IEC 60317-0-3

Edition 4.0 2024-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Specifications for particular types of winding wires – Part 0-3: General requirements – Enamelled round aluminium wire

Spécifications pour types particuliers de fils de bobinage – Partie 0-3: Exigences générales – Fil de section circulaire en aluminium émaillé

IEC 60317-0-3:2024-09(en-fr)

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Spécifications pour types particuliers de fils de bobinage – Partie 0-3: Exigences générales – Fil de section circulaire en aluminium émaillé

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

Part 0-3: General requirements – Enamelled round aluminium wire

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IEC 60317-0-3 has been prepared by IEC technical committee 55: Winding wires. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2008, Amendment 1:2013 and Amendment 2:2019. This edition constitutes a technical revision.

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

a) Revision to Clause 7, designating the test as inappropriate;
b) Revision to Clause 10, designating the test as inappropriate.

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

Draft	Report on voting
55/2049/FDIS	55/2054/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
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INTRODUCTION

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This part of IEC 60317 is one of a series that deals with insulated wires used for windings in electrical equipment. The series has three groups describing

1) winding wires and 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 0-3: General requirements – Enamelled round aluminium wire

1 Scope

This part of IEC 60317 specifies the general requirements of enamelled round aluminium winding wires with or without a bonding layer.

The range of nominal conductor diameters is given in 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 60317 (all parts), *Specifications for particular types of winding wires*

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

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

ASTM B233-97, *Standard Specification for Aluminum 1350 Drawing Stock for Electrical Purposes*

EN 1715-2, *Aluminium and aluminium alloys – Drawing stock – Part 2: Specific requirements for electrical applications*

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 terminology databases for use in standardization at the following addresses:

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

3.1.1
bonding layer
material which is deposited on an enamelled wire, and which has the specific function of bonding wires together

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3.1.2
class
thermal performance of a wire expressed by the temperature index and the heat shock temperature

3.1.3
coating
material which is deposited on a conductor or wire by a suitable means and then dried and/or cured

3.1.4
conductor
bare metal after removal of the insulation

3.1.5
crack
opening in the insulation which exposes the conductor to view at the stated magnification

3.1.6
enamelled wire
wire coated with an insulation of cured resin

3.1.7
grade
range of thickness of the insulation of a wire

3.1.8
insulation
coating or covering on the conductor with the specific function of withstanding voltage

3.1.9
nominal conductor diameter
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

3.2 General notes

3.2.1 Methods of test

All methods of test to be used for this part of IEC 60317, independent of the class of wire, are given in the IEC 60851 series.

The clause numbers used in this document are identical with the respective test numbers of the IEC 60851 series.

In case of inconsistencies between the publication on methods of test and this document, IEC 60317-0-3 shall prevail.

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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 40 °C and a relative humidity of 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

See the relevant specification sheet.

In addition, 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 diameter in millimetres;
- grade.

EXAMPLE IEC 60317-1 – 0,500 Grade 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, as wound on the original spool or reel.

When agreed upon between the user and supplier, examination using 6× to 10× magnification shall be used for wires with a nominal diameter less than 0,10 mm.

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 may 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 or Table 2.

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

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Table 1 – Dimensions of enamelled wires (R 20)

Nominal conductor diameter	Conductor tolerance ±	Minimum increase due to the insulation mm			Maximum overall diameter mm		
mm	mm	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3
0,250	0,004	0,017	0,032	0,048	0,281	0,297	0,312
0,280	0,004	0,018	0,033	0,050	0,312	0,329	0,345
0,315	0,004	0,019	0,035	0,053	0,349	0,367	0,384
0,355	0,004	0,020	0,038	0,057	0,392	0,411	0,428
0,400	0,005	0,021	0,040	0,060	0,439	0,459	0,478
0,450	0,005	0,022	0,042	0,064	0,491	0,513	0,533
0,500	0,005	0,024	0,045	0,067	0,544	0,566	0,587
0,560	0,006	0,025	0,047	0,071	0,606	0,630	0,653
0,630	0,006	0,027	0,050	0,075	0,679	0,704	0,728
0,710	0,007	0,028	0,053	0,080	0,762	0,789	0,814
0,800	0,008	0,030	0,056	0,085	0,855	0,884	0,911
0,900	0,009	0,032	0,060	0,090	0,959	0,989	1,018
1,000	0,010	0,034	0,063	0,095	1,062	1,094	1,124
1,120	0,011	0,034	0,065	0,098	1,184	1,217	1,248
1,250	0,013	0,035	0,067	0,100	1,316	1,349	1,381
1,400	0,014	0,036	0,069	0,103	1,468	1,502	1,535
1,600	0,016	0,038	0,071	0,107	1,670	1,706	1,740
1,800	0,018	0,039	0,073	0,110	1,872	1,909	1,944
2,000	0,020	0,040	0,075	0,113	2,074	2,112	2,148
2,240	0,022	0,041	0,077	0,116	2,316	2,355	2,392
2,500	0,025	0,042	0,079	0,119	2,578	2,618	2,656
2,800	0,028	0,043	0,081	0,123	2,880	2,922	2,961
3,150	0,032	0,045	0,084	0,127	3,233	3,276	3,316
3,550	0,036	0,046	0,086	0,130	3,635	3,679	3,721
4,000	0,040	0,047	0,089	0,134	4,088	4,133	4,176
4,500	0,045	0,049	0,092	0,138	4,591	4,637	4,681
5,000	0,050	0,050	0,094	0,142	5,093	5,141	5,186
NOTE The dimensions of intermediate nominal conductor diameters for R 40 series are given in Annex A.							

