

INTERNATIONAL STANDARD



**Specifications for particular types of winding wires –
Part 46: Aromatic polyimide enamelled round copper wire, class 240**



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INTERNATIONAL
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CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative reference.....	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 2,500 mm).....	7
12 Resistance to solvents.....	8
13 Breakdown voltage.....	8
14 Continuity of insulation.....	8
15 Temperature index.....	8
16 Resistance to refrigerants.....	9
17 Solderability.....	9
18 Heat or solvent bonding.....	9
19 Dielectric dissipation factor.....	9
20 Resistance to transformer oil.....	9
21 Loss of mass.....	9
23 Pin hole test.....	9
30 Packaging.....	9
Bibliography.....	10
Table 1 – Resistance to abrasion.....	8

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 60317-46 edition 2.1 contains the second edition (2013-10) [documents 55/1420/FDIS and 55/1441/RVD] and its amendment 1 (2024-06) [documents 55/1993/CDV and 55/2029/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 60317-46 has been prepared by IEC technical committee 55: Winding wires.

This second edition cancels and replaces the first edition published in 1997. This edition constitutes a technical revision.

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

- deletion of the “in some countries” statement in the scope;
- new subclause containing general notes on winding wire, formerly a part of the scope;
- new subclause containing requirements for appearance;
- revision to the notes in Clause 19, Dielectric dissipation factor;
- new Clause 23, Pin-hole test.

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

This International standard is to be read in conjunction with the IEC 60317-0-1:2013 and its Amendment 1:2019.

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.

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 committee has decided that the contents of this document and its amendment will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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- revised.

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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).

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SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

Part 46: Aromatic polyimide enamelled round copper wire, class 240

1 Scope

This part of IEC 60317 specifies the requirements of enamelled round copper winding wire of class 240 with a sole coating of aromatic polyimide resin.

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

- grade 1: 0,020 mm up to and including 2,000 mm;
- grade 2: 0,020 mm up to and including 5,000 mm.

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

2 Normative reference

~~The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application.~~ 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 60317-0-1¹:2013, *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

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

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

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

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://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.

In case of inconsistencies between IEC 60317-0-1:2013 and this ~~standard~~ document, ~~the latter~~ IEC 60317-46 shall prevail.

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

3.2.2 Winding wire

Class 240 is a thermal class that requires a minimum temperature index of 240 and heat shock temperature of at least 260 °C.

The temperature in degrees Celsius corresponding to the temperature index is not necessarily that at which it is recommended that the wire be used, 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. For 8.4, the constant K used for the calculation of the number of revolutions for the peel test shall be 90 mm.

9 Heat shock

Clause 9 of IEC 60317-0-1:2013 applies. The minimum heat shock temperature shall be 260 °C.

10 Cut-through

No failure shall occur within 2 min at 450 °C.

11 Resistance to abrasion (nominal conductor diameters from 0,250 mm up to and including 2,500 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 is taken.

Table 1 – Resistance to abrasion

Nominal conductor diameter mm	Grade 1		Grade 2	
	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	2,00	1,70	3,35	2,85
0,280	2,15	1,85	3,60	3,05
0,315	2,30	2,00	3,90	3,30
0,355	2,50	2,15	4,20	3,55
0,400	2,70	2,30	4,50	3,80
0,450	2,90	2,45	4,80	4,05
0,500	3,10	2,65	5,15	4,35
0,560	3,35	2,85	5,50	4,65
0,630	3,60	3,05	5,90	5,00
0,710	3,90	3,30	6,35	5,40
0,800	4,20	3,60	6,80	5,80
0,900	4,50	3,90	7,30	6,20
1,000	4,90	4,20	7,80	6,60
1,120	5,30	4,50	8,35	7,10
1,250	5,70	4,80	8,95	7,60
1,400	6,15	5,20	9,60	8,15
1,600	6,65	5,60	10,3	8,75
1,800	7,15	6,05	11,0	9,35
2,000	7,70	6,55	11,8	10,0
2,240	–	–	12,6	10,7
2,500	–	–	13,4	11,4

12 Resistance to solvents

Clause 12 of IEC 60317-0-1:2013 applies, except that the change shall not exceed one grade of pencil hardness.

13 Breakdown voltage

Clause 13 of IEC 60317-0-1:2013 applies. The elevated temperature shall be 240 °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 240.

16 Resistance to refrigerants

Test appropriate, but no requirements specified.

17 Solderability

Test inappropriate.

18 Heat or solvent bonding

Test inappropriate.

19 Dielectric dissipation factor

The dielectric dissipation factor $\tan \delta$ shall not exceed 60×10^{-4} at a frequency of 1 000 Hz.

NOTE 1 Test under consideration.

NOTE 2 In case the dielectric dissipation factor $\tan \delta$ cannot be measured, this measurement is replaced by a measurement of the loss of mass.

20 Resistance to transformer oil

~~Test appropriate, but no requirements specified.~~

Test inappropriate.

21 Loss of mass

Test appropriate, but no requirements specified.

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*

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CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative reference.....	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 2,500 mm).....	7
12 Resistance to solvents.....	8
13 Breakdown voltage.....	8
14 Continuity of insulation.....	8
15 Temperature index.....	8
16 Resistance to refrigerants.....	9
17 Solderability.....	9
18 Heat or solvent bonding.....	9
19 Dielectric dissipation factor.....	9
20 Resistance to transformer oil.....	9
21 Loss of mass.....	9
23 Pin hole test.....	9
30 Packaging.....	9
Bibliography.....	10
Table 1 – Resistance to abrasion.....	8

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Part 46: Aromatic polyimide enamelled round copper wire, class 240

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The temperature in degrees Celsius corresponding to the temperature index is not necessarily that at which it is recommended that the wire be used, 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

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