

# INTERNATIONAL STANDARD



**Specifications for particular types of winding wires –  
Part 12: Polyvinyl acetal enamelled round copper wire, class 120**

IECNORM.COM : Click to view the full PDF of IEC 60317-12:2020 RLV



**THIS PUBLICATION IS COPYRIGHT PROTECTED**  
**Copyright © 2020 IEC, Geneva, Switzerland**

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

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

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

**About the IEC**

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

**About IEC publications**

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

**IEC publications search - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)**

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

**IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)**

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

**IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)**

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [sales@iec.ch](mailto:sales@iec.ch).

**Electropedia - [www.electropedia.org](http://www.electropedia.org)**

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

**IEC Glossary - [std.iec.ch/glossary](http://std.iec.ch/glossary)**

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IECNORM.COM : Click to view the full text of IEC 60384-12:2020 PLV



IEC 60317-12

Edition 4.0 2020-06  
REDLINE VERSION

# INTERNATIONAL STANDARD



Specifications for particular types of winding wires –  
Part 12: Polyvinyl acetal enamelled round copper wire, class 120

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

ICS 29.060.10

ISBN 978-2-8322-8486-5

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

FOREWORD .....	3
INTRODUCTION .....	5
1 Scope .....	6
2 Normative references .....	6
3 Terms, definitions <del>and</del> , general notes <del>on methods of test</del> and appearance .....	6
3.1 Terms and definitions .....	6
3.2 General notes <del>on methods of test</del> .....	7
3.2.1 Methods of test .....	7
3.2.2 Winding wire .....	7
3.3 Appearance .....	7
4 Dimensions .....	7
5 Electrical resistance .....	7
6 Elongation .....	7
7 Springiness .....	7
8 Flexibility and adherence .....	7
9 Heat shock .....	7
9.1 Nominal conductor diameters up to and including 1,600 mm .....	8
9.2 Nominal conductor diameters over 1,600 mm .....	8
10 Cut-through .....	8
11 Resistance to abrasion (nominal conductor diameters from 0,250 mm up to and including 2,500 mm) .....	8
12 Resistance to solvents .....	9
13 Breakdown voltage .....	9
14 Continuity of insulation .....	9
15 Temperature index .....	9
16 Resistance to refrigerants .....	9
17 Solderability .....	9
18 Heat or solvent bonding .....	10
19 Dielectric dissipation factor .....	10
20 Resistance to transformer oil .....	10
21 Loss of mass .....	10
23 Pin hole test .....	10
30 Packaging .....	10
Bibliography .....	11
Table 1 – Heat shock .....	8
Table 2 – Resistance to abrasion .....	9

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

## Part 12: Polyvinyl acetal enamelled round copper wire, class 120

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

**This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.**

International Standard IEC 60317-12 has been prepared by IEC technical committee 55: Winding wires.

This fourth edition of IEC 60317-12 cancels and replaces the third edition published in 2010. This edition constitutes a technical revision.

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

- a) modification of the Scope;
- b) addition of reference to transformer oil resistance test method in Clause 20.

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

FDIS	Report on voting
55/1841/FDIS	55/1854/RVD

Full information on the voting for the approval of this document 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.

This International Standard is to be used in conjunction with IEC 60317-0-1:2013 and its Amendment 1:2019.

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 document 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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- 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 forms an element of a series of standards which deals with insulated wires used for windings in electrical equipment. It is composed of the following series:

- 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).

IECNORM.COM : Click to view the full PDF of IEC 60317-12:2020 RLV

# SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

## Part 12: Polyvinyl acetal enamelled round copper wire, class 120

### 1 Scope

This part of IEC 60317 specifies the requirements of enamelled round copper winding wires of class 120 with a sole coating based on polyvinyl acetal or polyvinyl formal resin, which ~~may~~ **can** be modified provided it retains the chemical identity of the original resin and meets all specified wire requirements.

NOTE 1 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.

