भारतीय मानक

Indian Standard

IS 13730 (Part 2) : 2024
IEC 60317-2 : 2019 +
AMD 1 : 2024 CSV

विशेष प्रकार की कुंडलण तारों की विशिष्टि

भाग 2 सोल्डरेबल पॉलीयुरेथेन एनामेल्ड गोल तांबे के तार, कक्षा 130, एक बंधन परत के साथ

(तीसरा पुनरीक्षण)

Specification for Particular Types of Winding Wires

Part 2 Solderable Polyurethane Enamelled Round Copper Wire, Class 130, with a Bonding Layer

(Third Revision)

ICS 29.060.10

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Winding Wire Sectional Committee, ETD 33

NATIONAL FOREWORD

This Indian Standard (Part 2) (Third Revision) which is identical to IEC 60317-2 : 2019 + AMD 1 : 2024 CSV 'Specifications for particular types of winding wires — Part 2: Solderable polyurethane enamelled round copper wire, class 130, with a bonding layer' issued by the International Electrotechnical Commission (IEC) is proposed to be adopted by the Bureau of Indian Standards on the recommendation of the Winding Wire Sectional Committee and approval of the Electrotechnical Division Council.

This standard was first published in 1996 and subsequently revised in 2012 and 2018. This revision has been undertaken to align it with the latest version of IEC 60317-2 : 2019 + AMD 1 : 2024 CSV.

This standard is published in various parts. Other parts in this series are:

Part 0	General requirements
Part 1	Polyvinyl acetal enamelled round copper wire, class 105
Part 3	Polyester enamelled round copper wire, class 155
Part 4	Solderable polyurethane enamelled round copper wire, class 130,
Part 5	Polyester enamelled round aluminium wire, Class 155
Part 6	Oleo-resinous enamelled round aluminium wire, class 105
Part 8	Polyesterimide enamelled round copper wire, class 180
Part 9	Polyester enamelled round aluminium wire, class 138
Part 12	Polyvinyl acetal enamelled round copper wire, class 120
Part 13	Polyester or polyesterimide overcoated with polyamide-imide enamelled round copper wire, class 200
Part 15	Polyesterimide enammelled round aluminium wire, class 180
Part 16	Polyester enamelled rectangular copper wire class 155
Part 17	Polyvinyl acetal enamelled rectangular copper wire, class 105
Part 20	Solderable polyurethane enamelled round copper wire, class 155
Part 21	Solderable polyurethane enamelled round copper wire overcoated with polyamide, class 155
Part 23	Solderable polyesterimide enamelled round copper wire, class 180
Part 25	Polyester or polyesterimide overcoated with polyamide-imide enamelled round aluminium wire, class 200
Part 26	Polyamide-imide enamelled round copper wire, class 200
Part 27	Paper tape covered rectangular copper wire
Part 28	Polyesterimide enamelled rectangular copper wire, class 180
Part 29	Polyester or polyesterimide overcoated with polyamide-imide enamelled rectangular copper wire, class 200
Part 31	Glass fibre wound, resin or varnish impregnated, bare or enamelled rectangular copper wire, temperature index 180
Part 32	Glass fibre wound, resin or varnish impregnated, bare or enamelled rectangular copper wire, temperature index 155
Part 33	Glass fibre wound, resin or varnish impregnated, bare or enamelled rectangular copper wire, temperature index 200
Part 34	Polyester enamelled round copper wire, class 130 L

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INTRODUCTION

This part of IEC 60317 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).

Indian Standard

SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES
PART 2 SOLDERABLE POLYURETHANE ENAMELLED ROUND COPPER WIRE, CLASS 130, WITH A BONDING LAYER

(Third Revision)

1 Scope

This part of IEC 60317 specifies the requirements of solderable enamelled round copper winding wire of class 130 with a dual coating. The underlying coating is based on polyurethane resin, which may be modified providing it retains the chemical identity of the original resin and meets all specified wire requirements. The superimposed coating is a bonding layer based on a thermoplastic resin.

NOTE A modified resin is a resin that has undergone a chemical change, or contains one or more additives to enhance certain performance or application characteristics.

The range of nominal conductor diameters covered by this standard is:

– Grade 1B: 0,020 mm up to and including 2,000 mm;

– Grade 2B: 0,020 mm up to and including 2,000 mm.

The nominal conductor diameters are specified in Clause 4 of IEC 60317-0-1:2013.

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 60317-0-1[1]:2013, *Specifications for particular types of winding wires – Part 0-1: General requirements – Enamelled round copper wire*
IEC 60317-0-1:2013/AMD1:2019

3 Terms, definitions, general notes and appearance

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60317-0-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

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

3.2 General notes

3.2.1 Methods of test

Subclause 3.2.1 of IEC 60317-0-1:2013 and IEC 60317-0-1:2013/AMD1:2019 applies.

