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Edition 2.0 2020-02
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INTERNATIONAL STANDARD

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Overhead lines – Requirements and tests for spacers

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IEC 61854:2020-02 RLV(en)

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OVERHEAD LINES – REQUIREMENTS AND TESTS FOR SPACERS

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 61854 has been prepared by IEC technical committee 11: Overhead lines.

This second edition cancels and replaces the first edition published in 1998. This edition constitutes a technical revision.

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

a) Consider the application of spacers on high temperature conductors specifying additional high temperature tests in clamp slip tests and for the characterization of elastic and damping properties;
b) Specify as far as possible test parameters and acceptance values;
c) Avoid as far as possible the alternative procedures for the same test;
d) Introduce a simpler test device for the simulated short circuit current test;
e) Introduce test at low temperature on fastener components such as break away bolts and conical spring washers;
f) Prescribe a different procedure for subspan oscillation tests on spacers equipped with clamps having rod attachments;
g) Modify the test procedure for the aeolian vibration tests;
h) Prescribe a different procedure for aeolian vibration tests on spacers equipped with clamps having rod attachments;
i) Re-edit all the figures in order to make them more clear and homogeneous;
j) Introduce an additional test device for the simulated short circuit current test.

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

FDIS	Report on voting
11/265/FDIS	11/272/RVD

IEC 61854:2020
https://standards.iteh.ai/catalog/standards/iec/fb24216e-95a6-40e8-8443-85315db90046/iec-61854-2020

Full information on the voting for the approval of this 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.

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.

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OVERHEAD LINES – REQUIREMENTS AND TESTS FOR SPACERS

1 Scope

This document applies to spacers for conductor bundles of overhead lines. It covers rigid spacers, flexible spacers and spacer dampers.

It does not apply to interphase spacers, hoop spacers and bonding spacers.

NOTE This document is written to cover the line design practices and spacers most commonly used at the time of writing. There may be other spacers available for which the specific tests reported in this document may not be applicable.

In ~~many~~ some cases, test procedures and test values are left to agreement between purchaser and supplier and are stated in the procurement contract. The purchaser is best able to evaluate the intended service conditions, which should be the basis for establishing the test severity.

In Annex A, the minimum technical details to be agreed between purchaser and supplier are listed.

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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 61854:2020
https://standards.iteh.ai/catalog/standards/iec/fb24216e-95a6-40e8-8443-85315db90046/iec-61854-2020

IEC 60050(466):1990, *International Electrotechnical vocabulary (IEV) – Chapter 466: Overhead lines*

IEC 60888:1987, *Zinc-coated steel wires for stranded conductors*

IEC 61284:1997, *Overhead lines – Requirements and tests for fittings*

ISO 34-1:~~1994~~2015, *Rubber, vulcanized or thermoplastic – Determination of tear strength – Part 1: Trouser, angle and crescent test pieces*

ISO 34-2:~~1996~~2015, *Rubber, vulcanized or thermoplastic – Determination of tear strength – Part 2: Small (Delft) test pieces*

ISO 37:~~1994~~2017, *Rubber, vulcanized or thermoplastic – Determination of tensile stress-strain properties*

ISO 188:~~1982~~2011, *Rubber, vulcanized or thermoplastic – Accelerated ageing or heat resistance tests*

ISO 812:~~1991~~2017, *Rubber, vulcanized or thermoplastic – Determination of low-temperature brittleness*

~~ISO 815:1991, *Rubber, vulcanized or thermoplastic – Determination of compression set at ambient, elevated or low temperatures*~~

ISO 815-1:2014, *Rubber, vulcanized or thermoplastic – Determination of compression set – Part 1: At ambient or elevated temperatures*

ISO 815-2:2014, *Rubber, vulcanized or thermoplastic – Determination of compression set – Part 2: At low temperatures*

ISO 868:~~1985~~2003, *Plastics and ebonite – Determination of indentation hardness by means of a durometer (Shore hardness)*

~~ISO 1183:1987, *Plastics – Methods for determining the density and relative density of non-cellular plastics*~~

ISO 1183-1:2019, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pycnometer method and titration method*

ISO 1431-1:~~1989~~2012, *Rubber, vulcanized or thermoplastic – Resistance to ozone cracking – Part 1: Static and dynamic strain testing*

ISO 1461:2009, *Hot dip galvanized coatings on fabricated ~~ferrous products~~ iron and steel articles – Specifications and test methods*~~[1)]~~