~~Class 120 is a thermal class that requires a minimum temperature index of 120 and a heat shock temperature of at least 155 °C.~~

~~The temperature in degrees Celsius 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.~~

NOTE 2 Polyvinyl acetal is a general name for a family of thermoplastic vinyl resins produced by the condensation of polyvinyl alcohol with an aldehyde. Examples are polyvinyl acetal, polyvinyl formal and polyvinyl butyral.

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

- Grade 1: 0,040 mm up to and including 2,500 mm;
- Grade 2: 0,040 mm up to and including 5,000 mm;
- Grade 3: 0,080 mm up to and including 5,000 mm.

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

### 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 60317-0-1:2008/2013, *Specifications for particular types of winding wires – Part 0-1: General requirements – Enamelled round copper wire*  
IEC 60317-0-1:2013/AMD1:2019

### 3 Terms, definitions ~~and~~, general notes ~~on methods of test~~ and appearance

#### 3.1 Terms and definitions

~~For terms and definitions, see 3.1 of IEC 60317-0-1. In case of inconsistencies between IEC 60317-0-1 and this standard, IEC 60317-12 shall prevail.~~

For the purposes of this document, the terms and definitions given in IEC 60317-0-1 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>

### **3.2 General notes ~~on methods of test~~**

#### **3.2.1 Methods of test**

~~For general notes on methods of test, see 3.2 of IEC 60317-0-1. In case of inconsistencies between IEC 60317-0-1 and this standard, IEC 60317-12 shall prevail.~~

Subclause 3.2.1 of IEC 60317-0-1:2013 and IEC 60317-0-1:2013/AMD1:2019 applies. In case of inconsistencies between IEC 60317-0-1 and this document, IEC 60317-12 shall prevail.

#### **3.2.2 Winding wire**

Class 120 is a thermal class that requires a minimum temperature index of 120 and a heat shock temperature of at least 155 °C.

The temperature in degrees Celsius 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 and IEC 60317-0-1:2013/AMD1:2019 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, where the constant  $K$  used for the calculation of the number of revolutions for the peel test shall be 175 mm.

## **9 Heat shock**

Clause 9 of IEC 60317-0-1:2013 applies. The minimum heat shock temperature shall be 155 °C.

**9.1 Nominal conductor diameters up to and including 1,600 mm**

The coating shall show no crack. The mandrel diameter shall be as specified in Table 1.

**Table 1 – Heat shock**

Nominal conductor diameter mm		Elongation before winding on mandrel %	Mandrel diameter <sup>b</sup>
Over	Up to and including		
–	0,050	20 <sup>a</sup>	0,150 mm
0,050	1,600	–	<i>D</i>

<sup>a</sup> Or ~~to the breaking point of the copper~~ until it breaks, whichever is less.  
<sup>b</sup> *D* is the overall diameter of the wire.

**9.2 Nominal conductor diameters over 1,600 mm**

Subclause 9.2 of IEC 60317-0-1:2013 applies.

**10 Cut-through**

No failure shall occur within 2 min at 170 °C.

**11 Resistance to abrasion (nominal conductor diameters from 0,250 mm up to and including 2,500 mm)**

The wire shall meet the requirements given in Table 2.