[1] There exists a consolidated edition 4.1:2021 that includes IEC 60317-0-1:2013 and its Amendment 1:2019.

In case of inconsistencies between IEC 60317-0-1 and this document, IEC 60317-2 shall prevail.

3.2.2 Winding wire

Class 130 is a thermal class that requires a minimum temperature index of 130 and a heat shock temperature of at least 155 °C.

The temperature in degrees Celsius corresponding to the temperature index is not necessarily that at which it is recommended that the wire be operated and this will depend on many factors, including the type of equipment involved.

3.3 Appearance

Subclause 3.3 of IEC 60317-0-1:2013 applies.

4 Dimensions

Clause 4 of IEC 60317-0-1:2013 applies.

5 Electrical resistance

Clause 5 of IEC 60317-0-1:2013 and IEC 60317-0-1:2013/AMD1:2019 applies.

6 Elongation

Clause 6 of IEC 60317-0-1:2013 applies.

7 Springiness

Clause 7 of IEC 60317-0-1:2013 applies.

8 Flexibility and adherence

Clause 8 of IEC 60317-0-1:2013 applies. The constant K used for the calculation of the number of revolutions for the peel test shall be 150 mm.

9 Heat shock

Clause 9 of IEC 60317-0-1:2013 applies. The minimum heat shock temperature shall be 155 °C.

10 Cut-through

No failure shall occur within 2 min at 170 °C.

11 Resistance to abrasion (nominal conductor diameters from 0,250 mm up to and including 2,000 mm)

The wire shall meet the requirements given in Table 1.

For intermediate nominal conductor diameters, the value of the next largest nominal conductor diameter applies.

Table 1 – Resistance to abrasion

Nominal conductor diameter	Grade 1		Grade 2	
	Minimum average force to failure	Minimum force to failure of each measurement	Minimum average force to failure	Minimum force to failure of each measurement
mm	N	N	N	N
0,250	2,30	1,95	4,10	3,50
0,280	2,50	2,10	4,40	3,70
0,315	2,70	2,30	4,75	4,00
0,355	2,90	2,50	5,10	4,30
0,400	3,15	2,70	5,45	4,60
0,450	3,40	2,90	5,80	4,90
0,500	3,65	3,10	6,20	5,25
0,560	3,90	3,30	6,65	5,60
0,630	4,20	3,55	7,10	6,00
0,710	4,50	3,80	7,60	6,45
0,800	4,80	4,10	8,10	6,90
0,900	5,20	4,40	8,70	7,40
1,000	5,60	4,75	9,30	7,90
1,120	6,00	5,15	10,0	8,50
1,250	6,50	5,55	10,7	9,10
1,400	7,00	5,95	11,4	9,70
1,600	7,50	6,35	12,2	10,4
1,800	8,00	6,80	13,1	11,1
2,000	8,60	7,30	14,0	11,9

12 Resistance to solvents

Test inappropriate.

13 Breakdown voltage

Clause 13 of IEC 60317-0-1:2013 applies. The elevated temperature shall be 130 °C.

14 Continuity of insulation

Clause 14 of IEC 60317-0-1:2013 applies.

15 Temperature index

Clause 15 of IEC 60317-0-1:2013 applies. The minimum temperature index shall be 130.

16 Resistance to refrigerants

Test inappropriate.

17 Solderability

17.1 General

The temperature of the solder bath shall be (375 ± 5) °C. The maximum immersion time shall be 2 s.

The surface of the tinned wire shall be smooth and free from holes and enamel residues.

17.2 Nominal conductor diameter up to and including 0,100 mm

The maximum immersion time shall be 2 s.

17.3 Nominal conductor diameter over 0,100 mm

The maximum immersion shall be the following multiple of the nominal conductor diameter (in millimetres) with a minimum of 2 s.

Grade 1B	Grade 2B
12 s/mm	16 s/mm

18 Heat or solvent bonding

18.1 Heat bonding

18.1.1 Heat bonding strength of a helical coil

18.1.1.1 At room temperature

The specimens shall be prepared according to the test method, and the temperature of the oven for bonding shall be fixed as agreed between purchaser and supplier for the different types of bonding enamels. The suggested temperature for polyamide bonding enamel is (200 ± 2) °C and the suggested temperature for polyvinyl butyral bonding enamel is (170 ± 2) °C.

Results: when testing the specimens according to the test method, under the action of load specified in Table 2, no turns (other than possibly the first and the last) shall be separated.

For nominal conductor diameters up to and including 0,050 mm, the test method and requirements are based upon agreement between purchaser and supplier.

18.1.1.2 At elevated temperature

The specimens shall be prepared and shall be conditioned as described in the test method.

