BS EN 50483-4:2009

BSI British Standards

Test requirements for low voltage aerial bundled cable accessories —

Part 4: Connectors

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BSI British Standards

National foreword

This British Standard is the UK implementation of EN 50483-4:2009.

The UK participation in its preparation was entrusted by Technical Committee GEL/20, Electric cables, to Subcommittee GEL/20/11, Cable accessories.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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

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

Prüfanforderungen für Bauteile für isolierte Niederspannungsfreileitungen - Teil 4: Verbinder

CENELEC

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

Central Secretariat: avenue Marnix 17, B - 1000 Brussels

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– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2011-12-01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

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:

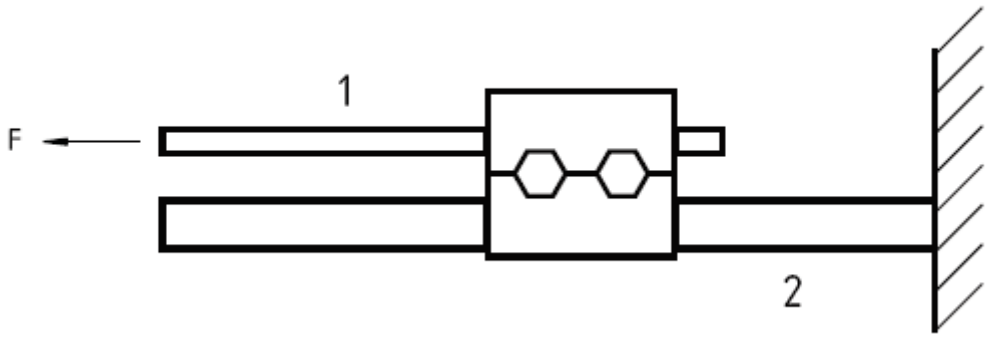
Main	Branch
min.	min.
max.	min.

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.

8.1.2.3.3 Procedure

The connectors shall be tightened, in accordance with EN 50483-1, 9.1.10, to the maximum torque specified by the manufacturer, plus 20 %.

NOTE A higher value of torque may be used when this is agreed between customer and supplier.

8.1.2.3.4 Requirements

The connector shall be undamaged.

8.1.2.4 Shear head function test

8.1.2.4.1 Principle

To ensure that the shear head mechanism functions correctly within the specified torque range.

8.1.2.4.2 Test arrangement

Six samples shall be tested at each of the following temperatures:

- the minimum temperature shall be (-10 ± 3) °C;
- the maximum temperature shall be (50 ± 3) °C.

NOTE See EN 50483-1, 9.1, for information on the use of a lower temperature.

The samples shall be tested in either of the following cross-section combinations:

Main	Branch
min.	min.
max.	max.

8.1.2.4.3 Procedure

The connector assemblies shall be placed in a temperature controlled environment until they reach the test temperature. The temperature shall be maintained for a minimum of 15 min.

The assembly can be removed from the chamber and the torque applied outside. In this case the temperature of the connector shall be monitored and the torque applied within the temperature limits defined above.

The shear head shall then be tightened, in accordance with the manufacturer’s installation instructions, until the head shears. This torque shall be recorded.

The test shall be repeated for the six samples at each of the specified temperatures and cross-section combination.

8.1.2.4.4 Requirements

For each of the test temperatures and cross-section combination, the torque at which the shear head shears, shall be within the tolerances of the manufacturer’s specified torque range.

8.1.2.5 Low temperature impact test

8.1.2.5.1 Principle

To ensure that the connector can withstand an impact when it is cold.

8.1.2.5.2 Test arrangement

Two connectors shall be installed in the manner for which they are designed.

The samples shall be tested in the following cross-section combinations:

Main	Branch
max.	min.
max.	max.

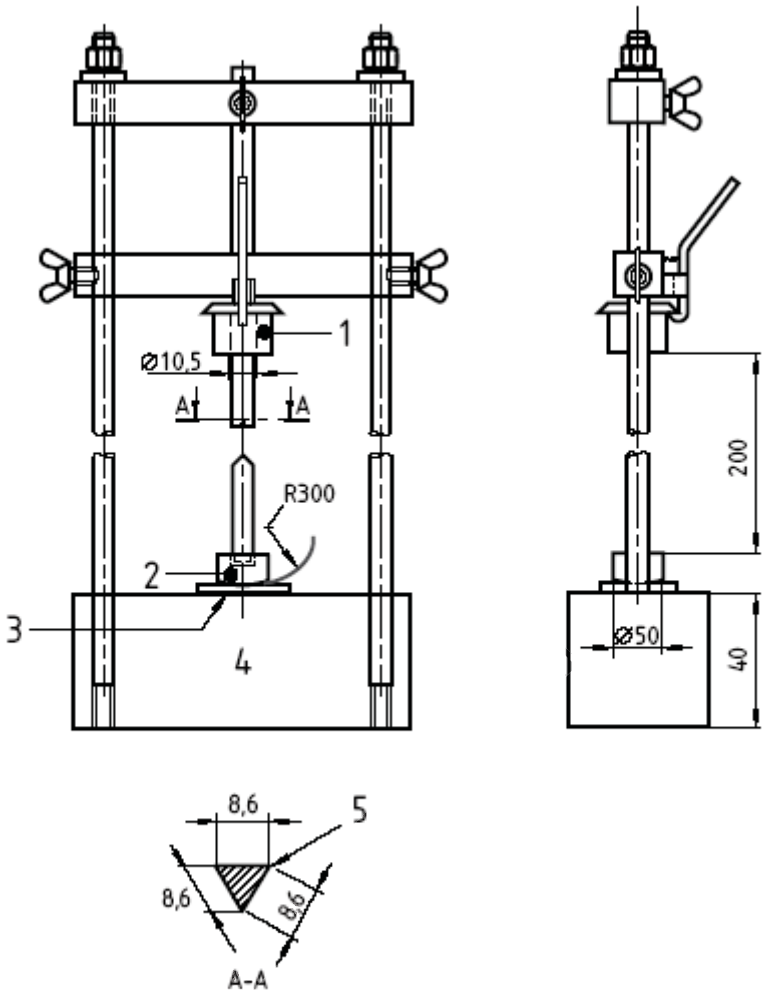
Figure 2 shows a typical test arrangement.

The connectors and the cores shall be placed in a temperature controlled environment at (-10 ± 3) °C until they reach the test temperature.

NOTE See EN 50483-1, 9.1, for information on the use of a lower temperature.

The assembly can be removed from the cold chamber in order to make the test. To ensure that the test is carried out at the specified temperature the impact test shall be made immediately.

Dimensions in millimetres



Key

1	hammer 900 g	4	steel 10 kg
2	steel intermediate piece 100 g	5	slightly round edges
3	test piece		

Figure 2 – Typical impact test arrangement

8.1.2.5.3 Procedure

The separate samples shall be placed in the impact test device and impacted with a cylindrical anvil approximately 50 mm in diameter with a spherical contact radius of approximately 300 mm. The anvil shall have a mass of approximately 100 g and shall transfer to the test sample the impact energy of a weight of 900 g falling freely through 200 mm.

Two impacts shall be made on each sample, one acting from the top and one acting on the side.

NOTE 1 The position of impact should be agreed between the manufacturer and the customer as being the most vulnerable points.

NOTE 2 The value of weight and distance of fall may be varied as long as the impact energy remains the same.

8.1.2.5.4 Requirements

No damage shall occur which would affect the correct function of the connector.

8.1.3 Dielectrical voltage tests and water tightness test

8.1.3.1 Dielectrical voltage test

This test is not applicable to IPC which connects a bare conductor to an insulated conductor.

In order to meet the requirements of the type tests at least one of the two dielectrical tests shall be carried out.

Connector classes:

Class 1: connector subjected to dielectric test in water;

Class 2: connector subjected to dielectric test in air.

NOTE The choice of the class should be agreed between the manufacturer and the customer.

8.1.3.1.1 Principle

To ensure that the connector can withstand a dielectrical voltage.

8.1.3.1.2 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.

8.1.3.1.3 Procedure

The connector shall be tightened to the minimum torque indicated by the manufacturer.

Initially, for reusable connectors, the tap core shall be successively, mounted four times and removed three times.

Should the shear head break whilst mounting the connector then the torque shall be raised to the minimum value according to the method defined in 8.1.1.

The mounting and removal shall entail taking the conductor out of the connector, but there shall be no change in orientation, or modification of the stripped end of the conductor.

While mounting and removing the conductor, the bolts shall be tightened to the minimum torque and then un-tightened.

8.1.3.1.3.1 Test in water (For Class 1 connectors only)

The assembly, of connector and cores, shall be placed at the bottom of a water tank. During the movement of the assembly it may be supported to ensure no bending of the core or unnecessary movement of the component parts.

The connector may be placed either vertically or horizontally.

The depth of water shall be measured from the upper part of the connector. The cores shall be of such length to ensure that they are sufficiently above the water level to prevent flashover (see Figure 3).

The maximum leakage current shall be in accordance with EN 50483-1, 9.1.5.

