

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Lightning protection system components (LPSC) –
Part 1: Requirements for connection components**

**Composants des systèmes de protection contre la foudre (CSPF) –
Partie 1: Exigences pour les composants de connexion**

<https://standards.iteh.ai/catalog/standards/sist/c9364a5c-835f-47e9-a302-68b60dbe11a3/iec-62561-1-2023>



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LIGHTNING PROTECTION SYSTEM COMPONENTS (LPSC) –

Part 1: Requirements for connection components

FOREWORD

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IEC 62561-1 has been prepared by IEC technical committee 81: Lightning protection. It is an International Standard.

This third edition cancels and replaces the second edition published in 2017. This edition constitutes a technical revision.

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

- a) definitions of connection types mentioned in the scope have been added;
- b) location classification has been expanded in detail;
- c) the document has been updated in line with the new edition of ISO 22479:2019 on humid sulphurous atmosphere treatment;
- d) a new normative Annex E for reduced test procedures has been introduced.

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

Draft	Report on voting
81/721/FDIS	81/724/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 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- withdrawn,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
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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.

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LIGHTNING PROTECTION SYSTEM COMPONENTS (LPSC) –

Part 1: Requirements for connection components

1 Scope

This part of IEC 62561 specifies the requirements and tests for metallic connection components that form part of a lightning protection system (LPS). Typically, these can be connectors, clamps, bonding and bridging components, expansion pieces and test joints.

For the purposes of this document the following connection types are considered as connection components: exothermic, brazing, welding, clamping, crimping, seaming, screwing or bolting.

Testing of components for an explosive atmosphere is not covered by this document.

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 60068-2-52:2017, *Environmental testing – Part 2-52: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

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IEC 62561-2, *Lightning protection system components (LPSC) – Part 2: Requirements for conductors and earth electrodes*

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

ISO 22479:2019, *Corrosion of metals and alloys – Sulfur dioxide test in a humid atmosphere (fixed gas method)*

3 Terms and definitions

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

ISO and IEC maintain terminology 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

connection component

part of an external LPS which is used for the connection of conductors to each other or to metal installations

EXAMPLE Examples of connection components are given in Clause 1.

**3.2
metal installation**

extended metal items in the structure to be protected which can form a path for lightning current

EXAMPLE Pipes, staircases, elevator guide rails, ventilation, heating and air conditioning ducts, and interconnected reinforcing steel.

**3.3
conductor**

element intended to carry electric current

Note 1 to entry: A metal installation is not intended to carry electrical current.

[SOURCE: IEC 60050-151:2001, 151-12-05, modified – The notes have been replaced with a new Note 1 to entry.]

**3.4
bridging component**

connection component for the connection of metal installations

**3.5
expansion piece**

connection component designed to compensate for changes in length in conductors or metal installations or both caused by temperature changes

**3.6
connector**

connection component to interconnect two or more conductors

**3.7
clamp**

connection component for the connection of conductors to metal installations

**3.8
pipe clamp**

clamp for the connection of conductors to metal pipes

**3.9
test joint**

connection component designed to facilitate electrical testing and measurement of LPS components

**3.10
connection range**

minimum to maximum range for which a specific connection component is designed to be used

**3.11
bonding**

technique for joining one object to another

[SOURCE: IEC 60050-523:2018, 523-06-01, modified – The example has been deleted.]

3.12**bonding bar**

connection component such as a metal bar on which metal installations, external conductive parts, electric power and telecommunication lines and other cables can be connected to an LPS

3.13**type test**

test made before supplying a type of material covered by IEC 62561-1 on a general commercial basis, in order to demonstrate satisfactory performance characteristics to meet the intended application

3.14**permanent connection**

connection that cannot or is not intended to be dismantled

3.15**non-permanent connection**

connection that can or is intended to be dismantled

3.16**exothermic connection**

welding process that employs molten metal to permanently join the conductors

Note 1 to entry: The electrical connection suitability and electrical durability of the exothermic connection is tested using a lightning current test.

