

TECHNICAL REPORT

**Electrical installations in ships –
Part 370: Guidance on the selection of cables for telecommunication and data
transfer including radio-frequency cables**





THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2019 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.



TECHNICAL REPORT

**Electrical installations in ships –
Part 370: Guidance on the selection of cables for telecommunication and data
transfer including radio-frequency cables**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.060.20; 47.020.60

ISBN 978-2-8322-7596-2

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD	3
INTRODUCTION	5
1 Scope	6
2 Normative references	6
3 Terms and definitions	6
4 Selection of cables	6
5 Fundamental considerations	7
6 Constructional considerations	7
6.1 Selection of conductor	7
6.2 Selection of insulation	7
6.3 Cable elements	7
6.4 Selection of screen, core screen or shield	8
6.5 Selection of outer sheath	8
6.6 Selection of metallic sheath (covering), braid or armour	8
7 Marking	8
8 Guidance on the selection of appropriate tests	9
9 Guide to use	9
9.1 Purpose	9
9.2 General	9
9.3 Voltage rating	10
9.3.1 Data and telecommunication cables	10
9.3.2 High-frequency radio communications cables	10
9.4 Current ratings	10
9.5 Thermal considerations	10
9.6 Size of conductors	10
9.7 Radius of bend	11
9.8 Tensile stress	11
9.9 Compression	11
9.10 Mechanical damage	11
9.11 Electromagnetic interference	12
9.12 Terminations	12
9.13 Joints	12
10 Performance in a fire	12
Annex A (informative) Table of tests	14
Bibliography	17
Table 1 – Classification of cables by frequency range	9
Table A.1 – Table of tests for cables according to the standard IEC 60092-370	14

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL INSTALLATIONS IN SHIPS –**Part 370: Guidance on the selection of cables for telecommunication
and data transfer including radio-frequency cables**

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a Technical Report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC TR 60092-370, which is a Technical Report, 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 second edition cancels and replaces the first edition published in 2009. This edition constitutes a technical revision.

This edition includes the following significant technical change with respect to the previous edition: 30 V AC was added in voltage rating for data cables.

The text of this Technical Report is based on the following documents:

Draft TR	Report on voting
18A/421/DTR	18A/422/RVDTR

Full information on the voting for the approval of this Technical Report 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.

A list of all parts of the IEC 60092 series, published 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.

INTRODUCTION

IEC 60092 (all parts) concerns electrical installations in sea-going ships, and fixed and mobile offshore units, incorporating good practice and co-ordinating as far as possible existing rules.

These standards form a code of practical interpretation and amplification of the requirements of the International Convention on Safety of Life at Sea, a guide for future regulations which may be prepared and a statement of practice for use by shipowners, shipbuilders, mobile and fixed offshore units owners and builders and appropriate organisations. 

Cables selected for installation on board ships and on offshore installations are usually installed and are expected to operate in much harsher environments than equivalent land based types. The risk of mechanical abuse during installation, physical dislocation due to tension and bending allied with extremes of temperature are examples of the conditions to which these cables may be subject. If faults occur unlike onshore installations, trained experienced technicians may not always be readily available to affect a repair or replacement.

ELECTRICAL INSTALLATIONS IN SHIPS –

Part 370: Guidance on the selection of cables for telecommunication and data transfer including radio-frequency cables

1 Scope

This part of IEC 60092, which is a Technical Report, gives guidance and lays down the basic recommendations for the selection and installation of shipboard and offshore unit cables intended for electrical systems used in both essential and non-essential analogue or digital signal communication, transmission and control networks, including types suitable for high-frequency signals (i.e. signals with a frequency of more than 10^5 Hz). These cables are not suitable for direct connection to low impedance supplies. Where such cables are required, attention is drawn to IEC 60092-353.

Cables intended to have limited circuit integrity (fire resistance) when affected by fire are not covered by this document.

Fibre optical cables are not included.

Sub-sea or umbilical cables are not included.

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 60092-350, *Electrical installations in ships – Part 350: General construction and test methods of power, control and instrumentation cables for shipboard and offshore applications*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60092-350 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>

4 Selection of cables

Cables with physical and electrical characteristics in accordance with IEC 60092 (all parts) are recommended for use in the marine environment.

Cables constructed in accordance with the following standards are acceptable provided that due consideration has been given to their use in a marine environment: IEC 60189-1, IEC 60189-2, IEC 60189-3, and IEC 60096-0-1.

5 Fundamental considerations

The choice of materials and cable construction should be suitable for the intended application and installation of the cable.

The high level of electrical performance associated with many modern cables is only achieved by the accurate, consistent positioning of the various components within the cable. Careless or excess tension, compression or bending can alter this relationship. This may then have significant detrimental effects upon the fundamental performance of the cable at high data rates.

Similarly, these high levels of electrical performance can usually only be achieved by the use of polymers and insulation systems that may not have the same reaction to fire characteristics as the more traditional materials used in other marine cables. In recognition of this, careful consideration should be given to the method of installation to select that most appropriate to the particular application (see also Clause 8).

6 Constructional considerations

6.1 Selection of conductor

Only circular copper conductors, either plain or metal coated, or copper covered steel, are recommended for use in a marine environment. Stranded conductors are recommended for general use. Where the applicable product standard specifies solid conductors, consideration should be given to the possible effects of vibration (due to the movement of the ship or installation) or movement (due to motion of the ship or installation).