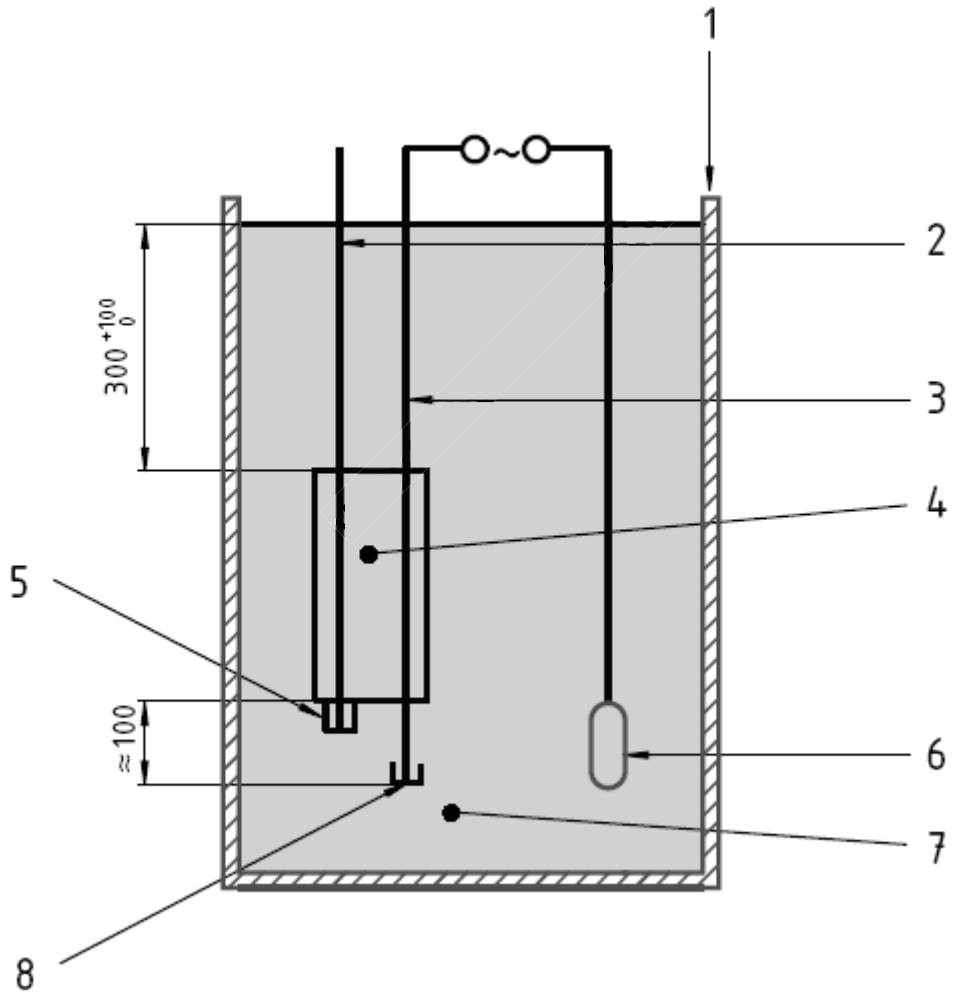
The resistivity ρ of the water used in this test shall be in accordance with EN 50483-1, 9.1.6.

The voltage shall be applied at a speed specified in EN 50483-1, 9.1.7.

After 30 min under water, the voltage test shall be applied to the sample with a 4 kV a.c. for 60 s according to Figure 3.

NOTE A voltage of 6 kV may be used when agreed between customer and manufacturer.

Dimensions in millimetres



Key

1	tank	5	part of connectors for watertight of tap core
2	insulated tap conductor	6	metallic electrode
3	insulated main conductor	7	water
4	mounted connector	8	watertight insulating cap or core bent so that end is above the surface of water

Figure 3 – Illustrative arrangement for dielectrical test in water

8.1.3.1.3.2 Test in air (For Class 2 connectors only)

Two methods are provided; compliance with either will meet the requirements of this type test.

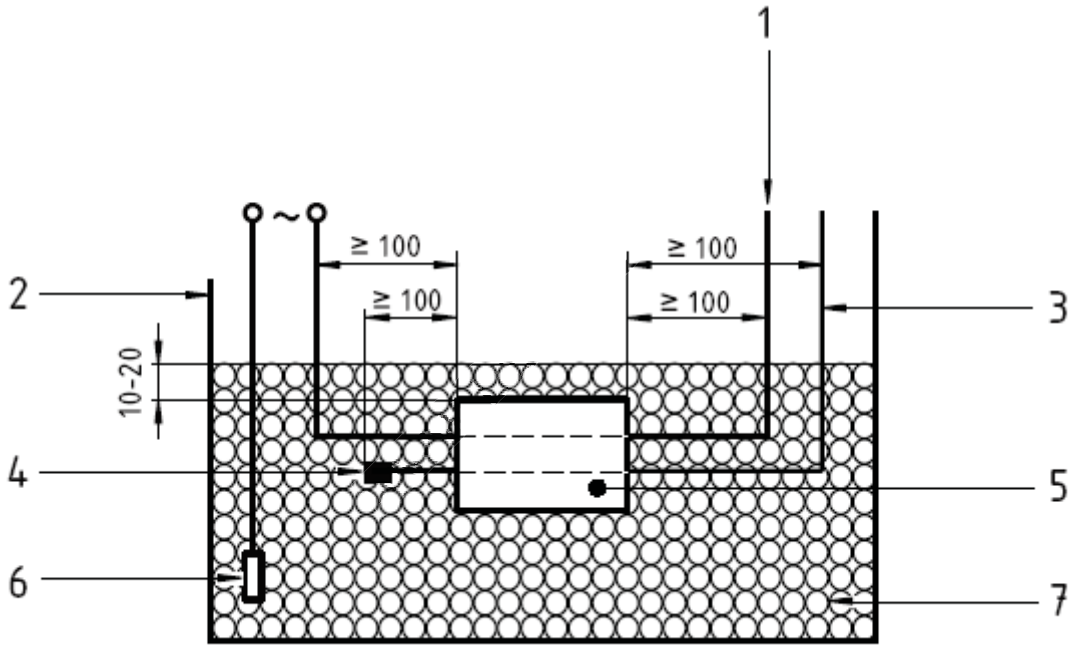
8.1.3.1.3.2.1 Method 1

The core shall not be bent near to the connector. Any change in orientation of the core shall be at least 10 cm from the connector. The assembly shall be mounted so that the connectors lie horizontally.

The assembly shall be covered by 1 cm to 2 cm of metallic balls with 1,3 mm to 1,7 mm diameter. The metallic balls shall not apply undue mechanical stress to the assembly.

The test arrangement is shown in Figure 4.

Dimensions in millimetres



Key

1	insulated main conductor	5	mounted connector
2	tank	6	metallic electrode
3	insulated tap conductor	7	metallic balls
4	insulating cap		

Figure 4 – Arrangement for dielectrical test in metallic balls

After a minimum period of 60 s, a voltage test of 4 kV a.c. shall be applied for 60 s between the core conductors and the metallic balls.

NOTE 1 A voltage of 6 kV a.c. may be used when agreed between customer and manufacturer.

NOTE 2 A metallic foil may be used instead of metallic balls when agreed between the customer and manufacturer.

The maximum leakage current shall be in accordance with EN 50483-1, 9.1.5.

The voltage shall be applied at a speed specified in EN 50483-1, 9.1.7.

8.1.3.1.3.2.2 Method 2

The assembled connectors shall be closely wrapped with metallic gauze having a mesh size < 5 mm, which shall be clear of any test connections. If necessary these test points shall be temporarily insulated.

NOTE 1 Figure 5 shows a typical test arrangement. Where the insulated end cap is incorporated into the design of the connector it may be included within the gauze screen.

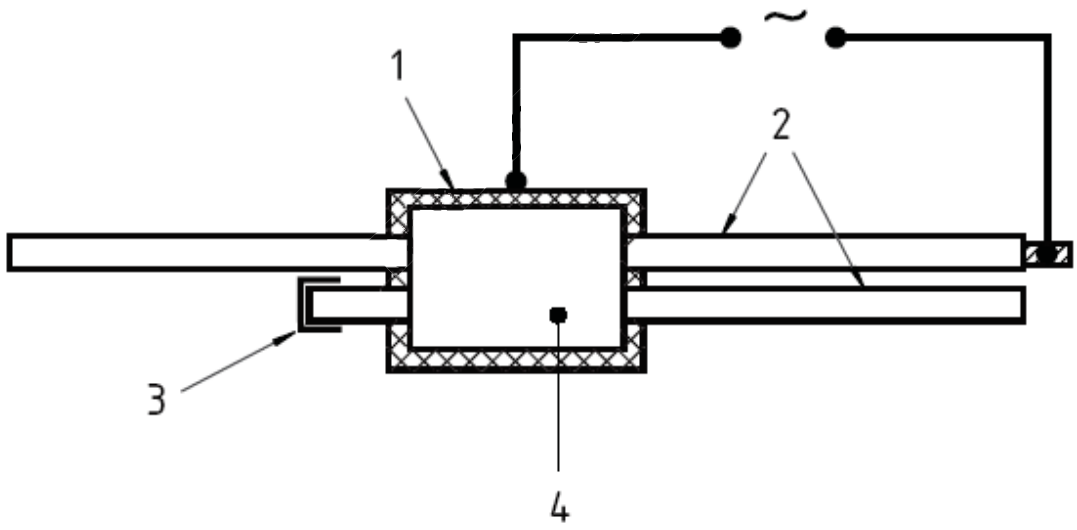
A test voltage of 4 kV a.c. shall be applied for 60 s between the main conductor and the gauze.

NOTE 2 A voltage of 6 kV a.c. may be used when agreed between customer and manufacturer.

For 10 min immediately preceding the test, and during the time the voltage is applied, the connectors shall be exposed to artificial rain of characteristics defined in EN 60529:1991, Class IPX3.

The maximum leakage current shall be in accordance with EN 50483-1, 9.1.5.

The voltage shall be applied at a speed specified in EN 50483-1, 9.1.7.



Key

1	metallic gauze	3	insulating cap
2	ABC cores	4	connector

Figure 5 – Typical arrangement for dielectrical test with metallic gauze

8.1.3.1.4 Requirements

No flashover or breakdown shall occur (tripping of voltage generator).

8.1.3.2 Water tightness test

This test is required for connectors for which the dielectric test in water is not applicable due to the connector design.

8.1.3.2.1 Principle

To ensure that water cannot migrate to the ABC when it is used to connect the ABC to ABC or to a bare conductor.

