



SLOVENSKI STANDARD

SIST EN 50540:2011

01-junij-2011

Aluminijevi vodniki z jekleno podporo (ACSS) za nadzemne vode

Aluminium Conductors Steel Supported (ACSS) for overhead lines

Leiter für Freileitungen - Aluminiumleiter, von beschichtetem Stahl getragen (Ausführung ACSS)

Conducteurs pour lignes aériennes - Conducteurs à faible dilatation (ACSS)

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Ta slovenski standard je istoveten z: **EN 50540:2010**

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ICS:

29.060.20	Kabli	Cables
29.240.20	Daljnovodi	Power transmission and distribution lines

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EUROPEAN STANDARD
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EN 50540

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English version

**Conductors for overhead lines -
Aluminium Conductors Steel Supported (ACSS)**

Conducteurs pour lignes aériennes -
Conducteurs à faible dilatation (ACSS)

Leiter für Freileitungen -
Aluminiumleiter, von beschichtetem Stahl
getragen (Ausführung ACSS)

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

This European Standard was prepared by CENELEC BTTF 132-1, Aluminium conductors steel supported (ACSS type) for overhead electrical lines, based on the text of BT/ES0023/NOT. It was submitted to the CENELEC Unique Acceptance Procedure and was approved by CENELEC as EN 50540 on 2010-04-01.

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The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2011-04-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2013-04-01

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Contents

1	Scope	5
1.1	Outer/conductive layers	5
1.2	Steel core	5
2	Normative references	5
3	Definitions	6
4	Designation system	7
5	Requirements for ACSS stranded conductors	8
5.1	Material	8
5.2	Stranding	11
5.3	Surface condition	12
5.4	Conductor diameter	12
5.5	Mechanical characteristics	12
5.6	Joints	13
5.7	Conductor mass per unit length	13
5.8	Nominal DC resistance	15
5.9	Variation in Aluminium area	16
6	Tests	16
6.1	Classification of tests	16
6.2	Sample size	17
6.3	Rounding rules	17
6.4	Properties of conductor	17
6.5	Properties of wires	19
6.6	Inspection	19
6.7	Acceptance or rejection	20
7	Packaging and marking	20
7.1	Packaging	20
7.2	Marking and tare	20
7.3	Random lengths	20
7.4	Accuracy of lengths	20
7.5	Drum barrel dimensions	21
8	Information to be clarified by the purchaser and manufacturer	21
	Annex A (normative) Stress - strain test method	22
	Annex B (informative) Lay ratios used for calculation of increments due to stranding in Tables 5 and 6	25
	Annex C (normative) Test for ability of a conductor to be erected using tension stringing	26
	Annex D (informative) AC resistance measurement method	28
Figures		
	Figure C.1 - Test arrangement	27
	Figure C.2 – Drum holder and tensioner set-up	27

Tables

Table 1 - Mechanical characteristics steel ST6A wires before stranding	8
Table 2 - Characteristics of Extra High Strength <u>Zn95Al5</u> steel wires (before stranding)	9
Table 3 - Characteristics of Ultra High Strength <u>Zn95Al5</u> steel wires (before stranding)	9
Table 4 - Characteristics of Extra High Strength aluminium clad steel wires 20EHSA (before stranding)	10
Table 5 - Characteristics of Extra High Strength aluminium clad steel wires 14EHSA (before stranding)	10
Table 6 - Physical constants	11
Table 7 - Lay ratios for galvanized steel, Zn95Al5 coated steel or aluminium-clad steel layers	12
Table 8 - Lay ratios for aluminium layers	12
Table 9 - Number of joints permitted in a given length	13
Table 10 - Increments due to stranding for formed Al wires	14
Table 11 - Increments due to stranding for round Al wires	15
Table 12 - Type and sample tests for conductors and wires	16
Table 13 - Permitted reductions in wire properties after stranding	19
Table B.1 - Lay ratios used for calculation of increments due to stranding in Tables 10 & 11 ..	25

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1 Scope

This European Standard specifies the electrical and mechanical characteristics of ACSS conductors made of round or formed annealed aluminium wires and steel wires stranded in alternate directions, made of one or a combination of any of the following.

1.1 Outer/conductive layers

Annealed Aluminium wire as per requirements of Clause 5.

1.2 Steel core

- a) Galvanized steel wire type ST6A according to EN 50189 and requirements of Clause 5;
- b) Zn95Al5 alloy coated steel wire with MM (mischmetal) as per EN 10244-2 and mechanical and mass of coating requirements as per Tables 2 and 3, in the following options:
 - i Extra High Strength;
 - ii Ultra High Strength.

NOTE MM elements are mandatory. Coatings without MM can be used, if agreed between Supplier and Purchaser. Tests without MM must show the same behaviour than the MM coatings.

- c) Aluminium-clad steel wire 20,3 % conductivity in the following options:
 - as per EN 61232 with class designation 20 SA;
 - aluminium-clad steel wire Extra High Strength with designation 20 EHSA as per Table 4.
- d) Aluminium-clad steel wire 14 % conductivity, Extra High Strength with designation 14 EHSA as per Table 5.