The properties of copper conductors should be in accordance with IEC 60228. Joints in solid conductors or complete stranded conductors are not permitted; however, joints in individual strands are allowed.

When cables are subject to continuous flexing, the advice of the manufacture should be sought.

6.2 Selection of insulation

The range of materials for use as conductor insulation should, where possible, be selected from those listed in IEC 60092-360 or as given in IEC 60096-0-1 and IEC 61156-5-1. For cables operating at the higher frequencies, the insulation may be solid, cellular or a foam skin composite. The rated operating temperature of the insulating material should be at least 10 °C higher than the maximum ambient temperature likely to exist, or to be produced, in the space where the cable is installed.

The insulation should be continuous, having a thickness as uniform as possible. The insulation should be applied to fit closely to the conductor.

6.3 Cable elements

The cores within each pair, triple, or quad should be clearly identified by colour or number as given in the applicable cable standard. The identification used should be durable and legible.

The choice of the maximum average length of lay in the finished cable should be selected with respect to the specified crosstalk requirements, handling performance and the pair or quad integrity.

6.4 Selection of screen, core screen or shield

If a screen is required, it may consist of the following:

- a) a metallic laminated tape bonded to polyester and a drain wire in direct contact with the metallic side of the tape;
- a) plain or metal coated copper braid;
- b) a metallic laminated tape bonded to polyester and a drain wire in direct contact with the metallic side of the tape with a plain or metal coated copper braid.

The construction of the screen, core screen or shield should be as listed in IEC 60092-350 or the applicable cable standard. Care should be taken when putting dissimilar metals in contact with each other. Coatings or other methods of protection may be necessary to prevent galvanic interaction often encountered in the marine environment.

6.5 Selection of outer sheath

The range of materials for use as protective sheath should, where possible, be selected from those listed in IEC 60092-360, which have been proven by experience to be suitable for use in the marine environment. Materials listed in IEC 60096-0-1 and IEC 61156-1 may also be considered; the material chosen should meet the requirements of this document.

The material selected should be compatible with the cable components with which it is in contact and compatible with the intended environment and operating temperature of the cable.

In instances where the construction of a cable does not conform with a standard from IEC 60092 (all parts), it should be ensured that the material used as the protective sheath has adequate mechanical strength in respect of the mechanical hazards to which it may be subjected during installation and service. The potential for corrosion, of underlying layers, encountered in the marine environment should also be considered. Attention is drawn to the list of permitted protective coverings given in IEC 60092-350.

Due consideration should be given to fluid resistance for cables installed where water condensation or harmful vapours (including oil vapour) may be present. In this instance, the cables should meet the appropriate fluid resistance requirements of IEC 60092-360.

Also, consideration should be given to the fire performance characteristics given in Clause 10.

The minimum thickness of sheath considered as being acceptable for cables for installation on board a ship or offshore installation is 0,7 mm.

6.6 Selection of metallic sheath (covering), braid or armour

The construction of the metal braid armour should be in accordance with IEC 60092-350. The type of metal braid armour should be carefully selected by the user in respect of not only the mechanical hazards but also the potential for corrosion encountered in the marine environment. Care should be taken when putting dissimilar metals in contact with each other. Coatings or other methods of protection may be necessary to prevent galvanic interaction often encountered in the marine environment.

7 Marking

Cables should be provided with a continuous indication of origin (manufacturers name or trade mark), by one of the following methods:

- a) printing, indenting or embossing on the outer sheath;
- b) a printed tape within the cable;

- c) the inclusion of identification threads within the cable;
- d) printing on the insulation of at least one core.

The marking should be durable and legible.

The spacings and dimensions of the indication of origin should be as given in the applicable product standard.

8 Guidance on the selection of appropriate tests

Unless otherwise specified in the applicable product standard, tests should be made at an ambient temperature of $(20 \pm 15) ^\circ\text{C}$.

This document defines, by the frequency range in the intended application, seven classes of cable (Table 1) and, in Annex A, gives guidance in the selection of the appropriate tests to be applied, related to each class.

Table 1 – Classification of cables by frequency range

Cable type	Frequency range
1	$f_{\max} < 100 \text{ kHz}$
2	$100 \text{ kHz} < f < 1 \text{ MHz}$
3	$1 \text{ MHz} < f < 16 \text{ MHz}$
4	$16 \text{ MHz} < f < 125 \text{ MHz}$
5	$125 \text{ MHz} < f < 250 \text{ MHz}$
6	$250 \text{ MHz} < f < 600 \text{ MHz}$
7	$250 \text{ Hz} < f < 1\,000 \text{ MHz}$
NOTE All cables are backwards compatible.	

9 Guide to use

9.1 Purpose

The aim of Clause 9 is to inform users of characteristics and limitations of electric cables and thereby to minimise misuse.

It is assumed that the design of installation and the specification, purchase and installation of cables in accordance with this document is entrusted to suitable skilled and competent people.

In case of doubt as to the suitability of cables covered by this document for a particular use, further specific information should be obtained from the manufacturer.

9.2 General

All cables should be stored in a suitable place until required. Consideration should be given to security and environmental conditions.

Any protective packaging should not be removed until the cable is to be installed.

The ends of cables should always remain sealed during storage and installation to prevent the ingress of water and other contaminants.

以上内容仅为本文档的试下载部分，为可阅读页数的一半内容。如要下载或阅读全文，请访问：<https://d.book118.com/83714105000006121>