SLOVENSKI STANDARD
oSIST prEN IEC 60851-3:2023

01-marec-2023

Navijalne žice - Preskusne metode - 3. del: Mehanske lastnosti

Winding wires - Test methods - Part 3: Mechanical properties

Wickeldrähte - Prüfverfahren - Teil 3: Mechanische Eigenschaften

Fils de bobinage - Méthodes d'essai - Partie 3: Propriétés mécaniques

Ta slovenski standard je istoveten z: **prEN IEC 60851-3:2023**

ICS:

29.060.10 Žice Wires

oSIST prEN IEC 60851-3:2023 **en**

55/1938/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: **IEC 60851-3 ED4**	
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SUPERSEDES DOCUMENTS: **55/1923/CD, 55/1932A/CC**	

IEC TC 55 : WINDING WIRES	
SECRETARIAT: United States of America	SECRETARY: Mr Mike Leibowitz
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 2,TC 14	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	
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- any relevant patent rights of which they are aware and to provide supporting documentation,
- any relevant “in some countries” clauses to be included should this proposal proceed. Recipients are reminded that the enquiry stage is the final stage for submitting "in some countries" clauses. See AC/22/2007.

TITLE:

Winding wires - Test methods - Part 3: Mechanical properties

PROPOSED STABILITY DATE: 2025

NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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WINDING WIRES – TEST METHODS

Part 3: Mechanical properties

FOREWORD

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IEC 60851-3 has been prepared by IEC technical committee 55: Winding wires. It is an International Standard.

This fourth edition cancels and replaces the third edition published 2009-01-28, Amendment 1:2013 and Amendment 2:2019. This edition constitutes a technical revision.

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

a) Clarification of the distance measurement for determining loss of adhesion in 5.5.2, 5.5.3 for fibre-covered wires and 5.5.4 for tape-covered wires

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

Draft	Report on voting
XX/XX/FDIS	XX/XX/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 https://www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at https://www.iec.ch/standardsdev/publications.

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
- amended.

INTRODUCTION

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent. IEC takes no position concerning the evidence, validity, and scope of this patent right.

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This part of IEC 60851 forms an element of a series of standards, which deals with insulated wires used for windings in electrical equipment. The series has three groups describing

a) winding wires – Test methods (IEC 60851);

b) specifications for particular types of winding wires (IEC 60317);

c) packaging of winding wires (IEC 60264).

WINDING WIRES – TEST METHODS

Part 3: Mechanical properties

1 Scope

This part of IEC 60851 specifies the following methods of test for winding wires:

– Test 6: Elongation;
– Test 7: Springiness;
– Test 8: Flexibility and adherence;
– Test 11: Resistance to abrasion;
– Test 18: Heat bonding.

For definitions, general notes on methods of test and the complete series of methods of test for winding wires, IEC 60851-1 applies.

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 60851-1, *Winding wires – Test methods – Part 1: General*

IEC 60851-2:2009 *Winding wires – Test methods – Part 2: Determination of dimensions*

ISO 178:2001, *Plastics – Determination of flexural properties*

Amendment 1:2004

3 Test 6: Elongation

3.1 Elongation at fracture

Elongation is the increase in length expressed as a percentage of the original length.

A straight piece of wire shall be elongated to the point of fracture of the conductor at a rate of (5 ± 1) mm/s with an elongation tester or with tensile testing equipment with a free measuring length of between 200 mm and 250 mm. The linear increase at fracture shall be calculated as a percentage of the free measuring length.

Three specimens shall be tested. The three single values shall be reported. The mean value represents elongation at fracture.

3.2 Tensile strength

Tensile strength is the ratio of the force at fracture to initial cross-section.

A straight piece of wire shall be elongated to the point of fracture of the conductor at a rate of (5 ± 1) mm/s with tensile testing equipment with a free measuring length of between 200 mm and 250 mm and which records the force at fracture.

Three specimens shall be tested. The initial cross-section and the three single values of the force at fracture shall be reported. The mean value of the ratio of the force at fracture and the initial cross-section represents the tensile strength.

4 Test 7: Springiness

Springiness is the recoil measured in degrees after the wire is wound in the form of a helical coil or bent through an angle.

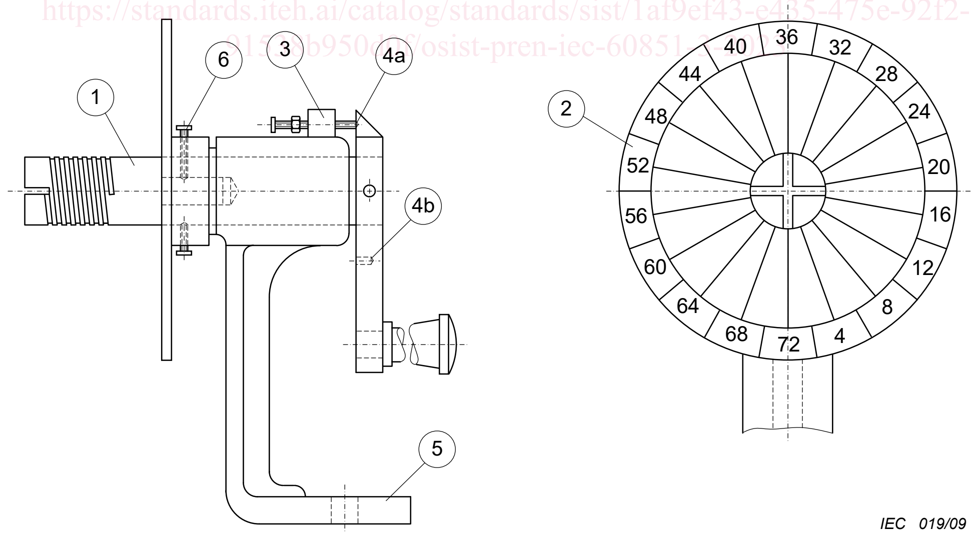
4.1 Round wire with a nominal conductor diameter from 0,080 mm up to and including 1,600 mm

4.1.1 Principle

A straight piece of wire is wound five times around a mandrel with a diameter and under a tension applied to the wire as specified in the relevant standard. The reading of the angle by which the end of the five turns recoils is the measure of springiness.

