# IEC 60317-44

Edition 1.1 2010-07

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

colour inside

## Specifications for particular types of winding wires –
## Part 44: Aromatic polyimide tape wrapped rectangular copper wire, class 240



## Spécifications pour types particuliers de fils de bobinage –
## Partie 44: Fil de section rectangulaire en cuivre recouvert d'un ruban de polyimide aromatique, classe 240



IEC 60317-44:1997+A1:2010

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.060.10

ISBN 978-2-88910-961-6

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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 60317-44 has been prepared by IEC technical committee 55: Winding wires.

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).

# SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

## Part 44: Aromatic polyimide tape wrapped rectangular copper wire, class 240

## 1 Scope

This part of IEC 60317 specifies the requirements of tape wrapped rectangular 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 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 dimensions covered by this standard is:

– width: min. 2,00 mm, max. 16,00 mm;
– thickness: min. 0,80 mm, max. 5,60 mm.

The specified combinations of width and thickness as well as the specified ratio width/thickness are given in IEC 60317-0-2.

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

– reference to IEC 60317-44;
– dimension of the nominal conductor (width x thickness);
– grade.

Example: 60317-44 IEC 4,00 mm x 1,00 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 60317-0-2:1990, *Specifications for particular types of winding wires – Part 0: General requirements – Section 2: Enamelled rectangular copper wire*

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 dimensions is given for a test, the test applies to all nominal conductor dimensions 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 dimensions

See 4.1 of IEC 60317-0-2.

### 4.2 Tolerance on conductor dimensions

See 4.2 of IEC 60317-0-2.



### 4.3 Rounding of corners

See 4.3 of IEC 60317-0-2.



### 4.4 Increase in dimensions due to the insulation

The minimum increase in width or thickness due to the insulation shall be as given in table 1.

**Table 1 – Minimum increases due to the insulation**

| Single tape | | Double tape | |
|---|---|---|---|
| Grade | Minimum increase in dimensions due to the insulation<br>mm | Grade | Minimum increase in dimensions due to the insulation<br>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 |

### 4.5 Maximum overall dimensions

The overall dimensions shall not exceed the sum of the maximum conductor dimensions given in 4.2 and the maximum increase in dimensions due to the insulation given in table 2.

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

One or two tapes may be applied with a degree of overlapping agreed upon 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.

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

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

| Single tape | | Double tape | |
|---|---|---|---|
| Grade | Maximum increase in dimensions due to the insulation mm | Grade | Maximum increase in dimensions 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 dimensions of a wire with a nominal conductor width of 4,000 mm and a conductor thickness of 1,000 mm, insulated with a single tape to grade A.3 (including adhesive) are:

for the width: 4,050 mm + 0,240 mm = 4,290 mm; and

for the thickness: 1,030 mm + 0,240 mm = 1,270 mm.



## 5 Electrical resistance

The resistance of the wire shall be expressed as the d.c. resistance at 20 °C. The method used shall provide an accuracy of 0,5 %.

The maximum value of resistance shall be not greater than the value calculated for the minimum tolerated cross-sectional area of the conductor resulting from the minimum dimensions in thickness and width and the maximum for the corner radius, with a resistivity of 1/58 $\Omega\ mm^2m^{-1}$.

One measurement shall be made.

## 6 Elongation

~~The elongation at fracture shall be in accordance with the values given in table 3.~~ Test inappropriate.

**Table 3 – Elongation requirements**

| Nominal thickness of the conductor mm | | Minimum elongation % |
|---|---|---|
| Over | Up to and including | |
| – | 2,500 | 30 |
| 2,500 | 5,600 | 33 |