This test is applicable for insulated to bare conductors and for Class 2 connectors, if required.

8.1.3.2.2 Test arrangement

Two samples shall be tested. Where the connector 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.
min.	max.

8.1.3.2.3 Procedure

Figure 6 shows the test arrangement.

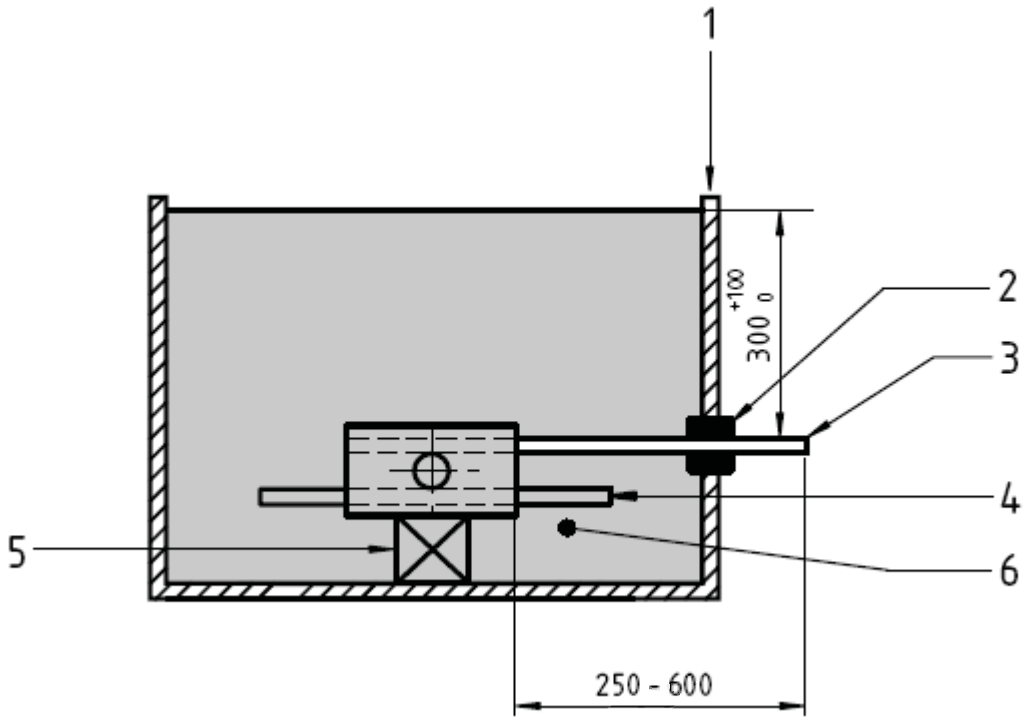
The length of main cores shall be approximately 30 cm. The connectors shall be tightened to the minimum torque specified by the manufacturer.

The assembly of connector and cores shall be placed at the bottom of a water tank. The depth of water shall be measured above the core.

The tap core shall pass out of the tank through an appropriate seal, which shall be designed to prevent any excessive stress on the insulation.

The assembly shall be left in the water for 24 h.

Dimensions in millimetres



Key

1	tank	4	bare or insulated main conductor
2	sealing	5	support if any
3	tap core	6	water

Figure 6 – Test arrangement for the water tightness test

8.1.3.2.4 Requirements

No trace of water shall be observed at the end of the core.

8.1.4 Low temperature assembly test

8.1.4.1 Principle

To ensure electrical contact is established when the IPC is applied in cold conditions.

8.1.4.2 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:

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

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

8.1.4.3 Procedure

The connectors and core shall be further pre-conditioned until they reach the test temperature of (-10 ± 3) °C, then they shall be assembled at this temperature in the cold chamber.

NOTE 1 See EN 50483-1, 9.1, for information on the use of a lower temperature.

Electrical continuity shall be measured between the main and branch cables.

The IPC shall be installed in accordance with the manufacturer's instructions using a torque meter.

Alternatively the assembly can be removed from the cold chamber and the torque applied outside. In this case the temperature of the connector and the core shall be monitored and the torque applied within the temperature limits defined above. This temperature shall be within these limits once contact is made.

The torque at which continuity is achieved shall be recorded.

NOTE 2 Accuracy of torque meters is usually guaranteed at positive temperature ranges. Where the torque is measured within the cold chamber the accuracy of the torque meter may not be guaranteed.

8.1.4.4 Requirements

Electrical continuity shall be achieved at a torque value less than, or equal to, 70 % of the manufacturer's specified minimum installation torque.

8.1.5 Environmental tests

In order to meet the requirements of the type tests at least one of the three corrosion tests (as detailed in EN 50483-6, 8.4) and one of the two climatic tests (as detailed in EN 50483-6, 8.5) shall be carried out.

The choice of the test shall be agreed between the manufacturer and the customer.

8.1.5.1 Corrosion tests

8.1.5.1.1 Principle

To ensure that the IPC is not affected in corrosive atmospheres.

8.1.5.1.2 Test arrangement - Salt mist test and gas atmosphere test

Two samples shall be tested in accordance with the following conductor combination:

Main	Branch
min.	min.

For immersion test see test arrangement in EN 50483-6, 8.4.3.1.

8.1.5.1.3 Procedure - Salt mist test and gas atmosphere test

The connector shall be placed in the middle of the main core of length 0,5 m to 1,5 m. It shall be tightened to the minimum torque specified by the manufacturer.

For the immersion test see procedure in EN 50483-6, 8.4.3.1.

8.1.5.1.3.1 Salt mist test

The number of cycles shall be 4 (4 weeks) as defined in EN 50483-6, 8.4.1.

8.1.5.1.3.2 Gas atmosphere test

Method 1: Combined test. There shall be 4 cycles of 14 days. This 14-day cycle consists of 7 days of salt mist and 7 days in SO_2 atmosphere as defined in of EN 50483-6, 8.4.1 and EN 50483-6, 8.4.2.

Method 2: There shall be 500 cycles of 2 h (approximately 6 weeks).

8.1.5.1.3.3 Immersion test

See EN 50483-6, 8.4.3.

Method 1: There shall be 1 000 heat cycles in immersion as defined in EN 50483-6, 8.4.3.1.

Method 2: Method 2 is defined in EN 50483-6, 8.4.3.2, (included in the climatic ageing test EN 50483-6, 8.5.1).

8.1.5.1.4 Requirements

Visual inspection shall be carried out and there shall be no significant trace of red rust.

NOTE Significant rusting would constitute more than 10 % of the exposed surface area of the metallic parts.

The sample's identification marking shall be legible when examined with normal or corrected vision, without magnification.

No deterioration of the connectors shall occur which would impair their normal function.

For a connector designed with a shear-head it shall be able to be removed with a torque below, or equal to, the manufacturer's specified maximum torque.

For a connector designed without a shear-head it shall be able to be removed with a torque below or equal to 1,1 times the manufacturer's specified nominal torque.

Additional test requirement for a connector which connects a bare conductor to an insulated conductor are as follows:

A continuously increasing load shall be applied to the main conductor up to 90 % of the value indicated in 8.1.2.1.

The load shall be increased in accordance with of EN 50483-1, 9.1.4.

The load shall be maintained for 60 s.

No breaking of the conductor strands shall be observed throughout the application of the load.

Additional test requirement for IPC submitted to immersion test, Method 1, are defined in EN 50483-6, 8.4.3.1.

8.1.5.2 Climatic ageing test

NOTE It is recommended that these tests should be carried out on samples that have met the requirements of the dielectrical voltage or water tightness tests.

8.1.5.2.1 Principle

To ensure that the connector is not affected by climatic conditions.

8.1.5.2.2 Test arrangement

See test arrangements of dielectrical voltage or water tightness as given in 8.1.3.

8.1.5.2.3 Procedure

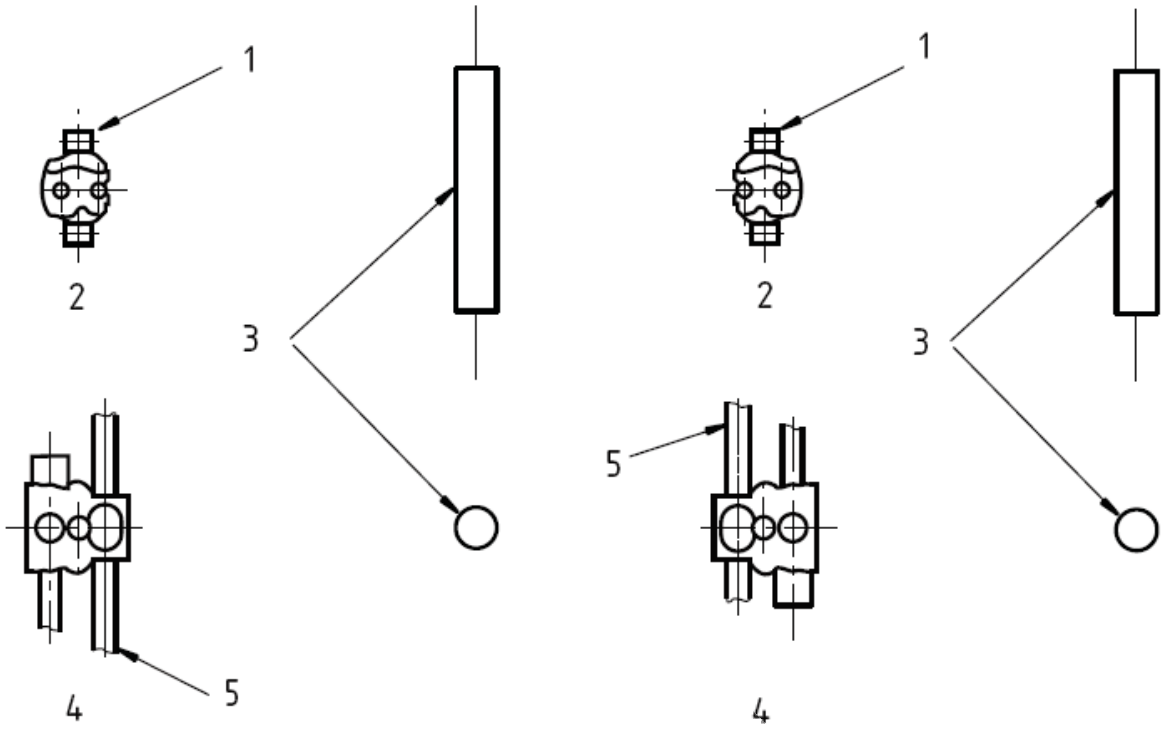
8.1.5.2.3.1 Climatic ageing test - Method 1

There shall be 6 cycles of 1 week, as defined in EN 50483-6, 8.5.1.

