		50 mm ²		1,7 mm min. diameter of each strand
	Solid round ^b		50 mm ²		8 mm diameter
	Solid tape ^b		50 mm ²		min. 2 mm thick
	Solid round	15 mm diameter			
	Pipe	20 mm diameter			min. 2 mm wall thickness
	Solid plate			500 mm x 500 mm	min. 2 mm thick
	Lattice plate ^h			600 mm x 600 mm	$\overline{A_1}$ 25 mm x 2 mm section for tape and 8 mm diameter for round $\overline{A_1}$
Steel	Galvanized solid round ^c	16 mm diameter ^d	10 mm diameter		
	Galvanized pipe ^c	25 mm diameter ^d			min. 2 mm wall thickness
	Galvanized solid tape ^c		90 mm ²		min. 3 mm thick
	Galvanized solid plate ^c			500 mm x 500 mm	min. 3 mm thick
	Galvanized lattice plate ^c			600 mm x 600 mm	$\overline{A_1}$ 30 mm x 3 mm section for tape and 10 mm diameter for round $\overline{A_1}$
	Copper coated solid round ^e	14 mm diameter			250 microns minimum radial copper coating 99,9 % copper content
	Bare solid round ^f		10 mm diameter		
	Bare or galvanized solid tape ^{f,g}		75 mm ²		min. 3 mm thick
	Galvanized stranded ^{f,g}		70 mm ²		1,7 mm min. diameter of each strand
	Galvanized cross profile ^c	50 mm x 50 mm x 3 mm			
Stainless steel	Solid round	16 mm diameter	10 mm diameter		
	Solid tape		100 mm ²		min. 2 mm thick

^a Allowable tolerance: - 3 %.

^b Can also be tin plated.

$\overline{A_1}$ ^c The coating should be smooth continuous and free from flux stains with a minimum weight of 350 g/m² for solid round material and 500 g/m² for solid tape material. The coating can be measured in accordance with EN ISO 1460 with a sample length of approximately 200 mm. $\overline{A_1}$

^d Threads shall be machined prior to galvanizing.

^e The copper shall be intrinsically bonded to the steel. $\overline{A_1}$ The coating can be measured using an electronic coating measuring thickness instrument. $\overline{A_1}$

$\overline{A_1}$ ^f Shall be embedded in concrete for a minimum depth of 20 mm. $\overline{A_1}$

^g Only allowed when correctly connected at least every 5 m with the reinforcement steel in those parts of the foundation which are in contact with the soil.

$\overline{A_1}$ ^h Lattice plate constructed with a minimum total conductor length of 4,8 m. $\overline{A_1}$

Table 4 - Mechanical and electrical characteristics of earth electrodes

Material	Configuration	Tensile strength			Maximum electrical resistivity $\mu\Omega\text{m}$
		N/mm ²			
		Earth rod	Earth conductor	Earth plate	
Copper	Stranded	N/A	200 - 450	N/A	0,025
	Solid round	200 - 450	200 - 450	N/A	
	Solid tape	N/A	200 - 450	N/A	
	Pipe	200-450	N/A	N/A	
	Solid plate	N/A	N/A	200 - 450	
	Lattice plate	N/A	N/A	200 - 450	
Steel	Galvanized solid round	$\langle A_1 \rangle$ 350 - 770 ^a $\langle A_1 \rangle$	290 - 510	N/A	0,25
	Galvanized pipe	$\langle A_1 \rangle$ 350 - 770 ^a $\langle A_1 \rangle$	N/A	N/A	
	Galvanized solid tape	N/A	290 - 510	N/A	
	Galvanized solid plate	N/A	N/A	290 - 510	
	Galvanized lattice plate	N/A	N/A	290 - 510	
	Copper coated solid round	600 - 770 ^a	N/A	N/A	
	Bare solid	$\langle A_1 \rangle$ 350 - 770 ^a $\langle A_1 \rangle$	N/A	N/A	
	Bare or galvanized solid tape	N/A	290 - 510	N/A	
	Galvanized stranded	N/A	1 500 - 2 100	N/A	
	Galvanized cross profile	600 - 770	N/A	N/A	
Stainless steel	Solid round ^b	500 - 730	400 - 730	N/A	0,80
	Solid tape ^b	N/A	400 - 730	N/A	

NOTE Mechanical and electrical characteristics under consideration.

$\langle A_1 \rangle$ ^a Yield/tensile ratio 0,80 - 0,95.

