

BS EN 62561-4:2011



BSI Standards Publication

Lightning protection system components (LPSC)

Part 4: Requirements for conductor fasteners

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National foreword

This British Standard is the UK implementation of EN 62561-4:2011. It is derived from IEC 62561-4:2010. It supersedes BS EN 50164-4:2008, which will be withdrawn on 21 February 2014.

The CENELEC common modifications have been implemented at the appropriate places in the text and are indicated by tags (e.g. C C1).

The UK participation in its preparation was entrusted to Technical Committee GEL/81, Protection against lightning.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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ISBN 978 0 580 66652 0

ICS 29.020; 91.120.40

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 August 2011.

Amendments/corrigenda issued since publication

Date	Text affected
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English version

**Lightning protection system components (LPSC) -
Part 4: Requirements for conductor fasteners**
(IEC 62561-4:2010, modified)

Composants de système de protection
contre la foudre (CSPF) -
Partie 4: Exigences pour les fixations de
conducteur
(CEI 62561-4:2010, modifiée)

Blitzschutzsystembauteile (LPSC) -
Teil 4: Anforderungen an Leitungshalter
(IEC 62561-4:2010, modifiziert)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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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

The text of the International Standard EN 62561-4:2010, prepared by IEC TC 81, Lightning protection, together with common modifications prepared by the Technical Committee CENELEC TC 81X, Lightning protection, was submitted to the formal vote and was approved by CENELEC as EN 62561-4 on 2011-02-21.

This European Standard supersedes EN 50164-4:2008.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

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) 2012-02-21
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2014-02-21

Endorsement notice

The text of the International Standard EN 62561-4:2010 was approved by CENELEC as a European Standard with agreed common modifications as given below.

In the official version, for Bibliography, the following note has to be added for the standard indicated: EN

EN 62305-1:2006 NOTE Harmonized as en 62305-1:2006 (not modified).

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application 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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60068-2-75	1997	Environmental testing - Part 2-75: Tests - Test Eh: Hammer tests	EN 60068-2-75	1997
ISO 4892-3	2006	Plastics - Methods of exposure to laboratory light sources - Part 3: Fluorescent UV lamps	EN ISO 4892-3	2006
ISO 4892-4	2004	Plastics - Methods of exposure to laboratory light sources - Part 4: Open-flame carbon-arc lamps	-	-
ISO 6957	1988	Copper alloys - Ammonia test for stress corrosion resistance	-	-

CONTENTS

INTRODUCTION	5
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions.....	6
4 Classification	7
5 Requirements.....	7
5.1 General.....	7
5.2 Environmental requirements.....	7
5.3 Mechanical strength	8
5.4 Installation instructions	8
5.5 Marking.....	8
6 Tests.....	8
6.1 General test conditions	8
6.2 Preparation of the specimen.....	9
6.3 Environmental influence test	9
6.4 Resistance to mechanical effects.....	11
6.5 Installation instructions	14
6.6 Marking test	15
6.7 Construction.....	15
7 Electromagnetic compatibility (EMC)	15
8 Structure and content of the test report.....	15
8.1 General.....	15
8.2 Report identification	16
8.3 Specimen description	16
8.4 Characterization and condition of the test sample and/or test assembly.....	16
8.5 Conductor	16
8.6 Standards and references.....	17
8.7 Test procedure	17
8.8 Testing equipment, description.....	17
8.9 Measuring instruments description.....	17
8.10 Results and parameters recorded	17
Annex A (normative) Environmental test for metallic conductor fasteners	18
Annex B (normative) Environmental test for non-metallic conductor fasteners – Resistance to ultraviolet light.....	19
Annex C (normative) Flow chart of tests.....	20
Bibliography.....	21
Figure 1 – Basic arrangement of specimens	10
Figure 2– Basic arrangement of lateral load test	12
Figure 3– Typical arrangement for axial movement test.....	13
Figure 4 – Impact test apparatus.....	14

INTRODUCTION

This Part 4 of EN 62561 deals with the requirements and tests for conductor fasteners as being a lightning protection system component (LPSC) designed and implemented according to the EN 62305 series of standards.

