

INTERNATIONAL STANDARD



Subsea equipment –

Part 1: Power connectors, penetrators and jumper assemblies with rated voltage from 3 kV ($U_{\max} = 3,6$ kV) to 30 kV ($U_{\max} = 36$ kV)

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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CONTENTS

FOREWORD.....	10
INTRODUCTION.....	12
1 Scope.....	13
2 Normative references	13
3 Terms, definitions and abbreviated terms	14
3.1 Terms and definitions.....	15
3.2 Abbreviated terms.....	19
4 Documentation and marking	20
4.1 Design documentation	20
4.2 Type test documentation	20
4.3 Routine test documentation.....	20
4.4 As built documentation.....	21
4.5 Design analysis.....	21
4.6 Data sheet	21
4.7 Equipment marking	22
4.7.1 Connectors and penetrators.....	22
4.7.2 Jumper assemblies	22
5 Design.....	22
5.1 General design requirements	22
5.2 Temperature class	23
5.3 Electrical design requirements	23
5.3.1 Ratings	23
5.3.2 Earthing.....	24
5.3.3 Dummy connectors	24
5.4 Mechanical design requirements	25
5.4.1 Pressure classes	25
5.4.2 Rapid gas decompression.....	25
5.4.3 External forces	25
5.5 Material requirements	25
5.5.1 General material requirements.....	25
5.5.2 Material certification requirements	26
5.6 Connector specific requirements	26
5.6.1 General requirements	26
5.6.2 Wet mateable connectors	26
5.6.3 Dry mateable connectors	27
5.7 Penetrator specific requirements.....	27
5.7.1 Penetrators for pressure compensated equipment	27
5.7.2 Penetrators for pressure retaining equipment	27
5.8 Seals	28
5.8.1 General seal requirements.....	28
5.8.2 Water seals	28
5.8.3 Additional requirements for pressure integrity seals.....	28
5.9 Electric field control	28
5.10 Jumper assemblies	29
5.11 Storage and transportation.....	29
6 Tests	29

6.1	Structure of test clauses	29
6.2	General test requirements.....	29
6.3	Artificial sea water	30
6.4	Test media.....	30
7	Routine tests – Connectors and penetrators	33
8	Routine tests – Dummy and test connectors	34
9	Routine tests – Jumper assemblies	34
10	Sample tests – Hoses.....	35
11	Type and special tests – Connectors and penetrators.....	35
11.1	Order of tests and type test requirements	35
11.2	Type tests – Dummy and test connectors.....	38
11.3	Type tests – New interface cable	38
11.4	Prototype manufacturing acceptance test.....	39
11.4.1	Objective	39
11.4.2	Sequence	39
11.4.3	Acceptance criteria	39
11.5	Electrical and thermal tests.....	40
11.5.1	Objective	40
11.5.2	Sequence	40
11.5.3	Acceptance criteria	41
11.6	Electrical short circuit test.....	42
11.6.1	Objective	42
11.6.2	Sequence	42
11.6.3	Acceptance criteria	42
11.7	Hyperbaric test	42
11.7.1	Objective	42
11.7.2	Sequence	42
11.7.3	Acceptance criteria	44
11.8	Pressure cycling test – Penetrators.....	44
11.8.1	Objective	44
11.8.2	Sequence	44
11.8.3	Acceptance criteria	45
11.9	Combined pressure and temperature cycling test – Penetrators	45
11.9.1	Objective	45
11.9.2	Sequence	45
11.9.3	Acceptance criteria	46
11.10	Rapid gas decompression test	46
11.10.1	Objective	46
11.10.2	Sequence	46
11.10.3	Acceptance criteria	47
11.11	Mechanical and environmental stress test.....	47
11.11.1	Objective	47
11.11.2	Sequence	47
11.11.3	Acceptance criteria	48
11.12	Endurance test – Connectors	48
11.12.1	Objective	48
11.12.2	Sequence	48
11.12.3	Acceptance criteria	49

