IEC 60317-0-10

Edition 1.0 2017-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Specifications for particular types of winding wires – Part 0-10: General requirements – Polyester glass-fibre wound fused, unvarnished, or resin or varnish impregnated, bare or enamelled round copper wire

Spécifications pour types particuliers de fils de bobinage – Partie 0-10: Exigences générales – Fil de section circulaire en cuivre nu ou émaillé, guipé de fibres de verre polyester fondues, non vernies ou imprégnées de vernis ou de résine

IEC 60317-0-10:2017-05(en-fr)

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ELECTROTECHNICAL
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COMMISSION
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INTERNATIONALE

ICS 29.060.10

ISBN 978-2-8322-4261-2

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SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

Part 0-10: General requirements – Polyester glass-fibre wound fused, unvarnished, or resin or varnish impregnated, bare or enamelled round copper wire

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International Standard IEC 60317-0-10 has been prepared by IEC technical committee 55: Winding wires.

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

FDIS	Report on voting
55/1601/FDIS	55/1608/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.

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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 numbering of clauses in this standard is not continuous from Clauses 21 through 30 in order to reserve space for possible future wire requirements prior to those for wire packaging.

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

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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) *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 0-10: General requirements – Polyester glass-fibre wound fused, unvarnished, or resin or varnish impregnated, bare or enamelled round copper wire

1 Scope

This part of IEC 60317 specifies the general requirements of polyester glass-fibre wound fused, unvarnished, or resin or varnish impregnated bare, grade 1 or grade 2 or enamelled round copper winding wires.

The range of nominal conductor dimensions is given in Table 1, Table 2, Table A.1 and Table A.2.

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

IEC 60851-5:2008, *Winding wires – Test methods – Part 5: Electrical properties*

ISO 3, *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.

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

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

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3.1.4
crack
opening in the insulation which exposes the conductor to view at the stated magnification

3.1.5
enamelled wire
wire coated with an insulation of cured resin

3.1.6
fused
state of polyester fibres after having been melted then re-solidified for support/adherence of glass fibres

3.1.7
grade
range of increase in dimension of the wire due to the insulation

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 IEC 60317

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

3.2 General notes

3.2.1 Methods of test

All methods of test to be used for this standard 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 60317-0-10 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.

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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 fibre covering shall consist of a combination of polyester and glass fibres. The glass fibres shall be electrical-grade continuous-filament glass yarn. The polyester fibre shall be a high-grade yarn resulting from the linear polymerization of ethylene glycol and terephthalic acid. The maximum content by weight of polyester fibre in the yarn shall not exceed 50 %.

The coating shall be characterized by the following different grades of thickness:

– PG1, bare conductor with 1 layer of polyester glass fibre or 2 layers of finer polyester glass fibres that together, comply with the dimensional requirements in Table 1.
– PG2, bare conductor with 2 layers of polyester glass fibre;
– Grade 1 PG1, enamelled grade 1 (grade 1) with 1 layer of polyester glass fibre (PG1);
– Grade 1 PG2, enamelled grade 1 (grade 1) with 2 layers of polyester glass fibre (PG2);
– Grade 2 PG1, enamelled grade 2 (grade 2) with 1 layer of polyester glass fibre (PG1);
– Grade 2 PG2, enamelled grade 2 (grade 2) with 2 layers of polyester glass fibre (PG2).

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

– reference to IEC specification;
– nominal conductor diameter in millimetres;
– grade.

3.3 Appearance

The fibrous covering shall be smooth as agreed upon between customer and supplier in accordance with good commercial practice, and free from physical damage and foreign material when examined with normal vision, as wound on the original spool or reel.

NOTE Evidence of physical damage includes gashes, broken fibre strands, and the like.

4 Dimensions

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 and Table 2.

The series of intermediate diameters from which the user shall 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 limit given in Table 1 and Table 2.

For intermediate nominal conductor diameters, the minimum increase figure corresponding to the next larger diameter shall be taken.

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Table 1 – Dimensional requirements of (single) polyester glass-fibre wound fused and unvarnished or resin or varnish impregnated over grade 1 or grade 2 enamelled round copper winding wire (R20)

