IEC 60317-53

Edition 2.0 2014-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Specifications for particular types of winding wires –
Part 53: Aromatic polyamide (aramid) tape wrapped rectangular copper wire, temperature index 220**

**Spécifications pour types particuliers de fils de bobinage –
Partie 53: Fil de section rectangulaire en cuivre enveloppé avec un ruban polyamide aromatique (aramide), d'indice de température 220**

IEC 60317-53:2014-03(en-fr)

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FOREWORD

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International Standard IEC 60317-53 has been prepared by IEC technical committee 55: Winding wires.

This second edition cancels and replaces the first edition published in 1999. This edition constitutes a technical revision.

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

– new 3.2.2 containing general notes on winding wire, formerly a part of the scope;
– new 3.3, containing requirements for appearance;
– modification to Clause 15 to delete the note on revisions to IEC 60172;
– new Clause 23, Pin hole test.

The text of this standard is based on the following documents:

CDV	Report on voting
55/1396/CDV	55/1458/RVC

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

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

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 publication 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

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- withdrawn,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

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).

SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

Part 53: Aromatic polyamide (aramid) tape wrapped rectangular copper wire, temperature index 220

1 Scope

This part of IEC 60317 specifies requirements for tape wrapped rectangular copper winding wire of temperature index 220. The insulation consists of one or more wrappings of aromatic polyamide (aramid) tape of various thicknesses.

NOTE The heat shock test is inappropriate for this type of wire, and therefore a heat shock temperature cannot be established. Consequently, a class based on the requirements for temperature index and heat shock temperature cannot be specified.

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 Table 1.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 winding wires*

IEC 60819-3-3:2011, *Non-cellulosic papers for electrical purposes – Part 3: Specifications for individual materials – Sheet 3: Unfilled aramid (aromatic polyamide) papers*

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

3 Terms, definitions, general notes and appearance

3.1 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

3.1.1
class
thermal performance of a wire expressed by the temperature index and the heat shock temperature

3.1.2
conductor
bare metal after removal of the insulation

3.1.3
covering
material which is wound, wrapped or braided around a bare or insulated conductor

3.1.4
insulation
coating or covering on the conductor with the specific function of withstanding voltage

3.1.5
winding wire
wire used for winding a coil to provide a magnetic field

3.1.6
wire
conductor coated or covered with an insulation

3.2 General notes

3.2.1 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 to the corresponding test numbers in the IEC 60851 series of standards.

In case of inconsistencies between the publication on methods of test and this standard, IEC 60317-53 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.

3.2.2 Winding wire

One or more tape layers may be applied. Combinations of different types, different thickness and degree of overlap shall be agreed between the purchaser and the supplier.

Where adhesive is used to secure the loose ends of the tape, it shall be compatible with the insulation system in use.

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

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

– reference to IEC 60317-53;
– dimensions of the conductor;
– reference should also be made to the number and thickness of the papers used and to the degree of overlap, as agreed between purchaser and supplier.

3.3 Appearance

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

The tape covering shall be essentially smooth and continuous, wrapped around the conductor tightly, evenly and free from creases, wrinkles and foreign material when examined with normal vision, as wound on the original spool or reel.

4 Dimensions

4.1 Conductor dimensions

The dimensions for widths and thicknesses of conductors of winding wires with rectangular cross-section recommended in this standard are taken from the R 20 and R 40 series according to ISO 3.

Preferred sizes are combinations of width and thickness both according to the R 20 series.

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

This standard covers:

– widths from 2,00 mm up to and including 16,00 mm;
– thicknesses from 0,80 mm up to and including 5,60 mm.*

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 1.**

The nominal cross-sectional areas for preferred sizes are given in Table 1.

---

* 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 and combinations of R 40 and R 40 are not allowed in the case of additional sizes.