ISO 1817:~~1985~~2015, *Rubber, vulcanized or thermoplastic – Determination of the effect of liquids*

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ISO 2781:~~1988~~2018, *Rubber, vulcanized or thermoplastic – Determination of density*

ISO 2859-1:~~1989~~1999/AMD1:2011, *Sampling procedures for inspection by attributes – Part 1: Sampling ~~plans~~ schemes indexed by acceptable quality ~~level~~ limit (AQL) for lot-by-lot inspection*

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ISO 2859-2:1985, *Sampling procedures for inspection by attributes – Part 2: Sampling plans indexed by limiting quality level (LQ) for isolated lot inspection*

ISO 2921:~~1982~~2011, *Rubber, vulcanized – Determination of low-temperature ~~characteristics~~ retraction (TR test) ~~– Temperature-retraction procedure (TR test)~~*

~~ISO 3417:1991, *Rubber – Measurement of vulcanization characteristics with the oscillating disc curemeter*~~

~~ISO 3951:1989, *Sampling procedures and charts for inspection by variables for percent nonconforming*~~

ISO 3951-1:2013, *Sampling procedures for inspection by variables -- Part 1: Specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection for a single quality characteristic and a single AQL*

ISO 3951-2:2013, *Sampling procedures for inspection by variables -- Part 2: General specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection of independent quality characteristics*

ISO 4649:~~1985~~2017, *Rubber, vulcanized or thermoplastic – Determination of abrasion resistance using a rotating cylindrical drum device*

~~[1)] To be published.~~

ISO 4662:~~1986~~2017, *Rubber, vulcanized or thermoplastic – Determination of rebound resilience ~~of vulcanizates~~*

ISO 6502-2:2018, *Rubber – Measurement of vulcanization characteristics using curemeters – Part 2: Oscillating disc curemeter*

ISO 9001:2015, *Quality management systems – Requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-466 apply as well as the following.

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
rigid spacer
spacer allowing no relative movement between the subconductors at the spacer location

3.2
flexible spacer
spacer allowing relative movements between the subconductors at the spacer location

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3.3
spacer system
complex of spacers and the relevant in-span distribution

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3.4
high temperature conductors
HTC
conductors which are designed to have a maximum continuous operating temperature over 95 °C

Note 1 to entry: HTCa: conductors using annealed wires; HTCna: conductors using non-annealed wires.

3.5
maximum continuous operating temperature
conductor temperature specified by the manufacturer and measured at the outer wire layers

4 General requirements

4.1 Design

The spacer shall be designed as to:

– maintain subconductor spacing (at spacer locations), within any prescribed limits, under all conditions of service excluding short-circuit currents;

– prevent, in subspans between spacers, physical contact between subconductors, except during the passage of short circuit currents when the possibility of contact is accepted provided that the specified spacing is restored immediately following fault clearance;

– withstand mechanical loads imposed on the spacer during installation, maintenance and service (including short circuit conditions) without any component failure or unacceptable permanent deformation;

– avoid damage to the subconductor under specified service conditions;
– be free from unacceptable levels of corona and radio interference under specified service conditions;
– be suitable for safe and easy installation. For the bolted and latching clamp the design shall retain all parts when opened for attachment to the conductor;
– ensure that individual components will not become loose in service;
– be capable of being removed and re-installed on the subconductors without damage to the spacer or subconductors;
– maintain its function over the entire service temperature range;
– avoid audible noise.

~~NOTE~~ Other desirable characteristics, which are not essential to the basic functions of the spacer but which may be advantageous to the purchaser, include:

- verification of proper installation from the ground,
- ease of installation and removal from energized lines

Detailed information on design, best practice and experience of spacers and spacer dampers is given in [6][2].

4.2 Materials

4.2.1 General

Spacers shall be made of any materials suitable for their purpose. Unless additional requirements are stated, the material shall conform to the requirements of IEC 61284.

4.2.2 Non-metallic materials

In addition to the requirements of IEC 61284, the conductivity of the various non-metallic components shall be such that when properly installed

– potential differences between metallic components do not cause damage due to discharge;
~~– any current flow between subconductors does not degrade spacer materials .~~
– line current including short circuit current and any current flow through the spacer do not degrade spacer components.

4.3 Mass, dimensions and tolerances

Spacer mass and significant dimensions, including appropriate tolerances, shall be shown on contract drawings.

~~NOTE~~ Tolerances applied to the mass and to the dimensions should ensure that the spacers meet their specified mechanical and electrical requirements.