^b Chromium \geq 16 %, Nickel \geq 10 %, Molybdenum \geq 2 %, Carbon \leq 0,08 %. $\langle A_1 \rangle$

N/A = Not applicable.

5 Tests

5.1 General conditions for tests

5.1.1 Tests according to this standard are type tests.

5.1.2 Unless otherwise specified, tests are carried out with the specimens assembled and installed as in normal use according to the manufacturer's or supplier's instructions.

5.1.3 Unless otherwise specified all tests are carried out on new specimens.

5.1.4 Unless otherwise specified, three specimens are subjected to the tests and the requirements are satisfied if all the tests are met.

If only one of the specimens does not satisfy a test due to an assembly or a manufacturing fault, that test and any preceding one which may have influenced the results of the test shall be repeated and also the tests which follow shall be carried out in the required sequence on another full set of specimens, all of which shall comply with the requirements.

NOTE The applicant, when submitting a set of specimens, may also submit an additional set of specimens which may be necessary should one specimen fail. The testing station will then, without further request, test the additional set of specimens and will reject only if a further failure occurs. If the additional set of specimens is not submitted at the same time, the failure of one specimen will entail rejection.

5.2 Air termination conductors, air termination rods, earth lead-in rods, down conductors and earth conductors

A1 5.2.1 Bend test for coated conductors

Coated conductors each approximately 500 mm long shall be bent through a radius equal to five times its solid round diameter or five times its solid tape thickness up to an angle of 90°.

After the test, the specimens shall show no sharp edges, cracks or peeling. **A1**

5.2.2 Environmental test for conductors, air termination rods and earth lead-in rods

The specimens used in and complying with 5.2.1, air termination rods and earth lead-in rods each approximately 500 mm long shall be subjected to the following test:

- air termination conductors, air termination rods, earth lead-in rods and down conductors as specified in Annex A;
- earth conductors and earth lead-in rods as specified in Annex B.

After the test, the specimens shall satisfy the following criteria:

- the electrical resistance over a 100 mm length measured after the tests shall not exceed the resistance value measured before the tests by more than 50 %;
- the base metal shall not exhibit any visual corrosive deterioration;
- the specimens shall be of a smooth profile with blended radii (no sharp corners).

5.3 Earth rods

Copper coated steel earth rods shall be subjected to the tests according to 5.3.1 and with new specimens according to 5.3.2. Other earth rods shall only be subjected to the test according to 5.3.2.

NOTE An adhesion test for galvanized steel earth rods is under consideration.

5.3.1 Adhesion test

Specimens each approximately 500 mm long with one end cut to an angle of approximately 45° chamfer shall be subjected to the following test.

The specimens are driven through two steel clamping plates or the jaws of a vice set 1 mm – $\frac{0}{0,25}$ mm less than the diameter of the specimens, so as to shear off sufficient metal to expose the bond between the coating and the parent metal. A typical test arrangement for the adhesion test is shown in Figure 3.

After the test, the coating of the specimens shall show adherence to the parent metal. Separation of the copper from the steel is not acceptable.

5.3.2 Environmental test

Specimens each approximately 500 mm long shall be subjected to an environmental test as specified in Annex B.

After the test the specimens shall satisfy the following criteria:

- the specimens shall be straight, of good visual appearance and have no rough edges or burrs throughout their length;
- the specimens shall not exhibit any visual corrosive deterioration.

NOTE 1 White rust is not considered as corrosive deterioration.

NOTE 2 100 mm from both ends of the specimens are excluded from inspection.

5.4 Joints for earth rods

Joints for earth rods shall be subjected to the compression tests according to 5.4.1 and 5.4.2.

Each specimen shall be assembled from two parts of rods each 500 mm long. They shall be subjected to the tests according to 5.4.1 and 5.4.2. The tests shall be performed with suitable driving heads and driving tools following the manufacturers or suppliers instructions.

5.4.1 Compression test by manual means (hammer)

The top of the specimens shall be subjected to 25 blows, each with an impact energy of 55 Nm.

A typical test arrangement is shown in Figure 1.

5.4.2 Compression test by mechanical means (vibration hammer)

The top of the specimens shall be impacted with a vibration hammer defined with the following parameters for a duration of 2 min.:

- percussion rate $(2\ 000 \pm 1\ 000)\ \text{min}^{-1}$;
- single stroke impact energy $(50 \pm 10)\ \text{Nm}$.

