

INTERNATIONAL STANDARD



Submarine power cables with extruded insulation and their accessories for rated voltages from 6 kV ($U_m = 7,2$ kV) up to 60 kV ($U_m = 72,5$ kV) – Test methods and requirements

[IEC 63026:2019](#)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SUBMARINE POWER CABLES WITH EXTRUDED INSULATION
AND THEIR ACCESSORIES FOR RATED VOLTAGES
FROM 6 kV ($U_m = 7,2$ kV) UP TO 60 kV ($U_m = 72,5$ kV) –
TEST METHODS AND REQUIREMENTS**

FOREWORD

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The text of this International Standard is based on the following documents:

FDIS	Report on voting
20/1888/FDIS	20/1895/RVD

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This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

As a result of the growing demand for inter-array cables for offshore windfarms, IEC TC 20 decided to develop an International Standard for medium voltage submarine cable systems.

The worldwide mandate to reduce carbon emissions has stimulated major developments of power production systems where the principal contribution comes from offshore wind farms.

Due to the location of these wind power generation systems, large amounts of submarine cables are required to inter-connect individual power generating units (inter-array cable) and to connect to the mainland (power export cable).

Many offshore wind farms have been built or are today under construction and there are plans for even more farms to be built in future. Although the focus is on wind farms, the need for cable connections to other types of offshore generation will increase. At this stage most of the information and expertise already available on cables for the connection to the mainland grid can be found in CIGRE documents.

Requirements of this document are mainly based on IEC 60502-2, IEC 60840 and CIGRE TB 490, *Recommendations for testing of long AC submarine cables with extruded insulation for system voltage above 30 (36) kV to 500 (550) kV*. References to the relevant applicable mechanical tests are taken from CIGRE TB 623, *Recommendations for mechanical testing of submarine cables*.

A list of relevant additional references is given in the bibliography.

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SUBMARINE POWER CABLES WITH EXTRUDED INSULATION AND THEIR ACCESSORIES FOR RATED VOLTAGES FROM 6 kV ($U_m = 7,2$ kV) UP TO 60 kV ($U_m = 72,5$ kV) – TEST METHODS AND REQUIREMENTS

1 Scope

This document specifies test methods and requirements for power cable systems, cables with extruded insulation and their accessories for fixed submarine installations, for rated voltages from 6 kV ($U_m = 7,2$ kV) up to 60 kV ($U_m = 72,5$ kV).

This document includes the electrical tests and the physical tests on materials and components as well as the specific mechanical tests that are applicable to submarine cable systems.

The requirements apply to armoured single-core cables and three-core cables in combination with their accessories, terminations and joints for usual conditions of installation and operation, but not to special cables and their accessories, such as submarine cables for dynamic applications (i.e. for direct connection to a floating structure), for which modifications to the standard tests can be necessary or special test conditions be devised.

This document is applicable to submarine cables installed in permanently submerged conditions with water depths up to 250 m.

NOTE This document does not include accessories having a mechanical function only, such as hang-offs or armour clamps.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60228, *Conductors of insulated cables*

IEC 60229:2007, *Electric cables – Tests on extruded oversheaths with a special protective function*

IEC 60230, *Impulse tests on cables and their accessories*

IEC 60287-1-1:2006, *Electric cables – Calculation of the current rating – Part 1-1: Current rating equations (100 % load factor) and calculation of losses – General*

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

IEC 60502-4, *Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m = 1,2$ kV) up to 30 kV ($U_m = 36$ kV) – Part 4: Test requirements on accessories for cables with rated voltages from 6 kV ($U_m = 7,2$ kV) up to 30 kV ($U_m = 36$ kV)*

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

IEC 60811-202, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 202: General tests – Measurement of thickness of non-metallic sheath*

IEC 60811-203, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 203: General tests – Measurement of overall dimensions*

IEC 60811-401, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 401: Miscellaneous tests – Thermal ageing methods – Ageing in an air oven*

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

IEC 60811-403, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 403: Miscellaneous tests – Ozone resistance test on cross-linked compounds*

IEC 60811-501, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 501: Mechanical tests – Tests for determining the mechanical properties of insulating and sheathing compounds*