4.4 Protection against corrosion

In addition to the applicable requirements of IEC 61284, stranded steel wires, if used, shall be protected against corrosion in accordance with IEC 60888.

4.5 Manufacturing appearance and finish

The spacers shall be free of defects and irregularities; all outside surfaces shall be smooth and all edges and corners well-rounded.

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2 Numbers in square brackets refer to the Bibliography.

4.6 Marking

The fitting marking requirements of IEC 61284 shall be applied to all clamp assemblies including those using breakaway bolts.

Correct position of the top of the spacer (for example arrows pointing upward), if necessary, shall also be provided.

4.7 Installation instructions

The supplier shall provide a clear and complete description of the installation procedure and, if required, the in-span location of the spacers.

The supplier shall make available any special installation tool that is required.

4.8 Specimen

All tests described in this document are based on bolted clamps and clamps with helical fixation. If other types of clamps are tested, the clamps should be installed according the suppliers installation instruction.

5 Quality assurance

A quality assurance programme taking into account the requirements of this document can be used by agreement between the purchaser and the supplier to verify the quality of the spacers during the manufacturing process.

Detailed information on the use of quality assurance is given in ~~the following ISO standards ISO 9000-1 [1]; ISO 9001 [2]; ISO 9002 [3]; ISO 9003 [4] and ISO 9004-1 [5]*~~ a system as per ISO 9001 or similar.

It is recommended that test and measuring equipment used to verify compliance to this document is routinely maintained and calibrated in accordance with a relevant quality standard.

6 Classification of tests

6.1 Type tests

6.1.1 General

Type tests are intended to establish design characteristics. They are normally made once and repeated only when the design or the material of the spacer is changed. The results of type tests are recorded as evidence of compliance with design requirements.

6.1.2 Application

Spacers shall be subjected to type tests as per Table 1. Each type test shall be performed on three samples which are identical, in all essential respects, with the spacers to be supplied under contract to the purchaser. All units shall pass the tests.

The spacers used for tests during which no damage occurs to the units or their components may be used in subsequent tests.

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* ~~Figures in square brackets refer to the bibliography.~~

NOTE The unit subjected to type tests can be either a complete spacer or a component of the spacer as appropriate to the test.

6.2 Sample tests

6.2.1 General

Sample tests are required to verify that the spacers meet the performance specifications of the type test samples. In addition, they are intended to verify the quality of materials and workmanship.

6.2.2 Application

Spacers shall be subjected to sample tests as per Table 1. The samples to be tested shall be selected at random from the lot offered for acceptance. The purchaser has the right to make the selection.

The spacers used for tests during which no damage occurs to the units or their components may be used in subsequent tests.

~~NOTE~~ The unit subjected to sample tests can be either a complete spacer or a component of the spacer as appropriate to the test.

6.2.3 Sampling and acceptance criteria

The sampling plan procedures according to ISO 2859-1 and ISO 2859-2 (inspection by attributes) and ISO 3951 (inspection by variables) and the detailed procedures (inspection level, AQL, single, double or multiple sampling, etc.) shall be agreed between purchaser and supplier for each different attribute or variable.

~~NOTE~~ Sampling inspection by variables is an acceptance sampling procedure to be used in place of inspection by attributes when it is more appropriate to measure on some continuous scale the characteristic(s) under consideration. In the case of failure load tests and similar expensive tests, better discrimination between acceptable quality and objective quality is available with acceptance sampling by variables than by attributes for the same sample size.

The purpose of the sampling process may also be important in the choice between a variables or attributes plan. For example, a customer may choose to use an attributes acceptance sampling plan to assure that parts in a shipment lot are within a required dimensional tolerance; the manufacturer may make measurements under a variables sampling plan of the same dimensions because of concern with gradual trends or changes which may affect the ability to provide shipment lots which meet the AQL.

6.3 Routine tests

6.3.1 General

Routine tests are intended to prove conformance of spacers to specific requirements and are made on every spacer. The tests shall not damage the spacers.

6.3.2 Application and acceptance criteria

Whole lots of spacers may be subjected to routine tests. Any spacer which does not conform to the requirements shall be discarded.

6.4 Table of tests to be applied

Table 1 indicates the tests which shall be performed. These are marked with an "X" in the table.

However, the purchaser may specify additional tests which are included in the table and marked with an "O".

Units or components damaged during the tests shall be excluded from the delivery to the customer.

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