Nominal conductor diameter mm	Conductor diameter tolerance ± mm	Minimum increase single polyester glass fibre covering mm	Maximum overall diameter single polyester glass fibre covering mm		
			PG1	Grade 1PG1	Grade 2PG1
0,500	0,005	0,064	0,606	0,645	0,667
0,560	0,006	0,089	0,693	0,733	0,757
0,630	0,006	0,089	0,763	0,806	0,831
0,710	0,007	0,089	0,844	0,889	0,916
0,800	0,008	0,089	0,935	0,982	1,011
0,900	0,009	0,089	1,036	1,086	1,116
1,000	0,010	0,089	1,137	1,189	1,221
1,120	0,011	0,089	1,258	1,311	1,344
1,250	0,013	0,089	1,390	1,443	1,476
1,400	0,014	0,089	1,527	1,595	1,629
1,600	0,016	0,089	1,743	1,797	1,833
1,800	0,018	0,089	1,945	1,999	2,036
2,000	0,020	0,089	2,147	2,201	2,239
2,240	0,022	0,089	2,389	2,443	2,482
2,500	0,025	0,089	2,652	2,705	2,745
2,800	0,028	0,102	2,980	3,032	3,074
3,150	0,032	0,102	3,334	3,385	3,428
3,550	0,036	0,102	3,738	3,787	3,831
4,000	0,040	0,102	4,192	4,240	4,285
4,500	0,045	0,102	4,697	4,743	4,789
5,000	0,050	0,102	5,202	5,245	5,293

NOTE 1 Dimensions for intermediate nominal conductor diameters for the R40 series are given in Annex A.

NOTE 2 PG1 is a single or double covering over bare. Grade 1PG1 is a single polyester glass fibre covering over grade 1 enamelled wire, and Grade 2PG1 is a single polyester glass fibre covering over grade 2 enamelled wire.

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Table 2 – Dimensional requirements of (double) polyester glass-fibre wound fused and unvarnished or resin or varnish impregnated over bare, grade 1, or grade 2 enamelled round copper winding wire (R20)

Nominal conductor diameter mm	Conductor diameter tolerance ± mm	Minimum increase double polyester glass fibre covering mm	Maximum overall diameter double polyester glass fibre covering mm		
			Grade PG2	Grade 1PG2	Grade 2PG2
0,500	0,005	0,114	0,670	0,709	0,731
0,560	0,006	0,140	0,770	0,810	0,834
0,630	0,006	0,140	0,840	0,883	0,908
0,710	0,007	0,140	0,921	0,966	0,993
0,800	0,008	0,140	1,012	1,059	1,088
0,900	0,009	0,140	1,113	1,163	1,193
1,000	0,010	0,140	1,214	1,266	1,298
1,120	0,011	0,140	1,335	1,388	1,421
1,250	0,013	0,140	1,467	1,520	1,553
1,400	0,014	0,140	1,618	1,672	1,706
1,600	0,016	0,140	1,820	1,874	1,910
1,800	0,018	0,140	2,022	2,076	2,113
2,000	0,020	0,140	2,224	2,278	2,316
2,240	0,022	0,140	2,466	2,520	2,559
2,500	0,025	0,140	2,729	2,782	2,822
2,800	0,028	0,152	3,056	3,108	3,150
3,150	0,032	0,152	3,410	3,461	3,504
3,550	0,036	0,152	3,814	3,863	3,907
4,000	0,040	0,152	4,268	4,316	4,361
4,500	0,045	0,152	4,773	4,819	4,865
5,000	0,050	0,152	5,278	5,321	5,369

NOTE 1 The dimensions of intermediate nominal conductor diameters for the R40 series are given in Annex A.

NOTE 2 Grade PG2 is a double polyester glass fibre covering over bare, Grade 1PG2 is a double polyester glass fibre covering over grade 1 enamelled wire, and Grade 2PG2 is a double polyester glass fibre covering over grade 2 enamelled wire.

4.2 Out of roundness of conductor

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

4.3 Minimum increase in diameter due to the covering

The minimum increase in diameter due to the covering shall not be less than the values given in Table 1 or Table 2.

4.4 Maximum overall diameter

The maximum overall diameter shall not exceed the values given in Table 1 or Table 2.

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5 Electrical resistance

No minimum or maximum resistance values are specified. For nominal resistance values see Annex B.

6 Elongation

The minimum elongation shall not be less than the value given in Table 3.

Table 3 – Elongation

Nominal conductor diameter mm		Minimum elongation %
Over	Up to and including	
---	0,630	---
0,630	1,250	15
1,250	2,800	20
2,800	5,000	30

7 Springiness

7.1 Nominal conductor diameters up to and including 1,600 mm

No requirements specified.

7.2 Nominal conductor diameters over 1,600 mm

The wire shall not exceed the maximum springback of:

– 5° for wires with a polyester glass fibre covering over a bare conductor;
– 5,5° for wires with a polyester glass fibre covering over an enamelled conductor.

8 Flexibility and adherence

8.1 Mandrel winding test

The covering shall not open sufficiently to expose the bare or enamelled wire after bending on a mandrel according to Table 4.

Table 4 – Mandrel winding

Wire size range		Mandrel diameter
Over	Up to and including	
0,500	2,500	5 x Nom conductor diameter
2,500	5,000	10 x Nom conductor diameter

8.2 Adherence test

The wire shall be stretched by 20 % or to its breakpoint whichever is less. There shall be no loosening, fraying or loss of adhesion of the covering except at the point of rupture.

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