The temperature during periods A and C shall be 70 °C.

NOTE The temperature may be lower if agreed between the customer and the manufacturer.

As far as possible, the samples shall be installed so that the axis of the main core is in a horizontal plane and the lamp in a vertical plane. These two planes shall intersect in the middle of the lamp and in the middle of the samples. The main core shall be orthogonal in the described vertical plane. Half of the samples shall be installed as per orientation 1, the other as per orientation 2 (see Figure 7).



ORIENTATION 1 **ORIENTATION 2**

Key

1	shear head	4	top view
2	front view	5	main cable
3	lamp		

Figure 7 – Orientation of the samples for the climatic ageing test

8.1.5.2.3.2 Climatic ageing test - Method 2

There shall be 56 cycles of 1 day (8 weeks), as defined in EN 50483-6, 8.5.2.

The samples shall be installed in the orientation shown in Figure 7.

8.1.5.2.4 Requirements

After the climatic ageing cycles and after a period of at least 24 h but not exceeding 72 h at the laboratory atmosphere, the samples shall meet the requirements of the following tests.

8.1.5.2.4.1 Test requirement for IPC

This test requirement is not applicable for connectors that connect a bare conductor to an insulated conductor.

The IPC Class 1 and Class 2 shall meet the requirements of the dielectrical voltage test in air, as given in 8.1.3.1.3.2.

For IPC Class 1 the assembly formed by the connector and the cores shall then taken out of the metallic balls, without any mechanical stress, and shall meet the requirements of the dielectrical voltage test in water as given in 8.1.3.1.3.1, but with a voltage of 1 kV.

8.1.5.2.4.2 Test requirement for a connector which connects a bare conductor to an insulated conductor and for Class 2 connectors, if required

The connector shall meet the requirements of the water tightness test as given in 8.1.3.2, but after an immersion time limited to 12 h.

8.1.5.2.4.3 Common test requirements

Visual inspection shall be carried out to determine that there has been no degradation of the organic parts which could affect the normal function of the sample.

The sample's identification marking shall be legible when examined with normal or corrected vision, without magnification.

8.1.6 Electrical ageing test

Test procedures, requirements and classes are defined in EN 50483-5.

This test does not apply to IPC connectors used for measuring voltages and short-circuiting ABC conductors to which the temperature rise and over-current tests are defined in Annex A.

8.2 Pre-insulated through connectors (sleeve)

8.2.1 Installation of connectors

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

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

For a connector designed for different cross-sections in the same side (e.g. bolted connectors), the maximum and minimum cross-sections shall be tested; that is max. max. and min. min.

Where bolted connectors are to be tested, the test installation shall be made as defined in 8.1.1 for IPCs.

8.2.2 Mechanical testing

8.2.2.1 Principle

The purpose of this test is to ensure that the connector makes an acceptable mechanical connection to the cable.

8.2.2.2 Test arrangement

Two samples shall be tested of each equal cross-section.

8.2.2.3 Procedure

The assembly shall be subjected to a tensile load applied to the conductor in accordance with Figure 8.

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

A tensile test load shall be applied to the conductor until it reaches the % MBL values of Table 1:

Table 1 – Initial loads required for marking

Self supporting system	4 mm² to 16 mm² Copper	10 % MBL for 60 s
	16 mm² to 25 mm² Aluminium	20 % MBL for 60 s
	35 mm^2 to 150 mm^2 Aluminium	**Full tension:** 20 % of MBL for 60 s **Partial tension:** 5 % of MBL for 60 s
Neutral messenger system	**Phases**: 16 mm² to 150 mm² Aluminium	30 % MBL for 60 s
	Neutral: 25 mm² to 95 mm² Aluminium alloy	60 % MBL for 60 s

NOTE 1 Loads for other designs of ABC should be agreed between the customer and the manufacturer.

The cable shall be marked at the point at which it leaves the connector.

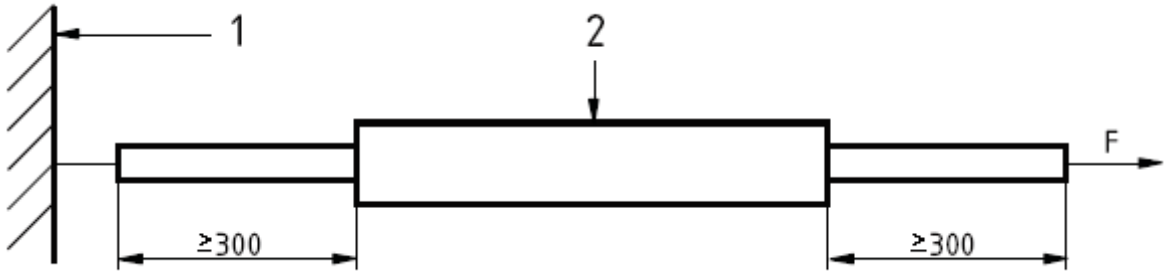
NOTE 2 For safety reason, the marking may be made either before the initial load, or after releasing the initial load, and before applying the test load.

The loads shall then be increased up to the % MBL values of Table 2.

Table 2 – Test loads

Self supporting system	4 mm² to 16 mm² Copper	20 % MBL for 60 s
	16 mm² to 25 mm² Aluminium	1 200 N or 40 % of MBL whichever is the greater for 60 s
	35 mm^2 to 150 mm^2 Aluminium	**Full tension:** 85 % MBL for 60 s **Partial tension:** 10 % MBL for 60 s
Neutral messenger system	**Phases:** 16 mm² to 150 mm² Aluminium	60 % MBL for 60 s
	Neutral: 25 mm² to 95 mm² Aluminium alloy	95 % MBL for 60 s

Dimensions in millimetres



Key

1 fixed point

2 pre-insulated sleeve

Figure 8 – Illustrative installation of the mechanical test

8.2.2.4 Requirement

No slippage or breakage shall occur.

8.2.3 Dielectrical voltage test and water tightness test

8.2.3.1 Dielectrical voltage test

In order to meet the requirements of the type tests at least one of the two dielectrical tests shall be carried out.

Connector classes:

Class 1: connector subjected to dielectric test in water;

Class 2: connector subjected to dielectric test in air.

NOTE The choice of the class should be agreed between the manufacturer and the customer.

8.2.3.1.1 Principle

To ensure that the connector can withstand a dielectrical voltage.

8.2.3.1.2 Test arrangement

Two samples shall be tested of each equal cross-section.

8.2.3.1.3 Procedure

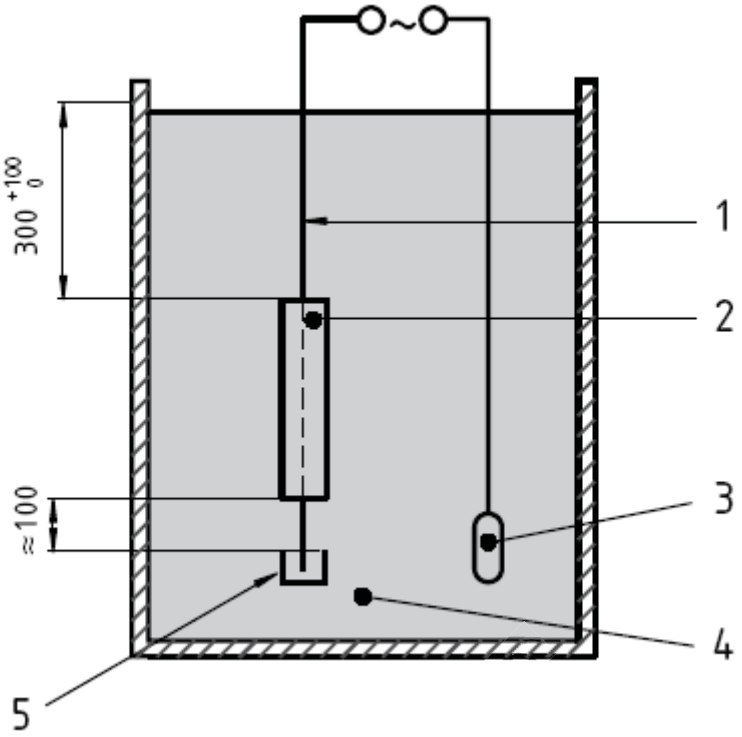
8.2.3.1.3.1 Test in water

See 8.1.3.1.3.1.

After 30 min under water, the voltage test shall be applied to the sample with a 4 kV a.c. for 60 s according to Figure 9.

NOTE A voltage of 6 kV a.c. may be used when agreed between customer and manufacturer.

Dimensions in millimetres



Key

1	core	4	water
2	joint sleeve	5	watertight insulating cap
3	metallic electrode		

Figure 9 – Illustrative set up for dielectrical voltage test

8.2.3.1.3.2 Test in air

See 8.1.3.1.3.2.

The test arrangement, as shown in Figures 4 or 5, shall be used where the pre-insulated through connector replaces the IPC.

