

# INTERNATIONAL STANDARD

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



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IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland  
Email: [inmail@iec.ch](mailto:inmail@iec.ch)  
Web: [www.iec.ch](http://www.iec.ch)

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Email: [csc@iec.ch](mailto:csc@iec.ch)  
Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00



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

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## 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: Cables and cable installations, of IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units.

This third edition cancels and replaces the second edition published in 2001 and constitutes a technical revision.

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

- a) the new insulating compounds contained in IEC 60092-351;
- b) the new sheathing compounds contained in IEC 60092-359;
- c) the publication of IEC 60092-376;
- d) the inclusion of cables up to 30 kV in the revision of IEC 60092-354;

- e) for use in a limited number of closely defined applications, the provision to allow the design of a single core cable with a single extrusion covering, having a thickness equal to that of both an insulation and sheath;
- f) new tests for the determination of enhanced cold properties, oil resistance, and resistance to drilling fluids.

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

FDIS	Report on voting
18A/285/FDIS	18A/286/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.

This publication 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 publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication 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 specifications, for example IEC 60227 and IEC 60245, 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 referenced documents are indispensable for the application 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 Electro-technical Vocabulary (IEV) – Chapter 461: Electric cables*

IEC 60092-351:2004, *Electrical installations in ships – Part 351: Insulating materials for shipboard and offshore units, power, control, instrumentation, telecommunication and data cables*

IEC 60092-359, *Electrical installations in ships – Part 359: Sheathing materials for shipboard power and telecommunication cables*

IEC 60228, *Conductors of insulated cables*

IEC 60331-11:1999, *Tests for electric cables under fire conditions – Circuit integrity – Part 11: Apparatus – Fire alone at a flame temperature of at least 750 °C*

IEC 60331-12:2002, *Tests for electric cables under fire conditions – Circuit integrity – Part 12: Apparatus – Fire with shock at a temperature of at least 830° C*

IEC 60331-21:1999, *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 60331-31:2002, *Tests for electric cables under fire conditions – Circuit integrity – Part 31: Procedures and requirements for fire with shock – Cables of rated voltage up to and including 0,6/1 kV*

IEC 60332-1-2:2004, *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 60332-3-22:2000, *Tests on electric cables under fire conditions – Part 3-22: Test for vertical flame spread of vertically-mounted bunched wires or cables – Category A*

IEC 60684-2:1997, *Flexible insulating sleeving – Part 2: Methods of test*  
Amendment 1 (2003)<sup>1)</sup>

IEC 60754-1:1994, *Test on gases evolved during combustion of materials from cables – Part 1: Determination of the amount of halogen acid gas*

IEC 60754-2:1991, *Test on gases evolved during combustion of materials from cables – Part 2: Determination of degree of acidity of gases by measuring pH and conductivity*

IEC 60811-1-1:1993, *Common test methods for insulating and sheathing materials of electric cables and optical cables – Part 1-1: Methods for general application – Measurement of thickness and overall dimensions – Tests for determining the mechanical properties*  
Amendment 1 (2001)<sup>2)</sup>

IEC 60811-1-2:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section Two: Thermal ageing methods*

IEC 60811-1-4:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section Four: Test at low temperature*

IEC 60811-2-1:1998, *Common test methods for insulating and sheathing materials of electric and optical cables – Part 2-1: Methods specific to elastomeric compounds – Ozone resistance, hot set and mineral oil immersion tests*  
Amendment 1 (2001)<sup>3)</sup>

IEC 60811-3-1:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 3: Methods specific to PVC compounds – Section One: Pressure test at high temperature – Tests for resistance to cracking*

IEC 60811-3-2:1985, *Common test methods of insulating and sheathing materials of electric and optical cables – Part 3: Methods specific to PVC compounds – Section Two: Loss of mass test – Thermal stability test*

IEC 61034-1:2005, *Measurement of smoke density of cables burning under defined conditions – Part 1: Test apparatus*

IEC 61034-2:2005, *Measurement of smoke density of cables burning under defined conditions – Part 2: Test procedure and requirements*

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<sup>1)</sup> There exists a consolidated edition 2.1 (2003), including IEC 60684-2:1997 and its Amendment 1.

<sup>2)</sup> There exists a consolidated edition 2.1 (2001), including IEC 60811-1-1:1993 and its Amendment 1.

<sup>3)</sup> There exists a consolidated edition 2.1 (2001), including IEC 60811-2-1:1998 and its Amendment 1.

ISO 1817:2005, *Rubber vulcanized – Determination of the effect of liquids*

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 as well as the following terms and definitions apply.

#### 3.1

##### **approximate value**

value which is neither guaranteed nor checked

NOTE It is used, for example, for the calculation of other dimensional values.

#### 3.2

##### **braid**

covering formed from plaited metallic or non-metallic material

[IEV 461-05-10]

#### 3.3

##### **braid armour**

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

NOTE 1 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 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

[IEV 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 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 (North America)**

assembly comprising a conductor and its own insulation (and screens, if any)

NOTE 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).