

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Specifications for particular types of winding wires –
Part 36: Solderable polyesterimide enamelled round copper wire, class 180, with
a bonding layer** (<https://standards.iteh.ai>)

**Spécifications pour types particuliers de fils de bobinage –
Partie 36: Fil brasable de section circulaire en cuivre émaillé avec
polyesterimide, classe 180, avec une couche adhérente**

<https://standards.iteh.ai/catalog/standards/iec/d3b2be8e-9f15-4a60-8af1-3511c3722dca/iec-60317-36-2013>





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IEC 60317-36

Edition 2.1 2019-06
CONSOLIDATED VERSION

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
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INTERNATIONALE

ICS 29.060.10

ISBN 978-2-8322-7040-0

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

**Part 36: Solderable polyesterimide enamelled
round copper wire, class 180, with a bonding layer**

FOREWORD

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IEC 60317-36 edition 2.1 contains the second edition (2013-10) [documents 55/1417/FDIS and 55/1438/RVD] and its amendment 1 (2019-06) [documents 55/1692/CDV and 55/1742/RVC].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 60317-36 has been prepared by IEC technical committee 55: Winding wires.

This second edition constitutes a technical revision.

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

- new 3.2.2 containing general notes on winding wire, formerly a part of the scope;
- revision to references to IEC 60317-0-1:2013 to clarify that their application is normative;
- consolidation of 17.1 and 17.2 of the solderability requirements;
- new Clause 23, Pin hole test.

This publication 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 20 and 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 the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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INTRODUCTION

This part of IEC 60317 is one of a series of standards 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).

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SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

Part 36: Solderable polyesterimide enamelled round copper wire, class 180, with a bonding layer

1 Scope

This part of IEC 60317 specifies the requirements of solderable enamelled round copper winding wire of class 180 with a dual coating. The underlying coating is based on polyesterimide 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 part is:

- Grade 1B: 0,020 mm up to and including 1,600 mm;
- Grade 2B: 0,020 mm up to and including 1,600 mm.

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

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 60317-0-1:2013, *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

Subclause 3.1 of IEC 60317-0-1:2013 applies.

3.2 General notes

3.2.1 Test methods

Subclause 3.2.1 of IEC 60317-0-1:2013 applies. In case of inconsistencies between IEC 60317-0-1:2013 and this part of IEC 60317, the latter shall prevail.

3.2.2 Winding wire

Class 180 is a thermal class that requires a minimum temperature index of 180 and a heat shock temperature of at least 200 °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 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. For 8.4, the constant K used for the calculation of the number of revolutions for the peel test shall be 110 mm.

9 Heat shock

Clause 9 of IEC 60317-0-1:2013 applies. The minimum heat shock temperature shall be 200 °C.

10 Cut-through

No failure shall occur within 2 min at 265 °C.

11 Resistance to abrasion (nominal conductor diameters from 0,250 mm up to and including 1,600 mm)

The wire shall meet the requirements given in Table 1.

For intermediate nominal conductor diameters, the value of the next larger nominal conductor diameter shall be taken.

Table 1 – Resistance to abrasion

Nominal conductor diameter mm	Grade 1B		Grade 2B	
	Minimum average force to failure N	Minimum force to failure of each measurement N	Minimum average force to failure N	Minimum force to failure of each measurement N
0,250	2,85	2,45	4,70	4,00
0,280	3,10	2,60	5,05	4,30
0,315	3,35	2,80	5,45	4,60
0,355	3,60	3,05	5,85	4,95
0,400	3,85	3,25	6,25	5,30
0,450	4,15	3,50	6,75	5,70
0,500	4,45	3,75	7,20	6,10
0,560	4,75	4,05	7,70	6,50
0,630	5,10	4,35	8,25	7,00
0,710	5,45	4,65	8,85	7,50
0,800	5,85	4,95	9,50	8,05
0,900	6,30	5,35	10,2	8,60
1,000	6,75	5,75	10,9	9,20
1,120	7,35	6,20	11,6	9,80
1,250	7,90	6,70	12,5	10,5
1,400	8,50	7,20	13,3	11,3
1,600	9,20	7,80	14,3	12,1

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12 Resistance to solvents

Test inappropriate.

13 Breakdown voltage

Clause 13 of IEC 60317-0-1:2013 applies. The elevated temperature shall be 180 °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 180.

16 Resistance to refrigerants

Test inappropriate.

17 Solderability

17.1 General

The temperature of the solder bath shall be $(470 \pm 5) ^\circ\text{C}$. The surface of the tinned wire shall be smooth and free from holes and enamel residues.

~~17.1~~17.2 Nominal conductor diameters up to and including 0,100 mm

~~The temperature of the solder bath shall be $(470 \pm 5) ^\circ\text{C}$.~~ The maximum immersion time shall be 3 s.

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

~~17.2~~17.3 Nominal conductor diameters over 0,100 mm

~~The temperature of the solder bath shall be $(470 \pm 5) ^\circ\text{C}$.~~ The maximum immersion time (in seconds) shall be the following multiple of the nominal conductor diameter (in millimetres) with a minimum of 3 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 2013

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 $(200 \pm 2) ^\circ\text{C}$ and the suggested temperature for aromatic polyamide bonding enamel is $(230 \pm 2) ^\circ\text{C}$.

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 separate.

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 $(155 \pm 2) ^\circ\text{C}$ and the suggested temperature for aromatic polyamide bonding enamel is $(170 \pm 2) ^\circ\text{C}$.

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 separate.

Table 2 – Loads

Nominal conductor diameter mm		Load N	
Over	Up to and including	Room temperature	Elevated temperature
–	0,050	a	a
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

^a For nominal conductor diameters up to and including 0,050 mm, the test method and requirements shall be agreed between purchaser and supplier.

18.1.2 Bond strength on a twisted coil

18.1.2.1 General

This test shall be considered only as a special test and is applicable to the diameter 0,315 mm.

18.1.2.2 At room temperature

When preparing a test sample of diameter 0,315 mm 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 bonding enamel is $(2,7 \pm 0,1)$ A and the suggested value for aromatic polyamide bonding enamel is $(3,0 \pm 0,1)$ A.

Results: when testing the samples according to the test method, under the action of the deflection force of 100 N, the sample shall not break.

18.1.2.3 At elevated temperature

The samples of diameter 0,315 mm shall be prepared according to the test method, using the parameters listed in 18.1.2.2 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 aromatic polyamide bonding enamel is (170 ± 2) °C.