SLOVENSKI STANDARD
SIST EN 50397-1:2021

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Nadomešča:
SIST EN 50397-1:2007

Oplaščeni vodniki za nadzemne vode in ustrezen pribor za naznačene izmenične napetosti nad 1 kV, ki ne presegajo 36 kV - 1. del: Oplaščeni vodniki

Covered conductors for overhead lines and the related accessories for rated voltages above 1 kV AC and not exceeding 36 kV AC - Part 1: Covered conductors

Kunststoffumhüllte Leiter und zugehörige Armaturen für Freileitungen mit Nennspannungen über 1 kV und nicht mehr als 36 kV Wechselspannung - Teil 1: Kunststoffumhüllte Freileitungsseile

Conducteurs gainés pour lignes aériennes et accessoires associés pour des tensions assignées supérieures à 1 kV en courant alternatif et ne dépassant pas 36 kV en courant alternatif - Partie 1: Conducteurs gainés

Ta slovenski standard je istoveten z: **EN 50397-1:2020**

ICS:

29.060.20	Kabli	Cables
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EUROPEAN STANDARD

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EN 50397-1

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ICS 29.240.20

Supersedes EN 50397-1:2006 and all of its amendments and corrigenda (if any)

English Version

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

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

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European foreword

This document (EN 50397-1:2020) has been prepared by WG 13 “Covered Overhead Line Conductors” of CLC/TC 20 “Electric cables”.

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2021-10-26
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2023-10-26

This document supersedes EN 50397-1:2006 and all of its amendments and corrigenda (if any).

EN 50397-1:2020 includes the following significant technical changes with respect to EN 50397-1:2006:

— new references to HD 605 S3 2019.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

The EN 50397 series consists of three parts:

— Part 1, “Covered conductors”;

— Part 2, “Accessories for covered conductors: Tests and acceptance criteria”; and

— Part 3, “Guide to use”

Introduction

The EN 50397 series covers the construction, performance and test requirements for covered conductors for overhead lines having a nominal voltage U above 1 kV AC up to and including 36 kV AC, and for the related accessories.

Covered conductors consist of a conductor surrounded by a covering made of insulating material as protection against accidental contacts with other covered conductors and with grounded parts such as tree branches, etc. In comparison with insulated conductors, this covering has reduced properties, but is able to withstand the phase-to-earth voltage temporarily.

Since covered conductors are unscreened, they are not touch-proof, i.e. they should be treated as bare conductors with respect to electric shock.

This document does not cover aspects related to the installation of overhead lines such as determination of clearances, spans, sags, etc.

1 Scope

This document contains the requirements for covered conductors with or without integrated longitudinal water tightness and/or semi-conductive conductor screen for applications in overhead lines with rated voltages *U* above 1 kV a.c. and not exceeding 36 kV a.c.

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.

EN 50182:2001, *Conductors for overhead lines - Round wire concentric lay stranded conductors*

EN 60811-201, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 201: General tests - Measurement of insulation thickness (IEC 60811-201)*

EN 60811-401:2012,[1] *Electric and optical fibre cables - Test methods for non-metallic materials - Part 401: Miscellaneous tests - Thermal ageing methods - Ageing in an air oven (IEC 60811-401:2012)*

EN 60811-402, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 402: Miscellaneous tests - Water absorption tests (IEC 60811-402)*

EN 60811-501:2012,[2] *Electric and optical fibre cables - Test methods for non-metallic materials - Part 501: Mechanical tests - Tests for determining the mechanical properties of insulating and sheathing compounds (IEC 60811-501:2012)*

EN 60811-502, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 502: Mechanical tests - Shrinkage test for insulations (IEC 60811-502)*

EN 60811-507, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 507: Mechanical tests - Hot set test for cross-linked materials (IEC 60811-507)*

EN 60811-508:2012,[3] *Electric and optical fibre cables - Test methods for non-metallic materials - Part 508: Mechanical tests - Pressure test at high temperature for insulation and sheaths (IEC 60811-508:2012)*

EN 60811-605:2012, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 605: Physical tests - Measurement of carbon black and/or mineral filler in polyethylene compounds (IEC 60811-605:2012)*

EN 62219, *Overhead electrical conductors - Formed wire, concentric lay, stranded conductors (IEC 62219)*

EN 62230, *Electric cables - Spark-test method (IEC 62230)*

HD 605 S3:2019, *Electric cables - Additional test methods*

IEC 60502-2:2014, *Power cables with extruded insulation and their accessories for rated voltages from 1 kV (U_m = 1,2 kV) up to 30 kV (U_m = 36 kV) - Part 2: Cables for rated voltages from 6 kV (U_m = 7,2 kV) up to 30 kV (U_m = 36 kV)*

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[1] As impacted by EN 60811-401:2012/A1:2017.

