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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Lightning protection system components (LPSC) – Part 2: Requirements for conductors and earth electrodes

Composants des systèmes de protection contre la foudre (CSPF) – Partie 2: Exigences pour les conducteurs et les électrodes de terre

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LIGHTNING PROTECTION SYSTEM COMPONENTS (LPSC) –

Part 2: Requirements for conductors and earth electrodes

FOREWORD

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International Standard IEC 62561-2 has been prepared by IEC technical committee 81: Lightning protection.

This bilingual version (2015-10) corresponds to the English version, published in 2012-02.

The text of this standard is based on the following documents:

FDIS	Report on voting
81/417/FDIS	81/423/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The content of this document is taken from the European Standard EN 50164-2.

A list of all the parts in the IEC 62561 series, published under the general title *Lightning protection system components (LPSC),* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

This part of IEC 62561 deals with the requirements and tests for lightning protection system components (LPSC) used for the installation of a lightning protection system (LPS) designed and implemented according to the IEC 62305 series of standards.

LIGHTNING PROTECTION SYSTEM COMPONENTS (LPSC) –

Part 2: Requirements for conductors and earth electrodes

1 Scope

This part of IEC 62561 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.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-2-52:1996, *Environmental testing – Part 2-52: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

IEC 60228, *Conductors of insulated cables*

IEC 62305-3, *Protection against lightning – Part 3: Physical damage to structures and life hazard*

IEC 62305-4, *Protection against lightning – Part 4: Electrical and electronic systems within structures*

IEC 62561-1, *Lightning protection system components (LPSC) – Part 1: Requirements for connection components*

ISO 1460, *Metallic coatings – Hot dip galvanized coatings on ferrous materials – Gravimetric determination of the mass per unit area*

ISO 1461, *Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods*

ISO 2178, *Non-magnetic coatings on magnetic substrates – Measurement of coating thickness – Magnetic method*

ISO 6892-1:2009, *Metallic materials – Tensile testing – Part 1: Method of test at room temperature*

ISO 6957:1988, *Copper alloys – Ammonia test for stress corrosion resistance*

ISO 6988:1985, *Metallic and other non-organic coatings – Sulphur dioxide test with general condensation of moisture*

3 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

3.1
air termination system
part of an external LPS using metallic elements such as rods, mesh conductors or catenary wires intended to intercept lightning flashes

3.2
air termination rod
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 1 to entry Typical examples are earth rod, earth conductor and earth plate.

3.6
earth rod
an earth electrode consisting of a metal rod driven into the ground

[IEC 60050-604:1987, 604-04-09]

3.7
earth conductor
earth electrode consisting of a conductor buried in the ground

3.8
earth plate
an earth electrode consisting of a metal plate buried in the ground

[IEC 60050-604:1987, 604-04-10]

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

3.11
earth lead-in rod
rod installed between the down conductor/test joint and the earth electrode

Note 1 to entry Earth lead-in rods are used to improve mechanical stability.

4 Requirements

4.1 General

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

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

A summary of the requirements and their corresponding tests are given in Annex F, Annex G and Annex H.

4.2 Documentation

The manufacturer or supplier of the conductors and earth electrodes shall provide adequate information in their 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 62305-3 and IEC 62305-4.

Compliance is checked by inspection.

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

The material, configuration and cross sectional area of the conductors and rods 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.

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

Compliance is checked by the tests described in 5.2.2, 5.2.3 and 5.2.4.

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

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

Material	Configuration	Cross sectional area [a] mm²	Recommended dimensions
Copper, Tin plated copper [b]	Solid tape	≥ 50	2 mm thickness
	Solid round [d]	≥ 50	8 mm diameter
	Stranded [d, g]	≥ 50	1,7 mm diameter of each strand [f]
	Solid round	≥ 176	15 mm diameter
Aluminium	Solid tape	≥ 70	3 mm thickness
	Solid round	≥ 50	8 mm diameter
	Stranded [g]	≥ 50	1,63 mm diameter of each strand
Copper coated aluminium alloy [e]	Solid round	≥ 50	8 mm diameter
Aluminium alloy	Solid tape	≥ 50	2,5 mm thickness
	Solid round	≥ 50	8 mm diameter
	Stranded [g]	≥ 50	1,7 mm diameter of each strand
	Solid round	≥ 176	15 mm diameter
Hot dipped galvanized steel	Solid tape	≥ 50	2,5 mm thickness
	Solid round	≥ 50	8 mm diameter
	Stranded [g]	≥ 50	1,7 mm diameter of each strand
	Solid round	≥ 176	15 mm diameter
Copper coated steel [e]	Solid round	≥ 50	8 mm diameter
	Solid tape	≥ 50	2,5 mm thickness
Stainless steel [c]	Solid tape	≥ 50	2 mm thickness
	Solid round	≥ 50	8 mm diameter
	Stranded [g]	≥ 70	1,7 mm diameter of each strand
	Solid round	≥ 176	15 mm diameter

NOTE For the application of the conductors, see IEC 62305-3.

[a] Manufacturing tolerance: –3 %.