4.1.2 Equipment

Figure 1 shows an example of the test equipment with details of the mandrel given in Figure 2 and Table 1. Figure 2 indicates a helical groove, which may be used to facilitate winding. The provision of this groove, however, is not mandatory. The dial is marked with 72 equally spaced divisions so that with five turns of the wire the reading corresponds to the number of degrees that each turn springs back.



Key

1 mandrel

2 dial

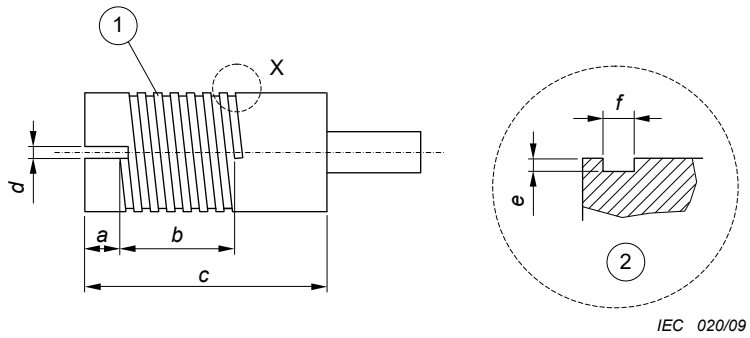
3 locking device

4 locking device

5 base-plate

6 mandrel-fixing screw

Figure 1 – Test equipment to determine springiness



Key

1 7 threads

2 part X enlarged

Figure 2 – Construction and details of the mandrel (see Table 1)

Table 1 – Mandrels for springiness

Mandrel diameter [a] mm	Dimensions [b] mm					
	a	b	c	d	e	f
5	6,0	7,5	32	0,30	0,05	0,13
7	6,0	9,0	34	0,40	0,07	0,18
10	6,0	9,0	34	0,60	0,10	0,25
12,5	6,0	9,0	40	0,80	0,14	0,35
19	10,0	11,0	45	1,20	0,20	0,50
25	12,5	12,5	45	2,00	0,28	0,70
37,5	12,5	14,5	47	2,40	0,40	1,00
50	12,5	17,5	50	3,00	0,80	2,00

[a] At the bottom of the groove, if provided.

[b] See Figure 2.

4.1.3 Procedure

The specified mandrel shall be mounted and locked in position with its axis horizontal and with the slot or hole for fastening the wire corresponding with the zero of the dial. The mandrel shall be dusted with powdered talc (French chalk) to prevent the wire clinging to the mandrel.

A tension shall be applied to a straight piece of wire of about 1 m in length by attaching the specified load to one end of the wire. The handle to rotate the mandrel shall be unlatched. The other end of the wire shall be inserted into the slot or hole so that sufficient wire projects on the other side of the mandrel and the wire is in firm contact with the mandrel. The weight shall be slowly lowered with the wire suspended vertically below the mandrel and with the dial zero and the slot or hole pointing downwards.

With the free end of the wire being held securely, the mandrel shall be rotated for five complete turns counterclockwise (looking at the face of the dial) and further until the zero on the dial is vertically upwards. The handle shall then be latched in this position. The load shall be removed while the wire is held in position, and the wire shall then be cut about 25 mm beyond the end of the fifth turn. This end of the wire shall be bent into a vertical position in line with the dial zero to act as a pointer.

A pencil or similar tool shall be placed to the left of this end of the wire to prevent any sudden springback. The coil shall then be allowed to unwind slowly and without jerking.

NOTE If the wire springs back suddenly, erroneous results may be obtained.

The mandrel and the dial shall then be unlatched and rotated clockwise to bring the pointer back into a vertical position. The springback angle is equal to the reading on the dial in line with the pointer. With very springy wires, the pointer may recoil more than one complete revolution. If this is the case, 72 shall be added to the dial reading for each complete revolution of recoil.

Three specimens shall be tested. The three single values shall be reported. The mean value represents springiness.

4.2 Round wire with a nominal conductor diameter over 1,600 mm and rectangular wire

4.2.1 Principle

A straight piece of wire shall be bent through an angle of 30°. After removing the force, the reading of the angle by which the wire springs back is the measure of springiness.

4.2.2 Equipment

Figure 3 shows an example of the test equipment basically consisting of two jaws, one of which is fixed (2) and one is movable (1), and a sector graduated in degrees (5) with the 0° to 10° sector of the scale graduated in 0,5° increments. The graduated sector is an arc placed in a plane at 90° to the clamp faces. Its centre is located at the outer edge of the fixed jaw (3). The lever arm with its fulcrum placed at the centre of the arc can move over the graduated sector in the vertical plane.

The lever arm shall have a pointer or marker to provide a proper reading of the springback angle. On the lever arm with approximately 305 mm length scaled off in millimetres with the origin at the centre of the arc, is a slider (4) with a knife edge.