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Zahteve za preskušanje pribora za nizkonapetostne izolirane nadzemne kable - 4. del: Spojke

Test requirements for low voltage aerial bundled cable accessories -- Part 4: Connectors

Prüfanforderungen für Bauteile für isolierte Niederspannungsfreileitungen – Teil 4: Verbinder

Prescriptions relatives aux essais des accessoires pour réseaux aériens basse tension torsadés -- Partie 4: Connecteurs

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CENELEC

European Committee for Electrotechnical Standardization
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Foreword

This European Standard was prepared by a sub-group of WG 11 of the Technical Committee CENELEC TC 20, Electric cables.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50483-4 on 2008-12-01.

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)	2009-12-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2011-12-01

This is Part 4 of CENELEC standard EN 50483 "*Test requirements for low voltage aerial bundled cable accessories*", which has six parts:

– Part 1: Generalities;

– Part 2: Tension and suspension clamps for self supporting system;

– Part 3: Tension and suspension clamps for neutral messenger system;

– Part 4: Connectors;

– Part 5: Electrical ageing test;

– Part 6: Environmental testing.

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1 Scope

EN 50483 series applies to overhead line fittings for tensioning, supporting and connecting aerial bundled cables (ABC) of rated voltage U_0/U (U_m): 0,6/1 (1,2) kV.

This Part 4 applies to connectors used for the electrical connection of ABC.

The connectors are designed to be installed on ABC defined in HD 626.

Tests described in this document are type tests.

NOTE This European Standard does not invalidate existing approvals of products achieved on the basis of national standards and specifications and/or the demonstration of satisfactory service performance. However, products approved according to such national standards or specifications cannot directly claim approval to this European Standard. It may be possible, subject to agreement between supplier and purchaser, and/or the relevant conformity assessment body, to demonstrate that conformity to the earlier standard can be used to claim conformity to this standard, provided an assessment is made of any additional type testing that may need to be carried out. Any such additional testing that is part of a sequence of testing cannot be done separately.

2 Normative references

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

EN 50483 series, *Test requirements for low voltage aerial bundled cable accessories*

EN 60529:1991, *Degrees of protection provided by enclosures (IP Code)* (IEC 60529:1989)

HD 626, *Overhead distribution cables of rated voltage $U_o/U(U_m)$: 0,6/1 (1,2) kV*

IEC 60050-461, *International Electrotechnical Vocabulary (IEV) – Part 461: Electric cables*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-461 and the following apply.

3.1
aerial bundled cable (ABC)
aerial cable consisting of a group of insulated conductors which are twisted together including, or not, a non insulated conductor
[IEV 461-08-02, modified]

NOTE The terms bundled conductors, bundled cables, bundled cores, conductor bundles and bundle could be used as equivalent to the term aerial bundled cable (ABC).

3.2
aerial-insulated-cable
insulated cable designed to be suspended overhead and outdoors
[IEV 461-08-01]

3.3
branch connector
metallic device for connecting a branch conductor to a main conductor at an intermediate point on the latter
[IEV 461-17-05]

3.4
branch conductor
conductor connected to the main conductor by a connector

3.5
conductor insulation
insulation applied on a conductor
[IEV 461-02-02, modified]

3.6
conductor (of a cable)
part of a cable which has the specific function of carrying current
[IEV 461-01-01]

3.7
connector
metallic device to connect cable conductors together
[IEV 461-17-03]

3.8
core
assembly comprising conductor and its own insulation
[IEV 461-04-04, modified]

3.9
insulation (of a cable)
insulating materials incorporated in a cable with the specific function of withstanding voltage
[IEV 461-02-01]

3.10
insulation piercing connector (IPC)
connector in which electrical contact with the conductor is made by metallic protrusions which pierce the insulation of the ABC core
[IEV 461-11-08, modified]

3.11
messenger
wire or rope, the primary function of which is to support the cable in aerial installations, which may be separate from or integral with the cable it supports
[IEV 461-08-03]

3.12
minimum breaking load (MBL)
minimum breaking load of the conductor given by HD 626 or the cable manufacturer if not defined in the standard or minimum breaking load of the clamp given by the clamp manufacturer

3.13
neutral messenger system
aerial insulated system where only the neutral messenger supports the ABC

3.14
pre-insulated (terminal) lug
insulated metallic device for connecting an insulated cable conductor to other electrical equipment

3.15
pre-insulated through connector (sleeve)
insulated metallic device for connecting two consecutive lengths of insulated conductors

3.16
rated tensile strength (RTS)
estimate of the conductor breaking load calculated using the specified tensile properties of the component wires
[EN 50182:2001, 3.7]

3.17
reusable connector
connector for connecting ABC to stripped cable or bare conductor where only the branch connection can be reused

3.18
self supporting system
aerial insulated system where all the cores of the ABC contribute to its support

3.19
sheath
uniform and continuous tubular covering of metallic or non metallic material, generally extruded
[IEV 461-05-03]

3.20
shear head
head of a bolt, or a device fitted over the head of a bolt or a nut, which is designed to break at a specified torque

3.21
type test
test required to be made before supplying a type of material covered by this standard on a general commercial basis, in order to demonstrate satisfactory performance characteristics to meet the intended application

NOTE These tests are of such a nature that, after they have been made, they need not be repeated unless changes are made to the accessory materials, design or type of manufacturing process which might change the performance characteristics.

