IEC 60317-52

Edition 2.0 2014-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Specifications for particular types of winding wires – Part 52: Aromatic polyamide (aramid) tape wrapped round copper wire, temperature index 220

Spécifications pour types particuliers de fils de bobinage – Partie 52: Fil de section circulaire en cuivre enveloppé avec un ruban polyamide aromatique (aramide), d'indice de température 220

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SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

Part 52: Aromatic polyamide (aramid) tape wrapped round copper wire, temperature index 220

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International Standard IEC 60317-52 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;

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– new Clause 23, Pin hole test.

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

CDV	Report on voting
55/1395/CDV	55/1457/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, 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

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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);
2) Specifications for particular types of winding wires (IEC 60317);
3) Packaging of winding wires (IEC 60264).

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SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

Part 52: Aromatic polyamide (aramid) tape wrapped round copper wire, temperature index 220

1 Scope

This part of IEC 60317 specifies requirements for tape wrapped round 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. 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 diameters covered by this standard is:

– 1,600 mm up to and including 5,000 mm;
– the nominal conductor diameters 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*

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

3 Terms, definitions, general notes and appearance

3.1 Terms and definitions

For the purposes 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

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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 60317-52 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.

3.2.2 Winding wire

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 60317-52;
– diameter of the conductor;
– reference should also be made to the number and thickness of the tapes used and to the degree of overlap, as agreed between the purchaser and supplier.

3.3 Appearance

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

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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 diameter

The series of preferred nominal conductor diameters shall correspond to series R20 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 R40 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.

Table 1 – Conductor diameters

Nominal conductor diameter mm	Tolerance ± mm	Nominal conductor diameter mm	Tolerance ± 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 R40 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 insulation

The minimum increase in diameter due to the insulation shall not be less than the values calculated using the following formula:

$$2 \Sigma T_{min.i} n_i$$

where

$T_{min.i}$ is the minimum thickness of the tape in layer number i and n_i is determined by the degree of overlap in that layer:

– for overlaps of 0 % up to, but not including 50 % $n = 1$;

– for overlaps of 50 % up to, but not including 66 % $n = 2$;

– for overlaps of 66 % up to, and including 75 % $n = 3$.

Minimum thickness shall be calculated from the values given in Table 1 of IEC 60819-3-3:2011 where the permissible deviation of the central thickness value is:

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– for nominal thickness 0,05 mm ± 20 %

– for nominal thicknesses 0,08 mm and greater ± 15 %.

EXAMPLE 1 For a construction using two layers of 0,05 mm tape with 50 % overlap:

$$T_{min.1} = 0{,}04 \text{ mm}, \; n_1 = 2$$

$$T_{min.2} = 0{,}04 \text{ mm}, \; n_2 = 2$$

Therefore, the minimum increase due to the insulation equals:

$$2\,(0{,}04 \times 2 + 0{,}04 \times 2) \text{ mm} = 0{,}320 \text{ mm}$$

EXAMPLE 2 For a construction using one layer of 0,05 mm tape with an overlap of 55 % followed by two layers of 0,08 mm tape with no overlap:

$$T_{min.1} = 0{,}04 \text{ mm}, \; n_1 = 2$$

$$T_{min.2} = 0{,}068 \text{ mm}, \; n_2 = 1$$

$$T_{min.3} = 0{,}068 \text{ mm}, \; n_3 = 1$$

Therefore, the minimum increase due to the insulation equals:

$$2\,(0{,}04 \times 2 + 0{,}068 \times 1 + 0{,}068 \times 1) \text{ mm} = 0{,}432 \text{ mm}$$

As there are many varied constructions of this type of wire, the dimensions due to the insulation are subject to agreement between purchaser and supplier and shall be clearly stated in the purchase order.

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 which is calculated using the formula given below.

One or more tapes 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 formula for calculating the maximum increase due to the insulation is:

$$2\,\Sigma\,(n_i + 1)\,T_{max.i}$$

where

n_i is determined by the degree of overlap in accordance with 4.3 in layer number i;

$T_{max.i}$ is the maximum paper thickness as calculated in accordance with 4.3 in that layer.

See the example given in Annex B.

5 Electrical resistance

No resistance values are specified.

The nominal resistance at 20 °C is given in Annex C.

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