IEC 62917

Edition 1.0 2016-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Railway applications – Fixed installations – Electric traction – Copper and copper alloy grooved contact wires

Applications ferroviaires – Installations fixes – Traction électrique – Fils de contact rainurés en cuivre et en cuivre allié

IEC 62917:2016-10(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 45.060.01

ISBN 978-2-8322-3625-3

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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RAILWAY APPLICATIONS – FIXED INSTALLATIONS – ELECTRIC TRACTION – COPPER AND COPPER ALLOY GROOVED CONTACT WIRES

FOREWORD

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International Standard IEC 62917 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

This first edition is based on European standard EN 50149:2012.

The main technical changes with regard to EN 50149:2012 are as follows:

- extended range of cross-sections,
- changed terms and definitions,
- additional electrical and mechanical properties,
- additional special national conditions,
- for grooved contact wires.

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

FDIS	Report on voting
9/2191/FDIS	9/2202/RVD

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

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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- withdrawn,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
- amended.

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RAILWAY APPLICATIONS – FIXED INSTALLATIONS – ELECTRIC TRACTION – COPPER AND COPPER ALLOY GROOVED CONTACT WIRES

1 Scope

This International Standard specifies the characteristics of copper and copper alloy grooved contact wires of cross-sections from 70 mm^2 to 170 mm^2 for use on overhead contact lines.

It establishes the product characteristics, the test methods, checking procedures to be used with the contact wires, together with the ordering and delivery condition.

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 60468:1974, *Method of measurement of resistivity of metallic materials*

ISO 6892-1, *Metallic materials – Tensile testing – Part 1: Method of test at room temperature*

ISO 7801:1984, *Metallic materials – Wire – Reverse bend test*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
feed stock
wire of a shape, whose cross-section is generally larger than the grooved wire cross-section, from which the contact wire is then drawn and/or rolled

3.2
sideways-coiled contact wire
contact wire coiled with vertical axis parallel or in an angle to the axis of the drum

3.3
perpendicularly coiled contact wire
contact wire coiled with the vertical axis perpendicular to the axis of the drum facing the drum with the bottom arc

3.4
joint
connection between feed stock wires before cold drawing

3.5
joint area
area of the contact wire influenced by a joint

3.6
contact wire
electric conductor of an overhead contact line with which the current collector makes contact

[SOURCE: IEC 60050-811:1991, 811-33-15]

3.7
grooved contact wire
contact wire characterised by two clamping grooves

Note 1 to entry: The contact wire hereinafter refers to a grooved contact wire according the scope of this International Standard.

4 Characteristics of contact wires

4.1 Contact wire designation system

The contact wire designation shall consist of:

- denomination (contact wire);
- number of this International Standard (IEC 62917);
- configuration designation (see 4.5.4);
- material designation, either symbol or number (see Table B.1, or material as agreed between purchaser and supplier);
- minimum tensile strength in MPa or minimum breaking load in kN;
- minimum conductivity in % IACS or maximum resistance per km in Ω/km.

EXAMPLE Contact wire IEC 62917 – AC-120 – CuMg0,5 – Strength 490 (MPa) – Conductivity 62 (% IACS).

4.2 Material designation

NOTE The contact wire shall consist of a copper or copper silver alloy, as defined for example in EN 1977:2013 (only for CEN/CENLEC members) or another copper alloy.

Annex B gives the designations of the feed stocks for some possible compositions of the contact wire. At the time of tender, the user shall specify explicitly the material(s) he wants or he is allowed to apply.

Copper cadmium alloys are not recommended for use for environmental reason, see Annex D.

4.3 Appearance and condition

The contact wires shall not present any imperfections (roughness, sliver, seam, inclusion, cracks, kinks, or sharp cutting edges) liable to affect the mechanical and/or electrical properties specified in this Standard or to cause difficulties during installation/operation.

The groove shall be even and without warp.

The surface shall be clean and free of oxide inclusions or sulphide generated during the manufacturing process or foreign substances such as pickling residue.

