IEC 60092-350

Edition 5.0 2020-01

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

Installations électriques à bord des navires –
Partie 350: Construction générale et méthodes d'essai des câbles d'énergie, de commande et d'instrumentation des navires et des unités mobiles et fixes en mer

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CONTENTS

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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

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/CDV	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- withdrawn,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.

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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-461 and the following 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
approximate value
value which is neither guaranteed nor checked

Note 1 to entry: It is used, for example, for the calculation of other dimensional values.

3.2
braid
covering formed from braided metallic or non-metallic material

[SOURCE: IEC 60050-461:2008, 461-05-10]

3.3
braid armour
covering formed from braided metal wires used to protect a cable from external mechanical effects

Note 1 to entry: Where the rules of the applicable national, regulatory or approval body permit the practice, it is also possible to use the braid armour as an earth conductor.

Note 2 to entry: Copper-wire braid armour may also provide a limited function of an electrostatic collective screen, provided it is effectively earthed.

3.4
compatibility test
test intended to check that the insulation and sheath are not liable to deteriorate in operation due to contact either with each other or with other components in the cable

3.5
conductor
<of a cable> part of a cable which has the specific function of carrying current

[SOURCE: IEC 60050-461:2008, 461-01-01]

3.6
conductor screen
non-metallic conducting layer applied between the conductor and insulation to equalise the electrical stress between these components

Note 1 to entry: It may also provide smooth surfaces at the boundaries of the insulation and assist in the elimination of spaces at these boundaries

3.7
core-insulated conductor, US
assembly comprising a conductor and its own insulation (and screens, if any)

Note 1 to entry: In North American usage, the core of a cable has been defined as the assembly of components of a cable lying under a common covering such as the sheath (jacket).

3.8
drain wire
un-insulated wire laid in contact with an electrical screen or an electrical shield which has the specific function of earthing an electrostatic screen by ensuring a low resistive path throughout the length of the cable

3.9
electrostatic screen
electrostatic shield, US
earthed metallic layer surrounding a cable which confines the electric field generated by the cable within the cable cores, pair(s), triples(s) or quad(s), and/or protects the core(s), pair(s), triple(s) or quad(s) from external influence

Note 1 to entry: Metallic sheaths, foils, braids, armours and earthed concentric conductors may also serve as an electrostatic screen, provided they are effectively grounded or earthed.

3.10
fictitious value
value calculated according to the "fictitious method" described in Annex A

3.11
filler
material used to fill the interstices between the cores of a multi-conductor cable

[SOURCE: IEC 60050-461:2008, 461-04-05]

3.12
fire resistance
circuit integrity
ability of an electric cable to continue to operate in a designated manner whilst subjected to a specified flame source for a specified period of time under specified conditions

3.13
flexible cable
cable which is required to be capable of being flexed while in service and of which the structure and materials are such as to fulfil this requirement

[SOURCE: IEC 60050-461:2008, 461-06-14]

3.14
individually screened cable
radial field cable
cable in which each core is covered with an individual screen

[SOURCE: IEC 60050-461:2008, 461-06-12]

3.15
inner covering
non-metallic covering which surrounds the core or the assembly of the cores or the cabling elements (and fillers, if any) of a multi-conductor cable and over which further layers are applied and which has no mechanical or electrical functions

Note 1 to entry: The inner covering can be either extruded or taped, and in either case forms a continuous layer, which has only an approximate value of thickness and no defined mechanical requirements.

Note 2 to entry: Taped inner coverings are also sometimes called "lapped beddings".

3.16
inner sheath
inner jacket, US
non-metallic sheath generally applied under a metallic sheath, reinforcement or armour

Note 1 to entry: The inner sheath shall have the following properties:

– it shall be extruded;
– it may be used to fill the interstices;
– it shall be of a material listed in IEC 60092-360;
– it shall have a defined nominal thickness (value).

[SOURCE: IEC 60050-461:2008, 461-05-13, modified – The note to entry has been added.]

3.17
insulated cable
assembly consisting of

– one or more cores;
– their individual covering(s) (if any);
– assembly protection (if any);
– protective covering(s) (if any).

Note 1 to entry: Additional un-insulated conductor(s) may be included in the cable.

Note 2 to entry: The assembly protection may consist of fillers, binders or inner coverings.

Note 3 to entry: The protective covering(s) consists of one or more "constituent elements" such as a metallic braid, wire or a metallic screen, thermosetting or thermoplastic sheaths, (impregnated) fibrous braid or woven tape, bedding for metal armour or paint for metal armour.

[SOURCE: IEC 60050-461:2008, 461-06-01, modified – Notes 2 and 3 to entry have been added.]