[2] As impacted by EN 60811-501:2012/A1:2018.

[3] As impacted by EN 60811-508:2012/A1:2017.

3 Definitions

For the purpose of this document, the following definitions 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 https://www.iso.org/obp

3.1 Definitions relating to tests

3.1.1
type tests
T
tests required to be made before supplying a type of product covered by this document on a general commercial basis in order to demonstrate satisfactory performance characteristics to meet the intended application

Note 1 to entry: These tests are of such nature that, after they have been made, they need not be repeated unless changes are made in the material, design or manufacturing process, which might change the performance characteristics.

3.1.2
sample tests
S
tests made on samples of completed product or components taken from the completed product adequate to verify that the finished product meets the design specifications

3.1.3
routine tests
R
tests made on all production lengths to demonstrate their integrity

3.2
rated voltage
reference voltage for which the conductor is designed and which serves to define the electrical tests

Note 1 to entry: The rated voltage is expressed by the value *U*, expressed in kilovolts, where *U* is the r.m.s. value between any two-phase conductors.

4 Covered conductors

4.1 Code designation

Covered conductors shall be designated as follows:

Type code	CC;
Covering material	S (for semi-conductive conductor screen, if any), X (for cross-linked polyethylene), T (for thermoplastic polyethylene);
Conductor material and cross-section	according to EN 50182;
Conductor design	W (for watertight), K (for compacted);
Rated voltage *U* in kV	…kV.

EXAMPLE 1 OF DESIGNATION

“CCX 66-AL3 WK 20kV” is a XLPE-covered conductor with a rated voltage of 20 kV, longitudinal watertight compacted conductor of aluminium alloy AL3 and a nominal conductor cross-section of 66 mm^2.

EXAMPLE 2 OF DESIGNATION

“CCST 66-A3F W 20 kV” is a thermoplastic polyethylene covered conductor with a rated voltage of 20 kV, longitudinal watertight conductor with formed aluminium alloy wire AF3 and a nominal conductor cross-section of 66mm^2.

4.2 Construction requirements

4.2.1 Conductor

Number of conductors:	1
Conductor material:	aluminium alloy or steel reinforced aluminium
Nom. cross-section:	25 mm^2 to 400 mm^2 for all conductors
Conductor design:	the conductors may be compacted or non-compacted, with round wire or profiled wire.

Information on bare conductors with round wires in frequent use can be found in the national lists, contained in EN 50182:2001, Annex F. However, for the purpose of this document, conductors may be selected from any national table. Conductors deviating in design from the standard values shall be given by the manufacturer, but fulfilling all requirements given in EN 50182.

Information about conductors made from profiled wires shall be provided by the manufacturer.

Non-compacted conductors shall comply with EN 50182 or EN 62219 (with the exception of the filling, if any).

For compacted conductors, based on conductors according to EN 50182, the following paragraph applies:

The outer diameter of the compacted conductor shall be 95 % (±1 % for 7 and 19-wire constructions, ± 1,5 % for 37-wire constructions) of the diameter given in EN 50182. The rated tensile strength (RTS) shall be at least 95 % of the value given in EN 50182. The DC resistance shall not exceed the value given in EN 50182 by more than 5 %.

4.2.2 Filling

The stranded conductor may be longitudinally watertight by means of adequate measures as e.g. filling with an adequate mass. The filling mass or other materials for obtaining the longitudinal watertightness, shall be compatible with the conductor material and the material of the covering (see Table 2).

4.2.3 Covering

The covering shall consist of a cross-linked polyethylene compound, which shall comply with the requirements according to Table 1, column 3 or of a thermoplastic polyethylene compound, complying with the requirements according Table 1, column 4.

It shall be possible to remove the covering without damage to the conductor.