11.13	Endurance test – Penetrators	49
11.13.1	Objective	49
11.13.2	Sequence	49
11.13.3	Acceptance criteria	50
11.14	Inner water seal hyperbaric test – Connectors	51
11.14.1	Objective	51
11.14.2	Sequence	51
11.14.3	Acceptance criteria	51
11.15	Inner water seal pressure cycling test – Penetrators	51
11.15.1	Objective	51
11.15.2	Sequence	51
11.15.3	Acceptance criteria	51
11.16	Outer water seal hyperbaric test – Connectors	51
11.16.1	Objective	51
11.16.2	Sequence	51
11.16.3	Acceptance criteria	51
11.17	Outer water seal pressure cycling test – Penetrators	52
11.17.1	Objective	52
11.17.2	Sequence	52
11.17.3	Acceptance criteria	52
11.18	Secondary pressure integrity seal test – Penetrators	52
11.18.1	Objective	52
11.18.2	Sequence	52
11.18.3	Acceptance criteria	52
11.19	Primary pressure integrity seal test – Penetrators	52
11.19.1	Objective	52
11.19.2	Sequence	52
11.19.3	Acceptance criteria	52
11.20	Secondary pressure integrity seal combined pressure and temperature cycling test – Penetrators	53
11.20.1	Objective	53
11.20.2	Sequence	53
11.20.3	Acceptance criteria	53
11.21	Primary pressure integrity seal combined pressure and temperature cycling test – Penetrators	53
11.21.1	Objective	53
11.21.2	Sequence	53
11.21.3	Acceptance criteria	53
11.22	Extended hyperbaric wet mate test	53
11.22.1	Objective	53
11.22.2	Sequence	53
11.22.3	Acceptance criteria	55
12	Type tests – Hose and hose terminations	55
12.1	General	55
12.2	Absorption/compensation test	56
12.2.1	Objective	56
12.2.2	Method	56
12.2.3	Acceptance criteria	56
12.3	Ozone resistance	57

12.3.1	Objective	57
12.3.2	Method	57
12.3.3	Acceptance criteria	57
12.4	Ultraviolet resistance	57
12.4.1	Objective	57
12.4.2	Method	57
12.4.3	Acceptance criteria	57
12.5	Thermal shock test.....	58
12.5.1	Objective	58
12.5.2	Method	58
12.5.3	Acceptance criteria	58
12.6	Destructive testing	58
12.6.1	Tensile failure.....	58
12.6.2	Burst pressure	59
12.6.3	Crush resistance.....	59
12.6.4	Outer sheath abrasion resistance	60
12.6.5	Hose kink test.....	60
13	Type tests – Jumper assemblies.....	61
13.1	General.....	61
13.2	Electrical and thermal type test – Jumper assemblies	61
13.2.1	Objective	61
13.2.2	Sequence	61
13.2.3	Acceptance criteria	62
13.3	Oscillating jumper test	62
13.3.1	Objective	62
13.3.2	Sequence	62
13.3.3	Acceptance criteria	63
13.4	Jumper pull test	63
13.4.1	Objective	63
13.4.2	Sequence	63
13.4.3	Acceptance criteria	64
13.5	Drop test.....	64
13.5.1	Objective	64
13.5.2	Sequence	64
13.5.3	Acceptance criteria	64
13.6	Jumper handling simulation test.....	64
13.6.1	Objective	64
13.6.2	Sequence	64
13.6.3	Acceptance criteria	66
13.7	Jumper simulated deployment test.....	66
13.7.1	Objective	66
13.7.2	Sequence	66
13.7.3	Acceptance criteria	67
14	Test procedures	67
14.1	Helium leak test.....	67
14.1.1	Objective	67
14.1.2	Method	68
14.1.3	Acceptance criteria	68
14.2	Contact resistance test	68

