SLOVENSKI STANDARD
oSIST prEN IEC 61854:2019

01-april-2019

Nadzemni vodi - Zahteve in preskusi za distančnike

Overhead lines - Requirements and tests for spacers

Freileitungen - Anforderungen und Prüfungen für Feldabstandhalter

Lignes aériennes - Exigences et essais applicables aux entretoises

Ta slovenski standard je istoveten z: **prEN IEC 61854:2019**

ICS:

29.240.20	Daljnovodi	Power transmission and distribution lines

oSIST prEN IEC 61854:2019 **en,fr,de**

11/259/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: **IEC 61854 ED2**	
DATE OF CIRCULATION: **2019-02-01**	CLOSING DATE FOR VOTING: **2019-04-26**
SUPERSEDES DOCUMENTS: **11/254/CD,11/256A/CC**	

IEC TC 11 : OVERHEAD LINES	
SECRETARIAT: South Africa	SECRETARY: Mr John Dlamini
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 7,TC 122	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☒ SAFETY	
☒ SUBMITTED FOR CENELEC PARALLEL VOTING	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

Attention IEC-CENELEC parallel voting

The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting.

The CENELEC members are invited to vote through the CENELEC online voting system.

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

Overhead lines - Requirements and tests for spacers

PROPOSED STABILITY DATE: 2025

NOTE FROM TC/SC OFFICERS:

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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OVERHEAD LINES – REQUIREMENTS AND TESTS FOR SPACERS

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

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International Standard IEC 61854 has been prepared by Maintenance Team MT1: Maintenance of TC 11 documents, of 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 the standard in order to make them more clear and homogeneous;

j) Update the normative references

k) Introduce an additional test device for the simulated short circuit current test.

Annexes A forms an integral part of this standard.

Annex B, C, D and E are for information only.

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

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

FDIS	Report on voting
XX/XXX/FDIS	XX/XXX/RVD

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.

OVERHEAD LINES – REQUIREMENTS AND TESTS FOR SPACERS

1 Scope

This International Standard 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 standard 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 standard may not be applicable.

In 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.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication of this standard, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

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

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

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

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

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

ISO 188:2011, *Rubber, vulcanized – Accelerated ageing or heat-resistance tests*

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

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

ISO 1183-1:2012*, Plastic – Methods for determining the density and relative density of non-cellular plastic*

ISO 10684:2008, *Fasteners – Hot dip galvanized coatings*

ISO 1431-1:2012, *Rubber, vulcanized or thermoplastic – Resistance to ozone cracking – Part 1: static and dynamic strain test*

ISO 1461:2009, *Hot dip galvanized coatings on fabricated iron and steel articles-Specifications and test methods*

ISO 1817:2015, *Rubber, vulcanized – Determination of the effect of liquids*

ISO 2781:2018, *Rubber, vulcanized – Determination of density*

ISO 2859-1:1999, *Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptable quality limit (AQL) for lot-by-lot inspection + Ammendment 1 (2011)*

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

ISO 3417:2008, *Rubber – Measurement of vulcanization characteristics with the oscillating disc curemeter*

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

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

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

ISO 9000:2015, *Quality management systems – Fundamentasl and vocabularies*

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

ISO 9004:2018, *Managing for the sustained success of an organization – A quality management approach*

3 Definitions

For the purpose of this International Standard the definitions of the International Electrotechnical Vocabulary (IEV) apply, in particular IEC 60050(466). Those which differ or do not appear in the IEV are given below.

1.1 3.1 rigid spacer

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

1.2 3.2 flexible spacer

spacer allowing relative movements between the subconductors at the spacer location

1.3 3.3 spacer system

complex of spacers and the relevant in-span distribution

1.4 3.4 high temperature conductors (HTC)

1.5 conductors which are designed to have a maximum continuous operating temperature over 95°C.

1.6 HTCa: conductors using annealed wires,

1.7 HTCna: conductors using non-annealed wires

1.8 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]

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;

– 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.

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 standard 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 standard 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 a system as per ISO 9001 or similar.

It is recommended that test and measuring equipment used to verify compliance to this standard 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.

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.

375

Table 1 – Tests on spacers

Clause	Test	Spacer damper			Flexible spacer			Rigid spacer		
		Type test	Sample test	Routine test	Type test	Sample test	Routine test	Type test	Sample test	Routine test
7.1	**Visual examination**	X	X	O	X	X	O	X	X	O
7.2	**Verification of dimensions, material and mass**	X	X	O	X	X	O	X	X	O
7.3	**Corrosion protection tests**	X [1)]	X [1)]		X [1)]	X [1)]		X [1)]	X [1)]	
7.4	**Non-destructive tests**	O	O	O	O	O	O	O	O	O
7.5	**Mechanical tests**									
7.5.1	– clamp slip tests	X	O		X	O		X	O	
7.5.2	– tests on bolt set	X	X		X	X		X	X	
7.5.3	– simulated short circuit current test	X	O		X	O		X	O	
7.5.4	– characterisation of the elastic and damping properties	X	O		O	O				
7.5.5	– flexibility tests	X	O		X	O				
7.5.6	– fatigue tests	X			O					
7.6	**Tests to characterise elastomers**	X	O		X [1)]	O [1)]				
7.7	**Electrical tests**									
7.7.1	– corona and radio interference voltage (RIV) tests	X			X			X		
7.7.2	– electrical resistance test	X	O		X [1)]	O [1)]		O [1)]		
7.8	**Verification of vibration behaviour of the bundle/spacer system**									
D.2	– aeolian vibration	O			O [2)]					
D.3	– subspan oscillation	O			O					

[1)] If applicable.

[2)] When used in conjunction with vibration dampers.

NOTE – The supplier should state in the tender quality plan, or other tender documentation, which testing is already complete (i.e: which type test) and which tests (sample or routine) are included in the tender, subject to the approval or change required by the purchaser.

376