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**Electrical installations in ships –
Part 350: General construction and test methods of power, control
and instrumentation cables for shipboard and offshore applications**

INTERNATIONAL
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CONTENTS

FOREWORD	7
1 Scope	9
2 Normative references	9
3 Terms and definitions	11
3.31 tests	15
4 Constructional requirements	16
4.1 General requirements	16
4.1.1 General	16
4.1.2 Voltage designation	16
4.1.3 Cable marking	16
4.1.4 Core identification.....	17
4.1.5 Halogen-free cables.....	18
4.2 Conductors	18
4.2.1 Material	18
4.2.2 Metal coating and separator	18
4.2.3 Class and form	18
4.2.4 Resistance	19
4.3 Insulation system	19
4.3.1 Material	19
4.3.2 Application.....	19
4.3.3 Insulation thickness	19
4.4 Screens	20
4.4.1 Conductor and insulation screens for high-voltage cables.....	20
4.4.2 Screens (shields) for low voltage cables	20
4.5 Cabling	21
4.5.1 Multi-core cables	21
4.5.2 Multi-unit cables	21
4.6 Inner coverings, fillers and binders	21
4.7 Inner sheath.....	21
4.7.1 Material	21
4.7.2 Application.....	21
4.7.3 Thickness of inner sheath	22
4.8 Metal braid armour.....	22
4.8.1 Material	22
4.8.2 Application.....	22
4.9 Outer sheath	23
4.9.1 Material	23
4.9.2 Application.....	23
4.9.3 Thickness of outer sheath.....	23
4.9.4 Calculation of lower and upper limits for the outer dimensions of cables	23
5 Test methods.....	23
5.1 Test conditions	23
5.1.1 Ambient temperature	23
5.1.2 Frequency, waveform and magnitude of power-frequency test voltages	23
5.2 Routine tests.....	23
5.2.1 General	23

5.2.2	Measurement of the electrical resistance of the conductors	24
5.2.3	Voltage test	24
5.2.4	Partial discharge test	26
6	Sample tests	26
6.1	General	26
6.2	Frequency of sample tests	26
6.3	Repetition of tests	27
6.4	Conductor examination	27
6.5	Measurement of thickness of insulation	27
6.5.1	General	27
6.5.2	Procedure	27
6.5.3	Requirements	27
6.6	Measurements of thickness of non-metallic sheaths	28
6.6.1	General	28
6.6.2	Procedure	28
6.6.3	Requirements	28
6.7	Measurement of external diameter	28
6.8	Hot-set test for insulations and sheaths	28
6.8.1	General procedure	28
6.8.2	Requirements	28
6.9	Insulation resistance test (volume resistivity determination)	28
7	Type tests, electrical	29
7.1	General	29
7.2	Insulation resistance measurement	29
7.2.1	Measurement at ambient temperature	29
7.2.2	Measurement at maximum rated temperature	30
7.3	Increase in AC capacitance after immersion in water	30
7.3.1	General	30
7.3.2	Preparation of test specimens	30
7.3.3	Apparatus	30
7.3.4	Procedure	31
7.3.5	Requirements	31
7.4	High-voltage test for 4 h for cables rated up to 1,8/3 kV	31
7.4.1	General	31
7.4.2	Requirement	31
7.5	Mutual capacitance (control and instrumentation cables only)	31
7.6	Inductance to resistance ratio (control and instrumentation cables only)	31
7.7	High voltage sequence test (cables having a voltage rating higher than 3,6/6 (7,2) kV)	32
7.7.1	General	32
7.7.2	Special provisions	32
7.7.3	Partial discharge test	32
7.7.4	Bending test	32
7.7.5	Tan δ measurement as a function of the voltage	33
7.7.6	Tan δ measurement as a function of the temperature	33
7.7.7	Heating cycle test plus partial discharge test	33
7.7.8	Impulse withstand test, followed by a power-frequency voltage test	33
7.7.9	High-voltage test for 4 h	34
8	Type tests (non-electrical)	34

