

**NORME
INTERNATIONALE
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STANDARD**

**CEI
IEC
851-1**

Deuxième édition
Second edition
1996-10

Fils de bobinage – Méthodes d’essai –

**Partie 1:
Généralités**

Winding wires – Test methods –

**Part 1:
General**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

WINDING WIRES – TEST METHODS –**Part 1: General**

FOREWORD

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International Standard IEC 851-1 has been prepared by IEC technical committee 55: Winding wires.

This second edition cancels and replaces the first edition published in 1985 and constitutes a technical revision.

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

FDIS	Report on voting
55/470A/FDIS	55/511/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.

Annex A is for information only.

INTRODUCTION

This part of IEC 851 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) methods of test (IEC 851);
- b) specifications (IEC 317);
- c) packaging (IEC 264).

WINDING WIRES – TEST METHODS –

Part 1: General

1 Scope

This part of IEC 851 specifies the general notes on methods of test for winding wires. It also gives the definitions for terms used in IEC 851. A survey of the contents of part 2 to part 6 of IEC 851 is given in annex A.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 851. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 851 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of the IEC and ISO maintain registers of currently valid International Standards.

IEC 317, *Specifications for particular types of winding wires*

IEC 851-2: 1996, *Winding wires – Test methods – Part 2: Determination of dimensions*

IEC 851-3: 1996, *Winding wires – Test methods – Part 3: Mechanical properties*

IEC 851-4: 1996, *Winding wires – Test methods – Part 4: Chemical properties*

IEC 851-5: 1996, *Winding wires – Test methods – Part 5: Electrical properties*

IEC 851-6: 1996, *Winding wires – Test methods – Part 6: Thermal properties*

3 Definitions and general notes on methods of test

3.1 Definitions

For the purpose of this International Standard the following definitions apply:

3.1.1 **bonding layer:** A material which is deposited on an enamelled wire and which has the specific function of bonding wires together.

3.1.2 **bunched wire:** A winding wire consisting of a number of small diameter insulated wires laid-up together without predetermined geometrical position and with or without additional covering.

3.1.3 **class:** The thermal performance of a wire expressed by the temperature index and the heat shock temperature.

3.1.4 **coating:** A material which is deposited on a conductor or wire by suitable means and then dried and/or cured.

3.1.5 **conductor:** The bare metal after removal of the insulation.

3.1.6 **covering:** A material which is wound, wrapped or braided around a bare or insulated conductor.

3.1.7 **crack:** An opening in the insulation which exposes the conductor to view at the stated magnification.

3.1.8 **dual coating:** An insulation composed of two different materials, an underlying and a superimposed coating.

3.1.9 **enamelled wire:** A wire coated with an insulation of cured resin.

3.1.10 **grade:** The range of increase in dimension of the wire due to insulation.

3.1.11 **insulation:** A coating or covering of the conductor with the specific function of withstanding voltage.

3.1.12 **nominal conductor dimension:** The designation of the conductor size in accordance with IEC 317.

3.1.13 **sole coating:** An insulation composed of one material.

3.1.14 **winding wire:** A wire used for winding a coil to provide a magnetic field.

3.1.15 **wire:** A conductor coated or covered with an insulation.

3.2 *General notes on methods of test*

Unless otherwise specified, all tests shall be carried out at a temperature from 15 °C to 35 °C and a relative humidity of 45 % to 75 %. Before measurements are made, the specimens shall be preconditioned under these atmospheric conditions for a time sufficient to allow the wire to reach stability.

The wire to be tested shall be removed from the packaging in such a way that the wire will not be subjected to tension or to unnecessary bends. Before each test, sufficient wire shall be discarded to ensure that any damaged wire is not included in the test specimens.

Normally, all mandatory requirements for a method of test are given in the description, and diagrams are intended only to illustrate one possible arrangement for conducting the test.

In case of inconsistencies between the specification sheet, IEC 317, and this standard, the specification sheet shall prevail.

When the test is restricted only to certain types of winding wires, this is specified with the test.

Those tests of IEC 851-2, IEC 851-3, IEC 851-4, IEC 851-5 and IEC 851-6 which in annex A are marked with an asterisk are periodic conformance tests. These tests are carried out upon request by the user, once in an agreed period of time.

The test numbers used in IEC 851-2, IEC 851-3, IEC 851-4, IEC 851-5 and IEC 851-6 correspond with the clause numbers of IEC 317.