4 Symbols

ρ resistivity (Ω.m)

5 Characteristics

These connectors shall connect cables designed to HD 626 and withstand the following type tests.

6 Marking

See Clause 6 of EN 50483-1.

7 General test conditions

See Clause 9 of EN 50483-1.

7.1 Generalities

Minimum and maximum cross-sections of the conductors used for the tests shall be the minimum and maximum cross-sections for which the connector is designed.

All conductors used in these tests shall be pre-conditioned in accordance with 7.2.

When tensile test loads are applied to conductors the rate of increase shall be in accordance with EN 50483-1, 9.1.4.

A torque meter shall be used for all tightening operations and it shall have a resolution and accuracy in accordance with EN 50483-1, 9.1.8.

All tests shall be carried out at ambient temperature unless otherwise stated in this standard.

The frequency of a.c. tests shall be in accordance with EN 50483-1, 9.1.1.

The relative humidity shall be in accordance with EN 50483-1, 9.1.9 unless otherwise altered by this standard.

If a cable breaks beyond any part of a connector, the test result shall be declared void without discrediting the connector. Tests can be repeated using a new connector and a new cable.

7.2 Preconditioning of ABC

New cores or cables shall be used.

Cores shall be pre-conditioned according to of EN 50483-1, 9.1 in order to ensure the dimensional stabilisation of the insulating sheath.

The extremities of the service cables shall be installed into the connector in accordance with the instructions given by the connector manufacturer.

For the voltage and water tightness tests in 8.1.3, if the connector is tested in horizontal position, the cores shall first be bent and held in a rigid position using an appropriate device in order to prevent damage to the connections during handling, as required in the specific test.

For the climatic ageing test in 8.1.5.2, the cores shall be bent as for the dielectrical voltage and water tightness tests and their ends shall be tightly capped to prevent moisture from penetrating the conductors, as required in the specific test.

When there is a requirement to bend the cables, the bending radius shall be at least 15 times the outer diameter of the core.

NOTE 1 It is recommended that the cores should be shaped before installing the connectors.

NOTE 2 Cores used should comply with the piercing test of the insulating sheath defined in HD 626 where the customer requires this and it is applicable to the type of cable being tested.

8 Type tests

8.1 IPC tests

8.1.1 Installation of IPCs

Connectors shall be installed in accordance with the manufacturer's instructions. A torque meter, in accordance with EN 50483-1, 9.1.8, shall be used for all tightening and untightening operations.

Tightening shall be at the rate specified in EN 50483-1, 9.1.10.

The same core (e.g. Phase 1) of a cable with the same cross-section shall be used for each test.

Connectors, used on cores with a cross-section lower than, or equal to, 35 mm², can be held in position during tightening if necessary.

8.1.2 Mechanical testing

The following tests are designed to ensure that the IPC is both mechanically sound and does not damage the conductors it connects:

Test	Subclause
Test for mechanical damage to the main conductor	8.1.2.1
Branch cable pull-out test	8.1.2.2
Connector bolt tightening test	8.1.2.3
Shear head function test	8.1.2.4
Low temperature impact test	8.1.2.5

8.1.2.1 Test for mechanical damage to the main conductor

8.1.2.1.1 Principle

This test ensures that the mechanical performance of the conductor is not impaired as a consequence of the installation of the IPC.

8.1.2.1.2 Test arrangement

Two samples shall be tested. Where the IPC is designed to accept more than one size of core, 2 samples shall be tested in each of the following conductor combinations:

Main	Branch
max.	max.
min.	min.
min.	max.

NOTE Where max. min. combination is required this may be agreed between the customer and the manufacturer.

The core shall be mounted in a tensile test machine in a suitable manner.

The core, on which the IPCs will be tested, shall be tensioned to between 10 % and 15 % of its MBL for aluminium conductors (AAC) and between 15 % and 20 % of its MBL for all other conductors as defined in HD 626 (for example copper and AAAC).

The core length shall be between 0,5 m and 1,5 m.