14.2.1	Objective	68
14.2.2	Method	68
14.2.3	Acceptance criteria	68
14.3	Shell continuity test.....	69
14.3.1	Objective	69
14.3.2	Method	69
14.3.3	Acceptance criteria	69
14.4	Screen continuity test	69
14.4.1	Objective	69
14.4.2	Method	69
14.4.3	Acceptance criteria	69
14.5	Partial discharge test	69
14.5.1	Objective	69
14.5.2	Method	69
14.5.3	Acceptance criteria	70
14.6	High voltage AC test	70
14.6.1	Objective	70
14.6.2	Method	70
14.6.3	Acceptance criteria	70
14.7	Impulse withstand voltage test	70
14.7.1	Objective	70
14.7.2	Method	70
14.7.3	Acceptance criteria	70
14.8	Insulation resistance test	71
14.8.1	Objective	71
14.8.2	Method	71
14.8.3	Acceptance criteria	71
14.9	Thermal shock test.....	71
14.9.1	Objective	71
14.9.2	Method	71
14.9.3	Acceptance criteria	72
14.10	Thermal short circuit test	72
14.10.1	Objective	72
14.10.2	Method	72
14.10.3	Acceptance criteria	72
14.11	Dynamic short circuit test.....	72
14.11.1	Objective	72
14.11.2	Method	72
14.11.3	Acceptance criteria	72
14.12	Temperature rise test.....	73
14.12.1	Objective	73
14.12.2	Method	73
14.12.3	Acceptance criteria	73
14.13	Extended temperature rise test	74
14.13.1	Objective	74
14.13.2	Method	74
14.13.3	Acceptance criteria	75
14.14	Thermal cycling.....	75
14.14.1	Objective	75

14.14.2	Method	75
14.14.3	Acceptance criteria	76
14.15	Bending moment and free fall tests	76
14.15.1	Objective	76
14.15.2	Method	76
14.15.3	Acceptance criteria	76
14.16	Static pressure test – Penetrators	77
14.16.1	Objective	77
14.16.2	Method	77
14.16.3	Acceptance criteria	77
14.17	Extended static pressure test – Penetrators	78
14.17.1	Objective	78
14.17.2	Method	78
14.17.3	Acceptance criteria	78
14.18	Combined pressure and temperature cycling test – Pressure retaining penetrators	78
14.18.1	Objective	78
14.18.2	Method	78
14.18.3	Acceptance criteria	78
14.19	Shock and vibration test.....	78
14.19.1	Objective	78
14.19.2	Method	78
14.19.3	Acceptance criteria	79
14.20	Cleaning and spillage test.....	79
14.20.1	Objective	79
14.20.2	Method	79
14.20.3	Acceptance criteria	79
14.21	Conductor pull test.....	79
14.21.1	Objective	79
14.21.2	Method	80
14.21.3	Acceptance criteria	80
14.22	Cable pull test.....	80
14.22.1	Objective	80
14.22.2	Method	80
14.22.3	Acceptance criteria	80
14.23	Cable termination bending test.....	80
14.23.1	Objective	80
14.23.2	Method	80
14.23.3	Acceptance criteria	80
14.24	Mate/de-mate operation test	81
14.24.1	Objective	81
14.24.2	Method	81
14.24.3	Acceptance criteria	81
14.25	Dismantling and examination	81
14.25.1	Objective	81
14.25.2	Method	81
14.25.3	Acceptance criteria	81
14.26	High voltage breakdown test	82
14.26.1	Objective	82

14.26.2	Method	82
14.26.3	Acceptance criteria	82
14.27	Rapid gas decompression (RGD) test – General	82
14.27.1	Objective	82
14.27.2	Method	82
14.27.3	Acceptance criteria	82
14.28	Material testing	83
14.28.1	Objective	83
14.28.2	General test requirements	83
14.28.3	Polymeric materials test requirements	83
14.28.4	Acceptance criteria	84
Annex A (informative)	Connector assembly data sheet	85
Annex B (informative)	Penetrator figures	88
Bibliography	96
Figure 1	– Jumper handling simulation test	66
Figure 2	– Typical extended temperature test results, method 1	74
Figure 3	– Typical extended temperature test results, method 2	75
Figure 4	– Bending moment test	76
Figure B.1	– Penetrator flange view	88
Figure B.2	– Pressure retaining penetrator – Definitions	89
Figure B.3	– Test set-up, pressure retaining penetrator – Direction 1	90
Figure B.4	– Test set-up, pressure retaining penetrator – Direction 2	91
Figure B.5	– Penetrator for pressure balanced conditions – Definitions	92
Figure B.6	– Test set-up, penetrator for pressure balanced conditions – Test of absolute pressure	93
Figure B.7	– Test set-up, penetrator for pressure balanced conditions – Direction 1	94
Figure B.8	– Test set-up, penetrator for pressure balanced conditions – Direction 2	95
Table 1	– Design documentation	20
Table 2	– Routine test documentation	20
Table 3	– As built documentation	21
Table 4	– Temperature classes	23
Table 5	– Voltage ratings	23
Table 6	– Current ratings	24
Table 7	– Pressure classes	25
Table 8	– Test media	31
Table 9	– Electrical routine tests	33
Table 10	– Routine test sequence – Connectors and penetrators	33
Table 11	– Routine test sequence – Complete jumper assemblies	34
Table 12	– Type test sequence	36
Table 13	– Intermediate electrical tests	37
Table 14	– Type test sequence – New interface cable	38
Table 15	– Prototype manufacturing acceptance test sequence	39
Table 16	– Electrical and thermal test sequence – Connectors	40

