

INTERNATIONAL STANDARD

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High voltage direct current (HVDC) power transmission – Cables with extruded insulation and their accessories for rated voltages up to 320 kV for land applications – Test methods and requirements

Câbles haute tension en courant continu (CCHT) – Câbles d'énergie à isolation extrudée et leurs accessoires pour des tensions assignées jusqu'à 320 kV pour les applications terrestres – Méthodes et exigences d'essai



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**HIGH VOLTAGE DIRECT CURRENT (HVDC) POWER TRANSMISSION –
CABLES WITH EXTRUDED INSULATION AND THEIR ACCESSORIES FOR
RATED VOLTAGES UP TO 320 kV FOR LAND APPLICATIONS –
TEST METHODS AND REQUIREMENTS**

FOREWORD

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The text of this standard is based on the following documents:

FDIS	Report on voting
20/1708A/FDIS	20/1726/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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INTRODUCTION

As a result of major developments in cable systems with extruded insulation for high voltage DC (HVDC) applications, CIGRE study committee B1 set up working group (WG) B1.32 in 2008 with the aim to prepare recommendations for testing DC extruded cable systems for power transmission at a rated voltage of up to 500 kV.

The recommendations of WG B1.32 were published in TB 496 in April 2012. At the time of preparing the CIGRE recommendation there was laboratory experience at voltages up to and including 500 kV, but operating experience was limited to 200 kV. At the time of preparation of this standard several projects up to 320 kV are in progress and many others are planned for the near future.

A list of relevant references is given in the Bibliography.

HIGH VOLTAGE DIRECT CURRENT (HVDC) POWER TRANSMISSION – CABLES WITH EXTRUDED INSULATION AND THEIR ACCESSORIES FOR RATED VOLTAGES UP TO 320 kV FOR LAND APPLICATIONS – TEST METHODS AND REQUIREMENTS

1 Scope

This International Standard specifies test methods and requirements for HVDC transmission power cable systems, employing cables with extruded insulation and their accessories, for fixed land installations, for rated voltages up to and including 320 kV.

Within the scope of this standard “extruded insulation” means insulation manufactured by extrusion of either thermoplastic (e.g. polyethylene) or crosslinked (e.g. crosslinked polyethylene, ethylene propylene rubber, etc.) material. The insulation material may be either unfilled or filled (e.g. with mineral or carbon).

The requirements apply to single-core cables in combination with their accessories, outdoor and terminations for gas insulated systems, joints, and asymmetric joints for usual conditions of installation and operation, but not to special cables and their accessories, such as submarine cables, for which modifications to the standard tests may be necessary or special test conditions may need to be devised.

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 60060-2, *High-voltage test techniques – Part 2: Measuring systems*

IEC 60228, *Conductors of insulated cables*

IEC 60229, *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 60287-1-1:2006/AMD1:2014

IEC 60332-1-2, *Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame*

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

IEC 60811-409, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 409: Miscellaneous tests – Loss of mass test for thermoplastic insulations and sheaths*

IEC 60811-412, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 412: Miscellaneous tests – Thermal ageing methods – Ageing in an air bomb*

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 60811-505, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 505: Mechanical tests – Elongation at low temperature for insulations and sheaths*

IEC 60811-506, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 506: Mechanical tests – Impact test at low temperature for insulations and 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 60811-509, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 509: Mechanical tests – Test for resistance of insulations and sheaths to cracking (heat shock test)*

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 60811-606, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 606: Physical tests – Methods for determining the density*

IEC 62067, *Power cables with extruded insulation and their accessories for rated voltages above 150 kV ($U_m = 170$ kV) up to 500 kV ($U_m = 550$ kV) – Test methods and requirements*

3 Terms and definitions

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

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: In this standard, nominal values usually give rise to values to be checked by measurements taking into account specified tolerances.

3.1.2

median value

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