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Table 2 – Dimensions of enamelled wires with a bonding layer (R 20)

Nominal conductor diameter	Conductor tolerance ±	Minimum increase underlying coating mm		Minimum increase bonding layer	Maximum overall diameter mm	
mm	mm	Grade 1B	Grade 2B	mm	Grade 1B	Grade 2B
0,250	0,004	0,017	0,032	0,013	0,300	0,316
0,280	0,004	0,018	0,033	0,013	0,331	0,348
0,315	0,004	0,019	0,035	0,014	0,369	0,387
0,355	0,004	0,020	0,038	0,015	0,413	0,432
0,400	0,005	0,021	0,040	0,016	0,461	0,481
0,450	0,005	0,022	0,042	0,016	0,514	0,536
0,500	0,005	0,024	0,045	0,017	0,568	0,590
0,560	0,006	0,025	0,047	0,017	0,630	0,654
0,630	0,006	0,027	0,050	0,018	0,704	0,729
0,710	0,007	0,028	0,053	0,019	0,788	0,815
0,800	0,008	0,030	0,056	0,020	0,882	0,911
0,900	0,009	0,032	0,060	0,020	0,987	1,017
1,000	0,010	0,034	0,063	0,021	1,091	1,123
1,120	0,011	0,034	0,065	0,022	1,214	1,247
1,250	0,013	0,035	0,067	0,022	1,346	1,379
1,400	0,014	0,036	0,069	0,023	1,499	1,533
1,600	0,016	0,038	0,071	0,023	1,702	1,738
1,800	0,018	0,039	0,073	0,024	1,905	1,942
2,000	0,020	0,040	0,075	0,025	2,108	2,146
NOTE The dimensions of intermediate nominal conductor diameters for R 40 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 column 2 of Table 1 or Table 2.

4.3 Minimum increase in diameter due to the insulation and the bonding layer

4.3.1 Enamelled wires without a bonding layer

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

4.3.2 Enamelled wires with a bonding layer

The minimum increase in diameter due to the insulation including the bonding layer shall not be less than the values given in Table 2.

4.4 Maximum overall diameter

4.4.1 Enamelled wires without a bonding layer

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

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4.4.2 Enamelled wires with a bonding layer

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

5 Electrical resistance

The aluminium rod being used shall comply with EN 1715-2 and ASTM B233-97.

No resistance values are specified.

By agreement between purchaser and supplier, resistance measurements may be made for nominal conductor diameters up to and including 1,000 mm. In case of such an agreement, the resistance at 20 °C shall be within the limits given in Annex C.

6 Elongation

The elongation at fracture and tensile strength shall not be less than the value given in Table 3.

Table 3 – Elongation

Nominal conductor diameter mm		Elongation minimum	Tensile strength minimum
Over	Up to and including	%	$N \cdot mm^{-2}$
–	0,400	10	90
0,400	1,000	12	90
1,000	2,000	15	80
2,000	5,000	15	70

7 Springiness

Test inappropriate.

8 Flexibility and adherence

8.1 Mandrel winding test (nominal conductor diameters up to and including 1,600 mm)

The coating shall show no crack after the wire has been wound on a mandrel as specified in Table 4.

Table 4 – Mandrel winding

Nominal conductor diameter mm		Mandrel diameter
Over	Up to and including	
–	1,600	$3d$[a]
[a] d is the nominal diameter of the wire.		

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