

# INTERNATIONAL STANDARD



**Specifications for particular types of winding wires –  
Part 59: Polyamide-imide enamelled round copper wire, class 240**



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IEC 60317-59

Edition 1.1 2024-06  
CONSOLIDATED VERSION

# INTERNATIONAL STANDARD



**Specifications for particular types of winding wires –  
Part 59: Polyamide-imide enamelled round copper wire, class 240**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

ICS 29.060.10

ISBN 978-2-8322-9238-9

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

#### Part 59: Polyamide-imide enamelled round copper wire, class 240

#### FOREWORD

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**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 60317-59 has been prepared by IEC technical committee 55: Winding wires.

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

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

A list of all the 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 between Clauses 20 and 30 in order to reserve space for possible future wire requirements prior to those for wire packaging.

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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 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 59: Polyamide-imide 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 single coating of polyamide-imide resin.

The range of nominal conductor diameters covered by this part of IEC 60317 is:

- grade 1: 0,180 mm up to and including 1,600 mm;
- grade 2: 0,180 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.~~ 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<sup>1</sup>: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 60317-0-1:2013 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 and this ~~part of IEC 60317~~ document, ~~the latter~~ IEC 60317-59 shall prevail.

<sup>1</sup> 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 a 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. 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, Peel test, the constant  $K$  used for the calculation of the number of revolutions shall be 75 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**

For 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 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	3,00	2,55	4,90	4,15
0,280	3,25	2,75	5,25	4,45
0,315	3,50	2,95	5,65	4,80
0,355	3,75	3,20	6,05	5,15
0,400	4,05	3,45	6,50	5,50
0,450	4,35	3,70	7,00	5,90
0,500	4,65	3,95	7,50	6,35
0,560	5,00	4,25	8,00	6,80
0,630	5,35	4,55	8,60	7,30
0,710	5,70	4,85	9,20	7,80
0,800	6,10	5,15	9,90	8,40
0,900	6,55	5,55	10,60	9,00
1,000	7,05	5,95	11,30	9,60
1,120	7,60	6,45	12,10	10,20
1,250	8,20	6,95	12,90	11,00
1,400	8,80	7,45	13,90	11,80
1,600	9,45	8,00	14,90	12,60

**12 Resistance to solvents**

Clause 12 of IEC 60317-0-1:2013 applies.

**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.~~

Test inappropriate.

## **17 Solderability**

Test inappropriate.

## **18 Heat or solvent bonding**

Test inappropriate.

## **19 Dielectric dissipation factor**

Test inappropriate.

## **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.

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## 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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### SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

#### Part 59: Polyamide-imide enamelled round copper wire, class 240

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## SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

### Part 59: Polyamide-imide 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 single coating of polyamide-imide resin.

The range of nominal conductor diameters covered by this part of IEC 60317 is:

- grade 1: 0,180 mm up to and including 1,600 mm;
- grade 2: 0,180 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

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IEC 60317-0-1:2013/AMD1:2019

#### 3 Terms, definitions, general notes and appearance

##### 3.1 Terms and definitions

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- 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 and this document, IEC 60317-59 shall prevail.

<sup>1</sup> 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 a 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. 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, Peel test, the constant  $K$  used for the calculation of the number of revolutions shall be 75 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**

For 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 applies.