LIGHTNING PROTECTION SYSTEM COMPONENTS (LPSC) –

Part 4: Requirements for conductor fasteners

1 Scope

This Part 4 of [C] EN 62561 [C] deals with the requirements and tests for metallic and non-metallic conductor fasteners that are used in conjunction with the air termination, down conductor and earth termination system.

This standard does not cover the fixing of conductor fasteners to the fabric/membrane/gravel roofing of structures due to the vast number and types used in modern day construction.

LPSC 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

The following referenced documents are indispensable for the application 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.

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

EN 62305-1, *Protection against lightning – Part 1: General principles* (IEC 62305-1)

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

EN 62305-4, *Protection against lightning – Part 4: Electrical and electronic systems within the structure* (IEC 62305-4)

EN ISO 4892-2:2006, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps* (ISO 4892-2:2006)

EN ISO 6988:1994, *Metallic and other non-organic coatings – Sulfur dioxide test with general condensation of moisture* (ISO 6988:1985) [C]

ISO 4892-4:2004, *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 purpose of this document, the following terms and definitions apply.

3.1

conductor fastener

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

4 Classification

Conductor fasteners are classified as follows:

a) According to material

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

b) According to fixing arrangement of the conductor within the conductor fastener

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

c) According to conductor clamping arrangement

- conductor fasteners that are designed to clamp the conductor;
- 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 should be provided by manufacturers as to their suitability in varying environments.

NOTE 2 Conductor fasteners should be 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 surrounding.

5.2 Environmental requirements

5.2.1 Corrosion resistance

Metallic or composite conductor fasteners shall withstand corrosion effects.

Compliance is checked following the manufacturer's declaration for the classification of the conductor fastener in accordance with Clause 4 and by test specified in 6.3.2 and 6.3.4.

5.2.2 UV resistance

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

Compliance is checked following the manufacturer's declaration for the classification of the conductor fastener in accordance with Clause 4 and by test specified in 6.3.3 and 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 test 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 test specified in 6.4.3.

5.4 Installation instructions

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 EN 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 may 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 standard 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.

The standard 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 and also 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 and an accuracy of ± 4 % or less.

The applicable tolerance for any applied mechanical load shall be within ± 5 %.

NOTE 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 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, e.g. 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 standard, 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 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

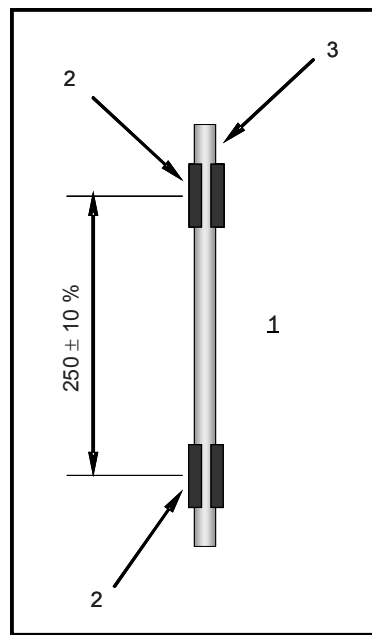
- ☐ Two sets, each one consisting of three arrangements, shall be assembled and mounted rigidly on an insulating plate (e.g. brick, Teflon) as shown in Figure 1 in accordance with the manufacturer's installation instructions, e.g. with the recommended conductors and the tightening torques for screwed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

The arrangements of specimens shall be subjected to environmental influence tests consisting of a salt mist test as specified in Clause A.1 followed by a humid sulphurous atmosphere test as specified in Clause A.2. An additional test by an ammonia atmosphere as specified in Clause A.3, shall be carried out for conductor fasteners made of copper alloys with copper content of less than 80 %. This is also valid for conductor fasteners having parts made of copper alloys with 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 is not considered as corrosive deterioration.

