IEC 60092-378

Edition 1.0 2024-11

INTERNATIONAL STANDARD

Electrical installations in ships – Part 378: Optical fiber cables

IEC 60092-378:2024-11(en)

IEC Secretariat
3, rue de Varembé
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 It also gives information on projects, replaced and withdrawn publications.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.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC 60092-378

Edition 1.0 2024-11

INTERNATIONAL STANDARD

Electrical installations in ships – Part 378: Optical fiber cables

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.060.20; 47.020.60

ISBN 978-2-8322-4907-9

CONTENTS

FOREWORD 4
1 Scope 6
2 Normative references 6
3 Terms and definitions 7
4 General requirements 8
4.1 Temperature range of the cables 8
4.2 Markings 8
4.2.1 Indication of origin and fibre identification 8
4.2.2 Continuity of marking 8
4.3 Fibre identification 8
4.3.1 General 8
4.3.2 Colours of fibres in loose tubes 8
4.4 Colours of units as buffer tubes, loose tubes and subunits of breakout cables 8
5 Construction requirements 9
5.1 General description 9
5.1.1 Overview 9
5.1.2 Unarmoured cables 9
5.1.3 Armoured cables 9
5.2 Optical fibres 9
5.3 Tensile strength elements 10
5.4 Cabling 10
5.5 Inner covering 10
5.5.1 General 10
5.5.2 Thickness of inner covering 10
5.6 Inner sheath 11
5.6.1 General 11
5.6.2 Material 11
5.6.3 Application 11
5.6.4 Thickness of inner sheath 11
5.7 Braid armour 11
5.7.1 General 11
5.7.2 Braid wire diameter 11
5.7.3 Coverage density 11
5.7.4 Application of the armour 12
5.8 Outer sheath 12
5.8.1 Material 12
5.8.2 Application 12
5.8.3 Thickness of the sheath 12
5.8.4 Colour of the outer sheath 12
6 Construction for special applications 13
6.1 Fire resistant cables 13
6.2 Cables for installation in areas with explosive atmospheres 13
6.3 Cables for installation between areas with and without explosive atmospheres 13
6.4 Cables with special metallic identification element 13
7 Test methods and requirements 13

7.1 General requirements 13
7.2 Additional tests on cables with functional integrity during fire 17
7.3 Tests on cables for installation in explosive atmospheres 17
7.4 Tests on cables for installation between areas with and without explosive atmospheres 17
7.5 Tests on cables with special metallic identification element 17
8 Recommendations for the installation of fibre optic cables on board of ships and offshore units 17
Annex A (informative) Recommendations for the installation of fibre optic cables on board of ships and offshore units 18
Bibliography 19

Table 1 – Multimode fibre maximum cable attenuation coefficient (dB/km) 10
Table 2 – Single-mode fibre maximum cable attenuation coefficient (dB/km) 10
Table 3 – Colour of outer sheath 13
Table 4 – Tests applicable to all cables 14
Table 5 – Additional test required for low smoke cables 16
Table 6 – Additional tests required for specific performances 16
Table 7 – Additional test required for fire resistant cables 17
Table 8 – Additional test for cables for installation between areas with and without explosive atmospheres 17
Table 9 – Additional test on cables with special metallic identification element 17

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

ELECTRICAL INSTALLATIONS IN SHIPS –

Part 378: Optical fibre 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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 60092-378 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. It is an International Standard.

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

Draft	Report on voting
18A/488/FDIS	18A/493/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in 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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

ELECTRICAL INSTALLATIONS IN SHIPS –

Part 378: Optical fibre cables

1 Scope

This part of IEC 60092 is applicable to shipboard and offshore optical fibre cables, intended for fixed installations.

Cables designed to maintain functional integrity during fire given in 6.1 and to be installed in explosive atmospheres given in 6.2 are included.

The various types of optical fibre cables are given in Clause 6. The constructional requirements and test methods are aligned with those indicated in IEC 60092-350, unless otherwise specified in this document.