8.2.3.2 Requirements

No flashover or breakdown (tripping of voltage generator) shall occur.

The maximum leakage current shall be in accordance with EN 50483-1, 9.1.5.

The voltage shall be applied at a speed specified in EN 50483-1, 9.1.7.

8.2.4 Low temperature assembly test

8.2.4.1 Principle

To ensure acceptable connection to the cable at low temperature.

8.2.4.2 Test arrangement

Two samples shall be tested of each equal cross-section.

8.2.4.3 Procedure

The connectors, conductor and tools shall be further pre-conditioned until they reach the test temperature of (-10 ± 3) °C, then they shall be assembled at this temperature in the cold chamber.

NOTE See EN 50483-1, 9.1, for information on the use of a lower temperature.

At least 3 h at ambient temperature after having been removed from the cold chamber, the sleeves shall be subjected to

- dielectrical voltage test in water, according to 8.2.3,

- mechanical testing, according to 8.2.2.

8.2.4.4 Requirements

No flashover or breakdown (tripping of voltage generator) shall occur.

No slippage or breakage shall occur.

The maximum leakage current shall be in accordance with EN 50483-1, 9.1.5.

The voltage shall be applied at a speed specified in EN 50483-1, 9.1.7.

8.2.5 Environmental test

8.2.5.1 Corrosion tests

In order to meet the requirements of the type tests at least one of the three corrosion tests (as detailed in EN 50483-6, 8.4) shall be performed where applicable.

8.2.5.1.1 Principle

To ensure that the connector is not affected by a corrosive environment.

8.2.5.1.2 Test arrangement

Two samples shall be tested for each cross-section.

The test arrangement shall be in accordance with EN 50483-6, 8.4.

8.2.5.1.3 Procedure

The procedure shall be in accordance with EN 50483-6, 8.4.

8.2.5.1.4 Requirements

The sample’s identification marking shall be legible when examined with normal or corrected vision, without magnification. No deterioration of the connectors shall occur which would impair their normal function.

8.2.5.2 Climatic ageing test

NOTE It is recommended that these tests should be carried out on samples that have met the requirements of the dielectrical voltage test.

In order to meet the requirements of the type tests at least one of the two climatic ageing tests (as detailed in EN 50483-6, 8.5) shall be completed. The choice of the test shall be agreed between the manufacturer and the customer.

8.2.5.2.1 Principle

To ensure that the connector is not affected by climatic conditions.

8.2.5.2.2 Test arrangement

Two samples shall be tested for each equal cross-section.

See test arrangement of dielectrical voltage test in water 8.2.3.

8.2.5.2.3 Procedure

The procedure shall be in accordance with EN 50483-6, 8.5.

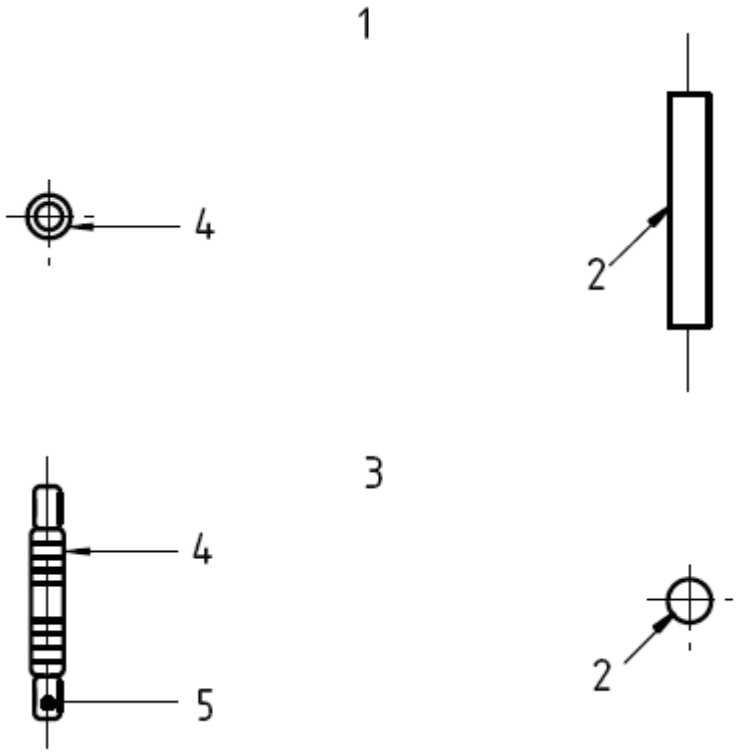
8.2.5.2.3.1 Climatic ageing test - Method 1

There shall be 6 cycles of 1 week, as defined in EN 50483-6, 8.5.1.

The temperature during periods A and C shall be 70 °C.

NOTE The temperature may be lower if agreed between the customer and the manufacturer.

As far as possible, the samples shall be installed so that the axis of the main core is in a horizontal plane and the lamp in a vertical plane. These two planes shall intersect in the middle of the lamp and in the middle of the samples. The main core shall be orthogonal in the described vertical plane (see Figure 10).



Key

1	front view	4	joint
2	lamp	5	core
3	top view		

Figure 10 – Climatic ageing test arrangement

8.2.5.2.3.2 Climatic ageing test - Method 2

There shall be 56 cycles of 1 day (8 weeks), as defined in EN 50483-6, 8.5.2.

The samples shall be installed in the orientation shown in Figure 10.

8.2.5.2.4 Requirements

After the climatic ageing cycles and after a period of at least 24 h but not exceeding 72 h at the laboratory atmosphere, the following tests shall be carried out.

The Class 1 and Class 2 sleeves shall meet the requirements of the dielectrical voltage test in air, 8.2.3.1.3.2.

For Class 1 sleeves, the assembly formed by the connector and the cores shall then be taken out of the metallic balls, without any mechanical stress, and shall meet the requirements of the dielectrical voltage test in water given in 8.2.3.1.3.1 but with a voltage of 1 kV a.c.

8.2.5.2.5 Common test requirements

Visual inspection shall be carried out to determine that there has been no degradation of the organic parts which could affect the normal function of the sample.

The sample's identification marking shall be legible when examined with normal or corrected vision, without magnification.

8.2.6 Electrical ageing test

Tests procedures, requirements and classes are defined in EN 50483-5.

8.2.7 Endurance tests

8.2.7.1 Principle

The purpose of this test is to ensure an acceptable dielectrical and mechanical behaviour when heat cycles and mechanical load are combined.

8.2.7.2 Test arrangement

When pre-insulated sleeves have the same external diameter, only maximum and minimum cross-sections of the same type of conductor are tested.

Four samples shall be tested of each cross-section.

The free length of core, between two adjacent sleeves, shall be (1,0 ± 0,1) m and the free length of core between the tensioning points and the extremities of the sleeves shall be at least 1 m.

Mechanical loads shall be applied to the extremities of the stripped cores using appropriate tensioning equipment.

Thermocouples shall be placed on the central conductive part of the two sleeves located at either end of the test assembly.

The reference temperature shall be measured in the middle of a stripped core of (1,0 ± 0,1) m and located not less than 1 m from any supporting or connecting components.

The test shall be carried out at ambient temperature.

The test arrangement is shown in Figure 11.

8.2.7.3 Procedure

The load, for the appropriate type of system, shall be applied to the extremities of the core and varied as required throughout the test.

Thermal cycles, with duration of 90 min, shall be applied to the test assembly.

There shall be 500 cycles.

For the first 45 min of every cycle, current flowing through the test assembly shall create the temperature rise.

The reference temperature of the conductor shall be maintained at the normal operating temperature within an interval of ± 3 K as shown in Annex C of EN 50483-1. This temperature shall be reached within 5 min to 15 min at the beginning of the cycle.

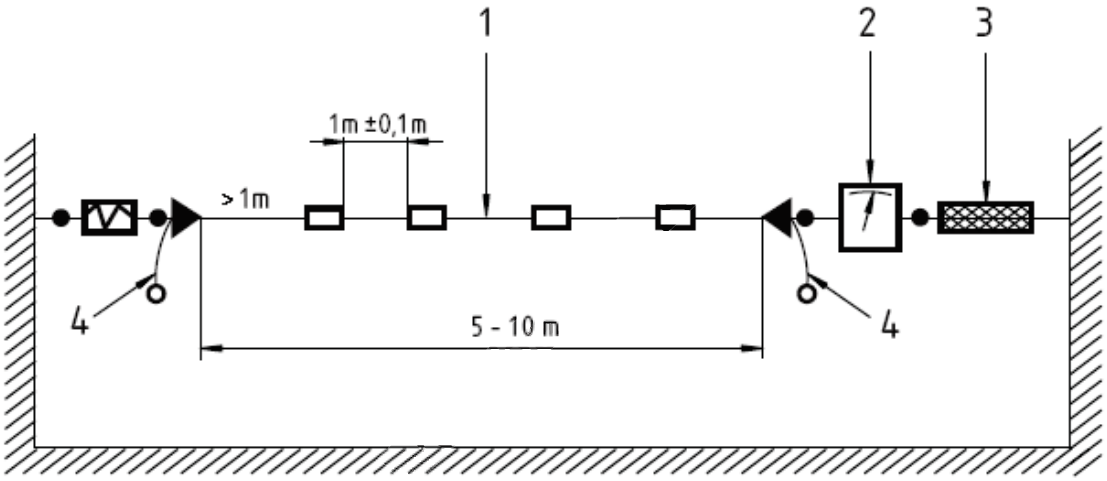
For the last 45 min, of each cycle, the test assembly shall be cooled to (25 ± 3) °C. The temperature shall then be maintained, at this value, until the end of the cycle.

At 24 h intervals, at the end of the normal operating temperature heating period, the temperatures reached by the two sleeves shall be recorded.

