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INTERNATIONAL STANDARD

colour inside

Winding wires – Test methods – Part 1: General

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a) revision to Clause 2 to update the list of normative references;

b) revision to 3.2 atmospheric conditions for testing;

c) addition to 3.2 with remarks concerning frequency and management of tests~~;~~.

~~d) revision to Annex A to update the contents list of IEC 60851 series of tests.~~

The language used for the development of this International Standard is English.

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~~Annex A is for information only.~~

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INTRODUCTION

This Part of IEC 60851 forms an element of a series of standards which deals with insulated wires used for windings in electrical equipment. It is composed of the following series:

1) *Winding wires – Test methods* (IEC 60851 series);
2) *Specifications for particular types of winding wires* (IEC 60317 series);
3) *Packaging of winding wires* (IEC 60264 series).

WINDING WIRES – TEST METHODS –

Part 1: General

1 Scope

This part of IEC 60851 specifies the general notes on methods of test for winding wires. It also gives the definitions for terms used in IEC 60851 (all parts). ~~A survey of the contents of IEC 60851-2 to IEC 60851-6 is given in Annex A.~~

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.

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IEC 60851-2:2009/AMD1:2015
IEC 60851-2:2009/AMD2:2019

IEC 60851-3:2009[2], *Winding wires – Test methods – Part 3: Mechanical properties*
IEC 60851-3:2009/AMD1:2013
IEC 60851-3:2009/AMD2:2019

IEC 60851-4:2016, *Winding wires – Test methods – Part 4: Chemical properties*

IEC 60851-5:2008[3], *Winding wires – Test methods – Part 5: Electrical properties*
IEC 60851-5:2008/AMD1:2011
IEC 60851-5:2008/AMD2:2019

IEC 60851-6:2012, *Winding wires – Test methods – Part 6: Thermal properties*

3 Terms, definitions and general notes on methods of test

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

1 A consolidated version of IEC 60851-2:2009 and its amendments exists.

2 A consolidated version of IEC 60851-3:2009 and its amendments exists.

3 A consolidated version of IEC 60851-5:2008 and its amendments exists.

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- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

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

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

3.1.3
class
thermal performance of a wire expressed by the temperature index and the heat shock temperature

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

3.1.5
conductor
bare metal after removal of the insulation

3.1.6
covering
material which is wound, wrapped or braided around a bare or insulated conductor

3.1.7
crack
opening in the insulation which exposes the conductor to view at the stated magnification

3.1.8
cure
process of converting a reactive compound into a stable, usable condition by polymerization (polycondensation and polyaddition) and/or crosslinking

[SOURCE: IEC 60050-212:2010, 212-13-07, modified – At the beginning of the definition, "convert a reactive compound" has been replaced by "process of converting a reactive compound" to define the term as a process.]

3.1.9
dual coating
insulation composed of two different materials, an underlying and a superimposed coating

3.1.10
enamelled wire
wire coated with an insulation of cured resin

3.1.11
grade
range of increase in dimension of the wire due to insulation

3.1.12
insulation
coating or covering of the conductor with the specific function of withstanding voltage

3.1.13
nominal conductor dimension
designation of the conductor size in accordance with the specification sheet in the IEC 60317 series

3.1.14
sole coating
insulation composed of one material

3.1.15
winding wire
wire used for winding a coil to provide a magnetic field

3.1.16
wire
conductor coated or covered with an insulation

3.1.17
normal vision
20/20 vision, with corrective lenses, if necessary

3.1.18
zero-defect wire
winding wire that exhibits no electrical discontinuities when tested under specific conditions

3.2 General notes on methods of test

Unless otherwise specified, all tests shall be carried out at a temperature from 15 °C to 40 °C and a relative humidity of 25 % 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 IEC 60317 specification sheet and this document, 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 60851-2, IEC 60851-3, IEC 60851-4, IEC 60851-5 and IEC 60851-6 ~~which in Annex A are marked with an asterisk~~ are periodic conformance tests. These tests are carried out at a frequency agreed upon request of the end user.

The test numbers used in IEC 60851-2, IEC 60851-3, IEC 60851-4, IEC 60851-5 and IEC 60851-6 correspond with the clause numbers in the IEC 60317 series.

IEC winding wire standards do not specify how to deal with the management of tests (routine versus non-routine/periodic). These are certification issues not governed by the standards. In some countries, there are local rules that apply, but in general, decisions are taken by agreement between customer and supplier.

The scope of IEC standards encompasses only the product requirements and does not extend to the management of certification matters or supplier-customer agreements.

Annex A
(informative)

Contents of IEC 60851-2 to IEC 60851-6 with indication of tests

A.1 General

The tables of contents as given in Clause A.2 to Clause A.6 are not exhaustive.

A.2 IEC 60851-2

The contents shown below refers to IEC 60851-2:2009, IEC 60851-2:2009/AMD1:2015 and IEC 60851-2:2009/AMD2:2019.

A.3 IEC 60851-3

The contents shown below refers to IEC 60851-3:2009, IEC 60851-3:2009/AMD1:2013 and IEC 60851-3:2009/AMD2:2019.

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 (for adhesive tape only)

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 and to enamelled rectangular wire)

7.1 Vertical bond retention of a helical coil

7.2 Bond strength of a twisted coil

7.3 Enamelled rectangular wire heat bonding

Annex A (informative) – Bond strength of heat bonding wires

Annex B (informative) – Friction test methods

A.4 IEC 60851-4

The contents shown below refers to IEC 60851-4:2016.

A.5 IEC 60851-5

The contents shown below refers to IEC 60851-5:2008, IEC 60851-5:2008/AMD1:2011 and IEC 60851-5:2009/AMD2:2019.

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

4.4 Enamelled round wire with a nominal conductor diameter over 0,100 mm and up to and including 2,500 mm, grade 1 to grade 3

4.5 Round wire with a nominal conductor diameter over 2,500 mm

4.6 Fibre wound round wire

4.7 Rectangular wire

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

5.1 General

5.2 Low-voltage continuity (nominal conductor diameter up to and including 0,050 mm, grade 1 to grade 3)

5.3 High-voltage continuity (nominal conductor diameter over 0,050 mm up to and including 1,600 mm, grade 1 to grade 3, and over 0,035 mm, up to and including 1,600 mm, grade 3 of FIW 3 to FIW 9)

5.4 Inline high-voltage continuity (wires in accordance with grade of FIW 3 to FIW 10 with nominal conductor diameter over 0,035 mm up to and including 1,600 mm)

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

6.1 Principle

6.2 Equipment

6.3 Specimen

6.4 Procedure

6.5 Result

7 Test 23: Pin hole test

Annex A (informative) Dissipation factor methods

A.6 IEC 60851-6

The contents shown below refers to IEC 60851-6:2012.

1 Scope

2 Normative references

3 Test 9: Heat shock (applicable to enamelled wire and tape wrapped wire)

3.1 General

3.2 Specimen

3.3 Procedure

3.4 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)

4.1 General

4.2 Equipment

4.3 Procedure

5 Test 15*: Temperature index

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

6.1 General

6.2 Specimen

6.3 Procedure

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

Bibliography

IEC 60264 (all parts), *Packaging of winding wires*

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