The object of this document is:

– to standardize cables whose safety and reliability is ensured when they are installed in accordance with the requirements of IEC 60092-352 or IEC 60092-401 or IEC 61892-4;
– to lay down standard manufacturing requirements and characteristics of such cables directly or indirectly bearing on safety, and;
– to specify test methods for checking conformity with those requirements.

All cables described in this document, are halogen-free as per Table 4.

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 (IEV) – Part 461: Electric cables*

IEC 60079-14:2013, *Explosive atmospheres – Part 14: Electrical installations design, selection and erection*

IEC 60092-350:2020, *Electrical installations in ships – Part 350: General construction and test methods of power, control and instrumentation cables for shipboard and offshore applications*

IEC 60092-352, *Electrical installations in ships – Part 352: Choice and installation of electrical cables*

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

IEC 60092-401, *Electrical installations in ships – Part 401: Installation and test of completed installation*

IEC 60304, *Standard colours for insulation for low-frequency cables and wires*

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 60331-25, *Tests for electric cables under fire conditions – Circuit integrity – Part 25: Procedures and requirements – Optical fibre cables*

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 60332-3-24, *Tests on electric and optical fibre cables under fire conditions – Part 3-24: Test for vertical flame spread of vertically-mounted bunched wires or cables – Category C*

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

IEC 60754-2:2011, *Test on gases evolved during combustion of materials from cables – Part 2: Determination of acidity (by pH measurement) and conductivity*

IEC 60794-1-1:2023, *Optical fibre cables – Part 1-1: Generic specification – General*

IEC 60794-1-21, *Optical fibre cables – Part 1-21: Generic specification – Basic optical cable test procedures – Mechanical tests methods*

IEC 60794-1-22, *Optical fibre cables – Part 1-22: Generic specification – Basic optical cable test procedures – Environmental test methods*

IEC 60794-1-23, *Optical fibre cables – Part 1-23: Generic specification – Basic optical cable test procedures – Cable element test methods*

IEC 60793-1-40, *Optical fibres – Part 1-40: Attenuation measurement methods*

IEC 60794-1-111, *Optical fibre cables – Part 1-111: Generic specification – Basic optical cable test procedures – Mechanical tests methods – Bend, method E11*

IEC 61892-4, *Mobile and fixed offshore units – Electrical installations – Part 4: Cables*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60092-350, IEC 60050-461 and IEC 60794-1-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

4 General requirements

4.1 Temperature range of the cables

The optical fibre cables specified in this document shall be designed for an operating temperature range from –25 °C to +70 °C. Another temperature range can be agreed between manufacturer and customer.

4.2 Markings

4.2.1 Indication of origin and fibre identification

Cables shall comply with IEC 60092-350:2020, 4.1.3, with respect to:

a) indication of origin,

b) fibre type and cable construction (number of fibres and type of fibres),

c) continuity of marking, and

d) durability and legibility.

4.2.2 Continuity of marking

The marking is deemed to be continuous if the distance between the beginning of any marking and the beginning of the next does not exceed 1 000 mm if the marking is on the outer surface of the cable. If the marking contains a length/meter indication, it shall be continuous and not restart from 000.

4.3 Fibre identification

4.3.1 General

Fibres shall be clearly identified by colours.

4.3.2 Colours of fibres in loose tubes

Colours for cables with up to 12 fibres in a loose tube shall be a match to IEC 60304. Fibres in cables with more than 12 fibres in a loose tube shall be coded in suitable manner.

4.4 Colours of units as buffer tubes, loose tubes and subunits of breakout cables

Units of the cable shall be uniquely identified.

The colours of loose tubes shall be a match to IEC 60304.

Colour code or colour sequence of loose tubes shall be agreed between customer and manufacturer.

Subunits of breakout cables shall be identified by number printing or colour code and shall be agreed between customer and manufacturer.

NOTE Examples of colour code for buffer tubes in breakout cables are given in IEC 60794-2.

Tight-buffered fibres in distribution cables shall be identified by colour code and shall be agreed between customer and manufacturer.