8.2.7.3.1 Test arrangement and procedure for phase conductors of neutral messenger system and self supporting systems

8.2.7.3.1.1 Test arrangement

Figure 11 shows a typical test arrangement. The test configuration can differ from this arrangement as long as it complies with the phase conductor lengths.



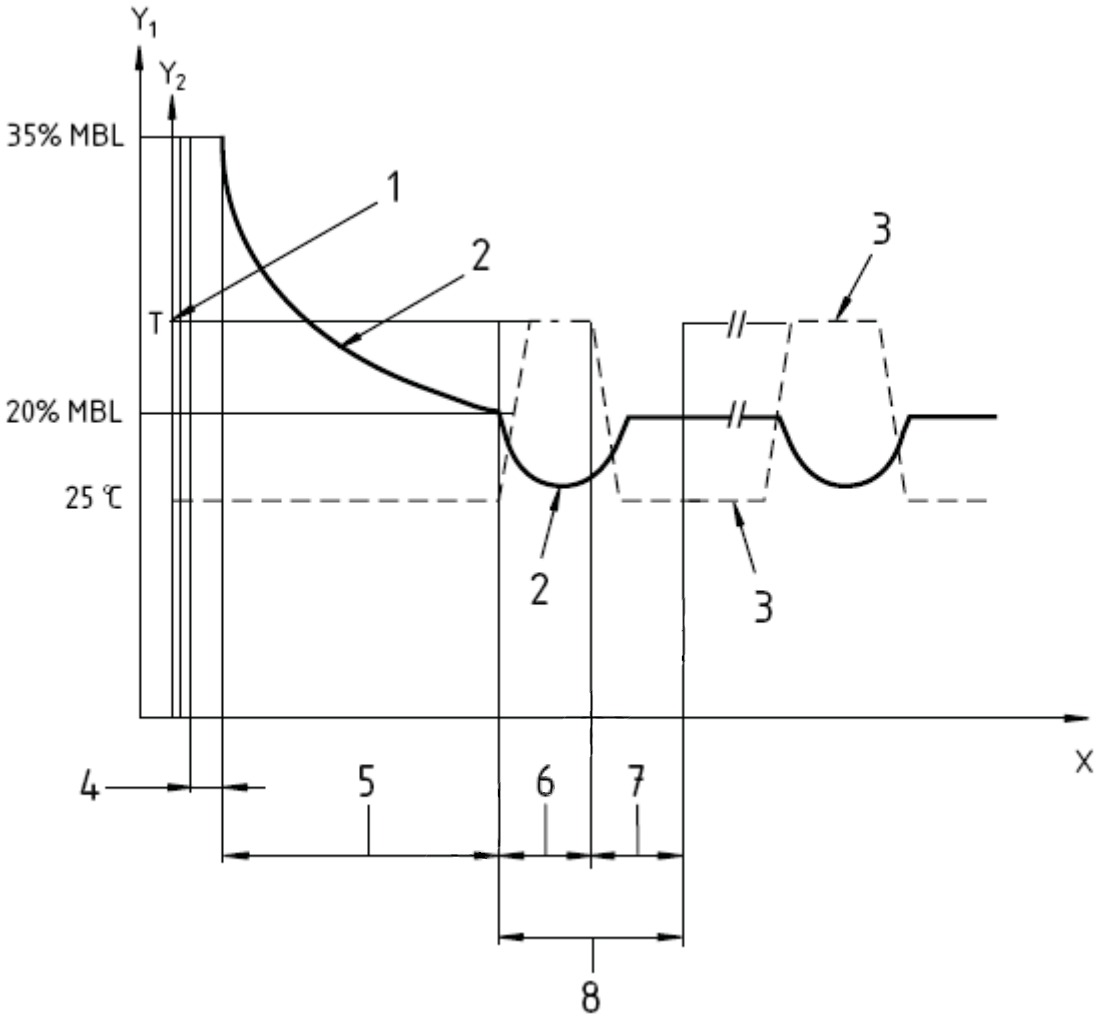
Key

1	phase conductor		tensioning equipment
2	mechanical load measurement device		mechanical junction allowing rotation
3	tensioning device		mechanical tension adjustment
4	minimum 1 m		current source connection
			test sleeve

Figure 11 – Illustrative set up of the testing assembly

8.2.7.3.1.2 Procedure

The variation in mechanical load and temperature is shown, diagrammatically, in Figure 12.



Key

1	normal operating temperature	7	45 min
2	mechanical load variation	8	90 min basic cycle
3	conductor temperature		
4	10 min	*X*	time axis
5	24 h	Y_1	mechanical load axis
6	45 min	Y_2	temperature axis

Figure 12 – Diagram of thermal cycles and mechanical stresses applied on phase conductor

A tensile load shall be applied until a value equal to 35 % of the MBL of the cable is reached. This value shall be achieved in approximately 60 s.

The load shall then be maintained for 10 min using a manual or automatic continuous adjustment. The assembly shall be left to self stabilize mechanically for 24 h without any adjustment.

Once the assembly has stabilized the thermal cycles shall be started. At the end of the first cycle, the tensile load shall be set at 20 % of MBL of the cable.

At least once every 24 h, the tensile load shall be adjusted to 20 % of the MBL of the cable.

8.2.7.3.2 Test arrangement and procedure for neutral messenger pre-insulated sleeves

8.2.7.3.2.1 Test arrangement

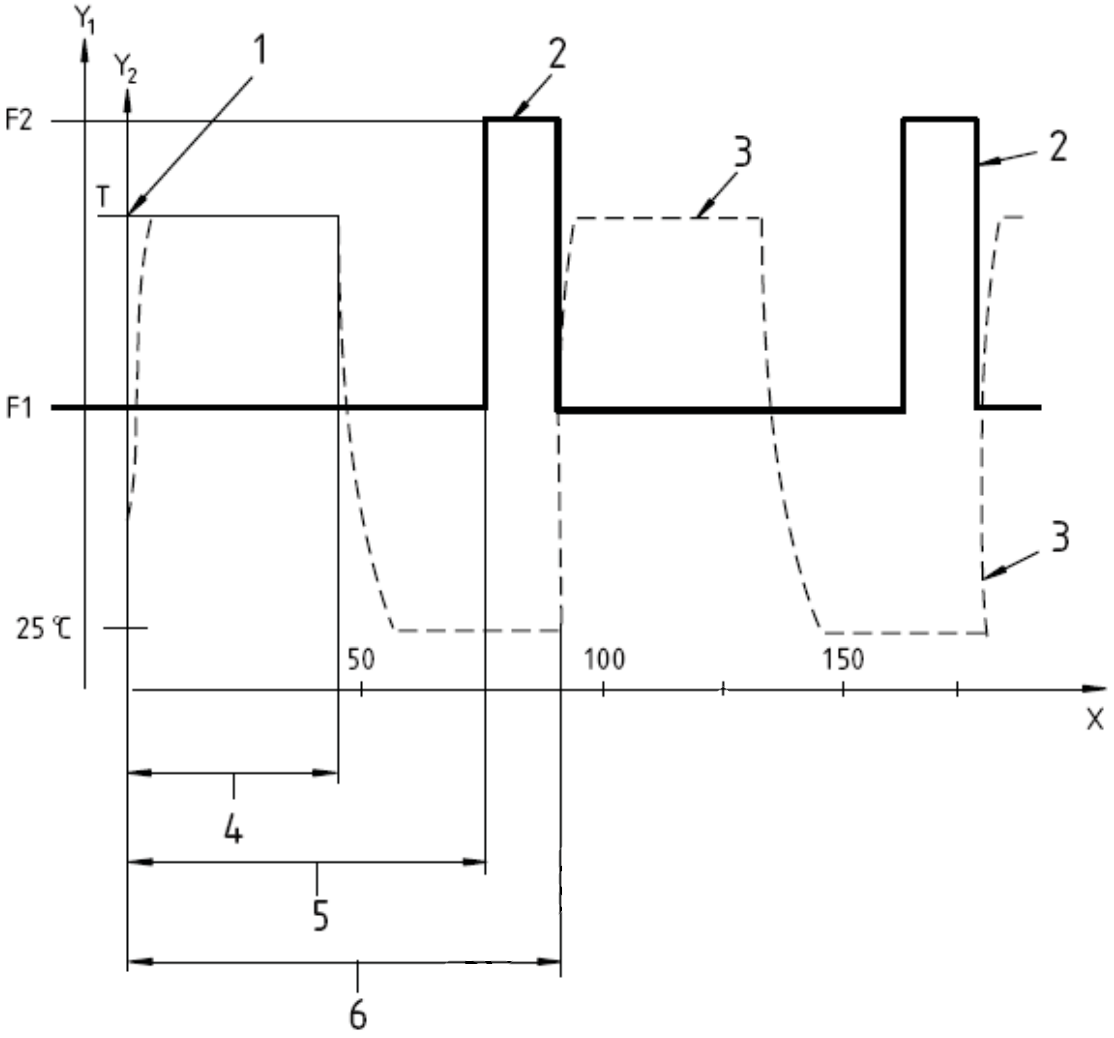
The test arrangement is shown in Figure 11 where the phase conductor shall be replaced with the neutral conductor.

8.2.7.3.2.2 Procedure

The variation in mechanical load and temperature is shown, diagrammatically, in Figure 13.

Thermal cycles shall be applied and for the first 75 min of the cycle, tensile load shall be maintained at the value F_1 of Table 3. This load shall then be increased to the value F_2 by applying a longitudinal load for the last 15 min of the cycle.

The longitudinal load shall be steadily increased to the required value in a period of between 5 s and 60 s inclusive.



Key

1	normal operating temperature	6	one cycle = 90 min
2	mechanical cycle		
3	thermal cycle	*X*	time axis
4	45 min	Y_1	mechanical load axis
5	75 min	Y_2	temperature axis

Figure 13 – Diagram of thermal cycles and mechanical loads on neutral conductor

Table 3 – Applied tensile load

Tensile loads	
F_1	F_2
20 % of MBL of the cable	45 % of MBL of the cable

8.2.7.4 Requirements

At the end of the heating period, the sleeves' temperatures shall be lower than the temperature of the reference core.