Table 1 — Properties of the covering materials

1	2	3	4
	Unit		
Compound designation		**X**	**T**
Basic material		**XLPE**	**PE**

1	2	3	4
	Unit		
Maximum operating temperature of the conductor	**°C**	**90** [a]	**70**
Mechanical properties			
before ageing on sample (EN 60811-501:2012, 4.2)			
minimum tensile strength	**MPa**	**12,5**	**12,5**
minimum elongation at break	**%**	**200**	**300**
after ageing on sample (of EN 60811-401:2012[1], 4.2.3.2)			
Temperature	**°C**	**135**	**110**
Duration	**h**	**168**	**336**
minimum tensile strength	**MPa**	**-**	**12,5**
maximum variation T1/T0	**%**	**± 25**	**-**
minimum elongation at break	**%**	**-**	**300**
maximum variation T1/T0	**%**	**± 25**	**-**
after ageing on complete product sample [b] (EN 60811-401:2012[1], 4.2.3.4)			
Temperature	**°C**	**100 ± 2**	**100 ± 2**
Duration	**h**	**168**	**168**
minimum tensile strength	**MPa**	**-**	**12,5**
maximum variation T2/T0	**%**	**± 25**	**-**
minimum elongation at break	**%**	**-**	**300**
maximum variation T2/T0	**%**	**± 25**	**-**
Physical and chemical properties			
hot set test (EN 60811-507)			
temperature	**°C**	**200**	**-**
duration	**min**	**15**	**-**
mechanical stress	**MPa**	**0,2**	**-**
maximum elongation under load	**%**	**175**	**-**
maximum residual elongation	**%**	**15**	**-**
pressure test at high temperature (EN 60811-508:2012[3], 4.3)			
temperature	**°C**	**-**	**80**
duration	**h**	**-**	**4**
coefficient k	**-**	**-**	**0,8**
maximum depth of indentation	**%**	**-**	**50**
Gravimetric water absorption (EN 60811-402)			
temperature	**°C**	**85**	**85**
duration	**h**	**336**	**336**
maximum variation of mass	**mg/cm²**	**1**	**1**
shrinkage test (EN 60811-502)			
distance L between marks	**mm**	**200**	**200**
duration	**h**	**1**	**1**

1	2	3	4
	Unit		
temperature	**°C**	**130 ± 3**	**100 ± 3**
maximum shrinkage	**%**	**4**	**4**
Shore D hardness (**HD 605 S3**:**2019**, 2.2.1)			
minimum hardness	**ShD**	**-**	**55**
a Maximum operating temperature of the conductor is limited to 80 °C due to mechanical reasons.			
b For use together with watertight conductors only. Adequate measures e.g. neutral capping to prevent leakage of filling material shall be taken.			

An UV-protection shall be provided. Covering materials having a content of carbon black of (2,5 ± 0,5) % are considered to have adequate protection. Otherwise protection against UV shall be demonstrated fulfilling the UV-test specified in Chapter 6, Table 2, No.4.3.

The nominal thickness of the covering shall be calculated according to the following formula:

$$S = 0{,}11\ U$$

where

S is the nominal thickness of the covering in mm (rounded to one decimal place);

U is the rated voltage (see 3.2) in kV.

The nominal thickness of the covering shall be not less than 2,3 mm.

The minimum thickness of the covering at any place shall not be less than the nominal value by more than (0,1 mm + 10 % of the nominal value). The mean value of the thickness of the covering shall not exceed the nominal value by more than (0,1 mm + 10 % of the nominal value).

A semi-conductive conductor screen, if any, shall not be measured as covering thickness.

The covering shall be applied onto the conductor by extrusion of one or more material layers. In screened versions (constructions), the extruded conductor screen should be durable firmly bonded to the closest layer of insulation.

5 Marking

5.1 Indication of origin

Covered conductors shall be provided with an identification of origin consisting of a continuous marking of the manufacturer's name or trademark on the surface of the covering. This marking shall be made by embossing.

5.2 Continuity of marks

The distance between the end of a mark and the beginning of the next identical mark shall not exceed 1 000 mm.

Figure 1 below shows an example of the marking, where the word "ORIGIN" stands for the mandatory information required in 5.1 and "XYZ" stands for one of any other mandatory marks required in 5.3.