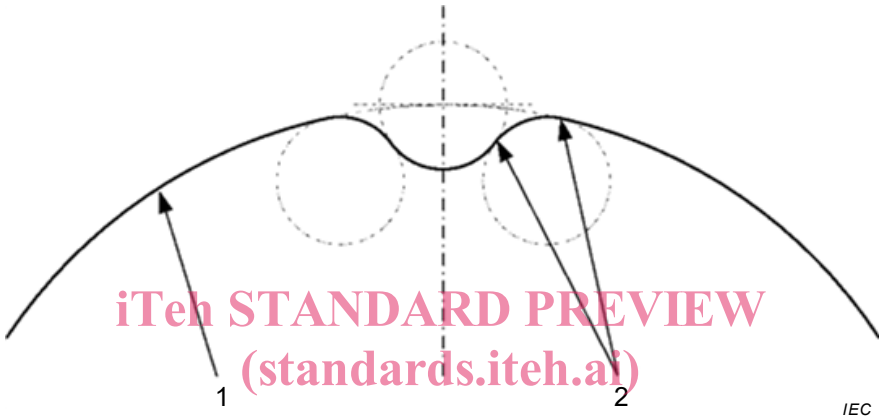
The colour of the metallic bright surface immediately after manufacturing may change due to atmospheric influence. This is acceptable.

4.4 Identification

4.4.1 General requirements

All contact wires manufactured from alloys shall be clearly identified except when there is another agreement between purchaser and supplier. For normal and high strength copper and copper-silver, copper-cadmium, copper-magnesium and copper-tin alloys the method of identification shall be by identification grooves as shown below. For other alloys the identification method (whether grooves or other method) shall be agreed between purchaser and supplier.

Identification grooves shall be set out as shown in Figure 1. The centre of the middle circle shall be on the projected circle of the contact wire. The connection between two successive arcs shall be without a straight line.



Key

1 diameter of contact wire

2 tangential connection between successive arcs

Figure 1 – Description of identification groove

4.4.2 Normal and high strength copper (Cu-ETP, Cu-FRHC, Cu-HCP, Cu-OF)

Contact wires of copper have no identification groove[1].

4.4.3 Copper-silver alloy (CuAg 0,1)

NOTE Contact wires of copper alloy with silver shall incorporate two identification grooves on the upper lobe of the contact wire in accordance with Figure 2 (only for CEN/CENELEC members, other countries see Annex E).

4.4.4 Copper-cadmium alloy (CuCd 0,7, CuCd 1,0)

Contact wires of copper alloy with cadmium shall incorporate one identification groove on the upper lobe of the contact wire in accordance with Figure 3[1].

This identification is only used for already installed contact wires. This identification should not be used for other copper-alloys (see also Annexes C and D).

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1 See Annex E, Special National Condition for United Kingdom.

4.4.5 Copper-magnesium alloy (CuMg 0,2, CuMg 0,5)

NOTE Contact wires of copper alloy with magnesium shall incorporate three identification grooves on the upper lobe of the contact wire in accordance with Figure 4 (only for CEN/CENELEC members, other countries see Annex E).

4.4.6 Copper-tin alloy (CuSn 0,2)

NOTE Contact wires of copper alloy with tin shall incorporate one identification groove set at an angle of 24° on the upper lobe of the contact wire in accordance with Figure 5 (only for CEN/CENELEC members, other countries see Annex E).

Dimensions in millimetres

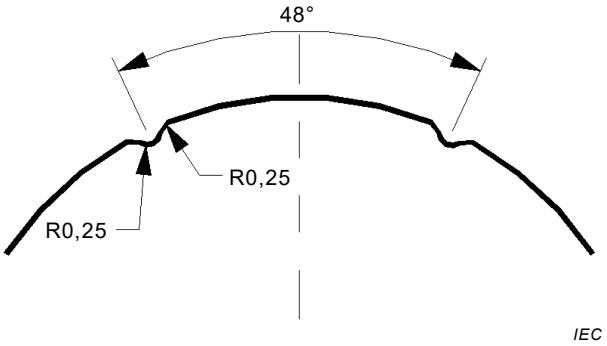


Figure 2 – Two identification grooves (CuAg)

Dimensions in millimetres

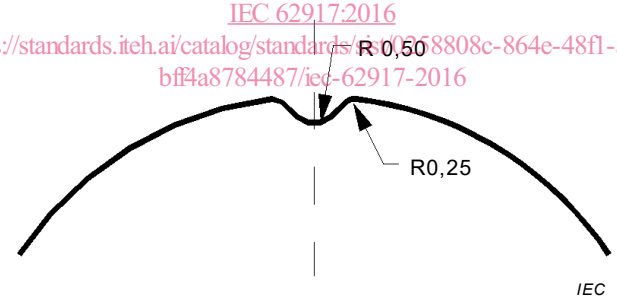


Figure 3 – One identification groove (CuCd)