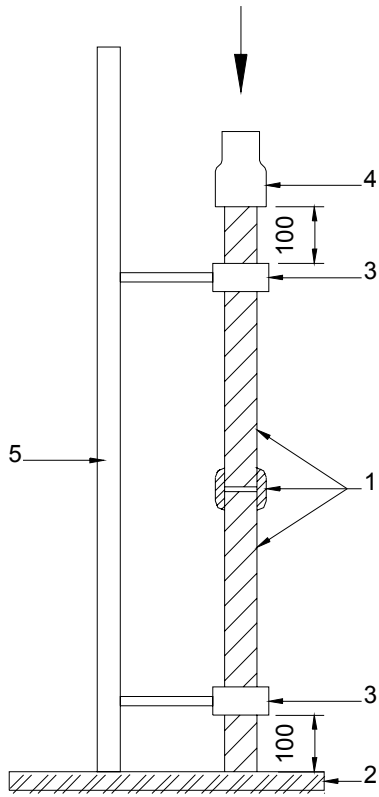
A typical test arrangement is shown in Figure 2.

5.4.3 Acceptance criteria

The specimens are deemed to have passed the tests of 5.4.1 and 5.4.2 if their joints are not broken and the tensile force achieved is equal to or greater than 1 000 N.

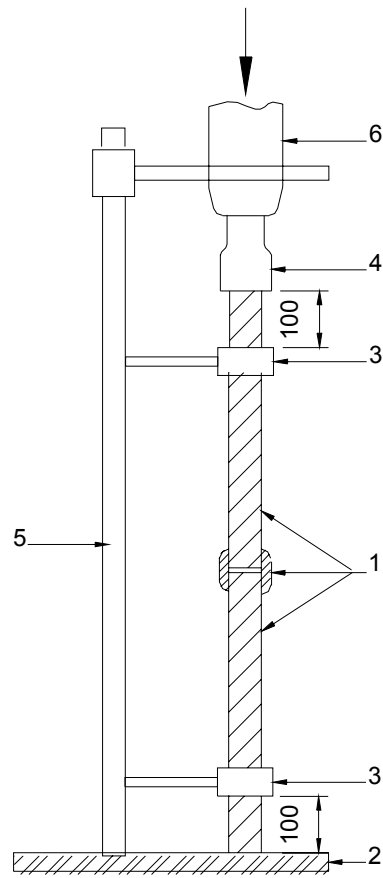
6 Electromagnetic compatibility (EMC)

Products covered by this standard are, in normal use, passive in respect of electromagnetic influences (emission and immunity).



- Key
1 Specimen
2 Metal plate
3 Bearing
4 Driving head
5 Test holder

Figure 1 – Typical test arrangement for the compression test by manual means



- Key
1 Specimen
2 Metal plate
3 Bearing
4 Driving head
5 Test holder
6 Vibration hammer

