SLOVENSKI STANDARD
SIST EN 4651:2014

01-julij-2014

Aeronavtika - Pobakreni vodniki iz aluminijeve zlitine za električne kable - Standard za proizvod

Aerospace series - Copper-clad aluminium alloy conductors for electrical cables - Product standard

Luft- und Raumfahrt - Leiter aus Aluminiumlegierung mit Kupferbeschichtung für elektrische Leitungen - Produktnorm

Série aérospatiale - Conducteurs en alliage d'aluminium chemisé cuivre pour câbles électriques - Norme de produit

Ta slovenski standard je istoveten z: **EN 4651:2014**

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This European Standard was approved by CEN on 24 August 2012.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 4651:2014) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of ASD, prior to its presentation to CEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2014, and conflicting national standards shall be withdrawn at the latest by October 2014.

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1 Scope

This European Standard specifies the dimensions, linear resistance, mechanical characteristics, construction and mass of copper-clad aluminium alloy (CCA) conductors, for lightweight electrical cables for aerospace applications.

It applies to stranded conductors, with a nominal cross-sectional area of 0,22 mm^2 to 22 mm^2 inclusive.

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.

EN 3475 (all parts), *Aerospace series — Cables, electrical, aircraft use — Test methods*

EN 9133, *Aerospace series - Quality management systems - Qualification procedure for aerospace standard parts*

ASTM B566-93 ASTM B 566a , *Standard specification for copper-clad aluminium wire* [1)]

3 Definitions and symbols

For the purposes of this standard, the definitions and symbols given in EN 3475-100 for conductors apply.

4 Conductor materials and construction

4.1 Materials

Conductor for nominal cross-sectional areas 0,25 mm^2 (code 002) and 0,40 mm^2 (code 004) are built from a 1 + 6 strands construction. The central strand is a copper alloy strand or equivalent, surrounded by 6 copper clad aluminium strands.

The conductors in accordance with this standard shall consist of individual copper clad aluminium strands (see ASTM B566-93(98) class 15A) with the following composition, for cross-sections of 0,25 mm^2 to 22,00 mm^2 inclusive:

For aluminium: See Table 1.

Table 1

%	Si	Fe	Al
min.	—	—	99,5
max.	0,10	0,40	—

For copper: ETP copper purity 99,9 % min.

4.2 Metal plating

The individual strands may be:

— uncoated (code A);

1) Published by: ASTM National (US) American Society for Testing and Materials http://www.astm.org/

— or provided with uniform platings of tin (code B) or silver (code C) or nickel (code D).

Plating thicknesses shall be at least 1,0 µm for silver and according to Table 2 for nickel.

When tin plating is authorized, the thickness shall be sufficient to comply with the tests specified in EN 3475-506 and EN 3475-507.

Table 2

Nominal diameter of strands	Plating thickness µm		AWG
mm	min.	max.	
0,20	1,3	2,3	24 – 20
0,25	1,3	2,3	22 –18 – 14
0,275	1,3	2,4	8
0,30	1,3	2,6	16
0,32	1,3	2,6	12 – 10
0,51	1,3	3,5	6 – 4

4.3 Characteristics

The maximum resistivity at 20 °C shall be: $2,68 \times 10^{-8}$ Ω.m.

The elongation at rupture on the complete conductor taken from the finished wire shall be ≥ 6 %. (Need to add a maximum value still under evaluation).

The tensile strength of the complete conductor taken from the finished wire shall be max 138 MPa (138 N/mm^2).

The 0.2 % offset yield strength of the complete conductor taken from the finished wire shall be at least 90 MPa (90 N/mm^2).

4.4 Construction of conductors

4.4.1 Lay length

Up to 5 mm^2 cross-section inclusive (code 050), concentric conductors are used. The lay for the strands of a concentric conductor, checked over the outside layer of a test piece 1 m long, shall be between eight times and 16 times the maximum diameter of this conductor.

From sectional area of 9 mm^2 (code 090), the conductor comprises concentric or bunched conductors twisted together.

The lay of the strands for the basic concentric or bunched conductors shall not exceed 30 times the diameter of the concentric or bunched conductor in question.

The lay for concentric (or bunched) conductors, measured over the outer layer of the conductor, shall be between eight times and 16 times the maximum conductor diameter.

In all cases the lay of the outer layer shall be left-hand.

4.4.2 Joints

The conductors shall be free from any joints. Each strand composing the conductors may, however, include soldered or brazed or butt joints.

The distance between two joints in individual strands shall exceed 3 m, measured between different strands.

4.4.3 Compaction

Compaction of the conductor, if causing deformation of the strands with damage to the plating, is not permitted. A minimum compaction rate of 95 % is acceptable.

NOTE The minimum compaction rate (%) is defined by the diameter of the compacted conductor by the diameter of the uncompacted conductor (× 100).

5 Required characteristics

According to Table 3.

Table 3

Code	Nominal cross-section mm²	Number of strands mm	Nominal diameter of strands [a] mm	Diameter of conductor mm min.	Diameter of conductor mm max.	Resistance max. at 20 °C [b c] Ω/km	Mass max. [b] kg/km	AWG [d]	Number of missing single strands
002	0,25	1 + 6	0,20	0,56	0,58	145,00	1,10	24	0
004	0,40	1 + 6	0,25	0,71	0,73	90,20	1,70	22	0
006	0,60	19	0,20	0,94	0,97	49,60	2,50	20	0
010	1,00	19	0,25	1,19	1,22	33,20	3,85	18	0
012	1,20	19	0,30	1,41	1,45	23,00	5,35	16	0
020	2,00	37	0,25	1,69	1,73	15,50	8,35	14	0
030	3,00	37	0,32	2,13	2,18	10,90	12,50	12	0
050	5,00	61	0,32	2,73	2,77	5,80	22,50	10	0
090	9,00	7 × 19	0,275	3,55	3,85	3,80	35,50	8	0
140	14,00	7 × 10	0,51	4,80	5,20	2,30	55,50	6	0
220	22,00	7 × 15	0,51	5,90	6,30	1,50	92,00	4	0

a Strands nominal diameter are given for information only.

b For other temperatures this may be calculated using the formula shown in EN 3475-301.

c Not taking into consideration metal plating, assuming that their effect is minimal.

d AWG = closest American Wire Gage.

6 Test methods

According to EN 3475-100.

See Table 4.