Dimensions in millimetres

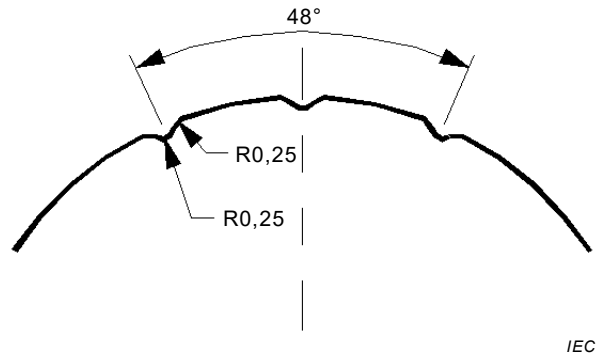


Figure 4 – Three identification grooves (CuMg)

Dimensions in millimetres

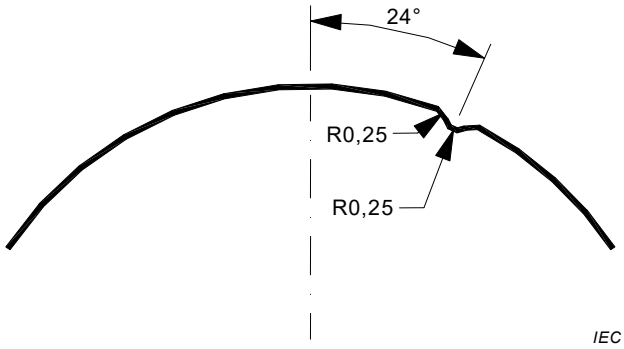


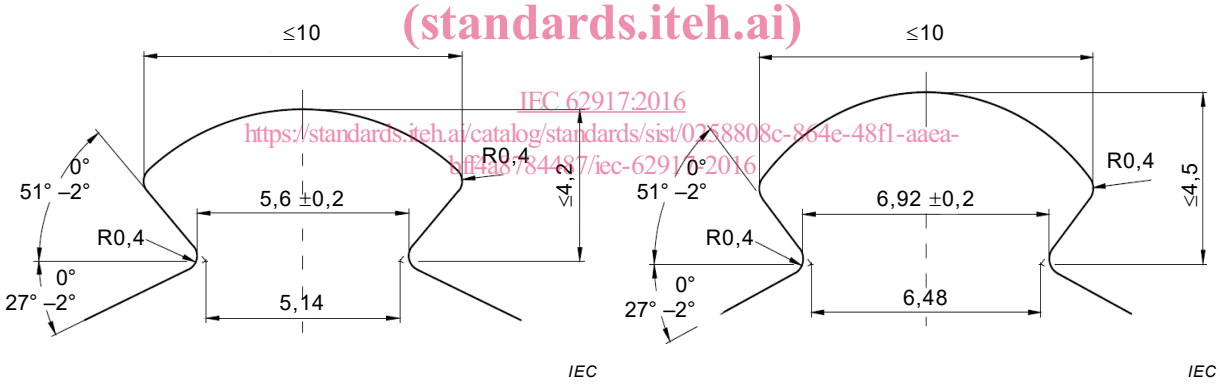
Figure 5 – One offset identification groove (CuSn)

4.5 Configuration, profile and cross-sections

4.5.1 Clamping grooves

Whatever cross-section of the contact wire is used, the dimensions of the clamping grooves shall be in accordance with for either type A or type B as given in Figure 6, or others clamping groove types as given in Annex E for the mentioned countries.

Dimensions in millimetres



Type A clamping groove

Type B clamping groove

Figure 6 – Clamping groove types A and B

4.5.2 Cross-sectional areas

This Standard details the following nominal cross-sections: 70 mm^2, 80 mm^2, 85 mm^2, 100 mm^2, 107 mm^2, 110 mm^2, 120 mm^2, 150 mm^2 and 170 mm^2.

4.5.3 Profiles

Profiles are of two main types, the circular profile and the flattened profile. Other profiles shall be permitted by agreement between purchaser and supplier.

4.5.4 Configurations

The configurations of the contact wires shall be in conformance with Table 1 for types A and B or with Annex E for other profile types in the mentioned countries. These are defined as combinations of the profile shape, the nominal cross-section and the type of clamping groove.

The dimensions of each configuration are shown in Annex A or Annex E.

Table 1 – Configurations and cross-sections for types A and B

Nominal cross-section	Clamping groove Type A		Clamping groove Type B			
mm^2	Circular		Circular		Flat	
	Designation	Figure No. in Annex A	Designation	Figure No. in Annex A	Designation	Figure No. in Annex A
80	AC-80	A.1				
100	AC-100		BC-100	A.2	BF-100	A.3
107	AC-107		BC-107		BF-107	
120	AC-120		BC-120		BF-120	
150	AC-150		BC-150		BF-150	

4.6 Electrical properties

4.6.1 Resistivity

The resistivity of the contact wire at 20 °C shall not exceed the values in Table 2 for alloys listed in Annex B. For other copper alloys the values shall be as agreed between purchaser and supplier.

