IEC 60317-2

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REDLINE VERSION

INTERNATIONAL STANDARD

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Specifications for particular types of winding wires – Part 2: Solderable polyurethane enamelled round copper wire, class 130, with a bonding layer

IEC 60317-2:2019-08 RLV(en)

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CONTENTS

FOREWORD 3
INTRODUCTION 5
1 Scope 6
2 Normative references 6
3 Terms, definitions, general notes and appearance 6
3.1 Terms and definitions 6
3.2 General notes 6
3.2.1 Methods of test 6
3.2.2 Winding wire 7
3.3 Appearance 7
4 Dimensions 7
5 Electrical resistance 7
6 Elongation 7
7 Springiness 7
8 Flexibility and adherence 7
9 Heat shock 7
10 Cut-through 7
11 Resistance to abrasion (nominal conductor diameters from 0,250 mm up to and including 2,000 mm) 7
12 Resistance to solvents 8
13 Breakdown voltage 8
14 Continuity of insulation 8
15 Temperature index 8
16 Resistance to refrigerants 8
17 Solderability 8
17.1 General 8
~~Nominal conductor diameters up to and including 0,050 mm~~ .....
17.2 Nominal conductor diameter~~s over 0,050 mm~~ up to and including 0,100 mm 9
17.3 Nominal conductor diameter over 0,100 mm 9
18 Heat or solvent bonding 9
18.1 Heat bonding 9
18.1.1 Heat bonding strength of a helical coil 9
18.1.2 Bond strength of a twisted coil 10
18.2 Solvent bonding 11
19 Dielectric dissipation factor 11
20 Resistance to transformer oil 11
21 Loss of mass 11
23 Pin hole test 11
30 Packaging 11
Bibliography 12

Table 1 – Resistance to abrasion 8
Table 2 – Loads 11

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SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

Part 2: Solderable polyurethane enamelled round copper wire, class 130, with a bonding layer

FOREWORD

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International Standard IEC 60317-2 has been prepared by IEC technical committee 55: Winding wires.

This fifth edition cancels and replaces the fourth edition published in 2012. This edition constitutes a technical revision.

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

a) addition of heat bonding test loads for nominal conductor diameters up to and including 0,050 mm;

b) addition of pin hole test requirements according to IEC 60317-0-1:2013.

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

FDIS	Report on voting
55/1785/FDIS	55/1797/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60317 series, published under the general title *Specifications for particular types of winding wires*, can be found on the IEC website.

The numbering of clauses in this standard is not continuous from Clauses 21 through 30 in order to reserve space for possible future wire requirements prior to those for wire packaging.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://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.

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INTRODUCTION

This part of IEC 60317 ~~is one~~ 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).

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SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

Part 2: Solderable polyurethane enamelled round copper wire, class 130, with a bonding layer

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:~~2008~~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:~~2008~~2013, *Specifications for particular types of winding wires – Part 0-1: General requirements – Enamelled round copper wire*

3 Terms, definitions, general notes and appearance

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ~~3.1 of~~ IEC 60317-0-1~~:2008~~ 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 of IEC 60317-0-1:~~2008~~2013 applies.

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

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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:~~2008~~2013 applies.

4 Dimensions

Clause 4 of IEC 60317-0-1:~~2008~~2013 applies.

5 Electrical resistance

Clause 5 of IEC 60317-0-1:~~2008~~2013 applies.

6 Elongation

Clause 6 of IEC 60317-0-1:~~2008~~2013 applies.

7 Springiness

Clause 7 of IEC 60317-0-1:~~2008~~2013 applies.

8 Flexibility and adherence

Clause 8 of IEC 60317-0-1:~~2008~~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:~~2008~~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.

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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:~~2008~~2013 applies. The elevated temperature shall be 130 °C.

14 Continuity of insulation

Clause 14 of IEC 60317-0-1:~~2008~~2013 applies.

15 Temperature index

Clause 15 of IEC 60317-0-1:~~2008~~2013 applies. The minimum temperature index shall be 130.

16 Resistance to refrigerants

Test inappropriate.

17 Solderability

17.1 General

~~17.1 Nominal conductor diameters up to and including 0,050 mm~~

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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~~s over 0,050 mm~~ up to and including 0,100 mm

~~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.~~

17.3 Nominal conductor diameter over 0,100 mm

~~The temperature of the solder bath shall be (375 ± 5) °C.~~ The maximum immersion ~~(in seconds)~~ 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

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

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.

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

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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.

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