Table 17 – Electrical and thermal test sequence – Pressure retaining penetrators	40
Table 18 – Electrical and thermal test sequence – Penetrators for pressure balanced equipment.....	41
Table 19 – Electrical short circuit test sequence	42
Table 20 – Hyperbaric test sequence – Wet mateable connectors.....	43
Table 21 – Hyperbaric test sequence – Dry mateable connectors	43
Table 22 – Pressure cycling test – Penetrators for pressure compensated equipment.....	44
Table 23 – Pressure cycling test – Pressure retaining penetrators	45
Table 24 – Combined pressure and temperature cycling test – Penetrators	46
Table 25 – RGD test sequence	46
Table 26 – Mechanical and environmental stress test sequence	47
Table 27 – Endurance test – Connectors	48
Table 28 – Endurance test – Pressure retaining penetrators	49
Table 29 – Endurance test – Penetrators for pressure compensated equipment.....	50
Table 30 – Extended hyperbaric wet mate test sequence	54
Table 31 – Hose type test sequence	55
Table 32 – Jumper assembly type test sequence	61
Table 33 – Electrical and thermal type test – Jumper assemblies	62
Table 34 – Oscillating jumper test	62
Table 35 – Jumper pull test.....	63
Table 36 – Drop test	64
Table 37 – Jumper handling simulation test	65
Table 38 – Jumper simulated deployment testing	67
Table 39 – Impulse withstand voltage test levels.....	70
Table 40 – Insulation resistance test – Voltage test levels	71
Table 41 – Static pressure test – Penetrators	77
Table A.1 – Typical product data sheet	85

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SUBSEA EQUIPMENT –

Part 1: Power connectors, penetrators and jumper assemblies with rated voltage from 3 kV ($U_{\max} = 3,6 \text{ kV}$) to 30 kV ($U_{\max} = 36 \text{ kV}$)

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International Standard IEC/IEEE 61886-1 has been prepared by IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units, in cooperation with the Subsea Electrical Applications Working Group of the IEEE Petrochemical and Chemical Industry Committee (PCIC), under the IEC/IEEE Dual Logo Agreement.

This publication is published as an IEC/IEEE dual logo standard.

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

FDIS	Report on voting
18/1710/FDIS	18/1716/RVD

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

International standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

A list of all parts in the IEC/IEEE 61886 series, published under the general title *Subsea equipment*, can be found on the IEC website.

The IEC Technical Committee and IEEE Technical Committee have 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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

Within the oil and gas industry there is an increasing use of electrical power equipment on the seabed. Subsea processing activities like compression and pumping require increasingly higher amount of electrical power. Power generation, whether onshore or offshore, requires development of equipment both for subsea transmission and distribution.

Current standards for topside equipment do not include requirements related to equipment installed below the sea surface. Project and client specific specifications are used for both design and testing. The fact that equipment is qualified on a project basis, rather than to common standards, has several drawbacks:

- similar equipment is qualified to different type and routine test specifications;
- equipment has to be re-qualified for new projects that have slightly different requirements, for instance increased water depth;
- project specific ratings leading to higher number of equipment versions than strictly required.

All these issues lead to increased costs and schedule (for type testing), and also increased risk for failure (several type test programs are performed on a high number of various designs). By standardizing tests and implement continuous improvement on fewer products, this risk will be reduced in the long term.

