

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

**Lightning protection system components (LPSC) –  
Part 4: Requirements for conductor fasteners**  
(standards.iteh.ai)

**Composants de système de protection contre la foudre (CSPF) –  
Partie 4: Exigences pour les fixations de conducteur**

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

Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

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# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

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Part 4: Requirements for conductor fasteners**

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Partie 4: Exigences pour les fixations de conducteur**

INTERNATIONAL  
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International Standard IEC 62561-4 has been prepared by IEC technical committee 81: Lightning protection.

This second edition cancels and replaces the first edition, published in 2010. This edition constitutes a technical revision.

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

- new detailed flow chart of the tests;
- in Annexes A and B, composite fasteners have been added.

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

FDIS	Report on voting
81/564/FDIS	81/567/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

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## INTRODUCTION

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

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## LIGHTNING PROTECTION SYSTEM COMPONENTS (LPSC) –

### Part 4: Requirements for conductor fasteners

#### 1 Scope

This part of IEC 62561 deals with the requirements and tests for metallic and non-metallic conductor fasteners that are used to retain and support the air-termination, down-conductor and earth-termination systems.

This document does not cover the fixing of conductor fasteners to the fabric of structures due to the vast number and types used in modern day construction.

LPSC can also be suitable for use in hazardous atmospheres. There are therefore additional requirements when installing the components in such conditions.

#### 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 60068-2-75:2014, *Environmental testing – Part 2: Tests – Test Eh: Hammer tests*

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

IEC 62561-1:2017, *Lightning Protection System Components (LPSC) – Part 1: Requirements for connection components*

ISO 4892-2:2013, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps*

ISO 4892-3:2016, *Plastics – Methods of exposure to laboratory light sources – Part 3: Fluorescent UV lamps*

ISO 4892-4, *Plastics – Methods of exposure to laboratory light sources – Part 4: Open-flame, carbon-arc lamps*

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

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

#### 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, which can be consulted at the following addresses:

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

### 3.1

#### **conductor fastener**

metallic, non-metallic or composite component designed to retain and support the air-termination, down-conductor and earth-termination systems, installed at intervals along the length of the conductors

## 4 Classification

### 4.1 According to material of conductor fastener

- a) metallic (e.g. hot dip galvanized steel, copper, aluminium, stainless steel);
- b) non-metallic (e.g. PVC, plastics);
- c) composite (combination of metal and plastic).

If a metallic conductor fastener is used for bonding of two metallic parts of the external LPS it becomes a connection component and shall comply with testing requirements according to IEC 62561-1.

### 4.2 According to fixing arrangement of the conductor within the conductor fastener

- a) with screws;
- b) without screws (e.g. clips, springs).

### 4.3 According to conductor clamping arrangement

- a) conductor fasteners that are designed to clamp the conductor;
- b) conductor fasteners that are designed to clamp but allow axial movement of the conductor.

## 5 Requirements

### 5.1 General

The conductor fastener shall carry out its function of clamping the conductor in an acceptable and safe manner when subjected to mechanical influences, lightning discharge stress and environmental influences.

Conductor fasteners shall comply with the tests given in Clause 6. The material of the conductor fastener shall be compatible with the conductor it is fastening and the surface material onto which it is mounted.

NOTE 1 Certain extreme environmental conditions make the choice of non-metallic conductor fasteners unsuitable. Specific recommendations are provided by manufacturers as to their suitability in varying environments.

NOTE 2 Conductor fasteners are so designed and constructed that safe handling is ensured, that retention and support for the conductor is provided, and that in normal use their performance is reliable and without danger to persons and the surroundings.

### 5.2 Environmental requirements

#### 5.2.1 Corrosion resistance

Metallic or composite conductor fasteners shall withstand corrosion effects.

Compliance is checked for metallic fasteners by the test specified in 6.3.2 or for composite fasteners by the tests described in 6.3.4.

### 5.2.2 Ultraviolet (UV) light resistance

Non-metallic and composite conductor fasteners shall withstand UV light effects.

Compliance is checked for non-metallic fasteners by the test specified in 6.3.3 or for composite fasteners by tests specified in 6.3.4.

## 5.3 Mechanical strength

### 5.3.1 Perpendicular and axial loads

The design of the conductor fastener shall be such that it carries the perpendicular loads caused by the weight of the conductor, snow, ice and wind and axial loads caused by the thermal expansion–contraction of the conductor and its weight.

Compliance is checked following the manufacturer's declaration for the classification of the conductor fastener in accordance with Clause 4 and by the tests specified in 6.4.1 and 6.4.2.

### 5.3.2 Impact tests

Conductor fasteners shall be so designed and constructed to withstand impact stresses caused accidentally.

Compliance is checked by the tests specified in 6.4.3.

## 5.4 Installation instructions

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The manufacturer or supplier of the conductor fastener shall provide adequate information in his literature to ensure that the installer can select and install the component in a suitable and safe manner, in accordance with IEC 62305-3.

Compliance is checked by inspection in accordance with 6.5.