2 Normative references

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The following referenced documents are indispensable for the application 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.

EN 10244-2	Steel wire and wire products. Non-ferrous metallic coating on steel wire Part 2: zinc or zinc alloy coatings
EN 50182	Conductors for overhead lines - Round wire concentric lay stranded conductors
EN 50189	Conductors for overhead lines - Zinc coated steel wires (for testing purposes only)
EN 60889	Hard-drawn aluminum wire for overhead line conductors (for testing purposes only) (IEC 60889)
EN 61232	Aluminium-clad steel wires for electrical purposes (IEC 61232)
EN 62219	Overhead electrical conductors - Formed wire, concentric lay, stranded conductors (IEC 62219)
IEC 60050-466	International Electrotechnical Vocabulary (IEV) - Chapter 466: Overhead lines
IEC 60468	Method of measurement of resistivity of metallic materials

3 Definitions

In addition to the definitions given in IEC 60050-466, EN 50182 and EN 62219, the following definitions apply.

3.1

aluminium

the most abundant of all metals. It is a ductile metal, silver-white in colour, which can be readily worked by rolling, drawing, spinning, extruding, and forging. For the purpose of this European Standard, the aluminium must be annealed

3.2

conductor

material intended to be used for carrying electric current consisting of a plurality of uninsulated wires twisted together

3.3

concentric lay stranded conductor

conductor composed of a central core surrounded by one or more adjacent layers of wires being laid helically in opposite directions

3.4

lay length

axial length of one complete turn of the helix formed by an individual wire in a stranded conductor

3.5

lay ratio

ratio of the lay length to the external diameter of the corresponding layer of wires in the stranded conductor

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3.6

direction of lay

3.6.1

direction of lay (general definition)

direction of twist of a layer of wires as it moves away from the viewer

NOTE A right-hand lay is a clockwise direction and a left-hand lay is an anti-clockwise direction.

3.6.2

direction of lay (alternative definition)

the direction of lay is defined as right-hand or left-hand

NOTE With right-hand lay, the wires conform to the direction of the central part of the letter Z when the conductor is held vertically. With left-hand lay, the wires conform to the direction of the central part of the letter S when the conductor is held vertically.

3.7

round wire

filament of drawn metal having a constant circular cross-section

3.8

formed wire

filament of metal having a constant cross-section and a non-circular shape

3.9

equivalent wire diameter

the diameter of a round wire which would have the same cross-sectional area, mass and electrical resistance as a given formed wire of the same material

3.10**lot**

group of conductors manufactured by the same manufacturer under similar conditions of production

NOTE A lot may consist of part or all of the purchased quantity.

3.11**nominal**

name or identifying value of a measurable property by which a conductor or component of a conductor is identified and to which tolerances are applied

NOTE Nominal values should be target values.

3.12**rated tensile strength**

an estimate of the conductor breaking load calculated using the specified tensile properties of the component wires

4 Designation system

a) Annealed aluminium wire: **AL0**

b) Galvanized steel wire according to EN 50189: **ST6A**

c) Zn95Al5 coated steel: **MEHST** or **MUHST with mischmetal elements**

Zn95Al5 coated steel: **EHST** or **UHST without mischmetal elements** (see note in Scope)

d) Aluminium clad steel 20,3 % according to EN 61232 classes: **20SA** or **20EHSA**

e) Aluminium clad steel 14 % EHS: **14EHSA**

EXAMPLES:

401-AL0/28-ST6A	Conductor made of AL0 wires around a core of ST6 class A zinc coated steel wires. The integer area of AL0 is 401 mm ² and that of ST6A wires, 28 mm ² .
401-AL0/28-MEHST	Conductor made of AL0 wires around a core of Zn95Al5 coated MEHST steel wires. The integer area of AL0 is 401 mm ² and that of Zn95Al5 wires, 28 mm ² .
401-AL0/28-20EHSA	Conductor made of AL0 wires around a core of Aluminium clad steel 20,3 % wires. The integer area of AL0 is 401 mm ² and that of Aluminium clad steel 20,3 %, 28 mm ² .
401-AL0/28-14EHSA	Conductor made of AL0 wires around a core Aluminium clad 14 % EHS steel wires. The integer area of AL0 is 401 mm ² and that Aluminium clad steel 14 % wires, 28 mm ² .

f) Generic designations:

- **ACSS**: Concentric-Lay –Stranded Aluminium Conductors, Coated Steel Supported
- **ACSS/TW**: Formed Wire Compact Concentric-Lay –Stranded Aluminium Conductors, Coated Steel Supported.