Dimensions in millimetres



IEC 2591/10

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, Teflon) as shown in Figure 1 in accordance with the manufacturer's installation instructions, e.g. with the recommended conductors and the tightening torques for screwed conductor fasteners. ☐

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

- ☐ The specimens are deemed to have passed this part of the test if the conductor or metal parts of the conductor fastener do not exhibit any corrosive deterioration and if its plastic parts show no sign of disintegration and no cracks visible to normal or corrected vision. ☐

NOTE 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, Teflon) as shown in Figure 1 in accordance with the manufacturer's installation instructions, e.g. 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 its metal parts does not exhibit any corrosive deterioration and if its plastic parts show no sign of disintegration and no cracks visible to normal or corrected vision.

NOTE 1 Ensure that the surface of the mounting plate is suitable to resist UV radiation.

NOTE 2 White rust is not considered as corrosive deterioration.

6.4 Resistance to mechanical effects

6.4.1 Lateral load test

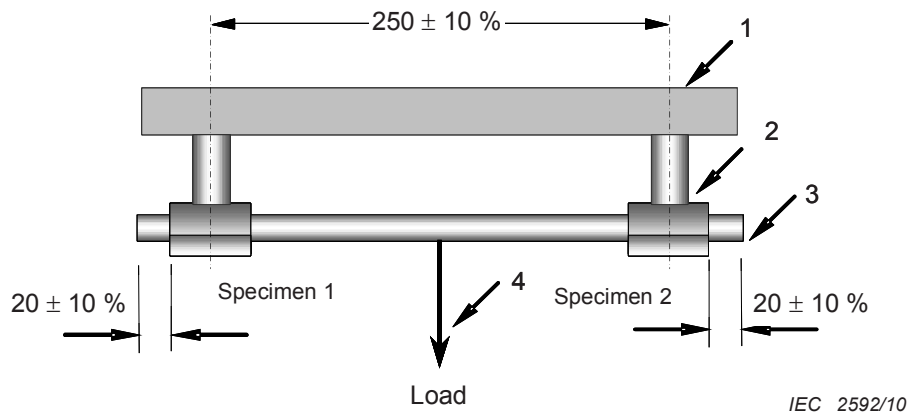
After the test of 6.3 a first set of three arrangements of specimens are subjected to a load test of 200 N applied in the mid distance between the conductor fasteners as illustrated in Figure 2. The test shall be performed using a stainless steel conductor with the appropriate dimensions.

For metallic conductor fasteners, the full test load is applied for period of 5 min to 6 min and for composite and non-metallic conductor fasteners, the full test load is applied for a minimum period of 60 min to 61 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 conductor is still located within the conductor fasteners.

Dimensions in millimetres



Key

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

Figure 2 – Basic arrangement of lateral load test

6.4.2 Axial load test

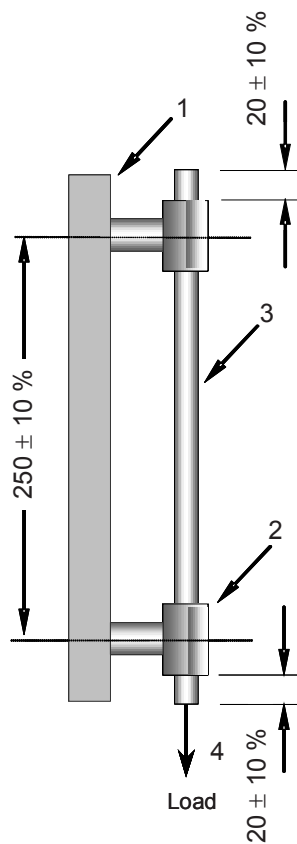
This test is only applicable to conductor fasteners classified according to 4.3.1.

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 period of 5 min to 6 min and for composite and non-metallic conductor fasteners, the full test load is applied for a minimum period of 60 min to 61 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.



IEC 2593/10

Key

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

Figure 3 – Typical arrangement for axial movement test

6.4.3 Impact test

This test is carried out on non-metallic and composite conductor fasteners.

After the test of 6.3 the third set of three arrangements is subjected to an impact test.

Each arrangement of specimens shall be mounted on an impact test apparatus as described in Clause 4 of IEC 60068-2-75:1997 and shown in Figure 4. The impact test apparatus shall be mounted on a solid wall or structure providing sufficient support for the test apparatus.