8.1	General.....	34
8.2	Measurement of thickness of insulation.....	34
8.3	Measurement of thickness of non-metallic sheaths (excluding inner coverings).....	34
8.4	Tests for determining the mechanical properties of insulation before and after ageing	34
8.4.1	Sampling	34
8.4.2	Ageing treatments	34
8.4.3	Conditioning and mechanical tests.....	34
8.4.4	Requirements	35
8.5	Tests for determining the mechanical properties of sheaths before and after ageing.....	35
8.5.1	Sampling	35
8.5.2	Ageing treatments	35
8.5.3	Conditioning and mechanical tests.....	35
8.5.4	Requirements	35
8.6	Additional ageing test on pieces of completed cables (compatibility test)	35
8.6.1	General	35
8.6.2	Sampling	35
8.6.3	Ageing treatment	35
8.6.4	Mechanical tests.....	35
8.6.5	Requirements	36
8.7	Loss of mass test on PVC ST 2 sheath	36
8.7.1	Procedure.....	36
8.7.2	Requirements	36
8.8	Test for the behaviour of PVC ST 2 and halogen-free SHF 1 sheaths at high temperature (hot pressure test).....	36
8.8.1	Procedure.....	36
8.8.2	Requirements	36
8.9	Test for the behaviour of PVC sheath ST 2 and halogen-free SHF 1 and SHF 2 sheaths at low temperature	36
8.9.1	Procedure.....	36
8.9.2	Requirements	36
8.10	Special test for low temperature behaviour (when required)	36
8.11	Test of the metal coating of copper wires	36
8.12	Galvanizing test	37
8.13	Test for resistance of PVC ST 2 and halogen-free SHF 1 sheaths to cracking (heat shock test)	37
8.13.1	Procedure.....	37
8.13.2	Requirements	37
8.14	Ozone resistance test for insulation and for sheaths	37
8.14.1	Procedure.....	37
8.14.2	Requirements	37
8.15	Hot oil immersion test and enhanced hot oil immersion test for sheaths	37
8.15.1	Hot oil immersion test	37
8.15.2	Enhanced hot oil immersion test (when required).....	37
8.16	Mud drilling fluid test (when required)	37
8.17	Fire tests	37
8.17.1	Flame-spread test on single cables.....	37
8.17.2	Flame-spread test on bunched cables.....	38

8.17.3	Smoke emission test.....	38
8.17.4	Acid gas emission test.....	38
8.17.5	pH and conductivity test.....	38
8.17.6	Fluorine content test.....	38
8.17.7	Fire-resistance test (test for circuit integrity cables).....	39
8.18	Determination of hardness for HEPR.....	39
8.19	Determination of elastic modulus for HEPR.....	39
8.20	Durability of print	39
Annex A (normative) Fictitious calculation method for determination of dimensions of protective coverings.....		40
A.1	Overview.....	40
A.2	General.....	40
A.3	Method	40
A.3.1	Conductors	40
A.3.2	Cores	41
A.3.3	Diameter over laid-up cores.....	42
A.3.4	Inner coverings.....	44
A.3.5	Sheath.....	44
A.3.6	Braid armour.....	45
Annex B (informative) Recommended minimum spark test voltage levels (according to IEC 62230)		46
B.1	General.....	46
B.2	Test voltages	46
B.2.1	General	46
B.2.2	Contact electrodes.....	46
B.2.3	Non-contact electrodes.....	47
Annex C (normative) Rounding of numbers.....		48
C.1	Rounding of numbers for the purpose of the fictitious calculation method.....	48
C.1.1	Rules.....	48
C.1.2	Illustrations.....	48
C.2	Rounding of numbers for other purposes	48
Annex D (normative) Calculation of the lower and upper limits for the outer dimensions of cables with circular copper conductors		49
D.1	General.....	49
D.2	Lower limit for the outer diameter.....	49
D.3	Upper limit for the outer diameter.....	49
D.4	Thickness of the mandatory or optional coverings other than the insulation and the sheath(s).....	50
Annex E (normative) Cold bend test and impact test for low temperature behaviour.....		52
E.1	Cold bend test at any specified low temperature	52
E.1.1	Method no. 1	52
E.1.2	Method no. 2	52
E.1.3	Examination and requirements.....	53
E.2	Impact test at any specified low temperature.....	53
E.2.1	Apparatus.....	53
E.2.2	Procedures	53
E.2.3	Requirements	53
Bibliography.....		54

