IEC 62561-2

Edition 2.0 2018-01

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

IEC 62561-2:2018-01(en-fr)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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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 subcommittee 81: Lightning protection.

This second edition cancels and replaces the first edition published in 2012. This edition constitutes a technical revision.

This edition includes the following significant technical change with respect to the previous edition:

a) Tables 2 and 4 have been merged into one Table (Table 2).
b) Figure 2 showing the coating measurement of a plate conductor has been added.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
81/577/FDIS	81/580/RVD

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

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

A list of all 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 document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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- withdrawn,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

The contents of the corrigendum of August 2019 have been included in this copy.

INTRODUCTION

This part of IEC 62561 deals with the requirements and tests for lightning protection system components (LPSC), specifically conductors and earth electrodes, used for the installation of a lightning protection system (LPS) designed and implemented according to IEC 62305 (all parts).

LIGHTNING PROTECTION SYSTEM COMPONENTS (LPSC) –

Part 2: Requirements for conductors and earth electrodes

1 Scope

Part 2 of IEC 62561 specifies the requirements and tests for:

– metallic conductors (other than "natural" conductors) that form part of the air-termination and down-conductor systems,

– metallic earth electrodes that form part of the earth-termination system.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

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

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 62561-1:2012, *Lightning protection system components (LPSC) – Part 1, Requirements for connection components*

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

ISO 6892-1, *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 purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

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
part of the air-termination system consisting of a metal rod for intercepting and conducting flashes to the down-conductor and earthing system components of the LPS

3.3
air-termination conductor
part of the air-termination system consisting of a conductor for intercepting and conducting flashes to the down-conductor and earthing system components of the LPS

3.4
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

3.5
earth-termination system
part of an external lightning protection system, which is intended to conduct and disperse lightning current to the earth

3.6
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

EXAMPLES: Earth rod, earth conductor and earth plate.

3.7
earth rod
earth electrode consisting of a metal rod driven into the ground

3.8
earth conductor
earth electrode consisting of a conductor buried in the ground

3.9
earth plate
earth electrode consisting of a metal plate buried in the ground

3.10
earth rod coupler
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

3.11
driving head
tool used in those applications where it is necessary to drive the earth rod

3.12
earth lead-in rod
rod installed between the down-conductor/test joint and the earth electrode

4 Requirements

4.1 General

Conductors and earth electrodes shall be designed in such a manner that, when they are installed in accordance with the manufacturer's instructions, their performance shall be reliable, stable and safe to persons and surrounding equipment.

The choice of a material depends on its ability to match the particular application requirements such as life cycle of the material, effects from galvanic corrosion and compatibility with other interconnected materials or services.

Summaries of the requirements are given in Annex C and Annex D and their corresponding tests are given in Annex A, Annex B and the sequence of tests in Annex E (Figure E.1), Annex F (Figure F.1) and Annex G (Figure G.1).

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 of 5.2.2, 5.2.3, 5.2.4, 5.2.5 and 5.2.6.

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

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

Material	Configuration	Cross-sectional area [a] mm^2	Recommended dimensions
Copper, Tin plated copper [b]	Solid tape	≥ 50	2 mm thickness
	Solid round [d]	≥ 50	8 mm diameter
	Stranded [f]	≥ 50	1,14 mm up to 1,7 mm strand diameter
	Rod solid round [h]	≥ 176	15 mm diameter
Aluminium	Solid tape	≥ 70	3 mm thickness
	Solid round	≥ 50	8 mm diameter
	Stranded [f]	≥ 50	1,63 mm strand diameter
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 [f]	≥ 50	1,7 mm strand diameter
	Rod solid round [h]	≥ 176	15 mm diameter
Hot dipped galvanized steel	Solid tape	≥ 50	2,5 mm thickness
	Solid round	≥ 50	8 mm diameter
	Stranded [f]	≥ 50	1,7 mm strand diameter
	Rod solid round [h]	≥ 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 [i]	≥ 50	2 mm thickness
	Solid round [i]	≥ 50	8 mm diameter
	Stranded [f]	≥ 70	1,7 mm strand diameter
	Rod Solid round [h]	≥ 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. There is no requirement to measure the tin plated copper because it is for aesthetic reasons only.

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

[d] 50 mm^2 (8 mm in diameter) may be reduced to 28 mm^2 (6 mm in diameter) in certain applications where mechanical strength is not an essential requirement. Consideration should, in this case, be given to reducing the spacing between the fasteners.

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

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

[g] If the earth lead-in rod is partially installed in soil it has to fulfil the requirements of Table 2 and Table 3.

[h] Applicable for air-termination rods and earth lead-in rods. For air-termination rods where mechanical stress such as wind loading is not critical, a 9,5-mm diameter, 1-m long rod may be used.

[i] If thermal and mechanical considerations are important then these values should be increased to 75 mm^2.

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. Moreover, its 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.

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

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

Material	Maximum electrical resistivity μΩm	Tensile strength N/mm^2
Copper	0,018	200 to 450
Aluminium	0,03	≤ 150
Copper coated aluminium	0,03	≤ 150 [b]
Aluminium alloy	0,036	120 to 280
Steel	0,25	290 to 510
Steel (earth rods)	0,25	350 to 770
Copper coated steel	0,25	290 to 510 [b]
Copper coated steel (earth rods) [a]	0,25	350 to 770 [b]
Stainless steel	0,80	350 to 770

[a] Yield/tensile ratio 0,80 to 0,95

[b] Based on dimensions/tests of only core material of coated conductors.

4.4.2 Earth rods

Earth rods shall be mechanically robust to ensure correct installation. The material of choice shall be sufficiently malleable to ensure that 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 tests according to 5.3.

4.4.3 Couplers for earth rods

Earth rods can be extended allowing them to be driven 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 sufficiently mechanically robust to withstand the driving forces generated during installation.

It shall also exhibit good corrosion resistance.

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

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

Compliance is checked by the tests of 5.4.2, 5.4.3, 5.4.4 and 5.4.5.

4.4.4 Earth conductors and earth plates

Earth electrode conductors and earth 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, 5.2.4, 5.2.5 and 5.2.6.

4.5 Marking

All products complying with this document shall be marked at least with the manufacturer's or responsible vendor's name or trade mark or 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 strand diameter
	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 and 1,5 mm thick[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 and 3 mm thick
	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 [k]	Stranded		≥ 70		1,7 mm strand diameter
	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 of 99,9 % copper content
	Solid round [l]		≥ 78		10 mm diameter, if 250 µm minimum radial copper coating of 99,9 % copper content
	Solid tape [l]		≥ 90		3 mm thick, if 250 µm minimum copper coating of 99,9 % copper content
Stainless steel [j]	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 earth electrodes, see IEC 62305-3.					