The Class 1 and Class 2 sleeves shall meet the requirements of the dielectrical voltage test in air, 8.2.3.1.3.2.

For Class 1 sleeves the assembly formed by the connector and the cores shall then taken out of the metallic balls, without any mechanical stress, and shall meet the requirements of the dielectrical voltage test in water, 8.2.3.1.3.1 but with a voltage of 1 kV.

The four sleeves shall meet the requirements of the mechanical test in 8.2.2.

8.3 Pre-insulated terminals (lugs)

8.3.1 Installation of lugs

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

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

The mechanical loads given below are applicable for neutral messenger and self-supporting ABC systems.

Where bolted lugs are to be tested the maximum and minimum cross-sections, for which the lug is designed, shall be used.

The torque used to make the test installation shall be as defined in 8.1.1 for IPCs.

8.3.2 Mechanical testing

8.3.2.1 Principle

The purpose of this test is to ensure that the lug makes an acceptable mechanical connection to the cable.

8.3.2.2 Test arrangement

Two samples shall be tested of each cross-section.

The test arrangement is shown in Figure 14.

8.3.2.3 Procedure

The assembly shall be subjected to a tensile load, applied to the conductor, in accordance with Figure 14.

The initial load shall be 10 % of the MBL of the conductor for which it is designed, or 1 500 N, whichever is less. The rate of load increase shall be in accordance with EN 50483-1, 9.1.4.

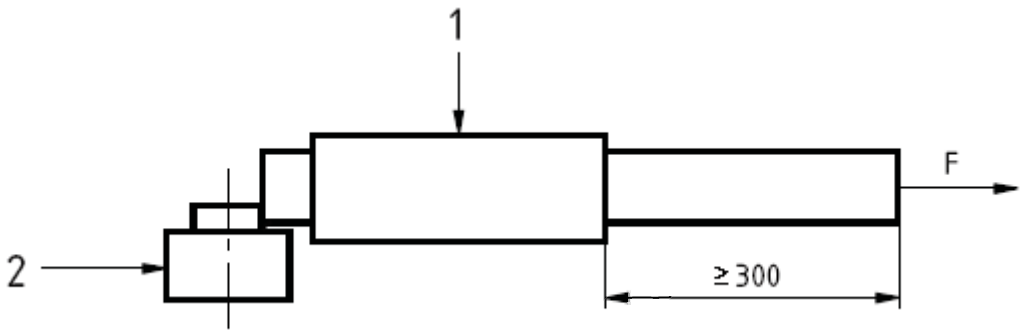
The cable shall be marked at the point at which it leaves the lug.

The loads shall then be increased to the values of Table 4.

Table 4 – Tensile loads

Conductor cross-section	Load
16 mm² to 25 mm²	1 200 N
35 mm² to 150 mm²	2 500 N

Dimensions in millimetres



Key

1 pre-insulated lug

2 fixed point

Figure 14 – Illustrative installation of the mechanical test

8.3.2.4 Requirements

No slippage or breakage shall occur.

8.3.3 Water tightness test

This test applies only to terminal lugs having a palm in aluminium or in aluminium alloy.

8.3.3.1 Principle

To ensure that water cannot migrate through the lug to the ABC.

8.3.3.2 Test arrangement

Two samples shall be tested of each cross-section.

The test arrangement is shown in Figure 15.

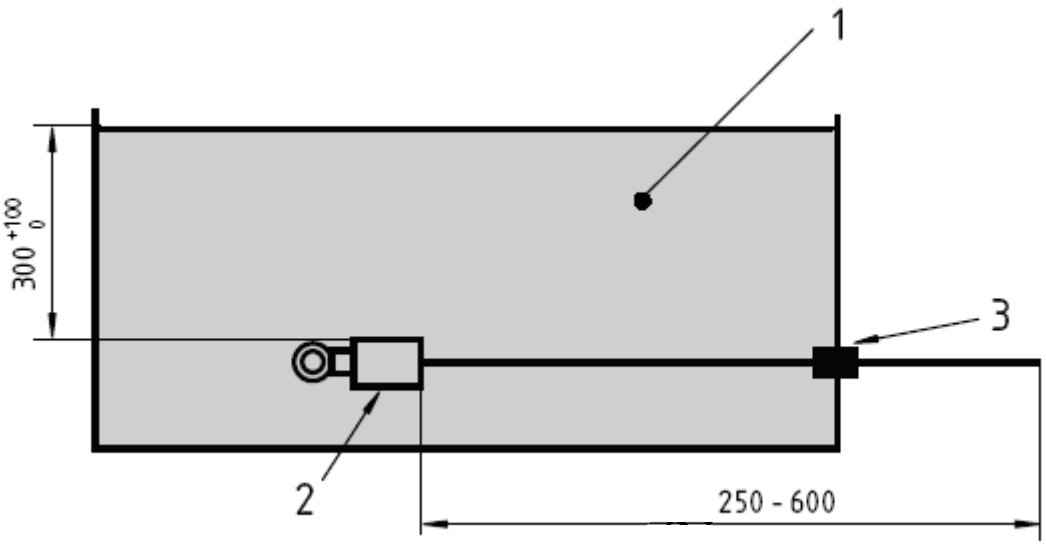
The test shall be carried out at ambient temperature.

The lug shall be installed on to the cable in accordance with the manufacturer's instructions.

The assembled lug and cable shall be placed in a tank and covered with water to a depth of ($300\ ^{+100}_{-0}$) mm measured above the lug.

The core shall pass out of the tank, through an appropriate seal, which shall be designed to prevent any excessive stress on the insulation.

Dimensions in millimetres



Key

1 water

2 lug

3 seal

Figure 15 – Illustrative figure of immersed lug

8.3.3.3 Procedure

The assembly shall be left in the water for 24 h.

8.3.3.4 Requirements

No trace of water shall be observed at the end of the core.

8.3.4 Low temperature assembly test

Where a pre-insulated sleeve has the same design as the barrel of the pre-insulated lug this test is not required if the pre-insulated sleeve has met the requirements of 8.2.4.

8.3.4.1 Principle

To ensure acceptable connection to the cable at low temperature.

8.3.4.2 Test arrangement

Two samples shall be tested of each cross-section.

8.3.4.3 Procedure

The lugs, conductor and tools shall be further pre-conditioned until they reach the test temperature of (-10 ± 3) °C, then they shall be assembled at this temperature in the cold chamber.

NOTE See EN 50483-1, 9.1, for information on the use of a lower temperature.

At least 3 h at ambient temperature after having been removed from the cold chamber, the lugs shall be subjected to the mechanical testing as detailed in 8.3.2.

8.3.4.4 Requirements

No slippage or breakage shall occur.

8.3.5 Environmental test

8.3.5.1 Climatic ageing test

8.3.5.1.1 Principle

To ensure that the lug is not affected by climatic conditions.

8.3.5.1.2 Test arrangement

See test arrangement of water tightness test given in 8.3.3.

8.3.5.1.3 Procedure

In order to meet the requirements of the type tests at least one of the two climatic ageing tests (as detailed in EN 50483-6, 8.5) shall be completed. The choice of the test shall be agreed between the manufacturer and the customer.

8.3.5.1.3.1 Climatic ageing test - Method 1

There shall be 6 cycles of 1 week, as defined in EN 50483-6, 8.5.1.

The temperature during periods A and C shall be 70 °C.

NOTE The temperature may be less if agreed between the customer and the manufacturer.

As far as possible, the samples shall be installed so that the axis of the main core is in a horizontal plane and the lamp in a vertical plane. These two planes shall intersect in the middle of the lamp and in the middle of the samples. The main core shall be orthogonal in the described vertical plane as in Figure 10 where the pre-insulated sleeve is replaced by the lug.

8.3.5.1.3.2 Climatic ageing test - Method 2

There shall be 56 cycles of 1 day (8 weeks), as defined in EN 50483-6, 8.5.2.

The sample shall be installed in the orientation shown in Figure 10 where the pre-insulated sleeve is replaced by the lug.

8.3.5.1.4 Requirements

After the climatic ageing cycles and after a period of at least 24 h but not exceeding 72 h at the laboratory atmosphere, the lugs shall meet the requirements of the water tightness test (8.3.3) after an immersion time of 12 h.

Visual inspection shall be carried out to determine that there has been no degradation of the organic parts which could affect the normal function of the sample.

The sample's identification marking shall be legible when examined with normal or corrected vision, without magnification.

8.3.5.2 Corrosion tests

In order to meet the requirements of the type tests at least one of the three corrosion tests (as detailed in EN 50483-6, 8.4) shall be performed where applicable.

8.3.5.2.1 Principle

To ensure that the lug is not affected by a corrosive environment.

8.3.5.2.2 Test arrangement

2 samples shall be tested for each cross-section.

The test arrangement shall be in accordance with EN 50483-6, 8.4.

8.3.5.2.3 Procedure

The procedure shall be in accordance with EN 50483-6, 8.4.

8.3.5.2.4 Requirements

Markings shall be legible.

No deterioration of the connectors shall occur which would impair their normal function.

8.3.5.3 Bi-metallic corrosion test in sodium hydroxide (NaOH) solution

This test applies only to terminal lugs having copper palms.

8.3.5.3.1 Principle

To ensure that when exposed to a corrosive environment corrosion of the copper palm does not affect the aluminium part of the connector or the ABC.

8.3.5.3.2 Test arrangement

Two samples shall be tested of each cross-section.

The test arrangement is shown in Figure 16.