Table 1 – Minimum size of conductors	18
Table 2 – Routine test voltage	25
Table 3 – Number of samples according to cable length	27
Table 4 – Tan δ versus voltage	33
Table 5 – Tan δ versus temperature	33
Table 6 – Impulse withstand voltages	34
Table 7 – Test methods and requirements for halogen-free components	39
Table A.1 – Fictitious diameter of conductor	41
Table A.2 – Increase of diameter for concentric conductors and metallic screens made of tape or wire.....	41
Table A.3 – Assembly coefficient k for laid-up	43
Table A.4 – Coefficient c_f	44
Table B.1 – Recommended minimum spark-test voltages for cables having rated voltage (U_0) between 150 V and 1 800 V	46
Table D.1 – Lower and upper limits of circular copper conductors for cables for fixed installations	51
Table E.1 – Details of low temperature bending test	52

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL INSTALLATIONS IN SHIPS –

Part 350: General construction and test methods of power, control and instrumentation cables for shipboard and offshore applications

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60092-350 has been prepared by subcommittee 18A: Electric cables for ships and mobile and fixed offshore units, of IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units.

This fifth edition cancels and replaces the fourth edition published in 2014 and constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) more detailed description of the test procedures in 7.7.6 and 7.7.7;
- b) description of the relationship between Annex A and Annex D.

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

CDV	Report on voting
18A/420/FDIS	18A/423/RVC

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

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

The list of all the parts of the IEC 60092 series, under the general title *Electrical installations in ships*, can be found on the IEC website.

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

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

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ELECTRICAL INSTALLATIONS IN SHIPS –

Part 350: General construction and test methods of power, control and instrumentation cables for shipboard and offshore applications

1 Scope

This part of IEC 60092 provides the general constructional requirements and test methods for use in the manufacture of electric power, control and instrumentation cables with copper conductors intended for fixed electrical systems at voltages up to and including 18/30(36) kV on board ships and offshore (mobile and fixed) units.

The reference to fixed systems includes those that are subjected to vibration (due to the movement of the ship or installation) or movement (due to motion of the ship or installation) and not to those that are intended for frequent flexing. Cables suitable for frequent or continual flexing use are detailed in other IEC standards, for example IEC 60227 (all parts) and IEC 60245 (all parts), and their uses are restricted to those situations which do not directly involve exposure to a marine environment, for example, portable tools and domestic appliances.

The following types of cables are not included:

- optical fibre;
- sub-sea and umbilical cables;
- data and communication cables;
- coaxial cables.

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 60050-461, *International Electrotechnical Vocabulary – Part 461: Electric cables* (available at www.electropedia.org)

~~IEC 60092-353, *Electrical installations in ships – Part 353: Power cables for rated voltages 1 kV and 3 kV*~~

IEC 60092-360:2014, *Electrical installations in ships – Part 360: Insulating and sheathing materials for shipboard and offshore units, power, control, instrumentation, and telecommunication and data cables*

IEC 60228, *Conductors of insulated cables*

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

IEC 60331-1, *Tests for electric cables under fire conditions – Circuit integrity – Part 1: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV and with an overall diameter exceeding 20 mm*

IEC 60331-2, *Tests for electric cables under fire conditions – Circuit integrity – Part 2: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV and with an overall diameter not exceeding 20 mm*

IEC 60331-11, *Tests for electric cables under fire conditions – Circuit integrity – Part 11: Apparatus – Fire alone at a flame temperature of at least 750 °C*

IEC 60331-21, *Tests for electric cables under fire conditions – Circuit integrity – Part 21: Procedures and requirements – Cables of rated voltage up to and including 0,6/1,0 kV*

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 60332-3-22, *Tests on electric and optical fibre cables under fire conditions – Part 3-22: Test for vertical flame spread of vertically-mounted bunched wires or cables – Category A*

IEC 60684-2, *Flexible insulating sleeving – Part 2: Methods of test*

IEC 60754-1, *Test on gases evolved during combustion of materials from cables – Part 1: Determination of the halogen acid gas content*

IEC 60754-2, *Test on gases evolved during combustion of materials from cables – Part 2: Determination of acidity (by pH measurement) and conductivity*

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 60811-404, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 404: Miscellaneous tests – Mineral oil immersion tests for sheaths*

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 60811-501, *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 60811-504, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 505: Mechanical tests – Bending tests at low temperature for insulations and sheaths*

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 505: 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 60885-2, *Electrical test methods for electric cables – Part 2: partial discharge tests*~~

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

IEC 61034-1, *Measurement of smoke density of cables burning under defined conditions – Part 1: Test apparatus*

IEC 61034-2, *Measurement of smoke density of cables burning under defined conditions – Part 2: Test procedure and requirements*

ISO 7989-2:2007, *Steel wire and wire products – Non-ferrous metallic coatings on steel wire – Part 2: Zinc or zinc-alloy coating*