The arrangement of specimens is placed in a cabinet at a temperature $-5\text{ }^{\circ}\text{C}$. After 2 h, the arrangement is removed from the cabinet and immediately placed in position in the impact test apparatus.

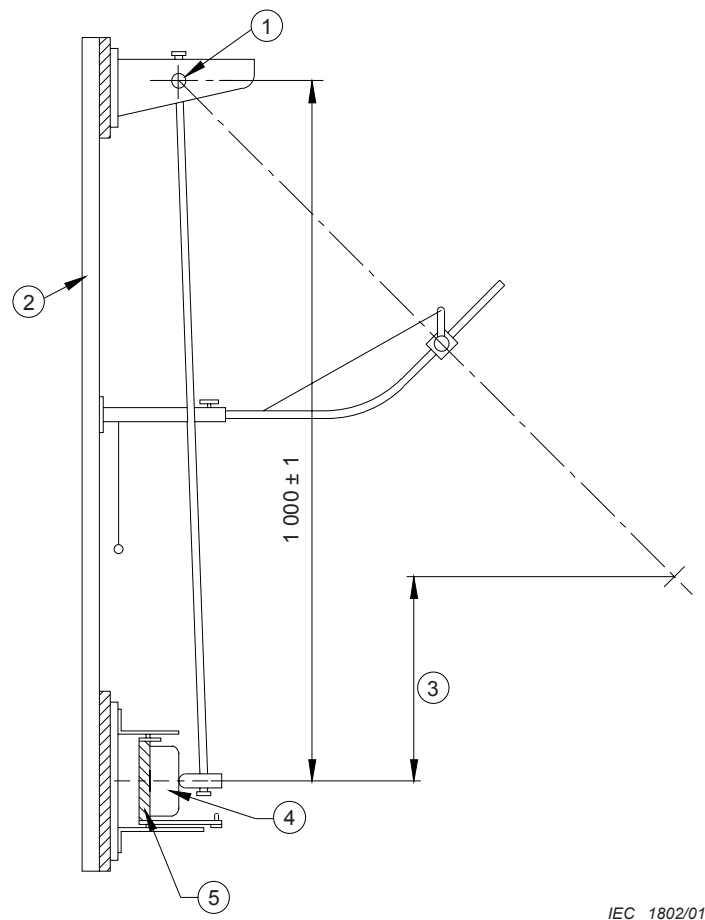
After removal of the arrangement from the cabinet, and after a period of $12\text{ s} \pm 2\text{ s}$, the hammer is allowed to fall (2 J, 0,5 kg, 400 mm as illustrated in Table 2 of IEC 60068-2-75:1997) so that three impacts are applied as far as possible perpendicular to the length of the arrangement.

The first impact should be to the left conductor fastener, the second to the other conductor fastener and the third to the middle length of the arrangement.

Instead of placing the arrangements in a cabinet and applying the impact at $12\text{ s} \pm 2\text{ s}$ after the removal of the sample from the cabinet, it is allowed to apply the impact in a climatic chamber at a temperature of $-5\text{ °C} (\pm 1\text{ °C})$ on samples placed at this temperature for at least 2 h prior to testing. Compliance in the climatic chamber is sufficient.

After the test, the specimens shall show no cracks or similar damage visible to normal or corrected vision without magnification and the conductor remains located within the conductor fasteners.

Dimensions in millimetres



Key

- 1 pendulum
- 2 frame
- 3 height of fall
- 4 specimen
- 5 mounting fixture

Figure 4 – Impact test apparatus

6.5 Installation instructions

The manufacturer or responsible vendor shall provide in his literature:

- the classifications according to Clause 4;
- the maximum and minimum conductor diameter;

- the materials of conductors to be used;
- the type of mounting surface to be fixed;
- the recommended method of assembly, installation and fixing to the mounting surface;
- the lateral load;
- the axial movement load.

Compliance is checked by inspection.

6.6 Marking test

Marking on the conductor fastener shall be durable and easily legible.

Compliance is checked by inspection and by rubbing the marking by hand for 15 s with a piece of cloth soaked with water and again for 15 s with a piece of cloth soaked with white spirit.

Marking made by moulding, pressing or engraving is not subjected to this test.

