SLOVENSKI STANDARD
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Zahteve za preskuġanje pribora za nizkonapetostne izolirane nadzemne kable - 5. del: Preskus elektriļ nega staranja

Test requirements for low voltage aerial bundled cable accessories -- Part 5: Electrical ageing test

Prüfanforderungen für Bauteile für isolierte Niederspannungsfreileitungen – Teil 5: Elektrische Alterungsprüfungen

Prescriptions relatives aux essais des accessoires pour réseaux aériens basse tension torsadés -- Partie 5: Essai de vieillissement électrique

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CENELEC

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

Central Secretariat: avenue Marnix 17, B - 1000 Brussels

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 50483-5 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– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2011-12-01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 5 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 5 applies to the connections described in EN 50483-4, including branch connectors, Insulation Piercing Connectors (IPC), pre-insulated lugs (terminals) and through pre-insulated connectors (sleeves).

The objective is to provide a method of testing the suitability of connectors when used under normal operating conditions with low voltage aerial bundled cables complying with HD 626**.**

Two classes of connectors are covered by this standard:

Class A: These are connectors intended for electricity distribution or industrial networks in which they can be subjected to short-circuits of relatively high intensity and duration. As a consequence, Class A connectors will be suitable for the majority of applications.

Class B: These are connectors for networks in which overloads or short-circuits are rapidly cleared by the operation of protection devices.

Depending on their application, the connectors are subjected to heat cycles and short-circuit current tests.

Class A: the connectors are subjected to heat cycles and short-circuit current tests.

Class B: the connectors are subjected to heat cycles only.

The object of this Part 5 is to define the heating cycles test methods and requirements which apply to compression through connectors, insulation piercing connectors and all other type of connections for low voltage aerial bundled cables.

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

EN 61238-1:2003, *Compression and mechanical connectors for power cables for rated voltages up to 36 kV (U_m = 42 kV) – Part 1: Test methods and requirements* (IEC 61238-1:2003, mod.)

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
adiabatic
occurring with no addition or loss of heat from the system under consideration

3.2
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).

3.3
aerial-insulated-cable
insulated cable designed to be suspended overhead and outdoors
[IEV 461-08-01]

3.4
branch connector
metallic device for connecting a branch conductor to a main conductor at an intermediate point on the latter
[IEV 461-17-05]

3.5
branch conductor
conductor connected to the main conductor by a connector

3.6
conductor insulation
insulation applied on a conductor
[IEV 461-02-02, modified]

3.7
conductor (of a cable)
part of a cable which has the specific function of carrying current
[IEV 461-01-01]

3.8
connector
metallic device to connect cable conductors together
[IEV 461-17-03]

3.9
core
assembly comprising conductor and its own insulation
[IEV 461-04-04, modified]

3.10
equalizer
arrangement used in the test loop to ensure a point of equipotential in a stranded conductor
[EN 61238-1:2003, 3.8]

3.11
insulation (of a cable)
insulating materials incorporated in a cable with the specific function of withstanding voltage
[IEV 461-02-01]

3.12
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]

3.13
median connector
connector which during the first heat cycle records the third highest temperature of the six connectors in the test loop
[EN 61238-1:2003, 3.11]

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
reference conductor
length of conductor(s) without any joints, which is included in the test loop and which enables the reference temperature and reference resistance(s) to be determined

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

3.18
sheath
uniform and continuous tubular covering of metallic or non metallic material, generally extruded
[IEV 461-05-03]

3.19
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

3.20
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

A, A_1, A_2	electrical cross-sectional area of the conductors
D	conductor diameter
D_{Eq}	equalizer diameter
d	conductor length between connectors
I	direct current flowing through a connection during resistance measurement
I_{rms}	equivalent r.m.s. short-circuit current
I_N	alternating current necessary to maintain the reference conductor at its equilibrium temperature
ℓ_a, ℓ_b, ℓ_j	lengths of the conductor assembly associated with the measurement points after jointing
ℓ_e	length of equalizer
ℓ_r, ℓ_{ra}, ℓ_{rb}	length of the reference conductor between measurement points
R_1, R_2	linear resistance of conductors of respectively cross-section A_1 and A_2
R_{20}, R_{ra}, R_{rb}	the calculated resistance between two equalizers and corrected to 20 °C
TC	thermocouple
t_1	heating period within heat cycle
t_2	cooling period within heat cycle
$t_{1\text{-}a}$	time period to reach the required temperature on the reference cable
$t_{1\text{-}b}$	time period of stable temperature on the median connector
U_{AB}	potential difference between measurement points of reference conductor of cross-section A_1
U_{CD}	potential difference between measurement points of the connector
U_{EF}	potential difference between measurement points of reference conductor of cross-section A_2
α	temperature coefficient of resistance at 20 °C
β	mean scatter of the connector resistance factors
$\Delta\theta_j$	temperature difference between reference cable and connector
δ	initial scatter of the connector resistance factors