INTERNATIONAL STANDARD

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CONTENTS

FOREWORD	7
1 Scope	9
2 Normative references	9
3 Terms and definitions	11
3.31 tests	15
4 Constructional requirements	16
4.1 General requirements	16
4.1.1 General	16
4.1.2 Voltage designation	16
4.1.3 Cable marking	16
4.1.4 Core identification.....	17
4.1.5 Halogen-free cables.....	17
4.2 Conductors	17
4.2.1 Material	17
4.2.2 Metal coating and separator	17
4.2.3 Class and form	18
4.2.4 Resistance	18
4.3 Insulation system	19
4.3.1 Material	19
4.3.2 Application.....	19
4.3.3 Insulation thickness	19
4.4 Screens	19
4.4.1 Conductor and insulation screens for high-voltage cables.....	19
4.4.2 Screens (shields) for low voltage cables	20
4.5 Cabling	20
4.5.1 Multi-core cables	20
4.5.2 Multi-unit cables	20
4.6 Inner coverings, fillers and binders	21
4.7 Inner sheath.....	21
4.7.1 Material	21
4.7.2 Application.....	21
4.7.3 Thickness of inner sheath	21
4.8 Metal braid armour.....	21
4.8.1 Material	21
4.8.2 Application.....	22
4.9 Outer sheath	22
4.9.1 Material	22
4.9.2 Application.....	22
4.9.3 Thickness of outer sheath.....	22
4.9.4 Calculation of lower and upper limits for the outer dimensions of cables	23
5 Test methods.....	23
5.1 Test conditions	23
5.1.1 Ambient temperature	23
5.1.2 Frequency, waveform and magnitude of power-frequency test voltages	23
5.2 Routine tests.....	23
5.2.1 General	23

5.2.2	Measurement of the electrical resistance of the conductors	23
5.2.3	Voltage test	24
5.2.4	Partial discharge test	25
6	Sample tests	26
6.1	General	26
6.2	Frequency of sample tests	26
6.3	Repetition of tests	26
6.4	Conductor examination	26
6.5	Measurement of thickness of insulation	27
6.5.1	General	27
6.5.2	Procedure	27
6.5.3	Requirements	27
6.6	Measurements of thickness of non-metallic sheaths	27
6.6.1	General	27
6.6.2	Procedure	27
6.6.3	Requirements	27
6.7	Measurement of external diameter	27
6.8	Hot-set test for insulations and sheaths	27
6.8.1	General procedure	27
6.8.2	Requirements	28
6.9	Insulation resistance test (volume resistivity determination)	28
7	Type tests, electrical	29
7.1	General	29
7.2	Insulation resistance measurement	29
7.2.1	Measurement at ambient temperature	29
7.2.2	Measurement at maximum rated temperature	29
7.3	Increase in AC capacitance after immersion in water	30
7.3.1	General	30
7.3.2	Preparation of test specimens	30
7.3.3	Apparatus	30
7.3.4	Procedure	30
7.3.5	Requirements	30
7.4	High-voltage test for 4 h for cables rated up to 1,8/3 kV	31
7.4.1	General	31
7.4.2	Requirement	31
7.5	Mutual capacitance (control and instrumentation cables only)	31
7.6	Inductance to resistance ratio (control and instrumentation cables only)	31
7.7	High voltage sequence test (cables having a voltage rating higher than 3,6/6 (7,2) kV)	31
7.7.1	General	31
7.7.2	Special provisions	31
7.7.3	Partial discharge test	32
7.7.4	Bending test	32
7.7.5	Tan δ measurement as a function of the voltage	32
7.7.6	Tan δ measurement as a function of the temperature	32
7.7.7	Heating cycle test plus partial discharge test	33
7.7.8	Impulse withstand test, followed by a power-frequency voltage test	33
7.7.9	High-voltage test for 4 h	33
8	Type tests (non-electrical)	33