## 5.5 Marking

Each conductor fastener shall be marked with:

- the manufacturer's or responsible vendor's name or logo or trademark,
- product identification or type.

Where it is not possible to make these marks directly onto the product, they shall be made on the smallest supplied packaging.

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

Compliance is checked in accordance with 6.6.

## 6 Tests

### 6.1 General test conditions

Tests specified in this document are type tests. These tests are of such a nature that, after they have been performed, they need not be repeated unless changes are made to the materials, design or type of manufacturing process, which might change the performance characteristics of the product.

The present document cannot cover all possible types of conductor fasteners and the way of fixing them on various surfaces of different materials. When required, for these applications, agreement should be obtained between the test engineer and manufacturer on the specific testing regime.

Unless otherwise specified, tests are carried out with the specimens assembled and installed as in normal use specified in the manufacturer's or supplier's instructions, with the recommended conductor materials, sizes and the tightening torques.

The tests shall be carried out in the sequence given after environmental tests of the specimen in accordance with 6.3.

Unless otherwise specified, 12 metallic or 18 composite/non-metallic specimens are subjected to the tests and the requirements are satisfied if all the tests are met.

If only one of the specimens fails to satisfy a test due to a manufacturing fault, that test and any preceding one which may have influenced the results of the test shall be repeated. The tests which follow shall be made in the same required sequence on another full set of samples, all of which shall comply with the requirements.

Tests for non-metallic conductor fasteners shall not commence earlier than 168 h from the time of their manufacturing.

A torque meter shall be used for all tightening operations. It shall have a resolution of at least 0,5 Nm with an accuracy of  $\pm 4$  % or less. The applicable tolerance for any applied mechanical load shall be within  $\pm 5$  %.

The applicant, when submitting the first set of samples, may also submit an additional set of samples that may be necessary should one sample fail. The testing laboratory shall then, without further request, test the additional set of samples, and shall only reject it if a further failure occurs. If the additional set of samples is not submitted at the same time, a failure of one sample shall entail rejection.

## 6.2 Preparation of the specimen

If not otherwise specified by the manufacturer, the conductors and specimens shall be cleaned by using a suitable degreasing agent followed by cleaning in demineralized water and drying. They shall then be assembled in accordance with the manufacturer's installation instructions, for example with the recommended conductors and the tightening torques.

The tightening torque should be applied in a steady and uniform manner.

Any conductor fastener accommodating conductors with differences in size (diameter, thickness and width) equal to or less than 2 mm shall be tested using the minimum conductor size recommended. If the range is greater than 2 mm, the conductor fastener shall be tested using the minimum and maximum of conductor sizes.

## 6.3 Environmental influence test

### 6.3.1 General

In order that a conductor fastener meets the requirements of this document, environmental tests shall be carried out according to Annex A and/or Annex B.

The selection of the tests to be performed depends upon the conductor fastener material.

Annex C provides a flow chart relating to the tests identified in 6.3.2, 6.3.3 and 6.3.4 to the conductor fastener material.

NOTE The sequence of performing the UV test prior to the salt mist test for composite fasteners is because during the salt mist test the specimen is covered by a salt layer. This would inhibit the UV exposure test.

### 6.3.2 Metallic

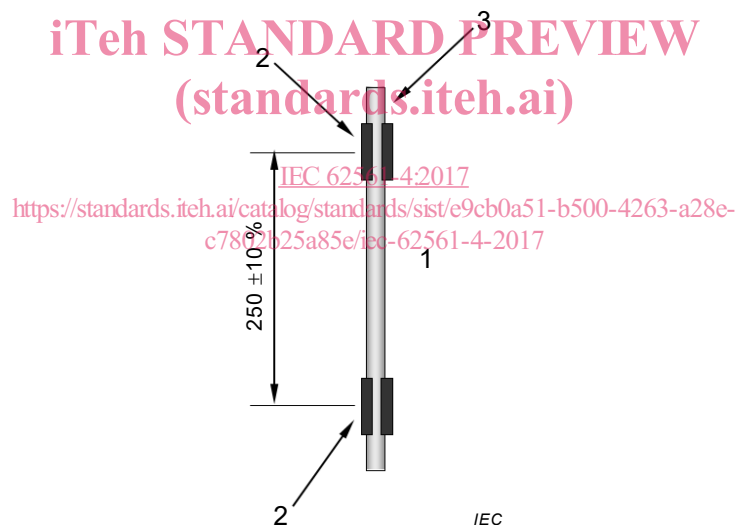
Two sets, each one consisting of three arrangements, shall be assembled and mounted rigidly on an insulating plate (e.g. brick, polytetrafluoroethylene (PTFE)) as shown in Figure 1 in accordance with the manufacturer's installation instructions, for example with the recommended conductors and the tightening torques for screwed fastening conductor fasteners.

The arrangements of specimens shall be subjected to environmental influence tests consisting of a salt mist test as specified in Clause A.2 followed by a humid sulphurous atmosphere test as specified in Clause A.3. An additional test by an ammonia atmosphere as specified in Clause A.4, shall be carried out for conductor fasteners made of copper alloys with a copper content of less than 80 %. This is also valid for conductor fasteners having parts made of copper alloys with a copper content of less than 80 %.