The elevated temperature shall be fixed as agreed between purchaser and supplier for the different types of bonding enamels. The suggested temperature for polyamide bonding enamel is (155 ± 2) °C and the suggested temperature for polyvinyl butyral bonding enamel is (90 ± 2) °C.

Results: when testing the specimens according to the test method, under the action of load specified in Table 2, no turns (other than possibly the first and the last) shall be separated.

Table 2 – Loads

Nominal conductor diameter mm		Room temperature	Elevated temperature
Over	Up to and including	Load N	Load N
—	0,050	*	*
0,050	0,071	0,05	0,04
0,071	0,100	0,08	0,06
0,100	0,160	0,12	0,08
0,160	0,200	0,25	0,19
0,200	0,315	0,35	0,25
0,315	0,400	0,70	0,55
0,400	0,500	1,10	0,80
0,500	0,630	1,60	1,20
0,630	0,710	2,20	1,70
0,710	0,800	2,80	2,10
0,800	0,900	3,40	2,60
0,900	1,000	4,20	3,20
1,000	1,120	5,00	3,80
1,120	1,250	5,80	4,40
1,250	1,400	6,50	4,90
1,400	1,600	8,50	6,40
1,600	1,800	10,00	7,90
1,800	2,000	12,00	7,90

* For nominal conductor diameters up to and including 0,050 mm, the test method and requirements are based upon agreement between purchaser and supplier.

18.1.2 Bond strength of a twisted coil

18.1.2.1 At room temperature

A test specimen of diameter 0,315 mm shall be prepared according to the test method. The time shall be 30 s and the current shall be fixed as agreed between purchaser and supplier. The suggested value for polyamide or polyvinyl butyral bonding enamel is (2,7 ± 0,1) A.

Results: when testing the specimens according to the test method, under the action of the deflection force of 100 N, the specimen shall not be broken.

18.1.2.2 At elevated temperature

Specimens of diameter 0,315 mm shall be prepared according to the test method using the parameters listed in 18.1.2.1 and shall then be conditioned as described in the test method.

The elevated temperature shall be fixed as agreed between purchaser and supplier. The suggested temperature for polyamide bonding enamel is (155 ± 2) °C and the suggested temperature for polyvinyl butyral bonding enamel is (90 ± 2) °C.

Results: when testing the specimens according to the test method, under the action of the deflection force of 10 N, the specimen shall not be broken.

18.2 Solvent bonding

Test required but not yet under consideration.

19 Dielectric dissipation factor

Test inappropriate.

20 Resistance to transformer oil

Test inappropriate.

21 Loss of mass

Test inappropriate.

23 Pin hole test

Clause 23 of IEC 60317-0-1:2013 applies.

30 Packaging

Clause 30 of IEC 60317-0-1:2013 applies.

Bibliography

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

IEC 60317 (all parts), *Specifications for particular types of winding wires*

IEC 60851 (all parts), *Winding wires – Test methods*

(*Continued from second cover*)

Part 35	Solderable polyurethane enamelled round copper wire, class 155, with a bonding layer
Part 36	Solderable polyesterimide enamelled round copper wire, class 180, with a bonding layer
Part 37	Polyesterimide enamelled round copper wire, class 180, with a bonding layer
Part 38	Polyester or polyesterimide overcoated with polyamide-imide, enamelled round copper wire, class 200, with a bonding layer
Part 39	Glass-fibre braided resin or varnish-impregnated, bare or enamelled rectangular copper wire, temperature index 180
Part 43	Aromatic polyimide tape wrapped round copper wire, class 240
Part 44	Aromatic polyimide tape wrapped rectangular copper wire, class 240
Part 45	Polyester enamelled round copper wire, class 130
Part 46	Aromatic polyimide enamelled round copper wire, class 240
Part 47	Aromatic polyimide enamelled rectangular copper wire, class 240
Part 48	Glass-fibre wound resin or varnish impregnated, bare or enamelled round copper wire, temperature index 155
Part 49	Glass-fibre wound, high temperature resin or varnish-impregnated, bare or enamelled round copper wire, class 180
Part 50	Glass-fibre wound, silicone resin or varnish impregnated, bare or enamelled round copper wire, class 200
Part 53	Aromatic polyimide (aramid) tape wrapped rectangular copper wire, temperature index 220

The text of the 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’ appears referring to this standard, they should be read as ‘Indian Standard’; and

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 International Standards for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted, are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 60317-0-1 : 2013 Specifications for particular types of winding wires — Part 0-1: General requirements — Enamelled round copper wire	IS 13730 (Part 0/Sec 1) : 2018/ IEC 60317-0-1 : 2013 Specifications for particular types of winding wires: Part 0 General requirements, Section 1 Enamelled round copper wire (*second revision*)	Identical

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, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with 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 website-www.bis.gov.in or www.standardsbis.in.

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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