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

Table 1 – Nominal cross-sectional areas of preferred sizes

Width ↓ / Thickness → (mm)	0,80	0,85	0,90	0,95	1,00	1,06	1,12	1,18	1,25	1,32	1,40	1,50	1,60	1,70	1,80	1,90	2,00	2,12	2,24	2,36	2,50	2,65	2,80	3,00	3,15	3,35	3,55	3,75	4,00	4,25	4,50	4,75	5,00	5,30	5,60
	Corner radius*					Corner radius 0,5 mm								Corner radius 0,65 mm						Corner radius 0,8 mm								Corner radius 1,0 mm							
2,00	1,463		1,626		1,785		2,025		2,285		2,585																								
2,12		—		—		—		—		—		—																							
2,24	1,655		1,842		2,025		2,294		2,585		2,921		3,369																						
2,36		—		—		—		—		—		—		—																					
2,50	1,863		2,076		2,285		2,585		2,910		3,285		3,785		4,137																				
2,65		—		—		—		—		—		—		—		—																			
2,80	2,103		2,346		2,585		2,921		3,285		3,705		4,265		4,677		5,237																		
3,00		—		—		—		—		—		—		—		—		—																	
3,15	2,383		2,661		2,935		3,313		3,723		4,195		4,825		5,307		5,937		6,693																
3,35		—		—		—		—		—		—		—		—		—		—															
3,55	2,703		3,021		3,335		3,761		4,223		4,755		5,465		6,027		6,737		7,589		8,326														
3,75		—		—		—		—		—		—		—		—		—		—		—													
4,00	3,063		3,426		3,785		4,265		4,785		5,385		6,185		6,837		7,637		8,597		9,451		10,65												
4,25		—		—		—		—		—		—		—		—		—		—		—		—											
4,50	3,463		3,876		4,285		4,825		5,410		6,085		6,985		7,737		8,637		9,717		10,70		12,05		13,63										
4,75		—		—		—		—		—		—		—		—		—		—		—		—		—									
5,00	3,863		4,326		4,785		5,385		6,035		6,785		7,785		8,637		9,637		10,84		11,95		13,45		15,20		17,20								
5,30		—		—		—		—		—		—		—		—		—		—		—		—		—		—							
5,60	4,343		4,866		5,385		6,057		6,785		7,625		8,745		9,717		10,84		12,18		13,45		15,13		17,09		19,33		21,54						
6,00		—		—		—		—		—		—		—		—		—		—		—		—		—		—		—					
6,30	4,903		5,496		6,085		6,841		7,660		8,605		9,865		10,98		12,24		13,75		15,20		17,09		19,30		21,82		24,34		27,49				
6,70		—		—		—		—		—		—		—		—		—		—		—		—		—		—		—		—			
7,10			6,216		6,885		7,737		8,660		9,725		11,15		12,42		13,84		15,54		17,20		19,33		21,82		24,66		27,54		31,09		34,64		
7,50				—		—		—		—		—		—		—		—		—		—		—		—		—		—		—		—	
8,00					7,785		8,745		9,785		10,99		12,59		14,04		15,64		17,56		19,45		21,85		24,65		27,85		31,14		35,14		39,14		43,94
8,50						—		—		—		—		—		—		—		—		—		—		—		—		—		—		—	
9,00							9,865		11,04		12,39		14,19		15,84		17,64		19,80		21,95		24,65		27,80		31,40		35,14		39,64		44,14		49,54
9,50								—		—		—		—		—		—		—		—		—		—		—		—		—		—	
10,0									12,29		13,79		15,79		17,64		19,64		22,04		24,45		27,45		30,95		34,95		39,14		44,14		49,14		55,14
10,6										—		—		—		—		—		—		—		—		—		—		—		—		—	
11,2											15,47		17,71		19,80		22,04		24,73		27,45		30,81		34,73		39,21		43,94		49,54		55,14		61,86
11,8												—		—		—		—		—		—		—		—		—		—		—		—	
12,5													19,79		22,14		24,64		27,64		30,70		34,45		38,83		43,83		49,14		55,39		61,64		69,14
13,2														—		—		—		—		—		—		—		—		—		—		—	
14,0															24,84		27,64		31,00		34,45		38,65		43,55		49,15		55,14		62,14		69,14		77,54
15,0																—		—		—		—		—		—		—		—		—		—	
16,0																	31,64		35,48		39,45		44,25		49,85		56,25		63,14		71,14		79,14		88,74

Upper right (blank area): Not recommended – Ratio width/thickness smaller than 1,4:1

Lower left (blank area): Not recommended – Ratio width/thickness over 8:1

Legend:

- 0,95 (small figure) – Figure from R 40 series
- 1,00 (large figure) – Figure from R 20 series
- 1,785 (boxed value) – Preferred size R 20 × R 20; Nominal cross-sectional area (mm^2)
- (empty box) – Intermediate size R 20 × R 40, R 40 × R 20; Nominal cross-sectional area (See Annex A)
- — – Dimension not recommended R 40 × R 40

* 0,5 nominal thickness.