BS EN 60317-2:2012

BSI Standards Publication

Specifications for particular types of winding wires

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

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National foreword

This British Standard is the UK implementation of EN 60317-2:2012. It is identical to IEC 60317-2:2012. It supersedes BS EN 60317-2:1996, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GEL/55, Winding wires.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English version

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

(IEC 60317-2:2012)

Spécifications pour types particuliers de fils de bobinage - Partie 2: Fil de section circulaire en cuivre émaillé avec polyuréthane brasable, classe 130, avec une couche adhérente (CEI 60317-2:2012)

Technische Lieferbedingungen für bestimmte Typen von Wickeldrähten - Teil 2: Runddrähte aus Kupfer, verzinnbar, lackisoliert mit Polyurethan und darüber mit Backlack, Klasse 130 (IEC 60317-2:2012)

CENELEC

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Foreword

The text of document 55/1325/FDIS, future edition 4 of IEC 60317-2, prepared by IEC/TC 55 "Winding wires" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60317-2:2012.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2013-05-16
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2015-08-16

This document supersedes EN 60317-2:1994 + A1:1998 + A2:2000.

EN 60317-2:2012 includes the following significant technical changes with respect to EN 60317-2:1994 + A1:1998 + A2:2000:

- addition of requirements for appearance, new Subclause 3.3;
- addition of pin hole test requirements, Clause 23: Pin hole test.

This standard is to be read in conjunction with EN 60317-0-1:2008.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 60317-2:2012 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60264 Series	NOTE	Harmonised as EN 60264 Series (not modified).
IEC 60317 Series	NOTE	Harmonised as EN 60317 Series (not modified).
IEC 60851 Series	NOTE	Harmonised as EN 60851 Series (not modified).

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60317-0-1	2008	Specifications for particular types of winding wires - Part 0-1: General requirements - Enamelled round copper wire	EN 60317-0-1	2008

CONTENTS

INTRODUCTION

This part of IEC 60317 is one of a series which deals with insulated wires used for windings in electrical equipment. The series has three groups describing:

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

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.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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, *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.

3.2 General notes

3.2.1 Methods of test

Subclause 3.2 of IEC 60317-0-1:2008 applies.

In case of inconsistencies between IEC 60317-0-1 and this standard, 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 60317-0-1:2008 applies.

4 Dimensions

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

5 Electrical resistance

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

6 Elongation

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

7 Springiness

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

8 Flexibility and adherence

Clause 8 of IEC 60317-0-1:2008 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 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 60317-0-1:2008 applies. The elevated temperature shall be 130 °C.

14 Continuity of insulation

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

15 Temperature index

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

16 Resistance to refrigerant

Test inappropriate.

17 Solderability

17.1 Nominal conductor diameters up to and including 0,050 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.

17.2 Nominal conductor diameters 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.

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

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

Requirements 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

Test requirements under consideration.

30 Packaging

Clause 30 of IEC 60317-0-1:2008 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*

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BSI Group Headquarters

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