

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Specifications for particular types of winding wires –  
Part 0-7: General requirements – Fully insulated (FIW) zero-defect enamelled  
round copper wire with nominal conductor diameter of 0,040 mm to 1,600 mm**

**Spécifications pour types particuliers de fils de bobinage –  
Partie 0-7: Exigences générales – Fil de section circulaire en cuivre émaillé sans  
défaut d'isolation électrique avec diamètre nominal de conducteur compris entre  
0,040 mm et 1,600 mm**



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## CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references .....	7
3 Terms, definitions, general notes and appearance.....	7
3.1 Terms and definitions .....	7
3.2 General notes.....	9
3.2.1 Methods of test.....	9
3.2.2 Winding wire.....	9
3.3 Appearance.....	9
4 Dimensions .....	9
4.1 Conductor diameter.....	9
4.2 Out of roundness of conductor (for nominal diameters over 0,063 mm).....	10
4.3 Minimum overall diameter.....	10
4.4 Maximum overall diameter.....	10
5 Electrical resistance .....	13
6 Elongation.....	13
7 Springiness .....	14
8 Flexibility and adherence.....	14
8.1 Mandrel winding test (for nominal conductor diameters up to and including 1,600 mm).....	14
8.2 Jerk test (for nominal diameters up to and including 1,000 mm).....	15
9 Heat shock.....	15
10 Cut Through.....	16
11 Resistance to abrasion.....	16
12 Resistance to solvents.....	16
13 Breakdown voltage.....	17
14 Continuity of insulation (nominal conductor diameters up to and including 1,600 mm).....	17
14.1 Off-line high voltage continuity.....	17
14.2 In-line high voltage continuity.....	17
15 Temperature index .....	17
16 Resistance to refrigerants.....	17
17 Solderability .....	18
18 Heat or solvent bonding.....	18
19 Dielectric dissipation factor.....	18
20 Resistance to transformer oil.....	18
21 Loss of mass.....	18
23 Pin-hole test.....	18
30 Packaging .....	18
Annex A (informative) Dimensions for intermediate nominal conductor diameter values (R 40).....	19

Table 1 – Dimensions of enamelled wires (R 20) (1 of 2) .....	11
Table 2 – Electrical resistance .....	13
Table 3 – Elongation at break .....	13
Table 4 – Springiness .....	14
Table 5 – Mandrel diameters for mandrel winding test .....	15
Table 6 – Heat shock .....	16
Table 7 – Breakdown voltage .....	17
Table A.1 – Dimensions of enamelled wires without a bonding layer (R 40) .....	19

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SPECIFICATIONS FOR PARTICULAR TYPES  
OF WINDING WIRES –**

**Part 0-7: General requirements –  
Fully insulated (FIW) zero-defect enamelled round copper wire  
with nominal conductor diameter of 0,040 mm to 1,600 mm**

FOREWORD

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International Standard IEC 60317-0-7 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
55/1303/FDIS	55/1321/RVD

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

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

This International standard is to be read in conjunction with the IEC 60851 series. The clause numbers used in this part of IEC 60317 are identical with the respective test numbers of the IEC 60851 series.

In case of inconsistencies between IEC 60851 and this part of IEC 60317, the latter shall prevail.

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

A list of all the 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 publication 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

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## 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 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 0-7: General requirements – Fully insulated (FIW) zero-defect enamelled round copper wire with nominal conductor diameter of 0,040 mm to 1,600 mm

#### 1 Scope

This part of IEC 60317 establishes general requirements for fully insulated (FIW) zero-defect enamelled round copper wires.

The nominal conductor diameter range is given in the relevant technical specification.

#### 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 60172, *Test procedure for the determination of the temperature index of enamelled winding wires*

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

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

IEC 60851-5:2008, *Winding wires – Test methods – Part 5: Electrical properties*  
Amendment 1:2011

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.

###### 3.1.1

###### **bonding layer**

material that is deposited on an enamelled wire and that has the specific function of bonding wires together

###### 3.1.2

###### **class**

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

**3.1.3**

**coating**

material that is deposited on a conductor or wire by 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 that exposes the conductor to view at the stated magnification

**3.1.6**

**dual coating**

insulation composed of two different materials, an underlying and a superimposed coating

**3.1.7**

**enamelled wire**

wire coated with an insulation of cured resin

**3.1.8**

**grade of FIW**

range of overall diameter of a wire

Note 1 to entry: This note applies to the French language only.

**3.1.9**

**insulation**

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

**3.1.10**

**nominal conductor dimension**

designation of the conductor size in accordance with IEC 60317-0-1

**3.1.11**

**normal vision**

20/20 vision, with corrective lenses if necessary

**3.1.12**

**sole coating**

insulation composed of one material

**3.1.13**

**winding wire**

wire used for winding a coil to provide a magnetic field

**3.1.14**

**wire**

conductor coated or covered with an insulation

**3.1.15**

**zero-defect wire**

winding wire that exhibits no electrical discontinuities when tested under specific conditions

### 3.2 General notes

#### 3.2.1 Methods of test

All test methods used in this standard shall be applied in accordance with the test methods of the IEC 60851 series.