Table 2 – Maximum resistivity and minimum conductivity

Material	Resistivity in 10^{-8} Ωm max.	Min. conductivity 10^6 S/m	Min. conductivity % IACS
Cu-ETP	1,777	56,3	97,0
Cu-FRHC	1,777	56,3	97,0
Cu-HCP	1,777	56,3	97,0
Cu-OF	1,777	56,3	97,0
CuAg0,1	1,777	56,3	97,0
CuMg0,2 (Normal conductivity 77,0 % IACS)	2,240	44,6	77,0
CuMg0,2 (High conductivity 80,0 % IACS)	2,155	46,4	80,0
CuMg0,5 (Normal conductivity 62,1 % IACS)	2,778	36,0	62,1
CuMg0,5 (High conductivity 70,0 % IACS)	2,463	40,6	70,0
CuSn0,2 (Normal conductivity 72,0 % IACS)	2,395	41,8	72,0
CuSn0,2 (High conductivity 80,0 % IACS) [a]	2,155	46,4	80,0
CuCd0,7	2,005	49,9	86,0
CuCd1,0	2,155	46,4	80,0

[a] CuSn0,2 (high conductivity) was previously denoted CuSn0,4.

4.6.2 Resistance per kilometre

The resistance per unit length at 20 °C shall not exceed the resistance value specified in Table 3 for materials listed in Annex B. For other copper alloys the values shall be as agreed between purchaser and supplier.

Values for electrical resistance per kilometre depending on conductivity and cross-section are given in Table C.1. The calculation used to determine the electrical resistance per kilometre at 20 °C is specified in Clause C.1 and is based on the values of resistivity in Table 2. The value of resistance at a joint area shall be no greater than specified for the contact wire material.

Table 3 – Maximum resistance per kilometre depending on material

Nominal cross-section mm²	Material designation [a]							
	Cu-ETP Cu-OF Cu-FRHC Cu-HCP 97,0 % IACS	CuAg0,1 97,0 % IACS	CuMg0,2 77,0 % IACS	CuMg0,5 62,1 % IACS	CuMg0,5 (High conduc-tivity) 70,0 % IACS	CuSn0,2 72,0 % IACS	CuCd0,7 86,0 % IACS	CuCd1,0 CuSn0,2 (high conductivity) [b] CuMg0,2 (high conductivity) 80,0 % IACS
80	0,229	0,229	0,289	0,358	0,317	0,309	0,258	0,278
100	0,183	0,183	0,231	0,286	0,254	0,247	0,207	0,222
107	0,171	0,171	0,216	0,268	0,237	0,231	0,193	0,208
120	0,153	0,153	0,192	0,239	0,212	0,206	0,172	0,185
150	0,122	0,122	0,154	0,191	0,169	0,165	0,138	0,148

[a] Values in Ω/km at 20°C – Calculated on minimum cross-sectional area (97 % of the nominal cross-section).

[b] CuSn0,2 (high conductivity) was previously denoted CuSn0,4.

For calculation formula, see Annex C.

4.7 Mechanical properties

4.7.1 Tensile strength and percentage elongation after fracture

The tensile strength and percentage elongation after fracture of the contact wire shall be in accordance with the values indicated in Table 4 for alloys listed in Annex B. For other copper alloys the values shall be as agreed between purchaser and supplier. Maximum percentage elongation values after fracture are recommended.

Table 5 shows the minimum values of calculated breaking load to be expected in tensile tests for alloys listed in Annex B, corresponding to the minimum tensile strength shown in Table 4.

Values for minimum breaking load dependent upon tensile strength and cross-section are given in Table C.2.

The value of tensile strength and the values for the percentage elongation after fracture at a joint area shall be in accordance with the specified values of the contact wire material.

4.7.2 Additional requirements

The contact wire shall withstand reverse bend loads, torsional loads and winding loads. These requirements should be tested in accordance with 5.5.2, 5.5.3 and 5.5.4 subject to agreement between purchaser and supplier.

4.7.3 Microwaves on longitudinal axis of contact wire

The contact wire longitudinal axis shall not show any inadmissible microwaves. After manufacturing, the vertical variation of the longitudinal axis of the contact wire should be not more than 0,1 mm as shown in Figure 7, subject to agreement between purchaser and supplier.