The specimens are deemed to have passed the tests if there are no signs of corrosive deterioration of the conductor or conductor fastener visible to normal or corrected vision.

NOTE White rust, patina and surface oxidation are not considered as corrosive deterioration.

Dimensions in millimetres



#### Key

- 1 mounting plate
- 2 fastener
- 3 conductor

**Figure 1 – Basic arrangement of specimens**

### 6.3.3 Non-metallic

Three sets, each one consisting of three arrangements, shall be assembled and mounted rigidly on an insulating plate (e.g. brick, polytetrafluoroethylene (PTFE)) as shown in Figure 1 in accordance with the manufacturer's installation instructions, for example with the recommended conductors and the tightening torques for screwed fastening conductor fasteners.

The arrangements of specimens shall be subjected to an environmental test consisting of an ultraviolet light test as specified in Annex B.

The specimens are deemed to have passed this part of the test if there are no signs of disintegration and no cracks visible to normal or corrected vision.

Ensure that the surface of the mounting plate is suitable to resist UV radiation.

#### 6.3.4 Composite

Three sets, each one consisting of three arrangements, shall be assembled and mounted on a rigid surface (e.g., brick, polytetrafluoroethylene (PTFE)) as shown in Figure 1 in accordance with the manufacturer's installation instructions, for example with the recommended conductors and the tightening torques for screwed fastening conductor fasteners.

The arrangement of specimens shall be subjected to the environmental tests in the following sequence:

- test as per 6.3.3 and
- test as per 6.3.2.

The specimens are deemed to have passed this part of the test if the base metal of their metal parts does not exhibit any corrosive deterioration and if their plastic parts show no sign of disintegration and no cracks visible to normal or corrected vision.

Ensure that the surface of the mounting plate is suitable to resist UV radiation.

NOTE White rust, patina and surface oxidation are not considered as corrosive deterioration.

### 6.4 Resistance to mechanical effects

#### 6.4.1 Lateral load test

After the test of 6.3 a first set of three arrangements of specimens are subjected to a load test of 200 N applied in the mid distance between the conductor fasteners as illustrated in Figure 2.

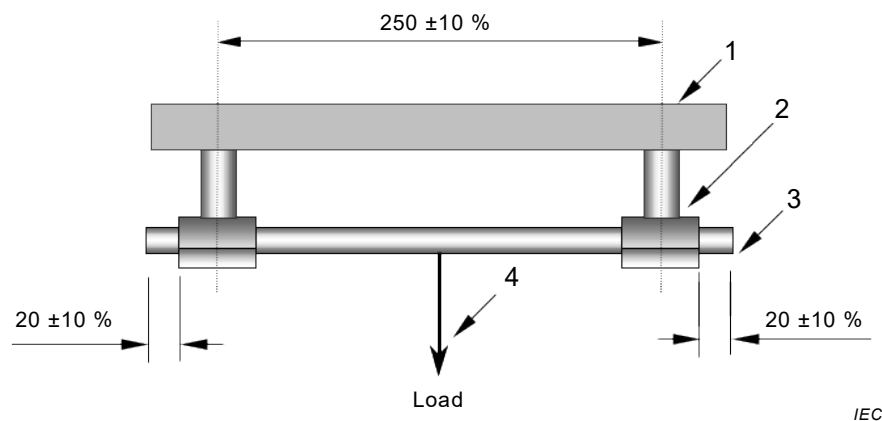
The test shall be performed using a stainless steel conductor with the appropriate dimensions.

For metallic conductor fasteners, the full test load is applied for a minimum of 5 min and for composite and non-metallic conductor fasteners, the full test load is applied for a minimum period of 60 min.

All tests are carried out at a temperature of  $-10\text{ °C}$  ( $\pm 1\text{ °C}$ ) and repeated at a temperature of  $+40\text{ °C}$  ( $\pm 4\text{ °C}$ ).

The specimens are deemed to have passed the tests provided that the conductor fasteners remain intact and the conductor is still located within the conductor fasteners.

Dimensions in millimetres



IEC

**Key**

- 1 mounting plate
- 2 fastener
- 3 conductor
- 4 load

**Figure 2 – Basic arrangement of lateral load test****6.4.2 Axial load test**

This test is only applicable to conductor fasteners classified according to 4.3 a).

After the test of 6.3 the second set of three arrangements are subjected to a load test of 50 N applied as shown in Figure 3.

The test shall be performed using the conductors designated by the manufacturer for the conductor fastener.

For metallic conductor fasteners, the full test load is applied for a minimum of 5 min and for composite and non-metallic conductor fasteners, the full test load is applied for a minimum period of 60 min.

All tests are carried out at a temperature of  $-10\text{ °C}$  ( $\pm 1\text{ °C}$ ) and repeated at a temperature of  $+40\text{ °C}$  ( $\pm 4\text{ °C}$ ).

The specimens are deemed to have passed the tests provided the conductor fasteners remain intact and the displacement of the conductor with respect to the conductor fasteners is not more than 3 mm.