3.17**brazed connection**

metal-joining process in which two or more metal items are joined together by melting and flowing a filler metal into the joint

Note 1 to entry: The electrical connection suitability and electrical durability of the brazed connection is tested using a lightning current test.

3.18**welded connection**

fabrication process that joins materials, usually metals

Note 1 to entry: The electrical connection suitability and electrical durability of the welded connection is tested using a lightning current test.

3.19**force-locked connection**

connection between two metal parts which does not allow any relative movement due to thermal expansion and to environmental load, for example snow, ice, wind

EXAMPLE Connection by means of crimping, clamping, bolting or screwing.

Note 1 to entry: The electrical connection suitability and electrical durability of the force-locked connection is tested using a lightning current test.

3.20**form-locked connection**

connection between two metal parts which allows a small relative movement of metal parts due to thermal expansion and to environmental load, for example snow, ice, wind

EXAMPLE Connection by means of seaming, overlapping and zipping, locked overlapping or hooking.

Note 1 to entry: The electrical connection suitability and electrical durability of the form-locked connection is tested using a lightning current test.

3.21**clamped connection**

force-locked connection, which can usually be disassembled, between two components

Note 1 to entry: The electrical connection suitability and electrical durability of the clamped connection is tested using a lightning current test.

3.22**crimped connection**

connection method of permanently attaching a termination to a conductor by pressure deformation or by reshaping the barrel around the conductor to establish good electrical and mechanical connection

Note 1 to entry: Crimping as a means of achieving a connection between two conductors may not always require an additional component to achieve the final connection.

Note 2 to entry: The electrical connection suitability and electrical durability of the crimped connection is tested using a lightning current test.

[SOURCE: IEC 60050-581:2008, 581-23-10, modified – The term "crimping" has been replaced with "crimped connection", in the definition "method" has been replaced with "connection method" and the notes to entry have been added.]

3.23**seamed connection**

form-locked connection created by bending of the edges of two adjacent metal sheets bringing them into intimate contact in a way that they cannot be separated by natural action

Note 1 to entry: The electrical connection suitability and electrical durability of the seamed connection is tested using a lightning current test.

3.24**screwed connection**

force-locked connection, which can be disassembled, between two components which have threads of their own and can be bolted directly

Note 1 to entry: The electrical connection suitability and electrical durability of the screwed connection is tested using a lightning current test.

3.25**bolted connection**

force-locked connection, which can be disassembled, between two components which can be bolted indirectly by means of third components (bolts and nuts)

Note 1 to entry: The electrical connection suitability and electrical durability of the bolted connection is tested using a lightning current test.

3.26**stranded conductor**

conductor consisting of a number of individual wires or strands all or some of which generally have helical form

Note 1 to entry: The cross-section of a stranded conductor can be circular or otherwise shaped.

Note 2 to entry: The term "strand" is also used to designate a single wire.

[SOURCE: IEC 60050-461:2008, 461-01-07]

3.27**rope lay conductor**

conductor composed of a central core surrounded by one or more layers of helically laid groups of wires

3.28

smooth weave stranded conductor

conductor constructed of multi-strand soft drawn wire, interwoven in a basket weave configuration so as to avoid fraying in application

4 Classification

4.1 According to the ability to withstand lightning current

- a) class H for heavy duty;
- b) class N for normal duty.

The selection of classes H or N should be performed by the manufacturer in accordance with the test parameters identified in Table 1.

4.2 According to the installation location

- a) outdoors;
- b) indoors;
- c) buried in ground;
- d) embedded in concrete;
- e) embedded in materials with thermal insulation.

The manufacturer's declaration of installation location shall determine whether it is necessary to carry out the conditioning and ageing test as identified in 6.5.

4.3 According to the mechanical behaviour of connection components

- a) intended to withstand a static mechanical stress;
- b) not intended to withstand a static mechanical stress.

The manufacturer's declaration of ability to withstand a static mechanical load shall determine whether it is necessary to carry out the static mechanical test as identified in 6.7.

4.4 According to whether or not a connection is permanent

- a) permanent connection such as exothermic process, brazing, welding, crimping, seaming;
- b) non-permanent connection such as screwing or bolting.