The specimen is deemed to have passed the test if the marking remains legible.

NOTE Marking may be applied, for example, by moulding, pressing, engraving, printing, adhesive labels, etc.

6.7 Construction

The surface of the conductor fastener shall be free from burrs from cutting process, flash, moulding joint deformation and similar inconsistencies which are likely to damage the conductors or inflict injury to the installer or user.

Compliance is checked by visual and manual inspection.

7 Electromagnetic compatibility (EMC)

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

8 Structure and content of the test report

8.1 General

- ☐ The purpose of this clause is to provide general requirements for type test reports issued by the testing laboratory. It is intended to promote clear, complete reporting procedures for laboratories submitting test reports. ☐

The results of each test carried out by the testing laboratory shall be reported accurately, clearly, unambiguously and objectively, in accordance with any instructions in the test methods. The results shall be reported in a test report and shall include all the information necessary for the interpretation of the test results and all information required by the method used.

Particular care and attention shall be paid to the arrangement of the report, especially with regard to presentation of the test data and ease of assimilation by the reader. The format shall be carefully and specifically designed for each type of test carried out, but the headings shall be standardized as indicated below.

The structure of each report shall include at least the information specified in 8.2 to 8.10.

8.2 Report identification

- 8.2.1 A title or subject of the report
- 8.2.2 Name, address and telephone number of the testing laboratory
- 8.2.3 Name, address and telephone number of the sub testing laboratory where the test was carried out if different from company which has been assigned to perform the test
- 8.2.4 Unique identification number (or serial number) of the test report
- 8.2.5 Name and address of the vendor
- 8.2.6 Report shall be paginated and the total number of pages indicated on each page including Appendices or Annexes
- 8.2.7 Date of issue of report
- 8.2.8 Date(s) of performance of test(s)
- 8.2.9 Signature and title, or an equivalent identification of the person(s) authorized to sign for the testing laboratory for the content of the report
- 8.2.10 Signature and title of person(s) conducting the test
- 8.2.11 Declaration to avoid misuse

The following declaration shall be included in the test report in order to avoid misuse.

“This type test report may not be reproduced other than in full, except with the prior written approval of the issuing testing laboratory. This type test report only covers the samples submitted for test and does not produce evidence of the quality for series production.”

8.3 Specimen description

- 8.3.1 Sample description
- 8.3.2 Functional parts and accessories description (e.g. screws, nuts, washers, quantity, material, etc.)
- 8.3.3 Manufacturing method (e.g. cast, hot forged, cold deformed, pressing, die casting etc.)
- 8.3.4 Detailed description and unambiguous identification of the test sample and/or test assembly

8.4 Characterization and condition of the test sample and/or test assembly

- 8.4.1 Sampling procedure, where relevant
- 8.4.2 Date of receipt of test samples
- 8.4.3 Photographs, drawings or any other visual documentation, if available

8.5 Conductor

- 8.5.1 Conductor material
- 8.5.2 Nominal cross-section area, dimensions and shape. It is recommended that the actual cross-sectional area should also be given

8.6 Standards and references

- 8.6.1** Identification of the test standard used and the date of issue of the standard
- 8.6.2** Reference to this standard may only be made if the full set of tests is performed and reported except where the deviations are clearly justified in 8.7.2
- 8.6.3** Other relevant documentation with the documentation date

8.7 Test procedure

- 8.7.1** Description of the test procedure
- 8.7.2** Justification for any deviations from, additions to or exclusions from the referenced standard
- 8.7.3** Any other information relevant to a specific test such as environmental conditions
- 8.7.4** Configuration of testing assembly
- 8.7.5** Location of the arrangement in the testing area and measuring techniques

8.8 Testing equipment, description

Description of equipment used for every test conducted i.e. generator, conditioning/ageing device

8.9 Measuring instruments description

Characteristics and calibration date of all instruments used for measuring the values specified in the standard i.e. ohmmeter, torque meter

8.10 Results and parameters recorded

- 8.10.1** The required passing criteria for each test, defined by the standard
- 8.10.2** The relevant observed or derived results of the tests
- 8.10.3** All results shall be presented as tables, graphs, drawings, photographs or other visual documentation, as appropriate
- 8.10.4** A statement of pass/fail identifying the part of the test for which the specimen has failed and also a description of the failure

Annex A (normative)

Environmental test for metallic conductor fasteners

A.1 Salt mist test

Salt mist treatment is specified in EN 60068-2-52:1996, except for Clauses 7, 10 and 11 which are not applicable.