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

IECNORM.COM : Click to view the full PDF of IEC 60317-12:2020 RLV

**Table 2 – Resistance to abrasion**

Nominal conductor diameter	Grade 1		Grade 2		Grade 3	
	Minimum average force to failure	Minimum force to failure of each measurement	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	N	N
0,250	3,00	2,55	4,90	4,15	5,80	4,90
0,280	3,25	2,75	5,25	4,45	6,25	5,30
0,315 0,320	3,50	2,95	5,65	4,80	6,70	5,70
0,360	3,75	3,20	6,05	5,15	7,20	6,10
0,400	4,05	3,45	6,50	5,50	7,70	6,50
0,450	4,35	3,70	7,00	5,90	8,25	7,00
0,500	4,65	3,95	7,50	6,35	8,85	7,50
0,560	5,00	4,25	8,00	6,80	9,50	8,05
0,630	5,35	4,55	8,60	7,30	10,2	8,65
0,710	5,70	4,85	9,20	7,80	10,9	9,25
0,800	6,10	5,15	9,90	8,40	11,7	9,90
0,900	6,55	5,55	10,6	9,00	12,5	10,6
1,000	7,05	5,95	11,3	9,60	13,3	11,3
1,120	7,60	6,45	12,1	10,2	14,2	12,0
1,250	8,20	6,95	12,9	11,0	15,2	12,9
1,400	8,80	7,45	13,9	11,8	16,4	13,9
1,600	9,45	8,00	14,9	12,6	17,6	14,9
1,800	10,1	8,60	16,0	13,5	18,8	16,0
2,000	10,9	9,20	17,1	14,4	20,2	17,1
2,240	11,7	9,90	18,2	15,4	21,6	18,3
2,500	12,5	10,6	19,4	16,4	23,0	19,5

**12 Resistance to solvents**

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

**13 Breakdown voltage**

Clause 13 of IEC 60317-0-1:2013 applies. The elevated temperature shall be 120 °C.

**14 Continuity of insulation**

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

**15 Temperature index**

Clause 15 of 60317-0-1:2013 applies. The minimum temperature index shall be 120.

**16 Resistance to refrigerants**

Test appropriate but no requirements specified.

**17 Solderability**

Test inappropriate.

## **18 Heat or solvent bonding**

Test inappropriate.

## **19 Dielectric dissipation factor**

Test inapapropriate.

## **20 Resistance to transformer oil**

~~Test appropriate but no requirements specified.~~

Test according to Clause 6 of IEC 60851-4:2016 appropriate. Test requirements are under consideration.

## **21 Loss of mass**

Test inappropriate.

## **23 Pin hole test**

Clause 23 of 60317-0-1:2013 applies.

## **30 Packaging**

Clause 30 of 60317-0-1:2013 applies.

IECNORM.COM : Click to view the full PDF of IEC 60317-12:2020 RLV

## Bibliography

IEC 60264 (all parts), *Packaging of winding wires*

IEC 60317 (all parts), *Specifications for particular types of winding wires*

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

IEC 60851-4:2016, *Winding wires – Test methods – Part 4: Chemical properties*

---

IECNORM.COM : Click to view the full PDF of IEC 60317-12:2020 RLV

IECNORM.COM : Click to view the full PDF of IEC 60317-12:2020 RLV

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Specifications for particular types of winding wires –  
Part 12: Polyvinyl acetal enamelled round copper wire, class 120**

**Spécifications pour types particuliers de fils de bobinage –  
Partie 12: Fil de section circulaire en cuivre émaillé avec acétal de polyvinyle,  
classe 120**

IECNORM.COM : Click to view the full PDF of IEC 60317-12:2020 RLV

## CONTENTS

FOREWORD .....	3
INTRODUCTION .....	5
1 Scope .....	6
2 Normative references .....	6
3 Terms, definitions, general notes and appearance .....	6
3.1 Terms and definitions .....	6
3.2 General notes .....	6
3.2.1 Methods of test .....	6
3.2.2 Winding wire .....	7
3.3 Appearance .....	7
4 Dimensions .....	7
5 Electrical resistance .....	7
6 Elongation .....	7
7 Springiness .....	7
8 Flexibility and adherence .....	7
9 Heat shock .....	7
9.1 Nominal conductor diameters up to and including 1,600 mm .....	7
9.2 Nominal conductor diameters over 1,600 mm .....	8
10 Cut-through .....	8
11 Resistance to abrasion (nominal conductor diameters from 0,250 mm up to and including 2,500 mm) .....	8
12 Resistance to solvents .....	9
13 Breakdown voltage .....	9
14 Continuity of insulation .....	9
15 Temperature index .....	9
16 Resistance to refrigerants .....	9
17 Solderability .....	9
18 Heat or solvent bonding .....	10
19 Dielectric dissipation factor .....	10
20 Resistance to transformer oil .....	10
21 Loss of mass .....	10
23 Pin hole test .....	10
30 Packaging .....	10
Bibliography .....	11
Table 1 – Heat shock .....	8
Table 2 – Resistance to abrasion .....	9

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –****Part 12: Polyvinyl acetal enamelled round copper wire, class 120**

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60317-12 has been prepared by IEC technical committee 55: Winding wires.