8.1	General.....	33
8.2	Measurement of thickness of insulation.....	34
8.3	Measurement of thickness of non-metallic sheaths (excluding inner coverings).....	34
8.4	Tests for determining the mechanical properties of insulation before and after ageing	34
8.4.1	Sampling	34
8.4.2	Ageing treatments	34
8.4.3	Conditioning and mechanical tests.....	34
8.4.4	Requirements	34
8.5	Tests for determining the mechanical properties of sheaths before and after ageing.....	34
8.5.1	Sampling	34
8.5.2	Ageing treatments	34
8.5.3	Conditioning and mechanical tests.....	34
8.5.4	Requirements	34
8.6	Additional ageing test on pieces of completed cables (compatibility test)	35
8.6.1	General	35
8.6.2	Sampling	35
8.6.3	Ageing treatment	35
8.6.4	Mechanical tests.....	35
8.6.5	Requirements	35
8.7	Loss of mass test on PVC ST 2 sheath	35
8.7.1	Procedure.....	35
8.7.2	Requirements	35
8.8	Test for the behaviour of PVC ST 2 and halogen-free SHF 1 sheaths at high temperature (hot pressure test).....	35
8.8.1	Procedure.....	35
8.8.2	Requirements	35
8.9	Test for the behaviour of PVC sheath ST 2 and halogen-free SHF 1 and SHF 2 sheaths at low temperature	36
8.9.1	Procedure.....	36
8.9.2	Requirements	36
8.10	Special test for low temperature behaviour (when required)	36
8.11	Test of the metal coating of copper wires	36
8.12	Galvanizing test	36
8.13	Test for resistance of PVC ST 2 and halogen-free SHF 1 sheaths to cracking (heat shock test)	36
8.13.1	Procedure.....	36
8.13.2	Requirements	36
8.14	Ozone resistance test for insulation and for sheaths	36
8.14.1	Procedure.....	36
8.14.2	Requirements	36
8.15	Hot oil immersion test and enhanced hot oil immersion test for sheaths	37
8.15.1	Hot oil immersion test	37
8.15.2	Enhanced hot oil immersion test (when required).....	37
8.16	Mud drilling fluid test (when required)	37
8.17	Fire tests	37
8.17.1	Flame-spread test on single cables.....	37
8.17.2	Flame-spread test on bunched cables.....	37

8.17.3	Smoke emission test.....	37
8.17.4	Acid gas emission test.....	37
8.17.5	pH and conductivity test.....	37
8.17.6	Fluorine content test.....	38
8.17.7	Fire-resistance test (test for circuit integrity cables).....	38
8.18	Determination of hardness for HEPR.....	38
8.19	Determination of elastic modulus for HEPR.....	38
8.20	Durability of print	38
Annex A (normative) Fictitious calculation method for determination of dimensions of protective coverings.....		39
A.1	Overview.....	39
A.2	General.....	39
A.3	Method	39
A.3.1	Conductors	39
A.3.2	Cores	40
A.3.3	Diameter over laid-up cores.....	41
A.3.4	Inner coverings.....	43
A.3.5	Sheath.....	43
A.3.6	Braid armour.....	44
Annex B (informative) Recommended minimum spark test voltage levels (according to IEC 62230)		45
B.1	General.....	45
B.2	Test voltages	45
B.2.1	General	45
B.2.2	Contact electrodes.....	45
B.2.3	Non-contact electrodes.....	46
Annex C (normative) Rounding of numbers.....		47
C.1	Rounding of numbers for the purpose of the fictitious calculation method.....	47
C.1.1	Rules.....	47
C.1.2	Illustrations.....	47
C.2	Rounding of numbers for other purposes	47
Annex D (normative) Calculation of the lower and upper limits for the outer dimensions of cables with circular copper conductors		48
D.1	General.....	48
D.2	Lower limit for the outer diameter.....	48
D.3	Upper limit for the outer diameter.....	48
D.4	Thickness of the mandatory or optional coverings other than the insulation and the sheath(s).....	49
Annex E (normative) Cold bend test and impact test for low temperature behaviour.....		50
E.1	Cold bend test at any specified low temperature	50
E.1.1	Method no. 1	50
E.1.2	Method no. 2	50
E.1.3	Examination and requirements.....	51
E.2	Impact test at any specified low temperature.....	51
E.2.1	Apparatus.....	51
E.2.2	Procedures	51
E.2.3	Requirements	51
Bibliography.....		52

Table 1 – Minimum size of conductors	18
Table 2 – Routine test voltage	25
Table 3 – Number of samples according to cable length	26
Table 4 – Tan δ versus voltage	32
Table 5 – Tan δ versus temperature	33
Table 6 – Impulse withstand voltages	33
Table 7 – Test methods and requirements for halogen-free components	38
Table A.1 – Fictitious diameter of conductor	40
Table A.2 – Increase of diameter for concentric conductors and metallic screens made of tape or wire.....	40
Table A.3 – Assembly coefficient k for laid-up	42
Table A.4 – Coefficient c_f	43
Table B.1 – Recommended minimum spark-test voltages for cables having rated voltage (U_0) between 150 V and 1 800 V	45
Table D.1 – Lower and upper limits of circular copper conductors for cables for fixed installations	49
Table E.1 – Details of low temperature bending test	50