5 Requirements

5.1 General

Connection components 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.

A summary of the requirements and their corresponding tests is given in Annex A.

5.2 Documentation and installation instructions

The manufacturer of the connection component shall provide adequate instructions in their literature to ensure that the installer of the connection component can select and install the components in a suitable and safe manner, containing at least the following information:

- a) classification and lightning current capability (I_{imp});
- b) classification according to the installation location;

- c) classification according to the mechanical behaviour;
- d) classification according to whether or not the connection is permanent;
- e) the range of conductor sizes and materials;
- f) the connection configuration;
- g) assembly instructions for permanent or non-permanent connection components (e.g. whether special tools are necessary, tightening torque, etc.).

Compliance is checked in accordance with 6.2.

5.3 Marking

5.3.1 Content of marking

The connection components shall be marked at least with the following:

- a) the manufacturer's or responsible vendor's name or trademark;
- b) identifying symbol (picture, product number, etc.);
- c) classification, i.e. class N or H;
- d) classification according to the installation location.

Compliance is checked by review in accordance with 6.3.1, a).

Where this proves to be impractical the marking in accordance with b), c) and d) may be given on the smallest packing unit label or on the accompanying documentation.

NOTE 1 Marking can be applied for example by moulding, pressing, engraving, printing and environmental stress adhesive labels.

NOTE 2 Marking can be applied by water slide transfers only for components classified as indoors.

5.3.2 Durability and legibility

The marking shall be durable and legible.

Compliance is checked by test in accordance with 6.3.1 b).

5.4 Lightning current carrying capability

Connection components shall have sufficient lightning current carrying capability.

Compliance is checked in accordance with 6.6 following the manufacturer's declaration for the class (H or N) of the connection components in accordance with 4.1.

5.5 Static mechanical withstand capability

Connection components classified according to 4.3 a) shall have a sufficient withstand capability against static mechanical stresses.

Equipotential bonding bars and connections made by seaming are excluded from this requirement.

Compliance is checked in accordance with 6.7.

5.6 Permanent connection

Where exothermic process, brazing, welding, crimping or seaming are used for connection, the design shall be such that the conductor and the metal installation is always securely bonded.

Compliance is checked by inspection and in accordance with 6.6.2 a), b) and g).

5.7 Non-permanent connection

Where screws or nuts are used as the clamping connection, the design shall be such that the conductor and the metal installation is always securely fastened by the screw or nut application.

Compliance is checked by inspection and in accordance with 6.6.2 a), b), d) and f).

Compliance of connection components classified according to 4.2 d) is checked by inspection according to 6.6.2 a), d) and g).

5.8 Dismantling of test joints

It shall be possible to dismantle the test joints after lightning current stress.

Compliance is checked by inspection and in accordance with 6.6.2 a), b), d) and f).

5.9 Expansion piece

In addition to the requirements of this document, the expansion piece (E of Figure 7) shall fulfil the requirements of IEC 62561-2 for air termination conductors.

6 Tests

6.1 General test conditions

- a) The tests in accordance with this document are type tests (see 3.13), performed in a sequence according to Annex C. Type tests are of such a nature that, after they have been made, unless changes are made to the accessory materials, design or type of manufacturing process which can change the performance characteristics, repeated testing is not required.
- b) 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 installation instructions with the recommended conductor materials, sizes and tightening torques.
- c) All tests are carried out on new specimens.
- d) Unless otherwise specified, three specimens are subjected to the tests and the requirements are satisfied if all the tests are met.
- e) 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 can influence 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.
- f) The electrical test shall be carried out in the order given, after conditioning and ageing of the arrangement of the specimen in accordance with 6.5.

The applicant, when submitting the sets of specimens, can also submit an additional set of specimens which can be used, should one specimen fail. The laboratory will then, without further request, test the additional set of specimens and will reject it 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.

For components already tested according to IEC 62561-1:2017, the reduced test procedure according to Annex E can be applied.

For new components complete type tests and samples according to Clause 6 are required.