This fourth edition of IEC 60317-12 cancels and replaces the third edition published in 2010. This edition constitutes a technical revision.

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

- a) modification of the Scope;
- b) addition of reference to transformer oil resistance test method in Clause 20.

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

FDIS	Report on voting
55/1841/FDIS	55/1854/RVD

Full information on the voting for the approval of this document 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.

This International Standard is to be used in conjunction with IEC 60317-0-1:2013 and its Amendment 1:2019.

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 document 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

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

IECNORM.COM : Click to view the full PDF of IEC 60317-12:2020 RLV

## 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. It is composed of the following series:

- 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).

IECNORM.COM : Click to view the full PDF of IEC 60317-12:2020 RLV

# SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

## Part 12: Polyvinyl acetal enamelled round copper wire, class 120

### 1 Scope

This part of IEC 60317 specifies the requirements of enamelled round copper winding wires of class 120 with a sole coating based on polyvinyl acetal or polyvinyl formal resin, which can be modified provided it retains the chemical identity of the original resin and meets all specified wire requirements.

NOTE 1 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.

NOTE 2 Polyvinyl acetal is a general name for a family of thermoplastic vinyl resins produced by the condensation of polyvinyl alcohol with an aldehyde. Examples are polyvinyl acetal, polyvinyl formal and polyvinyl butyral.

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

- Grade 1: 0,040 mm up to and including 2,500 mm;
- Grade 2: 0,040 mm up to and including 5,000 mm;
- Grade 3: 0,080 mm up to and including 5,000 mm.

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

### 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 60317-0-1:2013, *Specifications for particular types of winding wires – Part 0-1: General requirements – Enamelled round copper wire*  
IEC 60317-0-1:2013/AMD1:2019

### 3 Terms, definitions, general notes and appearance

#### 3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60317-0-1 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>

#### 3.2 General notes

##### 3.2.1 Methods of test

Subclause 3.2.1 of IEC 60317-0-1:2013 and IEC 60317-0-1:2013/AMD1:2019 applies. In case of inconsistencies between IEC 60317-0-1 and this document, IEC 60317-12 shall prevail.

### 3.2.2 Winding wire

Class 120 is a thermal class that requires a minimum temperature index of 120 and a heat shock temperature of at least 155 °C.

The temperature in degrees Celsius 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 and IEC 60317-0-1:2013/AMD1:2019 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, where the constant  $K$  used for the calculation of the number of revolutions for the peel test shall be 175 mm.

## 9 Heat shock

Clause 9 of IEC 60317-0-1:2013 applies. The minimum heat shock temperature shall be 155 °C.

### 9.1 Nominal conductor diameters up to and including 1,600 mm

The coating shall show no crack. The mandrel diameter shall be as specified in Table 1.

**Table 1 – Heat shock**

Nominal conductor diameter mm		Elongation before winding on mandrel %	Mandrel diameter <sup>b</sup>
Over	Up to and including		
–	0,050	20 <sup>a</sup>	0,150 mm
0,050	1,600	–	<i>D</i>
<sup>a</sup> Or until it breaks, whichever is less. <sup>b</sup> <i>D</i> is the overall diameter of the wire.			

**9.2 Nominal conductor diameters over 1,600 mm**

Subclause 9.2 of IEC 60317-0-1:2013 applies.

**10 Cut-through**

No failure shall occur within 2 min at 170 °C.

**11 Resistance to abrasion (nominal conductor diameters from 0,250 mm up to and including 2,500 mm)**

The wire shall meet the requirements given in Table 2.

