

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



Specifications for particular types of winding wires –  
Part 43: Aromatic polyimide tape wrapped round copper wire, class 240

Spécifications pour types particuliers de fils de bobinage –  
Partie 43: Fil de section circulaire en cuivre recouvert d'un ruban de polyimide  
aromatique, classe 240



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IEC Central Office  
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CH-1211 Geneva 20  
Switzerland  
Email: [inmail@iec.ch](mailto:inmail@iec.ch)  
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Tél.: +41 22 919 02 11  
Fax: +41 22 919 03 00

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

**Part 43: Aromatic polyimide tape wrapped round copper wire,  
class 240**

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**The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience. A vertical line in the margin shows where the base publication has been modified by amendment 1. Additions and deletions are displayed in red, with deletions being struck through.**

International Standard IEC 60317-43 has been prepared by IEC technical committee 55: Winding wires.

Annexes A and B are for information only.

The committee has decided that the contents of the base publication and its amendments 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 forms an element of a series of standards which deals with insulated wires used for windings in electrical equipment. The series has three groups describing:

- 1) methods of test (IEC 60851);
- 2) specifications (IEC 60317);
- 3) packaging (IEC 60264).

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## SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

### Part 43: Aromatic polyimide tape wrapped round copper wire, class 240

#### 1 Scope

This part of IEC 60317 specifies requirements of tape wrapped round copper winding wire of class 240. The insulation consists of one or two wrappings of aromatic polyimide tape.

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

NOTE In some countries, e.g. Canada, Russia, USA, this product is assigned a class 220.

The tape is coated on one or both sides with a suitable adhesive, for instance, fluorinated ethylene propylene. After wrapping, the tape is heat-sealed to form a continuous and adherent sheath. Specific requirements may be subject to contract.

The temperature in degrees Celsius corresponding to the temperature index is not necessarily that at which the wire is recommended to be used and this will depend on many factors, including the types of equipment involved.

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

1,600 mm up to and including 5,000 mm  
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The nominal conductor diameters are given in table 1.

When reference is made to winding wire according to this standard, the following information should be given:

- reference to IEC 60317-43;
- diameter of the conductor;
- grade.

Example: 60317-43 IEC 2,000 mm grade A2

#### 2 Normative references

The following referenced documents are indispensable for the application 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 60172:1987, *Test procedure for the determination of the temperature index of enamelled winding wires*

IEC 60851, *Methods of test for winding wires*

ISO 3:1973, *Preferred numbers – Series of preferred numbers*



### 3 Definitions and general notes on methods of test

#### 3.1 Terms and definitions

For the purpose of this part of IEC 60317, the following definitions apply.

##### 3.1.1

###### **class**

the thermal performance of a wire expressed by the temperature index and the heat shock temperature

##### 3.1.2

###### **conductor**

the bare metal after removal of the insulation

##### 3.1.3

###### **covering**

a material which is wound, wrapped or braided around a bare or insulated conductor

##### 3.1.4

###### **crack**

an opening in the insulation which exposes the conductor to view at the stated magnification

##### 3.1.5

###### **grade**

a range of thickness of the insulation of a wire

##### 3.1.6

###### **insulation**

a coating or covering on the conductor with the specific function of withstanding voltage

##### 3.1.7

###### **nominal conductor dimension**

the designation of the conductor size in accordance with IEC 60317

##### 3.1.8

###### **winding wire**

a wire used for winding a coil to provide a magnetic field

##### 3.1.9

###### **wire**

a conductor coated or covered with an insulation

#### 3.2 General notes on methods of test

All methods of test used in this part of IEC 60317 are given in IEC 60851. The clause numbers used in this standard are identical with the respective test numbers of IEC 60851.

In case of inconsistencies between IEC 60851 on methods of test and this part of IEC 60317, the latter shall prevail.

Where no specific range of nominal conductor diameters is given for a test, the test applies to all nominal conductor diameters covered by the specification sheet.

Unless otherwise specified, all tests shall be carried out at a temperature from 15 °C to 35 °C, and a relative humidity from 45 % to 75 %. Before measurements are made, the specimens shall be preconditioned under these atmospheric conditions for a time sufficient to allow the specimens to reach stability.

The wire to be tested shall be removed from the packaging in such a way that the wire will not be subjected to tension or unnecessary bends. Before each test, sufficient wire should be discarded to ensure that any damaged wire is not included in the test specimens.