λ resistance factor ratio; change in the resistance of the connector relative to its initial resistance

θ temperature of a connector while measuring resistances

θ_{max} maximum temperature recorded on a connector over the total period of test

θ_N highest rated temperature of insulating compound in normal operation

θ_R temperature of the reference conductor determined in the first heat cycle

θ_r temperature of the reference conductor while measuring resistances

θ_{ref} temperature of the reference conductor at the moment of measuring θ_{max}

5 Type test

5.1 Principle

Connectors shall be subjected to 1 000 cycles of heating and cooling. The cold resistance of the connectors shall be measured at specific steps to determine their suitability when used with conductors carrying a load.

Heat cycle and, short-circuit tests shall be made with alternating current.

NOTE Direct current may be used for heat cycle only when agreed between customer and manufacturer.

5.2 Test arrangement

5.2.1 Installation

The test circuit shall be as shown in Figure 5, 6, 7 or 8.

Figures 5, 6, 7 and 8 represent the test circuits respectively for main and branch connectors having equal cross-sections and linear resistance(s); for main and branch connectors having unequal cross-sections and linear resistance(s); for through connectors having equal or unequal cross-sections and linear resistance(s); for terminal lugs.

5.2.1.1 Optional immersion test

EN 50483-6, 8.4.3.1 provides an optional immersion test for samples which are intended for use in saline polluted areas. When the inclusion of this test has been agreed between the manufacturer and the customer this heat cycle test shall be modified to accommodate immersion of the test samples during each cycle.

5.2.2 Disconnection devices

The test circuit may include sectioning joints so that it can be dismantled and short-circuit tests can be made easily.

In Figure 6, the disconnection devices (X) are

- closed when the circuit is carrying heating current, and
- opened when resistance measurements and short-circuit applications are being made.

The sectioning joints shall be arranged and constructed so that they do not significantly affect the measurements.

5.2.3 Conductors

Phase and neutral conductors including reference conductors used in the test circuit shall remain insulated (except bare conductors).

5.2.4 Method of measuring ambient temperature

It is important that ambient temperature is measured accurately and is not affected by the heating produced by the test. The following provides a proven method for achieving this measurement though alternative methods can be used.

Ambient temperature shall be measured at the middle of the test loop with a thermocouple whose junction is placed in a polished metallic tube manufactured from metal foil formed into a cylinder. Its height shall be 100 mm and its diameter shall be between 35 mm and 45 mm. The thermocouple shall be located approximately at one third of the tube height from its upper end and fitted to it (e.g. with a cross-support).

5.2.5 Ambient conditions

The test loop shall be installed in a location where the air is not disturbed. The ambient temperature of the test location shall be between 15 °C and 30 °C.

During the connector installation and resistance measurements, ambient temperature shall remain within the limits of (23 ± 3) °C and recorded.