The test is carried out using severity (2) (as defined in Clause 6 of EN 60068-2-52:1996).

NOTE If the salt mist chamber can maintain the temperature conditions as specified in 9.3 of EN 60068-2-52:1996 and a relative humidity of not less than 90 % then the specimen may remain in it for the humidity storage period.

A.2 Humid sulphurous atmosphere test

Humid sulphurous atmosphere treatment is specified in EN ISO 6988:1994 using seven cycles with a concentration of sulphur dioxide of $(667 \pm 25)^{-6}$ (in volume), except for Clauses 9 and 10 which are not applicable.

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

NOTE If the test chamber maintains the temperature conditions as specified in 6.5.2 of EN ISO 6988:1994, then the specimen may remain in it for the rest period.

A.3 Ammonia atmosphere test

Ammonia atmosphere treatment is specified in ISO 6957:1988 for a moderate atmosphere with a pH value of 10, except for 8.4 and Clause 9 which are not applicable.

Annex B (normative)

Environmental test for non-metallic conductor fasteners – Resistance to ultraviolet light

B.1 General

For non-metallic conductor fasteners a set of samples shall be subjected to ultraviolet light conditioning specified in Clauses B.2, B.3 or B.4. All sets tested are considered representative of the material's entire colour range.

Samples shall be mounted on the inside of the cylinder in the ultraviolet light apparatus so that the samples do not touch each other and shall be positioned in such a way that the fixation surface for rod is perpendicular to the light source.

After the test there shall be no sign of disintegration nor shall there be any crack visible to normal or corrected vision.

B.2 The test

The specimens shall be exposed for $(1\,000 \pm 1)$ h to an Xenon-arc, Method A, in accordance with ISO 4892-2:2006. Continuous exposure to light and intermittent exposure to water spray, with a programmed cycle of (120 ± 1) min consisting of a (102 ± 1) min light exposure and a (18 ± 1) min exposure to water spray with light, shall be used. The apparatus shall operate with a water-cooled xenon-arc lamp, borosilicate glass inner and outer optical filters, a spectral irradiance of $0,35\text{ W}\times\text{m}^{-2}\times\text{nm}^{-1}$ at 340 nm and a black panel temperature of (65 ± 3) °C. The temperature of the chamber shall be (45 ± 5) °C. The relative humidity in the chamber shall be (50 ± 5) %.