#### 4 Dimensions

The dimensions due to the insulation depend upon an agreement between purchaser and supplier. The dimensions in this standard shall be used as a guide in forming that agreement.

##### 4.1 Conductor diameter

The series of preferred nominal conductor diameters shall correspond to series R 20 according to ISO 3. The actual values and their tolerances are given in table 1.

The series of intermediate diameters from which the user may select intermediate nominal conductor diameters, when required for technical reasons, shall correspond to series R 40 according to ISO 3. The actual values and their tolerances are given in annex A.

The conductor diameter shall not differ from the nominal diameter by more than the limits given in table 1.

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**Table 1 – Conductor diameters**

Nominal conductor diameter mm	Tolerance ± mm	Nominal conductor diameter mm	Tolerances ± mm
1,600	0,016	3,150	0,032
1,800	0,018	3,550	0,036
2,000	0,020	4,000	0,040
2,240	0,022	4,500	0,045
2,500	0,025	5,000	0,050
2,800	0,028		

NOTE The dimensions of intermediate nominal conductor diameters for R 40 series are given in annex A.

##### 4.2 Out-of-roundness of conductor

The difference between the minimum and maximum diameter, at any one point, shall not be more than the figure given in columns 2 and 4 of table 1.

##### 4.3 Minimum increase in diameter due to the insulation

The minimum increase in diameter due to the insulation shall not be less than the values given in table 2.

**Table 2 – Minimum increases due to the insulation**

Single tape		Double tape	
Grade	Minimum increase in diameter due to the insulation mm	Grade	Minimum increase in diameter due to the insulation mm
A1	0,100	B1	0,200
A2	0,130	B2	0,260
A3	0,170	B3	0,340
A4	0,210	B4	0,430
A5	0,260	B5	0,510

#### 4.4 Maximum overall diameter

The overall diameter shall not exceed the sum of the maximum conductor diameter given in table 1 and the maximum increase in diameter due to the insulation given in table 3.

Before wrapping, the conductor shall be completely free from copper dust and other extraneous matter.

One or two tapes may be applied. Combinations of different thicknesses and degree of overlap shall be agreed between purchaser and supplier.

The tape shall be wrapped on the conductor tightly, evenly, and free from creases or wrinkles, with the adhesive on the inside.

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After wrapping, the tape shall be heat-sealed by suitable means to form an adherent and continuous sheath.

**Table 3 – Maximum increases due to the insulation**

Single tape		Double tape	
Grade	Maximum increase in diameter due to the insulation mm	Grade	Maximum increase in diameter due to the insulation mm
A1	0,140	B1	0,280
A2	0,180	B2	0,360
A3	0,240	B3	0,480
A4	0,300	B4	0,600
A5	0,340	B5	0,680

Example: The maximum overall diameter of a wire with a nominal conductor diameter of 2,000 mm and insulated with a single tape to grade A3 (including adhesive) is

$$2,020 \text{ mm} + 0,240 \text{ mm} = 2,260 \text{ mm}.$$

## 5 Electrical resistance

No resistance values are specified.

The nominal resistance at 20 °C is given in annex B.

## 6 Elongation

~~The elongation at fracture shall be in accordance with the values given in table 4. Test inappropriate.~~

**Table 4 – Elongation requirements**

Nominal conductor diameter mm		Minimum elongation %
Over	Up to and including	
–	2,500	30
2,500	5,000	33

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## 7 Springiness

### 7.1 Nominal conductor diameter of 1,600 mm

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When tested on a mandrel of 50 mm using a tension of 15 N, the wire shall not exceed the maximum springback as follows:

- grade A: 28°;
- grade B: 30°.

### 7.2 Nominal conductor diameters over 1,600 mm

The wire shall not exceed the maximum springback of 5°.

## 8 Flexibility and adherence

### 8.1 Mandrel winding test

The covering shall show no crack or delamination after the wire has been wound on a mandrel with a diameter equal to four times the nominal conductor diameter.

### 8.2 Adherence test

The wire shall be stretched by 15 % for a single wrapping and 10 % for a double wrapping. The distance of loss of adhesion shall be less than:

- five times conductor diameter for sizes up to and including 3,000 mm;
- three times conductor diameter for sizes over 3,000 mm.