[b] Hot dipped or electroplated; minimum thickness coating of 1 µm. Tin plating is for aesthetic reasons only.

[c] Chromium ≥ 16 %; nickel ≥ 8 %; carbon ≤ 0,08 %.

[d] 50 mm² (8 mm diameter) may be reduced to 25 mm² (6 mm diameter) in certain applications where mechanical strength is not an essential requirement.

[e] Minimum 70 µm radial copper coating of 99,9 % copper content.

[f] In some countries 1,14 mm diameter of each strand may be used.

[g] The cross sectional area of stranded conductors is determined by the resistance of the conductor according to IEC 60228.

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

Material	Maximum electrical resistivity μΩm	Tensile strength N/mm^2
Copper	0,019	200 to 450
Aluminium	0,03	≤ 150
Aluminium alloy	0,036	120 to 280
Steel	0,15	290 to 510
Stainless steel	0,80	400 to 770

4.4 Earth electrodes

4.4.1 General

The 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 A summary of the requirements for dimensions, mechanical and electrical characteristics as well as tests is given in Annex C.

4.4.2 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.

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.

4.4.3 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.

Compliance is checked by the test of 5.4.2 and 5.4.3.

4.4.4 Earth conductors and plates

Earth electrode conductors and plates shall be corrosion resistant and any coating shall exhibit good adherence to the base material.

Compliance is checked by the test of 5.2.2, 5.2.3 and 5.2.4.

4.5 Marking

All products complying with this standard shall be marked at least with the following:

a) manufacturer's or responsible vendor's name or trade mark;

b) identifying symbol.

Where this proves to be impractical, the marking in accordance with the identifying symbol may be given on the smallest packing unit.

NOTE Marking can be applied for example by moulding, pressing, engraving, printing adhesive labels or water slide transfers.

Compliance is checked in accordance with 5.5.

Table 3 – Material, configuration and cross sectional area of earth electrodes

Material	Configuration	Cross sectional area [a]			Recommended dimensions
		Earth rod mm^2	Earth conductor mm^2	Earth plate cm^2	
Copper, tin plated copper [f]	Stranded		≥ 50 [i]		1,7 mm diameter of each strand
	Solid round		≥ 50		8 mm diameter
	Solid tape		≥ 50		2 mm thick
	Solid round	≥ 176			15 mm diameter
	Pipe	≥ 110			20 mm diameter with 2 mm wall thickness
	Solid plate			≥ 2 500	500 mm × 500 mm with 1,5 mm thickness [g]
	Lattice plate [g]			≥ 3 600	600 mm × 600 mm consisted of 25 mm × 2 mm section for tape or 8 mm diameter for round conductor
Hot dipped galvanized steel	Solid round		≥ 78		10 mm diameter
	Solid round	≥ 150 [b]			14 mm diameter
	Pipe	≥ 140 [b]			25 mm diameter with 2 mm wall thickness
	Solid tape		≥ 90		3 mm thick
	Solid plate			≥ 2 500	500 mm × 500 mm with 3 mm thickness
	Lattice plate [d]			≥ 3 600	600 mm × 600 mm consisted of 30 mm × 3 mm section for tape or 10 mm diameter for round conductor
	Profile	[e]			3 mm thick
Bare steel	Stranded		≥ 70		1,7 mm diameter of each strand
	Solid round		≥ 78		10 mm diameter
	Solid tape		≥ 75		3 mm thick
Copper coated steel [c]	Solid round	≥ 150 [h]			14 mm diameter, if 250 μm minimum radial copper coating, with 99,9 % copper content
	Solid round		≥ 50		8 mm diameter, if 250 μm minimum radial copper coating, with 99,9 % copper content
	Solid round		≥ 78		10 mm diameter, if 70 μm minimum radial copper coating, with 99,9 % copper content
	Solid tape		≥ 90		3 mm thickness, if 70 μm minimum radial copper coating, with 99,9 % copper content
Stainless steel	Solid round		≥ 78		10 mm diameter
	Solid round	≥ 176 [h]			15 mm diameter
	Solid tape		≥ 100		2 mm thick

NOTE For the application of the conductors, see IEC 62305-3.

[a] Manufacturing tolerance: –3 %.

[b] Threads, where utilized, shall be machined prior to galvanizing.

[c] The copper shall be intrinsically bonded to the steel. The coating can be measured using an electronic coating measuring thickness instrument.

[d] Lattice plate constructed with a minimum total conductor length of 4,8 m.

[e] Different profiles are permitted with a cross sectional area of 290 mm^2 and a minimum thickness of 3 mm, e.g. cross profile.

[f] Hot dipped or electroplated; minimum thickness coating of 1 μm. Tin plating is for aesthetic reasons only.

[g] In some countries, the cross sectional area may be reduced to ≥ 1 800 cm^2 and the thickness to ≥ 0,8 mm.

[h] In some countries, the cross sectional area may be reduced to 125 mm^2.

[i] The cross sectional area of stranded conductors is determined by the resistance of the conductor according to IEC 60228.