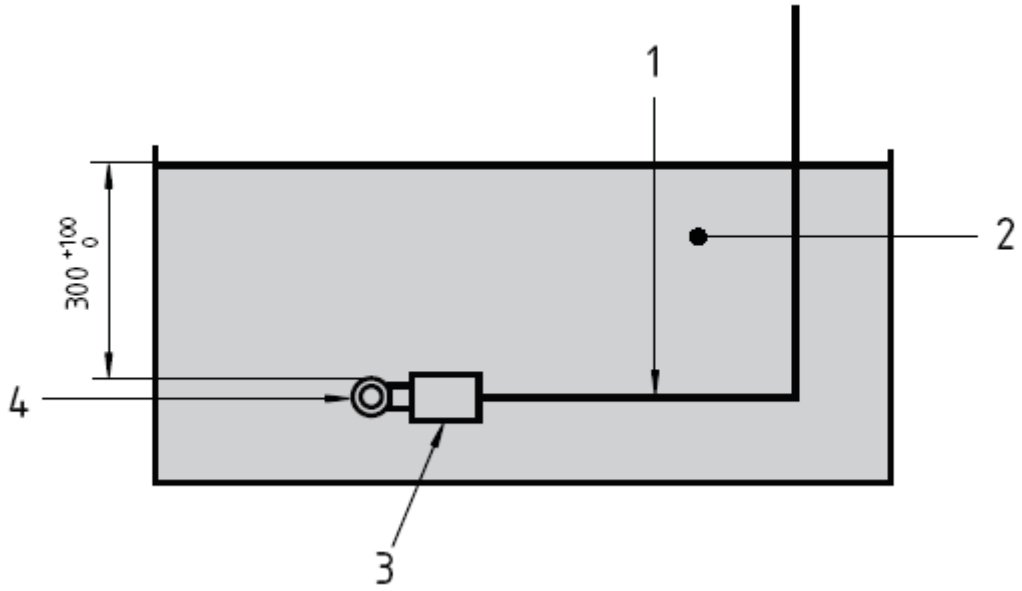
The test shall be carried out at ambient temperature.

The lug shall be installed onto the cable in accordance with the manufacturer's instructions.

The assembled lug and cable shall be placed in a tank and covered with a normal sodium hydroxide solution (40 g/l of water) to a depth of ($300\ ^{+100}_{-0}$) mm measured above the lug.

The end of the insulated core shall be brought out of the tank clear of the sodium hydroxide solution.

Dimensions in millimetres



Key

1	ABC core	3	lug
2	sodium hydroxide solution	4	copper part

Figure 16 – Illustrative arrangement of immersion test in sodium hydroxide solution

8.3.5.3.3 Procedure

The assembly shall be immersed for 24 h.

8.3.5.3.4 Requirements

After removing the insulation of the lug, no traces of corrosion shall be observed on the aluminium parts.

8.3.6 Electrical ageing test

Tests, procedures, requirements and classes are defined in EN 50483-5.

Annex A
(informative)

Temporary connectors – Temperature rise and overload test

(This test only applies to IPC connectors used for measuring voltages and short-circuiting ABC conductors)

A.1 Principle

To ensure that the IPC is suitable when used with conductors carrying current and short-circuit current.

A.2 Test arrangement

Four connectors should be fitted on maximum cross-section phase core.

The connectors should be tightened to the minimum torques specified by the manufacturer.

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

The connectors should be connected in pairs using a copper braid having a cross-section specified by the manufacturer.

One of the ends of the braid should be fitted with a connecting socket compatible with the connector pin (see Figure A.1).

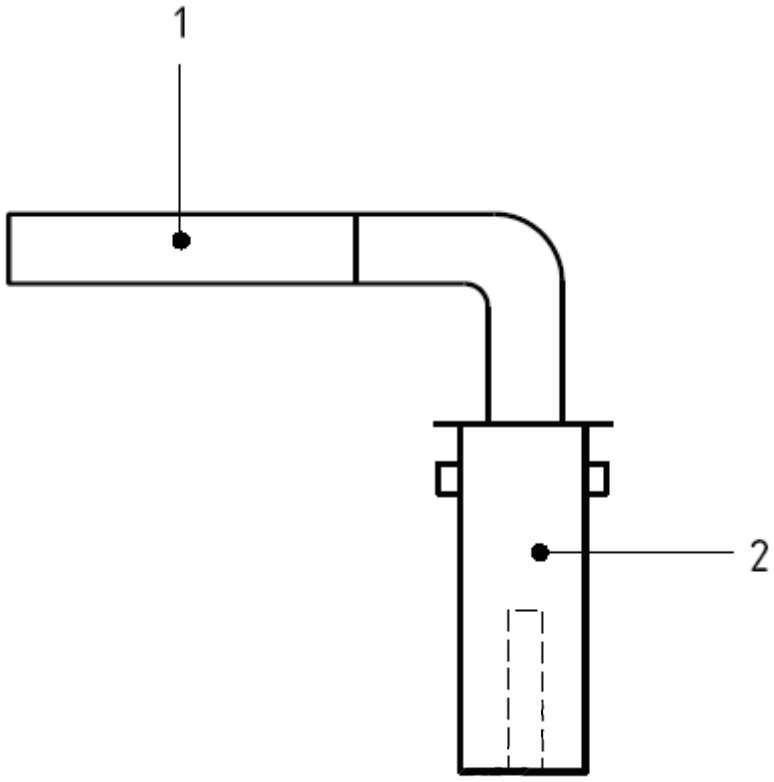
Each connector should be fitted with a thermocouple located as close as possible to the current path between the connected core.

Each pin should be fitted with a thermocouple close to the locking system.

The test loop should be arranged as shown in Figure A.2.

Distances between each connector and power source should be a minimum of 1 m length.

Preparation of cables and core before tests, installation of the connectors and method of temperature measurement on connectors, should be carried out in accordance with EN 50483-5, 5.3.2, EN 50483-5, 5.3.3 and EN 50483-5, 5.4.1.

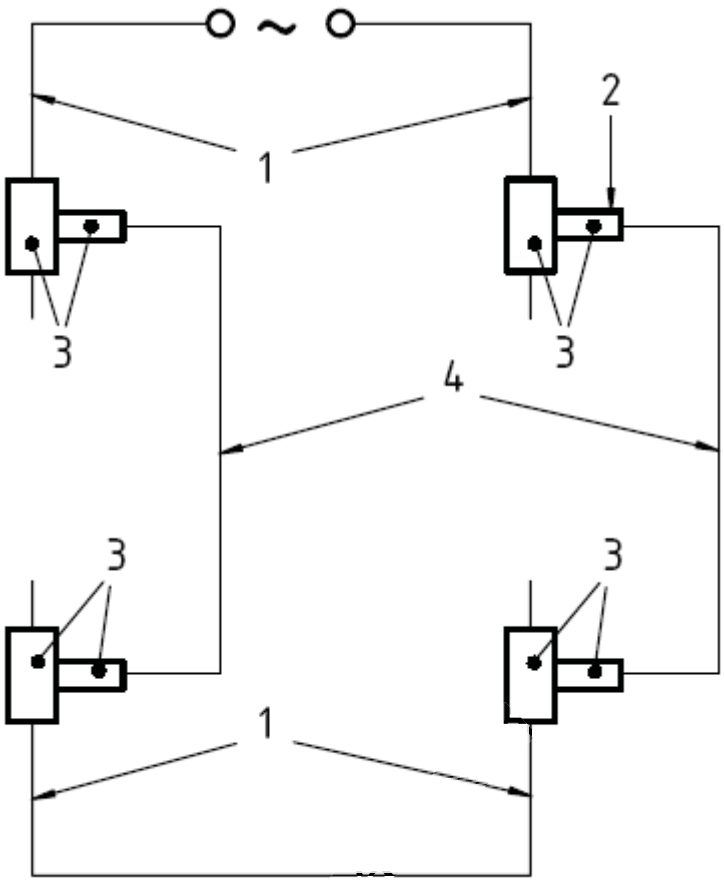


Key

1 insulated conductor (copper or aluminium core)

2 pin

Figure A.1 – Example of a pin connection



Key

1	main core	3	thermocouple position
2	temporary connecting system socket +pin	4	bare copper braid

Figure A.2 – Test loop

A.3 Procedure

A.3.1 Initial temperature rise test

An a.c. current for which the connector is designed should be applied until temperature stabilization of the different mounted elements is achieved.

The tolerance of the a.c. current should be ≤ ± 2 %.

Temperature stabilization should be considered to have been achieved when the temperature of each connector does not fluctuate by more than 2 K for 15 min.

Temperature T_1 of each connector and temperature T_2 of each pin linked to the connector should be recorded as well as the ambient temperature T_0.

A.3.2 Over-current test

The test loop should be allowed to cool down to ambient temperature.

A series of four over-currents should be applied for 1 s each.

The over-current value should be calculated with a current density of approximately 160 A/mm² for bare copper braid.

To enable a close approximation to the specified over-current value, the duration of the over-current, nominally 1 s, can be adjusted within a range of 0,85 s up to 1,15 s observing the relationship $I^2 \cdot t$ = Constant.

After each over-current, the loop should be allowed to cool down to a temperature ≤ 35 °C.

A.3.3 Final temperature rise test

After this over-current series, the a.c. current, as used before, should be applied once more to the assembly until temperature stabilization, of the different mounting elements, is achieved.

Temperature stabilization should be considered to have been achieved when the temperature of each connector does not fluctuate by more than 2 K for 15 min.

Temperature T_3 of each connector and temperature T_4 of each pin should be recorded as well as the ambient temperature T_5.

A.3.4 Requirement

Each connector and each pin should verify both conditions:

$(T_3 - T_5) - (T_1 - T_0) < 10$ K

$(T_4 - T_5) - (T_2 - T_0) < 10$ K

Bibliography

EN 61284, *Overhead lines – Requirements and tests for fittings* (IEC 61284)

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