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

IECNORM.COM : Click to view the full PDF of IEC 60317-12:2020 RLV

**Table 2 – Resistance to abrasion**

Nominal conductor diameter	Grade 1		Grade 2		Grade 3	
	Minimum average force to failure	Minimum force to failure of each measurement	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	N	N
0,250	3,00	2,55	4,90	4,15	5,80	4,90
0,280	3,25	2,75	5,25	4,45	6,25	5,30
0,320	3,50	2,95	5,65	4,80	6,70	5,70
0,360	3,75	3,20	6,05	5,15	7,20	6,10
0,400	4,05	3,45	6,50	5,50	7,70	6,50
0,450	4,35	3,70	7,00	5,90	8,25	7,00
0,500	4,65	3,95	7,50	6,35	8,85	7,50
0,560	5,00	4,25	8,00	6,80	9,50	8,05
0,630	5,35	4,55	8,60	7,30	10,2	8,65
0,710	5,70	4,85	9,20	7,80	10,9	9,25
0,800	6,10	5,15	9,90	8,40	11,7	9,90
0,900	6,55	5,55	10,6	9,00	12,5	10,6
1,000	7,05	5,95	11,3	9,60	13,3	11,3
1,120	7,60	6,45	12,1	10,2	14,2	12,0
1,250	8,20	6,95	12,9	11,0	15,2	12,9
1,400	8,80	7,45	13,9	11,8	16,4	13,9
1,600	9,45	8,00	14,9	12,6	17,6	14,9
1,800	10,1	8,60	16,0	13,5	18,8	16,0
2,000	10,9	9,20	17,1	14,4	20,2	17,1
2,240	11,7	9,90	18,2	15,4	21,6	18,3
2,500	12,5	10,6	19,4	16,4	23,0	19,5

**12 Resistance to solvents**

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

**13 Breakdown voltage**

Clause 13 of IEC 60317-0-1:2013 applies. The elevated temperature shall be 120 °C.

**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 120.

**16 Resistance to refrigerants**

Test appropriate but no requirements specified.

**17 Solderability**

Test inappropriate.

### **18 Heat or solvent bonding**

Test inappropriate.

### **19 Dielectric dissipation factor**

Test inappropriate.

### **20 Resistance to transformer oil**

Test according to Clause 6 of IEC 60851-4:2016 appropriate. Test requirements are under consideration.

### **21 Loss of mass**

Test inappropriate.

### **23 Pin hole test**

Clause 23 of IEC 60317-0-1:2013 applies.

### **30 Packaging**

Clause 30 of IEC 60317-0-1:2013 applies.

IECNORM.COM : Click to view the full PDF of IEC 60317-12:2020 RLV

## Bibliography

IEC 60264 (all parts), *Packaging of winding wires*

IEC 60317 (all parts), *Specifications for particular types of winding wires*

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

IEC 60851-4:2016, *Winding wires – Test methods – Part 4: Chemical properties*

---

IECNORM.COM : Click to view the full PDF of IEC 60317-12:2020 RLV

## SOMMAIRE

AVANT-PROPOS .....	13
INTRODUCTION .....	15
1 Domaine d'application .....	16
2 Références normatives .....	16
3 Termes, définitions, notes générales et aspect .....	16
3.1 Termes et définitions .....	16
3.2 Notes générales .....	17
3.2.1 Méthodes d'essai .....	17
3.2.2 Fil de bobinage .....	17
3.3 Aspect .....	17
4 Dimensions .....	17
5 Résistance électrique .....	17
6 Allongement .....	17
7 Effet de ressort .....	17
8 Souplesse et adhérence .....	17
9 Choc thermique .....	17
9.1 Diamètres nominaux des conducteurs jusques et y compris 1,600 mm .....	17
9.2 Diamètres nominaux des conducteurs supérieurs à 1,600 mm .....	18
10 Thermoplasticité .....	18
11 Résistance à l'abrasion (diamètres nominaux des conducteurs de 0,250 mm jusques et y compris 2,500 mm) .....	18
12 Résistance aux solvants .....	19
13 Tension de claquage .....	19
14 Continuité de l'isolant .....	19
15 Indice de température .....	19
16 Résistance aux réfrigérants .....	19
17 Brasabilité .....	19
18 Adhérence par chaleur ou par solvant .....	20
19 Facteur de dissipation diélectrique .....	20
20 Résistance à l'huile de transformateur .....	20
21 Perte de masse .....	20
23 Détection des microfissures en immersion .....	20
30 Conditionnement .....	20
Bibliographie .....	21
Tableau 1 – Choc thermique .....	18
Tableau 2 – Résistance à l'abrasion .....	19

## COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

**SPÉCIFICATIONS POUR TYPES PARTICULIERS DE FILS DE BOBINAGE –****Partie 12: Fil de section circulaire en cuivre émaillé  
avec acétal de polyvinyle, classe 120**

## AVANT-PROPOS

- 1) La Commission Electrotechnique Internationale (IEC) est une organisation mondiale de normalisation composée de l'ensemble des comités électrotechniques nationaux (Comités nationaux de l'IEC). L'IEC a pour objet de favoriser la coopération internationale pour toutes les questions de normalisation dans les domaines de l'électricité et de l'électronique. A cet effet, l'IEC – entre autres activités – publie des Normes internationales, des Spécifications techniques, des Rapports techniques, des Spécifications accessibles au public (PAS) et des Guides (ci-après dénommés "Publication(s) de l'IEC"). Leur élaboration est confiée à des comités d'études, aux travaux desquels tout Comité national intéressé par le sujet traité peut participer. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec l'IEC, participent également aux travaux. L'IEC collabore étroitement avec l'Organisation Internationale de Normalisation (ISO), selon des conditions fixées par accord entre les deux organisations.
- 2) Les décisions ou accords officiels de l'IEC concernant les questions techniques représentent, dans la mesure du possible, un accord international sur les sujets étudiés, étant donné que les Comités nationaux de l'IEC intéressés sont représentés dans chaque comité d'études.
- 3) Les Publications de l'IEC se présentent sous la forme de recommandations internationales et sont agréées comme telles par les Comités nationaux de l'IEC. Tous les efforts raisonnables sont entrepris afin que l'IEC s'assure de l'exactitude du contenu technique de ses publications; l'IEC ne peut pas être tenue responsable de l'éventuelle mauvaise utilisation ou interprétation qui en est faite par un quelconque utilisateur final.
- 4) Dans le but d'encourager l'uniformité internationale, les Comités nationaux de l'IEC s'engagent, dans toute la mesure possible, à appliquer de façon transparente les Publications de l'IEC dans leurs publications nationales et régionales. Toutes divergences entre toutes Publications de l'IEC et toutes publications nationales ou régionales correspondantes doivent être indiquées en termes clairs dans ces dernières.
- 5) L'IEC elle-même ne fournit aucune attestation de conformité. Des organismes de certification indépendants fournissent des services d'évaluation de conformité et, dans certains secteurs, accèdent aux marques de conformité de l'IEC. L'IEC n'est responsable d'aucun des services effectués par les organismes de certification indépendants.
- 6) Tous les utilisateurs doivent s'assurer qu'ils sont en possession de la dernière édition de cette publication.
- 7) Aucune responsabilité ne doit être imputée à l'IEC, à ses administrateurs, employés, auxiliaires ou mandataires, y compris ses experts particuliers et les membres de ses comités d'études et des Comités nationaux de l'IEC, pour tout préjudice causé en cas de dommages corporels et matériels, ou de tout autre dommage de quelque nature que ce soit, directe ou indirecte, ou pour supporter les coûts (y compris les frais de justice) et les dépenses découlant de la publication ou de l'utilisation de cette Publication de l'IEC ou de toute autre Publication de l'IEC, ou au crédit qui lui est accordé.
- 8) L'attention est attirée sur les références normatives citées dans cette publication. L'utilisation de publications référencées est obligatoire pour une application correcte de la présente publication.
- 9) L'attention est attirée sur le fait que certains des éléments de la présente Publication de l'IEC peuvent faire l'objet de droits de brevet. L'IEC ne saurait être tenue pour responsable de ne pas avoir identifié de tels droits de brevets et de ne pas avoir signalé leur existence.

