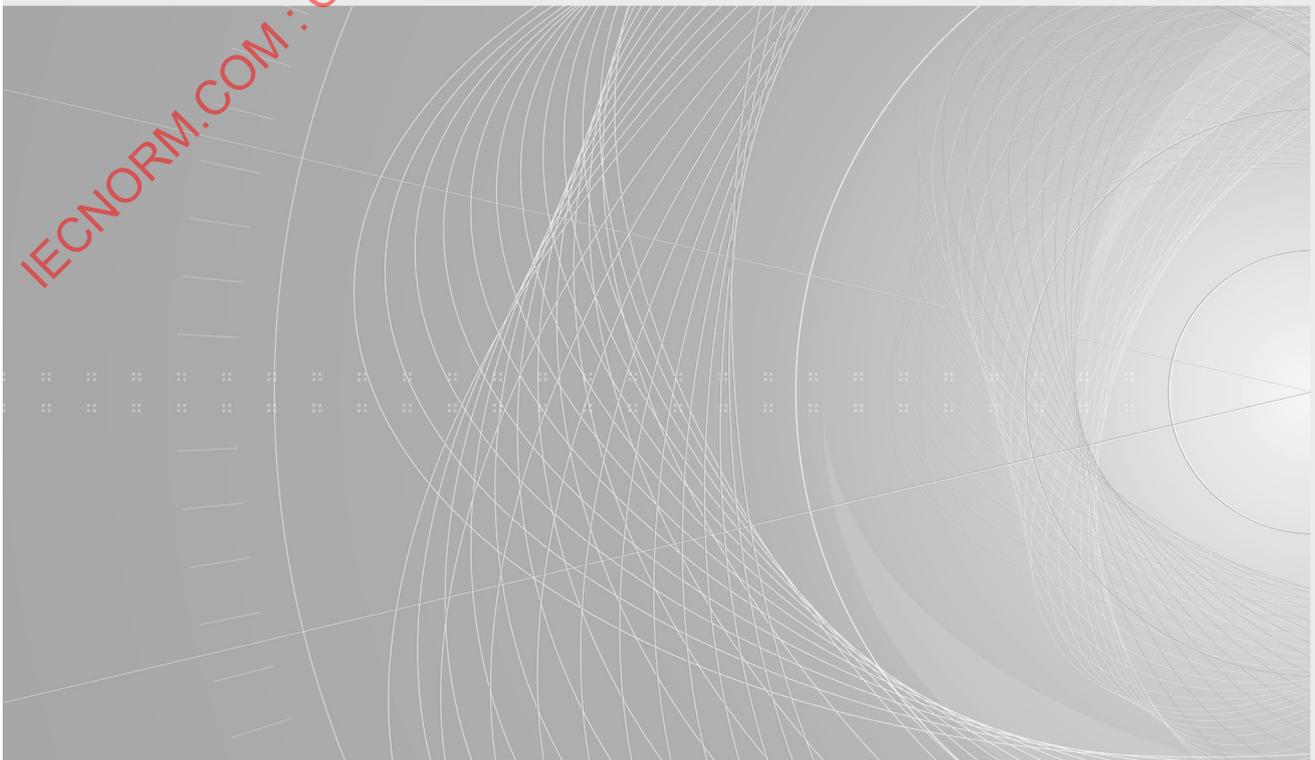


# INTERNATIONAL STANDARD



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

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# INTERNATIONAL STANDARD



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

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ELECTROTECHNICAL  
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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

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

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**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 60317-12 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.

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.

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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. 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).

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## 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.

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**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.~~

Test inappropriate.

**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.

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## 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*

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

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- b) addition of reference to transformer oil resistance test method in Clause 20.

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## 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.

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