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

IEC 60811-503, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 503: Mechanical tests – Shrinkage test for sheaths*

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

IEC 60811-508, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 508: Mechanical tests – Pressure test at high temperature for insulation and sheaths*

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

IEC 60840, *Power cables with extruded insulation and their accessories for rated voltages above 30 kV ($U_m = 36$ kV) up to 150 kV ($U_m = 170$ kV) – Test methods and requirements*

IEC 60885-3, *Electrical test methods for electric cables – Part 3: Test methods for partial discharge measurements on lengths of extruded power cables*

ISO 48-2, *Rubber, vulcanized or thermoplastic – Determination of hardness – Part 2: Hardness between 10 IRHD and 100 IRHD*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 Definitions of dimensional values (thicknesses, cross-sections, etc.)

3.1.1

nominal value

value by which a quantity is designated and which is often used in tables

Note 1 to entry: Usually, in this document, nominal values give rise to values to be checked by measurements taking into account specified tolerances.

3.1.2

median value

when several test results have been obtained and ordered in an increasing (or decreasing) succession, middle value if the number of available values is odd, and mean of the two middle values if the number is even

3.2 Definitions concerning tests

3.2.1

routine test

test made by the manufacturer on each manufactured component (length of cable or accessory) to check that the component meets the specified requirements

3.2.2

sample test

test made by the manufacturer on samples of completed cable or components taken from a completed cable or accessory, at a specified frequency so as to verify that the finished product meets the specified requirements

3.2.3

type test

test made before supplying on a general commercial basis a type of cable system covered by IEC 63026, in order to demonstrate satisfactory performance characteristics to meet the intended application

Note 1 to entry: Once successfully completed, these tests need not be repeated, unless changes are made in the cable or accessory with respect to materials, manufacturing process, design or design electrical stress levels, which might adversely change the performance characteristics.

3.2.4

electrical test after installation

test made to demonstrate the integrity of the cable system as installed

Note 1 to entry: Integrated optical elements, if present, will be tested upon customer request. Tests to be defined on agreement between customer and manufacturer.

3.3 Other definitions

3.3.1

cable system

cable with installed accessories including components used for thermo-mechanical restraint of systems limited to those used for terminations and joints only

3.3.2

nominal electrical stress

electrical stress calculated at U_0 using nominal dimensions

3.3.3

test object

object, which is a cable length or an accessory, to be subjected to testing

3.3.4

test assembly

assembly, which is a combination of series connected test objects, i.e. cable and accessories, simultaneously under test

3.4 Definitions concerning test objects

3.4.1

extrusion length

length of cable conductor with the insulation and semi-conducting layers continuously extruded in the same non-interrupted extrusion operation

3.4.2

manufacturing length

whole extrusion length (or parts thereof if cut), where construction elements (outside the outer semi-conducting layer) have been applied

3.4.3

delivery length

completed cable length, typically on a drum, in a coil or on a turntable

3.4.4

factory joint

joint between extrusion lengths/manufacturing lengths that is manufactured under controlled factory conditions

Note 1 to entry: Factory joints have the same mechanical and electrical performance as the original cable and are generally fully flexible.

3.4.5

field joint

joint between two delivery lengths of cable that is completed with all cable construction elements

Note 1 to entry: A field joint is generally used to connect two delivery lengths offshore or in the beach area. In this document the requirements for field joints are the same as for repair joints.

Note 2 to entry: The requirements in this document are different for rigid and flexible types of joint.

Note 3 to entry: Repair and field joints may be of identical design.

3.4.6

repair joint

joint used for repairing a damaged submarine cable

Note 1 to entry: The requirements in this document are different for rigid and flexible types of joint.

Note 2 to entry: Repair and field joints may be of identical design.

3.4.7

rigid joint

joint which cannot be subjected to the coiling or tensile bending tests

3.4.8

flexible repair joint

flexible field joint

repair (field) joint that is manufactured under controlled conditions and that is fully flexible

Note 1 to entry: Flexible repair (field) joints have the same mechanical and electrical performance as the original cable.