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Mazdoor Kisan Shakti Sangathan
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”
Jawaharlal Nehru
“Step Out From the Old to the New”

Indian Standard

WINDING WIRES — TEST METHODS

PART 1  GENERAL

( First Revision )

ICS 29.060.10
NATIONAL FOREWORD

This Indian Standard (Part 1) (First Revision) which is identical with IEC 60851-1 : 1996 ‘Winding wires — Test methods — Part 1: General’ issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of the Winding Wires Sectional Committee and approval of the Electrotechnical Division Council.

This standard was first published in 1993. This revision has been undertaken with a view to bring it in line with the latest version of IEC Standard.

The text of IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words ‘International Standard’ appear referring to this standard, they should be read as ‘Indian Standard’.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their respective places are listed below along with their degree of equivalence for the editions indicated:

<table>
<thead>
<tr>
<th>International Standard</th>
<th>Corresponding Indian Standard</th>
<th>Degree of Equivalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 60317 (Various Parts) Specifications for particular types of winding wires</td>
<td>IS 13730 (Various Parts) Specifications for particular types of winding wires</td>
<td>Technically Equivalent</td>
</tr>
</tbody>
</table>

1) Since revised in 2005.
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


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

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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)
INTRODUCTION

Replace the existing text with the following:

This standard is one of a series which deals with insulated wires used for windings in electrical equipment. The series comprises three groups:

1) winding wires – Test methods (IEC 60851);
2) specifications for particular types of winding wires (IEC 60317);
3) packaging of winding wires (IEC 60264).
Page 13
Annex A

Part 3: Mechanical properties

Replace, on page 15, “5.5.4 Tape wrapped round and rectangular wire” with the following text:

5.5.4  Tape wrapped round and rectangular wire (only for adhesive tape)

Replace the title of Test 18 with the following new title:

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

Add, after the reference to Annex A, the following:

Annex B  Friction test methods

Part 4: Chemical properties

Page 17

Replace the title and the text of Test 20 as follows:

6  Test 20*: Resistance to hydrolysis and to transformer oil (applicable to enamelled wire)

6.1  Round wire
6.2  Rectangular wire

Part 5: Electrical properties

In Test 13: Breakdown voltage, change the title of 4.6 and add 4.7 as follows:

4.6  Fibre wound round wire
4.7  Rectangular wire
Change the title of Test 19 as follows:

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

Add the following test:

7 Test 22: Pin hole test

Annex A Tangent delta
Amendment No. 1 to the above International Standard has been given at the end of this standard.

Only the English language text of the International Standard has been retained while adopting it as an Indian Standard, and as such the page numbers given here are not the same as in the IEC Publication.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2:1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

(Continued from second cover)
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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard alongwith amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of ‘BIS Catalogue’ and ‘Standards: Monthly Additions’.

This Indian Standard has been developed from Doc No.: ETD 33 (6066).

### Amendments Issued Since Publication

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<th>Date of Issue</th>
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