Figure 2 – Typical test arrangement for the compression test by mechanical means

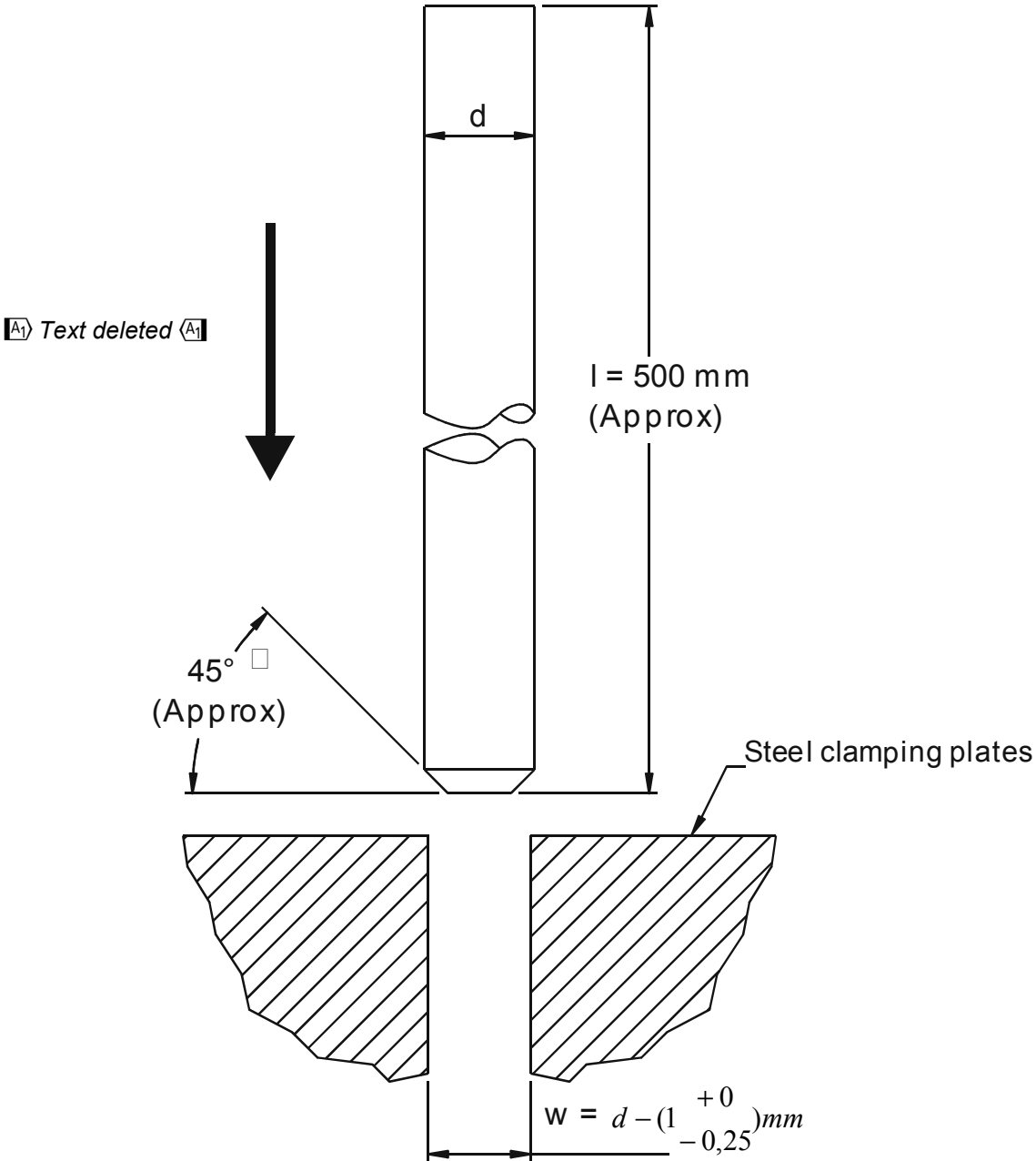


Figure 3 - Typical test arrangement for adhesion test

Annex A
(normative)

Environmental test for conductors, air termination rods and earth lead-in rods

A.1 General

The test consists of a salt mist test according to A.2 followed by a humid sulphurous atmosphere test according to A.3.

A.2 Salt mist test

Salt mist test according to EN 60068-2-52:1996, except for clauses 7, 10 and 11 which are not applicable.

The test is carried out using severity (2).

A.3 Humid sulphurous atmosphere test

Humid sulphurous atmosphere test according to EN ISO 6988:1994 with seven cycles with a concentration of sulphur dioxide of 667 ppm (in volume).

Each cycle which has a duration of 24 h is composed of a heating period of 8 h at a temperature of $40\text{ °C} \pm 3\text{ °C}$ in the humid saturated atmosphere which is followed by a rest period of 16 h. After that, the humid sulphurous atmosphere is replaced.

Annex B
(normative)**Environmental test for earth conductors, earth rods and earth lead-in rods**

The arrangement of the specimen is totally immersed in a non-stirred purified water solution, which contains chloride (CaCl_2) and sulphate (Na_2SO_4). The characteristics of the aqueous solution are given in Table B.1.

The volume of the solution shall be a minimum of 10 times the volume of the specimen arrangement.

The duration of the test shall be 28 days.

Table B.1 - Aqueous solution composition

H ₂ O volume	1 litre
CaCl ₂	650 mg
Na ₂ SO ₄	1 500 mg
Liquid temperature	20 °C
pH	5 to 9

Annex C
(normative)

Requirements for minimum cross sectional area, mechanical and electrical characteristics, tests to be applied

Summary of requirements for minimum cross sectional area, mechanical and electrical characteristics as well as tests to be applied for air termination conductors, air termination rods, earth lead-in rods and down conductors according to Table 1 and Table 2.