Annex A

(informative)

Contents of IEC 851-2 to IEC 851-6 with indication of tests

NOTE – This contents list is not exhaustive.

Part 2: Determination of dimensions

1 Scope

2 Normative references

3 Test 4: Dimensions

3.1 *Equipment*

3.1.1 Round and rectangular wire

3.1.2 Bunched wire

3.2 *Procedure*

3.2.1 Conductor dimension

3.2.1.1 Round wire

3.2.1.2 Rectangular wire

3.2.2 Out-of-roundness of the conductor

3.2.3 Rounding of corners of rectangular wire

3.2.4 Increase in dimension due to the insulation

3.2.4.1 Round wire

3.2.4.2 Rectangular wire

3.2.5 Overall dimension

3.2.5.1 Round wire

3.2.5.2 Rectangular wire

3.2.5.3 Bunched wire

3.2.6 Increase in diameter due to the bonding layer of enamelled round wire

Part 3: Mechanical properties

1 Scope

2 Normative references

3 Test 6: Elongation

3.1 *Elongation at fracture*

3.2 *Tensile strength*

4 Test 7: Springiness

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

5 Test 8: Flexibility and adherence

- 5.1 Mandrel winding test
 - 5.1.1 Round wire
 - 5.1.2 Rectangular wire
 - 5.1.3 Covered bunched wire
- 5.2 Stretching test (applicable to enamelled round wire with a nominal conductor diameter over 1,600 mm)
- 5.3 Jerk test (applicable to enamelled round wire with a nominal conductor diameter of up to and including 1,000 mm)
- 5.4 Peel test (applicable to enamelled round wire with a nominal conductor diameter of over 1,000 mm)
- 5.5 Adherence test
 - 5.5.1 Enamelled rectangular wire
 - 5.5.2 Impregnated fibre covered round and rectangular wire
 - 5.5.3 Fibre covered enamelled round and rectangular wire
 - 5.5.4 Tape wrapped round and rectangular wire

6 Test 11*: Resistance to abrasion (applicable to enamelled round wire)

7 Test 18*: Heat or solvent bonding (applicable to enamelled round wire with a nominal conductor diameter over 0,050 mm up to and including 2,000 mm)

- 7.1 Vertical bond retention of a helical coil
- 7.2 Bond strength of a twisted coil

Annex A – Bond strength of heat bonding wires

Part 4: Chemical properties

1 Scope

2 Normative references

3 Test 12*: Resistance to solvents (applicable to enamelled round wire with a nominal conductor diameter of over 0,250 mm and to enamelled rectangular wire)

- 4 **Test 16*: Resistance to refrigerants** (applicable to enamelled round wire)

 - 5 **Test 17: Solderability** (applicable to enamelled round wire and bunched wire)

 - 6 **Test 20*: Resistance to transformer oil**
 - 6.1 Equipment
 - 6.2 Enamelled round wire
 - 6.3 Enamelled rectangular wire
-

Part 5: Electrical properties

- 1 **Scope**

 - 2 **Normative references**

 - 3 **Test 5: Electrical resistance**

 - 4 **Test 13: Breakdown voltage**
 - 4.1 Principle
 - 4.2 Equipment
 - 4.3 Enamelled round wire with a nominal conductor diameter up to and including 0,100 mm
 - 4.4 Enamelled round wire with a nominal conductor diameter over 0,100 mm and up to and including 2,500 mm
 - 4.5 Round wire with a nominal conductor diameter over 2,500 mm
 - 4.6 Rectangular wire

 - 5 **Test 14: Continuity of insulation** (applicable to enamelled round and tape wrapped round wire)

 - 6 **Test 19: Dielectric dissipation factor** (applicable to enamelled round wire and bunched wire)
-

Part 6: Thermal properties

- 1 **Scope**

- 2 **Normative references**

- 3 **Test 9: Heat shock** (applicable to enamelled wire and tape wrapped wire)
 - 3.1 Specimen
 - 3.1.1 Round wire
 - 3.1.2 Rectangular wire

3.2 Procedure

3.3 Result

4 Test 10*: Cut-through (applicable to enamelled wire with a nominal conductor diameter over 0,100 mm up to and including 1,600 mm and tape wrapped round wire)

5 Test 15*: Temperature index

5.1 Enamelled wire

5.2 Tape wrapped wire

6 Test 21*: Loss of mass (applicable to enamelled round wire)

Annex A – **Test 22: High-temperature failure test** (applicable to enamelled round wire)