5.2.6 Equalizers

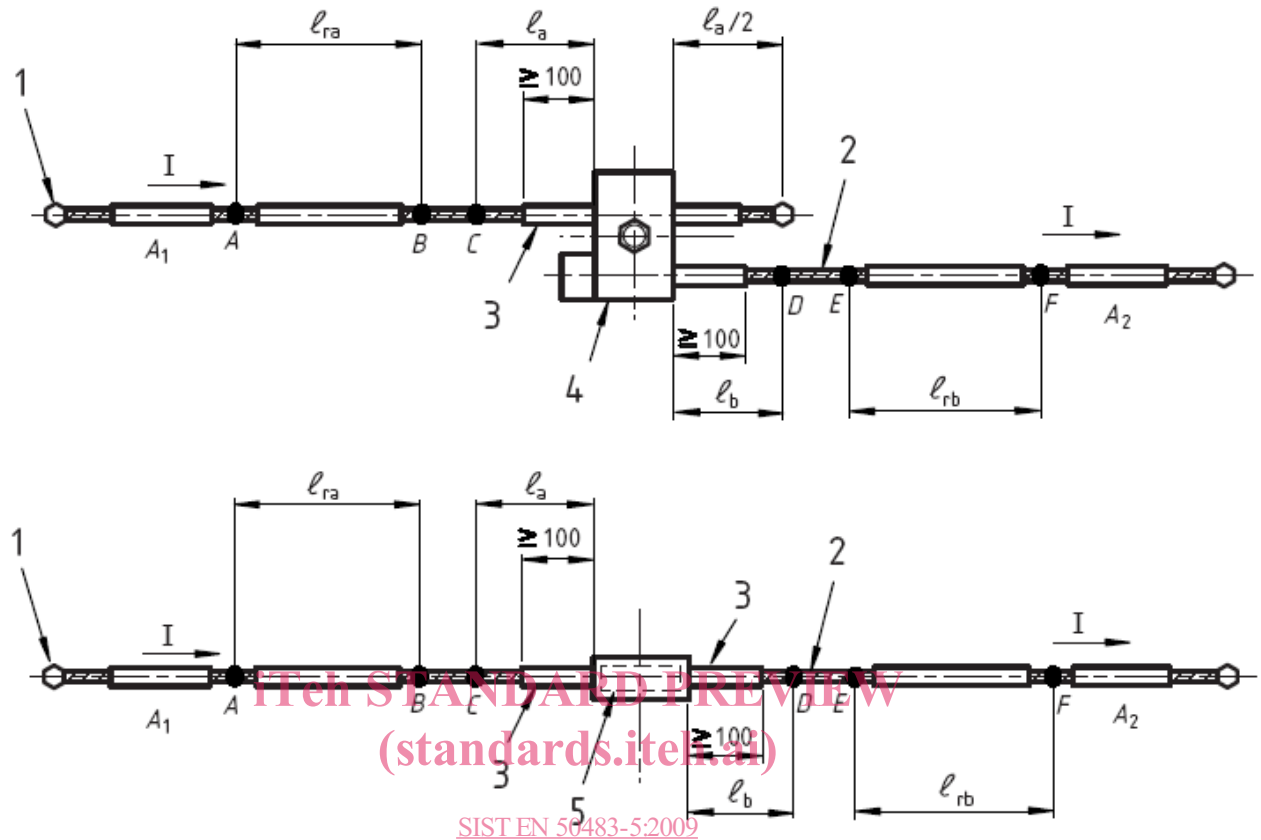
For stranded conductors, potential between the strands at measuring points can cause errors in measuring electrical resistance.

Welded or soldered equalizers, as shown in Annex A, shall be used to overcome this problem, and to ensure uniform current distribution in the reference conductor. Welded or soldered equalizers shall be the recommended methods to ensure reliable measurements.

NOTE Other methods may be used provided that they give comparable results and do not affect the temperature of the connectors or the reference conductor.

Annex A provides details on the construction of welded equalizers.

5.2.7 Lengths and configurations of conducting paths



Key

A, B, C, D, E, F	equalizers (see Annex A).	1	conductor 1
A_1 and A_2	cross-sections relative to conductivity of the conductors 1 and 2 in mm²	2	conductor 2
A, B	potential points for measuring the potential difference between the extremities of the reference conductor corresponding to conductor of cross-section A_1	3	insulation
E, F	potential points for measuring the potential difference between the extremities of the reference conductor corresponding to conductor of cross-section A_2	4	branch connector
ℓ_{ra}	distance between potential points A and B	5	sleeve connector
ℓ_{rb}	distance between potential points E and F		
C, D	potential points for measuring the potential difference between the extremities of the related connector		
ℓ_a	distance between C and the nearest surface of the connector body		
ℓ_b	distance between D and the nearest surface of the connector body		
ℓ_a and ℓ_b	are dependent on the cross-section A of the related conductor according to the Table 1 below		

Figure 1 – Lengths and configurations of conducting paths