

# INTERNATIONAL STANDARD



Specifications for particular types of winding wires –  
Part 0-2: General requirements – Enamelled rectangular copper wire

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**SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –****Part 0-2: General requirements – Enamelled rectangular copper wire**

## FOREWORD

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International Standard IEC 60317-0-2 has been prepared by IEC technical committee 55: Winding wires.

This fourth edition cancels and replaces the third edition published in 2013. This edition constitutes a technical revision.

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

- a) revision to Clause 2 to add new normative references for specifications for copper rods;
- b) revision to 3.1 to add a new definition for the term “bonding layer”;
- c) revision to 3.2.1 to the conditions specified for tests to be carried out;
- d) revision to 4.5 to add requirements for minimal, nominal and maximal overall dimensions with a bonding layer;
- e) revision to Clause 5 to reference specifications for rectangular and square copper rod;
- f) revision to Clause 6 to take into account nominal proof strength;
- g) revision to 8.2 to the adherence test requirement;
- h) revision to Clause 18 to make reference to the relevant specification sheet

The text of this International Standard is based on the following documents:

FDIS	Report on voting
55/1847/FDIS	55/1865/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

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

This International standard is to be read in conjunction with IEC 60851 (all parts). The clause numbers used in this part of IEC 60317 are identical with the respective test numbers of IEC 60851 (all parts).

In case of inconsistencies between IEC 60851 and this part of IEC 60317, the latter prevails.

The numbering of clauses in this standard is not continuous from Clauses 21 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 will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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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. It is composed of the following series:

- 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 0-2: General requirements – Enamelled rectangular copper wire

### 1 Scope

This part of IEC 60317 specifies the general requirements of enamelled rectangular copper winding wires.

The range of nominal conductor dimensions is given in 4.1 and the relevant specification sheet.

### 2 Normative references

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 60172, *Test procedure for the determination of the temperature index of enamelled and tape wrapped winding wires*

IEC 60851 (all parts), *Winding wires – Test methods*

IEC 60851-3, *Winding wires – Test methods – Part 3: Mechanical properties*

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

ISO 1190-1, *Copper and copper alloys – Code of designation – Part 1: Designation of materials*

ISO 6892-1:2016, *Metallic materials – Tensile testing – Part 1: Method of test at room temperature*

EN 1977, *Copper and copper alloys – Copper drawing stock (wire rod)*

ASTM B49, *Standard Specification for Copper Rod for Electrical Purposes*

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

#### 3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6892-1:2016 and the following apply.

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

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

**3.1.1****class**

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

**3.1.2****coating**

material which is deposited on a conductor or wire by a suitable means and then dried and/or cured

**3.1.3****conductor**

bare metal after removal of the insulation

**3.1.4****crack**

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

**3.1.5****dual coating**

insulation composed of two different materials, an underlying and a superimposed coating

**3.1.6****enamelled wire**

wire coated with an insulation of cured resin

**3.1.7****grade**

<enamelled rectangular copper wire>

~~range of thickness of the insulation of a wire~~

range of increase in the overall diameter of the wire due to the enamel

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**3.1.8****insulation**

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

**3.1.9****nominal conductor dimension**

designation of the conductor size in accordance with the IEC 60317 series

**3.1.10****normal vision**

20/20 vision, with corrective lenses, if necessary

**3.1.11****winding wire**

wire used for winding a coil to provide a magnetic field

**3.1.12****wire**

conductor coated or covered with an insulation

**3.1.13****bonding layer**

material that is deposited on an enamelled wire on which has the specific function of bonding wires together

## 3.2 General notes

### 3.2.1 Methods of test

All methods of test to be used for this document are given in IEC 60851 (all parts).

The clause numbers used in this document are identical to the corresponding test numbers in IEC 60851 (all parts).

In case of inconsistencies between the publication on methods of test and this document, IEC 60317-0-2 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~~ 40 °C and a relative humidity from ~~45~~ 25 % 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.

### 3.2.2 Winding wire

When reference is made to a winding wire according to a standard of the IEC 60317 series mentioned under Clause 2, the following information is given in the description:

- reference to IEC specification;
- nominal conductor dimensions in millimetres (width × thickness);
- grade;
- nominal proof strength minimum (and maximum) value.

EXAMPLE: IEC 60317-17 – 4,00 × 1,00 Grade 1  $R_{p0,2} = 120 \text{ N}\cdot\text{mm}^{-2}$

## 3.3 Appearance

The film coating shall be essentially smooth and continuous, free from streaks, blisters and foreign material when examined with normal vision, in accordance with good commercial practice, as wound on the original spool or reel.

## 4 Dimensions

### 4.1 Conductor dimensions

The dimensions for width and thickness of conductors of winding wires with rectangular cross-section, recommended in this document, are taken from the R 20 ~~and R 40~~ series in ISO 3.

Preferred sizes are combinations of width and thickness, both in accordance with the R 20 series.

Intermediate sizes are combinations of width or thickness in accordance with the R 20 series with the other dimension in accordance with the R 40 series.

This document covers:

- widths from 2,00 mm up to and including ~~16,00~~ 31,50 mm;

– thicknesses from 0,80 mm up to and including ~~5,60~~ 10,00 mm.

~~For thicknesses over 5,60 mm up to and including 10 mm and for widths over 16 mm up to and including 25 mm where, for technical reasons, additional sizes may be needed, the R 40 series shall be used.~~ The ratio width/thickness shall be within the specified limits. Combinations of R 40 and R 40 are not allowed in the case of additional sizes.

The ratio width/thickness shall be greater than or equal to 1,4:1 and shall not exceed 8:1.

The actual values of dimensions are given in Table 2\*.

The nominal cross-sectional areas for preferred sizes are given in Table 2, and the nominal cross-sectional areas for intermediate sizes are given in Table A.1.

#### 4.2 Tolerance on conductor dimensions

The conductor dimensions shall not differ from the nominal values by more than the tolerance given in Table 1.

**Table 1 – Conductor tolerances**

Nominal width or thickness of the conductor Mm		Tolerance
Over	Up to and including	± mm
–	3,15	0,030
3,15	6,30	0,050
6,30	12,50	0,070
12,50	16,00	0,100
16,00	22,40	0,130
22,40	31,50	0,150

#### 4.3 Rounding of corners

The arc shall merge smoothly into the flat surfaces of the conductor and the strip shall be free from sharp, rough and projecting edges. The conductor shall have radiused corners complying with Table 3. The specified radii shall be maintained within ±25 %.

\*—Dimensions according to R 20 series are printed in larger type.