La Norme internationale IEC 60317-12 a été établie par le comité d'études 55 de l'IEC: Fils de bobinage.

Cette quatrième édition de l'IEC 60317-12 annule et remplace la troisième édition parue en 2010. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

- a) modification du domaine d'application;
- b) ajout d'une référence à la méthode d'essai de résistance à l'huile de transformateur à l'Article 20.

Le texte de cette publication est issu des documents suivants:

FDIS	Rapport de vote
55/1841/FDIS	55/1854/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de ce document.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2.

La présente Norme internationale doit être utilisée conjointement avec l'IEC 60317-0-1:2013 et son Amendement 1:2019.

Une liste de toutes les parties de la série IEC 60317, publiées sous le titre général *Spécifications pour types particuliers de fils de bobinage*, peut être consultée sur le site web de l'IEC.

La numérotation des articles dans le présent document n'est pas continue entre les Articles 21 et 30 afin de permettre l'introduction d'éventuelles futures exigences concernant les fils avant celles concernant le conditionnement des fils.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "<http://webstore.iec.ch>" dans les données relatives au document recherché. A cette date, le document sera

- reconduit,
- supprimé,
- remplacé par une édition révisée, ou
- amendé.

IECNORM.COM : Click to view the full PDF of IEC 60317-12:2020 RLV

## INTRODUCTION

La présente partie de l'IEC 60317 appartient à une série de normes traitant des fils isolés utilisés pour les enroulements des appareils électriques. L'ensemble est composé des trois séries de normes suivantes:

- 1) *Fils de bobinage – Méthodes d'essai* (série IEC 60851);
- 2) *Spécifications pour types particuliers de fils de bobinage* (série IEC 60317);
- 3) *Conditionnement des fils de bobinage* (série IEC 60264).

IECNORM.COM : Click to view the full PDF of IEC 60317-12:2020 RLV

## SPÉCIFICATIONS POUR TYPES PARTICULIERS DE FILS DE BOBINAGE –

### Partie 12: Fil de section circulaire en cuivre émaillé avec acétal de polyvinyle, classe 120

#### 1 Domaine d'application

La présente partie de l'IEC 60317 spécifie les exigences relatives aux fils de bobinage de section circulaire en cuivre émaillés de classe 120 avec un revêtement simple à base de résine acétal de polyvinyle ou formol de polyvinyle qui peut être modifiée sous réserve qu'elle conserve l'identité chimique de la résine initiale et respecte l'ensemble des exigences spécifiées du fil.

NOTE 1 Une résine modifiée est une résine dont les propriétés chimiques ont été modifiées ou qui contient un ou plusieurs additifs visant à améliorer certaines performances ou caractéristiques d'application.

NOTE 2 L'acétal de polyvinyle est le nom générique désignant une famille de résines thermoplastiques vinyliques produites par la condensation de l'alcool polyvinylique avec un aldéhyde. Des exemples sont l'acétal de polyvinyle, le formol de polyvinyle et le butyral de polyvinyle.

La gamme des diamètres nominaux des conducteurs couverts par le présent document est:

- grade 1: 0,040 mm jusques et y compris 2,500 mm;
- grade 2: 0,040 mm jusques et y compris 5,000 mm;
- grade 3: 0,080 mm jusques et y compris 5,000 mm.

Les diamètres nominaux du conducteur sont spécifiés à l'Article 4 de l'IEC 60317-0-1:2013.

#### 2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60317-0-1:2013, *Spécifications pour types particuliers de fils de bobinage – Partie 0-1: Exigences générales – Fil de section circulaire en cuivre émaillé*  
IEC 60317-0-1:2013/AMD1:2019

#### 3 Termes, définitions, notes générales et aspect

##### 3.1 Termes et définitions

Pour les besoins du présent document, les termes et définitions donnés dans l'IEC 60317-0-1 s'appliquent.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse <http://www.electropedia.org/>
- ISO Online browsing platform: disponible à l'adresse <http://www.iso.org/obp>