When using bare main conductors according to EN 50182 not included in HD 626, RTS shall be used.

8.1.2.1.3 Procedure

Connectors shall be installed in accordance with the manufacturer's instructions.

When the connector is designed with a shear-head, it shall be tightened to the manufacturer's specified maximum torque.

When the connector is designed without a shear-head, it shall be tightened to 1,1 times the manufacturer's specified nominal torque.

The connectors shall not be removed from the core before the mechanical tensile test.

A tensile test load shall be applied to the main conductor until it reaches the following values:

System type	Conductor	Tensile test load
Self supporting	Copper (4 mm² to 16 mm²)	20 % MBL of the cable
	Copper (> 16 mm²)	80 % MBL of the cable
	Aluminium (16 mm² to 25 mm²)	1 200 N or 40 % MBL of the cable, whichever is the greater
	Aluminium (> 25 mm²)	80 % MBL of the cable
Neutral messenger	Phase	60 % MBL of the cable
	Neutral	90 % MBL of the cable

NOTE Loads for other designs of ABC shall be agreed between the customer and the manufacturer.

The load shall be maintained for 60 s.

8.1.2.1.4 Requirements

The conductor shall maintain the test load for 60 s without breaking or any damage that would prevent the correct function of the cable.

8.1.2.2 Branch cable pull-out test

8.1.2.2.1 Principle

To ensure that the IPC provides mechanical security of the branch cable.

8.1.2.2.2 Test arrangement

Two samples shall be tested. Where the IPC is designed to accept more than one size of conductor, two samples shall be tested in each of the following conductor combinations:

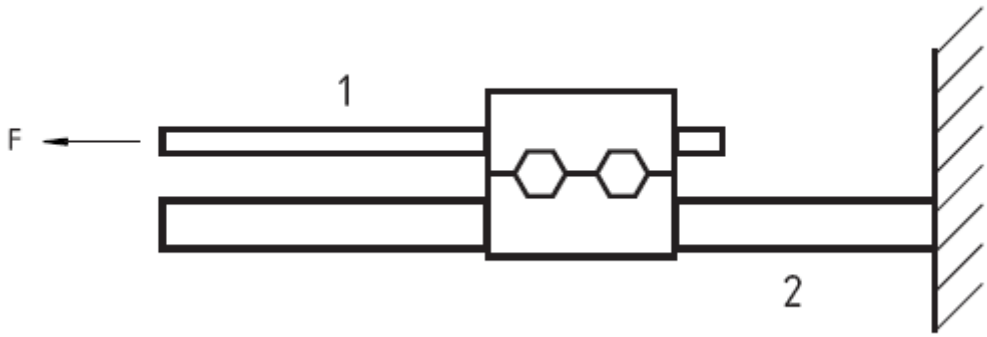
Main	Branch
min.	min.
max.	min.

NOTE Where other combinations are required these may be agreed between the customer and the manufacturer.

The branch connector shall be positioned and then installed in accordance with the manufacturer's instructions.

The core lengths shall be between 0,2 m and 0,5 m.

The general arrangement is shown in Figure 1. The IPC shall be installed in accordance with manufacturer's instructions.



Key

1 branch

2 main secured in mechanical device

Figure 1 – Test arrangement

8.1.2.2.3 Procedure

When the connector is designed with a shear-head, it shall be tightened to the manufacturer's specified maximum torque.

When the connector is designed without a shear-head, it shall be tightened to 1,1 times the manufacturer's specified nominal torque.

The core, or in the case of a bare conductor, the conductor, shall be marked at the IPC so that any slippage during the test can be measured.

A tensile load (*F*) shall be applied approximately axially, between the branch conductor and the opposing main conductor which shall be secured in a mechanical device, at a rate between 100 N/min and 500 N/min. This load shall be 1 kN or 10 % of the MBL of the branch conductor whichever is less.

The load shall be maintained for 60 s.

8.1.2.2.4 Requirements

Core slippage shall not exceed 3 mm.

The cores shall maintain the test load for 60 s without breaking or any damage that would prevent the correct function of the cable.

8.1.2.3 Connector bolt tightening test

8.1.2.3.1 Principle

To ensure that when tightened, the bolts used to make the electrical connection and provide mechanical security, do not cause the IPC to fail mechanically during installation.

8.1.2.3.2 Test arrangement

Two connectors shall be tested.

The core on to which the IPC is to be installed shall be tensioned to 20 % of its MBL.

The IPCs shall be installed on to cores for which it is designed. Where the IPC is designed to accept more than one size of conductor, two samples shall be tested in each of the following conductor combinations:

Main	Branch
max.	max.
min.	min.
min.	max.

NOTE Where max. min. combination is required this may be agreed between the customer and the manufacturer.