The clause numbers used in this standard are identical to the corresponding test numbers in the IEC 60851 series.

In case of inconsistencies between the test methods standard and this standard, this standard shall prevail.

Where no specific range of nominal diameter is given for a test, the test method shall apply to all nominal dimensions covered by this standard.

Unless otherwise agreed, all tests shall be carried out at a temperature between 15 °C and 40 °C, and at a relative humidity of 45 % to 75 %. Before each test, the specimen shall be preconditioned under these atmospheric conditions for a time sufficient to allow the specimens to reach a stable state. These requirements do not affect the online high voltage continuity test according to IEC 60851-5.

The wire to be tested shall be removed from the packaging in such a way that it is not subjected to elongation or unnecessary bending. Before each test, sufficient wire shall be discarded to ensure that no damaged wire is included in the test specimen.

#### 3.2.2 Winding wire

Where a wire type is referenced to Clause 2, the following information shall be provided:

- Reference to the relevant standard;
- Nominal conductor diameter in mm;
- Grade of FIW;
- Example: IEC 60317-56 – 0,500 grade of FIW 5.

### 3.3 Appearance

The wire coating shall be essentially smooth and uniform, and free from streaks, blisters and foreign material in accordance with good commercial practice when examined with normal vision, as wound on the original spool or reel.

When agreed upon between the user and supplier, examination using 6× – 10× magnification shall be used for wires with a nominal diameter less than 0,1 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.

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 Table A.1 of Annex A.

The conductor diameter shall not differ from the nominal diameter by more than the tolerance given in Table 1.

#### **4.2 Out of roundness of conductor (for nominal diameters over 0,063 mm)**

The difference between the minimum and maximum diameter shall not exceed the figures in column 2 of Table 1 at any point.

#### **4.3 Minimum overall diameter**

The minimum overall diameter of enamelled wires without a bonding layer shall not be less than the values in Table 1.

#### **4.4 Maximum overall diameter**

The maximum overall diameter of enamelled wires without a bonding layer shall not exceed the values in Table 1.

For intermediate nominal diameters, the minimum external diameter shall be calculated linearly to the next larger nominal diameter.

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Withholding

Table 1 – Dimensions of enamelled wires (R 20) (1 of 2)

Nominal conductor diameter mm	Conductor tolerance ± mm	Minimum overall diameter mm									Maximum overall diameter mm								
		Grade of FIW 3	Grade of FIW 4	Grade of FIW 5	Grade of FIW 6	Grade of FIW 7	Grade of FIW 8	Grade of FIW 9	Grade of FIW 3	Grade of FIW 4	Grade of FIW 5	Grade of FIW 6	Grade of FIW 7	Grade of FIW 8	Grade of FIW 9				
0,040		0,055	0,059	0,070	0,080	0,090	0,100	0,058	0,069	0,079	0,089	0,099	0,109						
0,045		0,062	0,067	0,079	0,090	0,101	0,112	0,066	0,078	0,089	0,100	0,111	0,122						
0,050		0,067	0,073	0,084	0,095	0,106	0,117	0,072	0,083	0,094	0,105	0,116	0,127						
0,056		0,075	0,082	0,093	0,105	0,117	0,129	0,081	0,092	0,104	0,116	0,128	0,140						
0,063		0,084	0,090	0,103	0,116	0,129	0,142	0,090	0,102	0,115	0,128	0,141	0,154						
0,071	0,003	0,092	0,098	0,111	0,124	0,137	0,150	0,098	0,110	0,123	0,136	0,149	0,162	0,175					
0,080	0,003	0,102	0,109	0,123	0,137	0,151	0,165	0,108	0,122	0,136	0,150	0,164	0,178	0,192					
0,090	0,003	0,114	0,121	0,135	0,149	0,163	0,177	0,120	0,134	0,148	0,162	0,176	0,190	0,204					
0,100	0,003	0,126	0,133	0,149	0,165	0,181	0,197	0,132	0,148	0,164	0,180	0,196	0,212	0,228					
0,112	0,003	0,140	0,148	0,165	0,182	0,199	0,216	0,147	0,164	0,181	0,198	0,215	0,232	0,249					
0,125	0,003	0,155	0,164	0,182	0,200	0,218	0,236	0,163	0,181	0,199	0,217	0,235	0,253	0,271					
0,140	0,003	0,172	0,182	0,202	0,222	0,242	0,262	0,181	0,201	0,221	0,241	0,261	0,281	0,301					
0,160	0,003	0,195	0,206	0,228	0,250	0,272	0,294	0,205	0,227	0,249	0,271	0,293	0,315	0,337					
0,180	0,003	0,218	0,230	0,254	0,278	0,302	0,326	0,229	0,253	0,277	0,301	0,325	0,349	0,373					
0,200	0,003	0,240	0,253	0,278	0,303	0,328	0,353	0,252	0,277	0,302	0,327	0,352	0,377	0,402					
0,224	0,003	0,267	0,281	0,308	0,335	0,362	0,389	0,280	0,307	0,334	0,361	0,388	0,415	0,442					
0,250	0,004	0,298	0,313	0,343	0,373	0,403	0,433	0,312	0,342	0,372	0,402	0,432	0,462	0,492					