The SEPS JIP (Subsea Electrical Power Standardization Joint Industry Project) was established in 2010 by seven oil and gas companies, with the aim to develop common operator standards for subsea electrical power equipment and systems and support further development of these into internationally recognized standards. This document is developed upon base material by SEPS. The aim for the SEPS JIP is to contribute to the development of IEC/IEEE dual logo standards; hence both IEC and relevant ANSI/IEEE standards are referenced where applicable. Relevant equipment manufacturers have contributed with review and comments to the document.

The lack of accessibility (for repair or replacement) defines strict requirements to reliability, beyond what is normally seen in topside applications.

As subsea equipment in many cases is interconnected to topside equipment, specifications for subsea equipment are considered to be within the scope of IEC TC 18 – Electrical installations of ships and of mobile and fixed offshore units.

SUBSEA EQUIPMENT –

Part 1: Power connectors, penetrators and jumper assemblies with rated voltage from 3 kV ($U_{\max} = 3,6$ kV) to 30 kV ($U_{\max} = 36$ kV)

1 Scope

This document is applicable to single and three-phase wet-mateable and dry-mateable AC connectors, penetrators and jumper assemblies with rated voltages from 3 kV ($U_{\max} = 3,6$ kV) to 30 kV ($U_{\max} = 36$ kV). This document relates to the requirements and tests for products in the "as manufactured and supplied" condition. This document is not applicable to requirements and tests for products that have been subsequently installed, deployed or retrieved.

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 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60156, *Insulating liquids – Determination of the breakdown voltage at power frequency – Test method*

IEC 60243-1:2013, *Electric strength of insulating materials – Test methods – Part 1: Tests at power frequencies*

IEC 60270, *High-voltage test techniques – Partial discharge measurements*

IEC 60721-3-2:2018, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Transportation and handling*

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

IEC 60986, *Short-circuit temperature limits of electric cables with rated voltages from 6 kV ($U_m = 7,2$ kV) up to 30 kV ($U_m = 36$ kV)*

IEC 61238-1-3:2018, *Compression and mechanical connectors for power cables – Part 1-3: Test methods and requirements for compression and mechanical connectors for power cables for rated voltages above 1 kV ($U_m = 1,2$ kV) up to 30 kV ($U_m = 36$ kV) tested on non-insulated conductors*

IEC 61442, *Test methods for accessories for power cables with rated voltages from 6 kV ($U_m = 7,2$ kV) up to 30 kV ($U_m = 36$ kV)*

IEC 62262, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

ISO 7326:2016, *Rubber and plastics hoses – Assessment of ozone resistance under static conditions*

ISO 12103-1, *Road vehicles – Test contaminants for filter evaluation – Part 1: Arizona test dust*

ISO 23936-2:2011, *Petroleum, petrochemical and natural gas industries – Non-metallic materials in contact with media related to oil and gas production – Part 2: Elastomers*

ISO 30013:2011, *Rubber and plastics hoses – Methods of exposure to laboratory light sources – Determination of changes in colour, appearance and other physical properties*

ANSI/ICEA T-27-581/NEMA WC 53, *Standard Test Methods for Extruded Dielectric Power, Control, Instrumentation, and Portable Cables for Test*

ANSI/API Spec 6A:2018, *Specification for Wellhead and Christmas Tree Equipment*

ANSI/NEMA WC 74 ICEA S-93-639, *5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy*

ANSI/NEMA WC 71 ICEA S-96-659, *Standard for Non-shielded Cables Rated 2001-5000 Volts for Use in the Distribution of Electric Energy*

ASTM D877, *Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes*

ASTM D1141-98, *Standard Practice for the Preparation of Substitute Ocean Water*

ASTM D1169, *Standard test method for Specific Resistance (Resistivity) of Electrical Insulating Liquids*

ASTM D1816, *Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids using VDE Electrodes*

EN 10204, *Metallic products – Types of inspection documents*

IEEE Std 386, *Separable Insulated Connector Systems for Power Distribution Systems Rated 2,5kV through 35kV*

IEEE Std 4, *Standard for High Voltage Testing Techniques*

NORSOK M-710:2014, *Qualification of Non-Metallic Sealing Materials and Manufacturers*