5 Requirements for ACSS stranded conductors

5.1 Material

5.1.1 ACSS conductors shall consist of a supporting core made of the following:

- a) Galvanized steel wire type ST6A according to Table 1 (based on EN 50189)

Table 1 - Mechanical characteristics steel ST6A wires before stranding

Nominal wire diameter		Diameter tolerance		Stress at 1 %	Ultimate tensile strength		Elongation at breaking on 250 mm A_{250}	Mandrel diameter for wrapping and adherence test	N° of 1 min immersions	Mass of coating	Number of torsions ^a
mm					R_m						
					Individual wires	Average					
Over	Up to	mm		MPa	N/mm ²		%	xD	N°	g/m ²	N°
		+	-		min.	min.					
1,75	2,25	0,04	0,04	1 450	1 700	1 800	2,0	4	2 1/2	215	14
2,25	2,75	0,04	0,04	1 410	1 650	1 750	2,0	4	3	230	14
2,75	3,00	0,05	0,05	1 410	1 650	1 750	2,5	4	3	230	12
3,00	3,50	0,05	0,05	1 380	1 600	1 700	2,5	4	3 1/2	245	12
3,50	4,25	0,06	0,06	1 340	1 600	1 700	2,5	5	3 1/2	260	10
4,25	4,75	0,06	0,06	1 340	1 600	1 700	2,5	5	4	275	10

^a In case of galvanizing before final drawing, minimum number of torsions will be increase by 2 and minimum elongation will be decreased in 1 %.

- b) Round steel wires coated by Zn95Al5 alloy, complying with the requirements of Tables 2 and 3
Rest of characteristics according to EN 50189 and zinc alloy coatings according to EN 10244-2

Table 2 - Characteristics of Extra High Strength Zn95Al5 steel wires (before stranding)

Nominal wire diameter mm		Diameter tolerance		Stress at 1 %	Ultimate tensile strength R _m	Elongation at breaking on 250 mm A ₂₅₀	Mandrel diameter for wrapping test	Mandrel diameter for adherence test	Mass of coating
Over	Up to	mm		MPa	MPa	%			g/m ²
		+	-	min.	min.	min.	xD	xD	min.
1,91	2,28	0,038	0,025	1 550	1 825	3,0	4	4	214
2,29	2,64	0,051	0,051	1 515	1 790	3,0	4	4	229
2,65	3,04	0,051	0,051	1 515	1 790	3,0	4	4	244
3,05	3,55	0,076	0,051	1 480	1 760	3,5	4	4	259
3,56	4,57	0,102	0,076	1 450	1 725	3,5	4	5	274
4,58	4,82	0,102	0,076	1 450	1 725	3,5	4	5	305

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Table 3 - Characteristics of Ultra High Strength Zn95Al5 steel wires (before stranding)

Nominal wire diameter mm		Diameter tolerance		Stress at 1 %	Ultimate tensile strength R _m	Elongation at breaking on 250 mm A ₂₅₀	Mandrel diameter for wrapping test	Mandrel diameter for adherence test	Mass of coating
Over	Up to	(mm)		MPa	MPa	(%)			g/m ²
		+	-	min.	min.	min.	xD	xD	min.
1,91	2,28	0,038	0,025	1 580	1 965	3,0	4	4	214
2,29	2,64	0,051	0,051	1 550	1 900	3,0	4	4	229
2,65	3,04	0,051	0,051	1 550	1 900	3,0	4	4	244
3,05	3,55	0,076	0,051	1 515	1 860	3,5	4	4	259
3,56	4,57	0,102	0,076	1 480	1 825	3,5	4	5	274
4,58	4,82	0,102	0,076	1 480	1 825	3,5	4	5	305

- c) Round aluminium clad steel wires type 20 SA, fully complying with the requirements of EN 61232
- d) Round aluminium clad Extra High Strength steel wires type 20 EHSA, as per the requirements of Table 4

**Table 4 - Characteristics of Extra High Strength aluminium clad steel wires 20EHSA
(before stranding)**

Diameter		Diameter tolerance	Stress at 1%	Tensile strength	Elongation at 250 mm	Torsions
mm		mm	MPa	MPa	%	N°
Over	Up to		min.	min.	min.	min.
1,28	2,28	± 0,04	1 390	1 620	1,5	20
2,29	3,04	± 0,05	1 360	1 580	1,5	20
3,05	3,55	± 0,05	1 330	1 545	1,5	20
3,56	4,82	± 0,06	1 300	1 515	1,5	20

- e) Round aluminium clad Extra High Strength steel wires type 14EHSA, as per the requirements of Table 5

**Table 5 - Characteristics of Extra High Strength aluminium clad steel wires 14EHSA
(before stranding)**

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Diameter		Diameter tolerance	Stress at 1%	Tensile strength	Elongation at 250 mm	Torsions
mm		mm	MPa	MPa	%	N°
Over	Up to		min.	min.	min.	min.
1,75	2,25	± 0,04	1 550	1 825	1,5	20
2,26	3,00	± 0,05	1 500	1 790	1,5	20
3,01	3,50	± 0,05	1 470	1 760	1,5	20
3,51	4,75	± 0,06	1 430	1 725	1,5	20