Material	Configuration	Minimum cross sectional area, mechanical and electrical characteristics, tests to be applied
Copper	Solid tape Solid round (8 mm Ø) Solid round (16 mm Ø; 10 mm Ø) Stranded	Table 1/Table 2/5.2.2 (Annex A) Table 1/Table 2/5.2.2 (Annex A) Table 1/Table 2/5.2.2 (Annex A/B) ^a Table 1/Table 2/5.2.2 (Annex A)
Tin plated copper	Solid tape Solid round (8 mm Ø) Solid round (16 mm Ø; 10 mm Ø) Stranded	Table 1/Table 2/5.2.1/5.2.2 (Annex A) Table 1/Table 2/5.2.1/5.2.2 (Annex A) Table 1/Table 2/5.2.2 (Annex A/B) ^a Table 1/Table 2/5.2.2 (Annex A)
Aluminium	Solid tape Solid round Stranded	Table 1/Table 2/5.2.2 (Annex A) Table 1/Table 2/5.2.2 (Annex A) Table 1/Table 2/5.2.2 (Annex A)
Aluminium alloy	Solid tape Solid round Stranded	Table 1/Table 2/5.2.2 (Annex A) Table 1/Table 2/5.2.2 (Annex A) Table 1/Table 2/5.2.2 (Annex A)
Galvanized steel	Solid tape Solid round (8 mm Ø) Solid round (16 mm Ø; 10 mm Ø) Stranded	Table 1/Table 2/5.2.1/5.2.2 (Annex A) Table 1/Table 2/5.2.1/5.2.2 (Annex A) Table 1/Table 2/5.2.2 (Annex A/B) ^a Table 1/Table 2/5.2.2 (Annex A)
Stainless steel	Solid tape Solid round (8 mm Ø) Solid round (16 mm Ø; 10 mm Ø) Stranded	Table 1/Table 2/5.2.1/5.2.2 (Annex A) Table 1/Table 2/5.2.1/5.2.2 (Annex A) Table 1/Table 2/5.2.2 (Annex A/B) ^a Table 1/Table 2/5.2.2 (Annex A)
^a For air termination rods: See Annex A. For earth lead-in rods: See Annex A and Annex B.		

Annex D
(normative)

Requirements for minimum dimensions, mechanical and electrical characteristics, tests to be applied

Summary of requirements for minimum dimensions, mechanical and electrical characteristics as well as tests to be applied for earth electrodes according to Table 3 and Table 4.

Material	Configuration	Application	Minimum dimensions, mechanical electrical characteristics, tests to be applied
Copper	Stranded	Earth conductor	Table 3/Table 4/5.2.2 (Annex B)
	Solid round	Earth conductor	Table 3/Table 4/5.2.2 (Annex B)
	Solid round	Earth rod	Table 3/Table 4/5.3.2 (Annex B)
	Solid tape	Earth conductor	Table 3/Table 4/5.2.2 (Annex B)
	Pipe	Earth rod	Table 3/Table 4/5.3.2 (Annex B)
	Solid plate	Earth plate	Table 3/Table 4
	Lattice plate	Earth plate	Table 3/Table 4
Copper coated steel	Solid round	Earth rod	Table 3/Table 4/5.3.1/5.3.2 (Annex B)
Galvanized steel	Solid round	Earth conductor	Table 3/Table 4/5.2.1/5.2.2 (Annex B)
	Solid round	Earth rod	Table 3/Table 4/5.3.2 (Annex B)
	Solid tape	Earth conductor	Table 3/Table 4/5.2.1/5.2.2 (Annex B)
	Pipe	Earth rod	Table 3/Table 4/5.3.2 (Annex B)
	Solid plate	Earth plate	Table 3/Table 4
	Lattice plate	Earth plate	Table 3/Table 4
	Cross profile	Earth rod	Table 3/5.3.2 (Annex B)
	Stranded	Earth conductor	Table 3/5.2.2 (Annex B)
Bare steel	Solid round	Earth conductor	Table 3
	Solid tape	Earth conductor	Table 3
Stainless steel	Solid round	Earth conductor	Table 3/Table 4/5.2.2 (Annex B)
	Solid round	Earth rod	Table 3/Table 4/5.3.2 (Annex B)
	Solid tape	Earth conductor	Table 3/Table 4/5.2.2 (Annex B)
Joints for earth rods	—	—	5.4.1/5.4.2 in addition: EN 50164-1 (6.2.2.2/6.3)

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