B.3 First alternative test to B.2

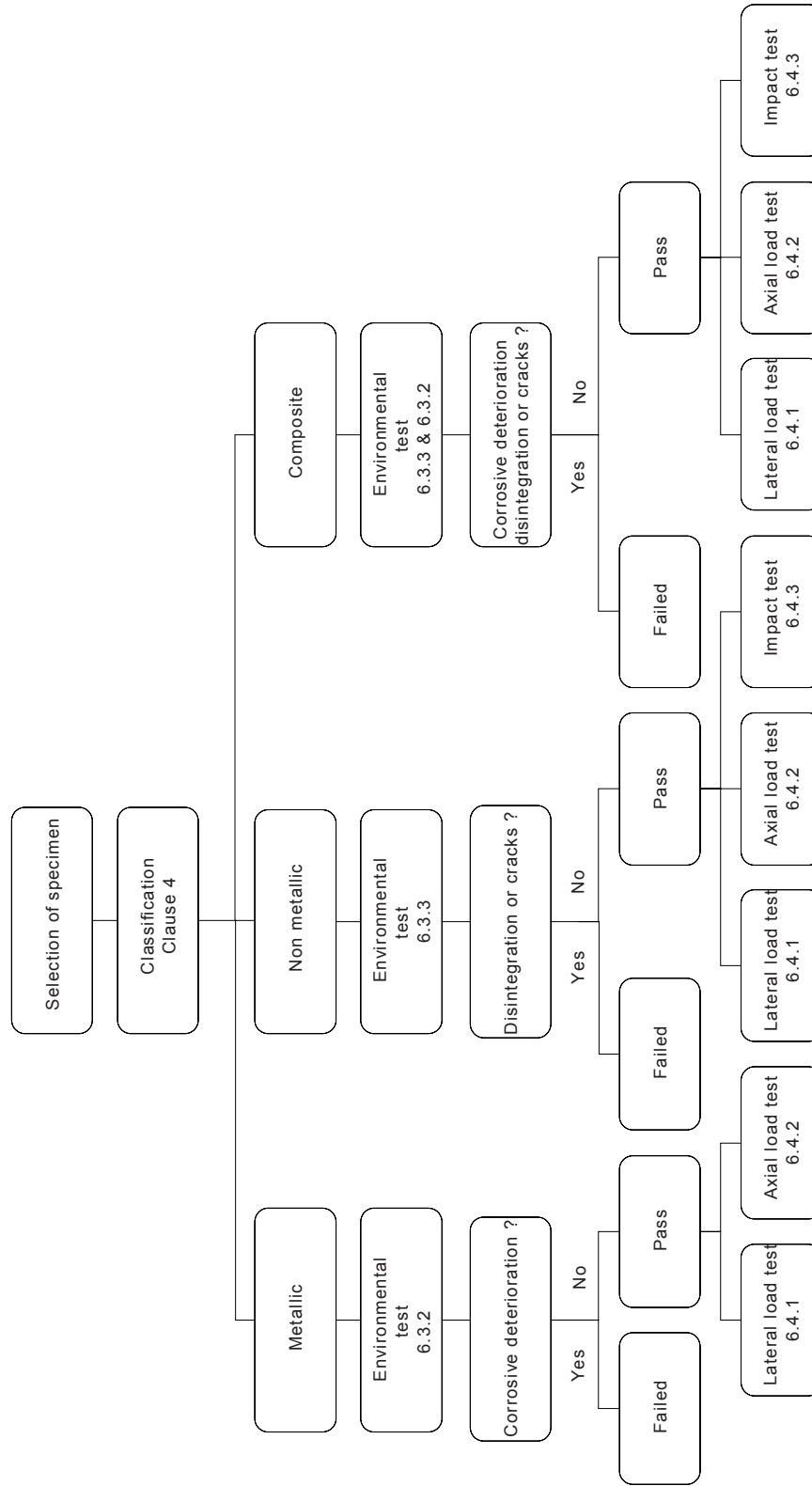
The specimens shall be exposed for (720 ± 1) h to open-flame sunshine carbon-arc, in accordance with ISO 4892-4. Continuous exposure to light and intermittent exposure to water spray, with a programmed cycle of (120 ± 1) min consisting of a (102 ± 1) min light exposure and an 18 min exposure to water spray with light, shall be used. The apparatus shall operate with an open-flame sunshine carbon-arc lamp, borosilicate glass type 1 inner and outer optical filters, a spectral irradiance of $0,35\text{ W}\times\text{m}^{-2}\times\text{nm}^{-1}$ at 340 nm and a black panel temperature of (63 ± 3) °C. The temperature of the chamber shall be (45 ± 5) °C with a relative humidity of (50 ± 5) %.

B.4 Second alternative test to B.2

The specimens shall be exposed for total irradiation energy equal to the values given in Clause B.2, to fluorescent UV in accordance with ISO 4892-3:2006. The exposure conditions shall be by continuous exposure to light and intermittent exposure to water spray, with a programmed cycle of (360 ± 1) min light exposure and (60 ± 1) min exposure to water spray with light as described in Table 4, Method A, cycle 3 of ISO 4892-3:1996.

Annex C (normative)

Flow chart of tests



Bibliography

EN 62305-1:2006, *Protection against lightning – Part 1: General principles*¹

EN 60068-2-75:1997, *Environmental testing - Part 2-75: Tests - Test Eh: Hammer tests*
(IEC 60068-2-75:1997).

¹ A second edition is in preparation.

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