

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Specifications for particular types of winding wires –
Part 21: Solderable polyurethane enamelled round copper wire overcoated with
polyamide, class 155**

**Spécifications pour types particuliers de fils de bobinage –
Partie 21: Fil brasable de section circulaire en cuivre émaillé avec polyuréthane
et avec surcouche polyamide, classe 155**

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IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

**Part 21: Solderable polyurethane enamelled round copper wire
overcoated with polyamide, class 155**

FOREWORD

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 60317-21 edition 3.1 contains the third edition (2013-10) [documents 55/1412/FDIS and 55/1433/RVD] and its amendment 1 (2019-06) [documents 55/1690/CDV and 55/1739/RVC].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 60317-21 has been prepared by IEC Technical Committee 55: Winding wires.

This third 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;
- revision to references to IEC 60317-0-1:2013 to clarify that their application is normative;
- consolidation of 17.1 and 17.2 of the solderability requirements;
- modification to Clause 19, Dielectric dissipation factor;
- new Clause 23, Pin hole test.

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

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 20 and 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 the base publication and its amendment 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 [IEC 60317-21:2013](#)
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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 21: Solderable polyurethane enamelled round copper wire overcoated with polyamide, class 155

1 Scope

This part of IEC 60317 specifies the requirements of solderable enamelled round copper winding wire of class 155 with a dual coating. The underlying coating is based on polyurethane resin, which may be modified providing it retains the chemical identity of the original resin and meets all specified wire requirements. The superimposed coating is based on polyamide resin.

NOTE A modified resin is a resin that has undergone a chemical change, or contains one or more additives to enhance certain performance or application characteristics.

The range of nominal conductor diameters covered by this standard is:

- Grade 1: 0,050 mm up to and including 1,600 mm;
- Grade 2: 0,050 mm up to and including 1,600 mm.

The nominal conductor diameters are specified in Clause 4 of IEC 60317-0-1:2013.

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 60317-0-1:2013, *Specifications for particular types of winding wires – Part 0-1: General requirements – Enamelled round copper wire*

3 Terms, definitions, general notes and appearance

3.1 Terms and definitions

Subclause 3.1 of IEC 60317-0-1:2013 applies.

3.2 General notes

3.2.1 Methods of test

Subclause 3.2.1 of IEC 60317-0-1:2013 applies. In case of inconsistencies between IEC 60317-0-1:2013 and this part of IEC 60317, the latter shall prevail.

3.2.2 Winding wire

Class 155 is a thermal class that requires a minimum temperature index of 155 and a heat shock temperature of at least 175 °C.

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

3.3 Appearance

Subclause 3.3 of IEC 60317-0-1:2013 applies.

4 Dimensions

Clause 4 of IEC 60317-0-1:2013 applies.

5 Electrical resistance

Clause 5 of IEC 60317-0-1:2013 applies.

6 Elongation

Clause 6 of IEC 60317-0-1:2013 applies.

7 Springiness

Clause 7 of IEC 60317-0-1:2013 applies.

8 Flexibility and adherence

Clause 8 of IEC 60317-0-1:2013 applies. For 8.4, the constant K used for the calculation of the number of revolutions for the peel test shall be 150 mm.

9 Heat shock

Clause 9 of IEC 60317-0-1:2013 applies. The minimum heat shock temperature shall be 175 °C.

10 Cut-through

No failure shall occur within 2 min at 200 °C.

11 Resistance to abrasion (nominal conductor diameters from 0,250 mm up to and including 1,600 mm)

The wire shall meet the requirements given in Table 1.

For intermediate nominal conductor diameters, the value of the next larger nominal conductor diameter shall be taken.

Table 1 – Resistance to abrasion

Nominal conductor diameter	Grade 1		Grade 2	
	Minimum average force to failure	Minimum force to failure of each measurement	Minimum average force to failure	Minimum force to failure of each measurement
mm	N	N	N	N
0,250	2,30	1,95	4,10	3,50
0,280	2,50	2,10	4,40	3,70
0,315	2,70	2,30	4,75	4,00
0,355	2,90	2,50	5,10	4,30
0,400	3,15	2,70	5,45	4,60
0,450	3,40	2,90	5,80	4,90
0,500	3,65	3,10	6,20	5,25
0,560	3,90	3,30	6,65	5,60
0,630	4,20	3,55	7,1	6,00
0,710	4,50	3,80	7,60	6,45
0,800	4,80	4,10	8,10	6,90
0,900	5,20	4,40	8,70	7,40
1,000	5,60	4,75	9,30	7,90
1,120	6,00	5,15	10,0	8,50
1,250	6,50	5,55	10,7	9,10
1,400	7,00	5,95	11,4	9,70
1,600	7,50	6,35	12,2	10,4

12 Resistance to solvents

Clause 12 of IEC 60317-0-1:2013 applies.

13 Breakdown voltage

13.1 General

The wire shall meet the requirements given in 13.2 and 13.3, respectively, when tested at room temperature and at 155 °C when this is required by the purchaser.

13.2 Nominal conductor diameters up to and including 0,100 mm

At least four of the five specimens tested shall not break down at a voltage less than or equal to that given in Table 2.

For intermediate nominal conductor diameters, the value of the next larger nominal conductor diameter shall be taken.

Table 2 – Breakdown voltage

Nominal conductor diameter mm	Minimum breakdown voltage (root-mean-square value) (r.m.s) V	
	Grade 1	Grade 2
	At room temperature	
0,050	275	550
0,056	300	600
0,063	350	650
0,071	375	650
0,080	375	750
0,090	450	800
0,100	450	850

13.3 Nominal conductor diameters over 0,100 mm up to and including 1,600 mm

At least four of the five specimens tested shall not break down at a voltage less than or equal to that given in Table 3.

For intermediate nominal conductor diameters, the value of the next larger nominal conductor diameter shall be taken.

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Table 3 – Breakdown voltage

Nominal conductor diameter mm	Minimum breakdown voltage (r.m.s) V			
	Grade 1		Grade 2	
	Room temperature	155 °C	Room temperature	155 °C
0,112	1 200	900	2 400	1 800
0,125	1 300	1 000	2 500	1 900
0,140	1 400	1 100	2 700	2 000
0,160	1 500	1 100	2 900	2 200
0,180	1 500	1 100	3 000	2 300
0,200	1 600	1 200	3 100	2 300
0,224	1 700	1 300	3 300	2 500
0,250	1 900	1 400	3 500	2 600
0,280	2 000	1 500	3 600	2 700
0,315	2 000	1 500	3 700	2 800
0,355	2 100	1 600	3 900	2 900
0,400	2 100	1 600	4 000	3 000
0,450	2 100	1 600	4 000	3 000
0,500	2 200	1 700	4 100	3 100
0,560	2 200	1 700	4 100	3 100
0,630	2 300	1 700	4 300	3 200
0,710	2 300	1 700	4 300	3 200
0,800	2 300	1 700	4 400	3 300
0,900	2 400	1 800	4 500	3 400
1,000 up to and including 1,600	2 400	1 800	4 500	3 400

14 Continuity of insulation

Clause 14 of IEC 60317-0-1:2013 applies.

15 Temperature index

Clause 15 of IEC 60317-0-1:2013 applies. The minimum temperature index shall be 155.