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL INSTALLATIONS IN SHIPS –**Part 350: General construction and test methods of power, control and instrumentation cables for shipboard and offshore applications**

FOREWORD

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International Standard IEC 60092-350 has been prepared by subcommittee 18A: Electric cables for ships and mobile and fixed offshore units, of IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units.

This fifth edition cancels and replaces the fourth edition published in 2014 and constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) more detailed description of the test procedures in 7.7.6 and 7.7.7;
- b) description of the relationship between Annex A and Annex D.

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

CDV	Report on voting
18A/420/FDIS	18A/423/RVC

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

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

The list of all the parts of the IEC 60092 series, under the general title *Electrical installations in ships*, can be found on the IEC website.

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

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

A bilingual version of this publication may be issued at a later date.

ELECTRICAL INSTALLATIONS IN SHIPS –

Part 350: General construction and test methods of power, control and instrumentation cables for shipboard and offshore applications

1 Scope

This part of IEC 60092 provides the general constructional requirements and test methods for use in the manufacture of electric power, control and instrumentation cables with copper conductors intended for fixed electrical systems at voltages up to and including 18/30(36) kV on board ships and offshore (mobile and fixed) units.

The reference to fixed systems includes those that are subjected to vibration (due to the movement of the ship or installation) or movement (due to motion of the ship or installation) and not to those that are intended for frequent flexing. Cables suitable for frequent or continual flexing use are detailed in other IEC standards, for example IEC 60227 (all parts) and IEC 60245 (all parts), and their uses are restricted to those situations which do not directly involve exposure to a marine environment, for example, portable tools and domestic appliances.

The following types of cables are not included:

- optical fibre;
- sub-sea and umbilical cables;
- data and communication cables;
- coaxial cables.

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 60050-461, *International Electrotechnical Vocabulary – Part 461: Electric cables* (available at www.electropedia.org)

IEC 60092-360:2014, *Electrical installations in ships – Part 360: Insulating and sheathing materials for shipboard and offshore units, power, control, instrumentation and telecommunication cables*

IEC 60228, *Conductors of insulated cables*

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

IEC 60331-1, *Tests for electric cables under fire conditions – Circuit integrity – Part 1: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV and with an overall diameter exceeding 20 mm*

IEC 60331-2, *Tests for electric cables under fire conditions – Circuit integrity – Part 2: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV and with an overall diameter not exceeding 20 mm*

IEC 60331-11, *Tests for electric cables under fire conditions – Circuit integrity – Part 11: Apparatus – Fire alone at a flame temperature of at least 750 °C*

IEC 60331-21, *Tests for electric cables under fire conditions – Circuit integrity – Part 21: Procedures and requirements – Cables of rated voltage up to and including 0,6/1,0 kV*

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 60332-3-22, *Tests on electric and optical fibre cables under fire conditions – Part 3-22: Test for vertical flame spread of vertically-mounted bunched wires or cables – Category A*

IEC 60684-2, *Flexible insulating sleeving – Part 2: Methods of test*

IEC 60754-1, *Test on gases evolved during combustion of materials from cables – Part 1: Determination of the halogen acid gas content*

IEC 60754-2, *Test on gases evolved during combustion of materials from cables – Part 2: Determination of acidity (by pH measurement) and conductivity*

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 60811-404, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 404: Miscellaneous tests – Mineral oil immersion tests for sheaths*

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 60811-501, *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 60811-504, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 505: Mechanical tests – Bending tests at low temperature for insulations and sheaths*

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 505: 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 60885-3, *Electrical test methods for electric cables – Part 3: Test methods for partial discharge measurements on lengths of extruded power cables*

IEC 61034-1, *Measurement of smoke density of cables burning under defined conditions – Part 1: Test apparatus*

IEC 61034-2, *Measurement of smoke density of cables burning under defined conditions – Part 2: Test procedure and requirements*

ISO 7989-2:2007, *Steel wire and wire products – Non-ferrous metallic coatings on steel wire – Part 2: Zinc or zinc-alloy coating*