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REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

Electrical installations in ships –
Part 306: Equipment – Luminaires and lighting accessories

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ELECTRICAL INSTALLATIONS IN SHIPS –

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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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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60092-306:2009. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 60092-306 has been prepared by IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 2009. This edition constitutes a technical revision.

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

a) additional technical and environmental requirements have been included;
b) Table 2 "Standard types of lamp holders" has been amended;
c) Subclause 4.3.2 has been amended with a new title "Distribution systems" and a reference to IEC 60092-201 has been added;
d) environmental requirements and tests, especially regarding shock and vibration have been changed, and references to IEC 60092-101 and IEC 60092-504 have been added;
e) requirements on coating thickness have been deleted, material requirements in 4.2.2 being sufficient;
f) the high voltage test has been amended with regard to electronic parts.

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

Draft	Report on voting
18/1786/FDIS	18/1790/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 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 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.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

IEC 60092 (all parts) forms a series of international standards for electrical installations in sea-going ships, incorporating good practice and coordinating, as far as possible, existing rules.

These standards form a code of practical interpretation and amplification of the requirements of the International Convention for the Safety of Life at Sea, a guide for future regulations which may be prepared and a statement of practice for use by shipowners, shipbuilders and appropriate organizations.

ELECTRICAL INSTALLATIONS IN SHIPS –

Part 306: Equipment – Luminaires and lighting accessories

1 Scope

This part of IEC 60092 applies to luminaires and lighting accessories for use in ships. It applies primarily to luminaires for illumination purposes.

~~NOTE Boats, submarines (except naval submarines), watercraft and floating equipment are ships to which this standard applies.~~

This document also applies to lighting accessories associated with the wiring and current consuming appliance of an installation.

This document does not apply to portable luminaires, navigation lights, search lights, daylight signalling lamps, signal lights including the relevant control and monitoring equipment and other lights used for navigation in channels, harbours, etc.

~~For navigation lights, see EN 14744, for search lights, see ISO 17884, for daylight signalling lamps, see ISO 25861.~~

Annex A provides EMC considerations for system integrators.

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 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

~~IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*~~

~~IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*~~

IEC 60068-2-30, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-52, *Environmental testing – Part 2-52: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60079 (all parts), ~~*Equipment for*~~ *Explosive atmospheres*

IEC 60092-101, *Electrical installations in ships – Part 101: Definitions and general requirements*

IEC 60092-201~~:1994~~, *Electrical installations in ships – Part 201: System design – General*

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

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

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 60092-504, *Electrical installations in ships – Part 504: Automation, control and instrumentation*

IEC 60155, *Glow-starters for fluorescent lamps*

IEC 60238, *Edison screw lampholders*

IEC 60309 (all parts), *Plugs, fixed or portable socket-outlets and appliance inlets for industrial purposes*

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 60400, *Lampholders for tubular fluorescent lamps and starterholders*

IEC 60417, *Graphical symbols for use on equipment, available at http://www.graphical-symbols.info/equipment*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60533, *Electrical and electronic installations in ships – Electromagnetic compatibility (EMC) – Ships with a metallic hull*

IEC 60598-1, *Luminaires – Part 1: General requirements and tests*

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

IEC 60695-7-2, *Fire hazard testing – Part 7-2: Toxicity of fire effluent – Summary and relevance of test methods*

IEC 60695-2-11, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products (GWEPT)*

~~*IEC/TR 60721-4-6, Classification of environmental conditions – Part 4-6: Guidance for the correlation and transformation of environmental condition classes of IEC 60721-3 to the environmental tests of IEC 60068 – Ship environment*~~

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

IEC 60838-1, *Miscellaneous lampholders – Part 1: General requirements and tests*

IEC 60945, *Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results*

IEC 61184, *Bayonet lampholders*

IEC 61300-3-2, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-2: Examination and measurements – Polarization dependent loss in a single-mode fibre optic device*

IEC 61347-2-1, *Lamp controlgear – Part 2-1: Particular requirements for starting devices (other than glow starters)*

IEC 61995-1, *Devices for the connection of luminaires for household and similar purposes – Part 1: General requirements*

IEC 61995-2, *Devices for the connection of luminaires for household and similar purposes – Part 2: Standard sheets for DCL*

IEC 62444, *Cable glands for electrical installations*[1]

IEC 62471:2006, *Photobiological safety of lamps and lamp systems*

IEC 62742, *Electrical and electronic installations in ships – Electromagnetic compatibility (EMC) – Ships with a non-metallic hull*

IEC TR 62778, *Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires*

~~ISO 2409, *Paints and varnishes – Cross-cut test*~~

~~ISO 3882, *Metallic and other inorganic coatings – Review of methods of measurement of thickness*~~

ISO 4892-2, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps*

ISO 4892-3, *Plastics – Methods of exposure to laboratory light sources – Part 3: Fluorescent UV lamps*

~~ISO 9001, *Quality management systems – Requirements*~~

~~ISO 17884, *Ships and marine technology – Searchlights for high-speed craft*~~

~~ISO 25861 *Ships and marine technology – Navigation – Daylight signalling lamps*~~

~~Defence Standard 02-713, *Determination of the Toxicity Index of the Products of Combustion from Small Specimens of Materials*~~

EN 12206-1, *Paints and varnishes – Coating of aluminium and aluminium alloys for architectural purposes – Part 1: Coatings prepared from thermosetting coating powder*

~~[1] To be published.~~

EN 13032-1, *Light and lighting – Measurement and presentation of photometric data of lamps and luminaires – Part 1: Measurement and file format*

EN 13438, *Paints and varnishes – Powder organic coatings for hot dip galvanized or sherardised steel products for construction purposes*

EN 13032-4, *Light and lighting – Measurement and presentation of photometric data of lamps and luminaires – Part 4: LED lamps, modules and luminaires*

~~EN 14744, *Inland navigation vessels and sea-going vessels – Navigation light*~~

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60598-1 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
luminaire
apparatus which distributes, filters or transforms the light transmitted from one or more lamps and which includes all the parts necessary for supporting, fixing and protecting the lamps, but not the lamps themselves, and where necessary, circuit auxiliaries together with the means for connecting them to the supply

[SOURCE: IEC 60598-1:2020, 1.2.1, modified – The note to entry has been deleted.]

3.2
lamp
~~source made in order to produce an optical radiation, usually visible~~

~~[IEV 845-07-03]~~

electric light source provided with at least one cap

Note 1 to entry: For products that have the same physical characteristics as electric lamps for general lighting, but that are built to emit optical radiation mainly in the IR or UV spectrum, the term "IR lamp" or "UV lamp" is often used.

Note 2 to entry: This entry was numbered 845-07-03 in IEC 60050-845:1987.

[SOURCE: IEC 60050-845:2020, 845-27-008, modified – In the term, the word "electric" has been deleted, as well as the second note to entry.]

3.3
lighting accessories
additional parts which are needed for mounting or for electrical connection and which are usually delivered together with the luminaire

EXAMPLE Ceiling rose, cable gland, plug, socket-outlet, fixing material.

3.4
continuous operation
operation for an unlimited period without interruption within the specified environmental conditions without the specified limits of temperature being exceeded

4 Requirements on luminaires

4.1 General

Luminaires shall comply with the requirements of IEC 60598-1 and with the additional or divergent requirements included in this document. Luminaires in accordance with this document shall be suitable for continuous operation.

4.2 Mechanical requirements

4.2.1 Design

The design of luminaires shall comply with the requirements of IEC 60092-101 and with the following additional requirements.

a) ~~Luminaires shall have sufficient mechanical resistance for the intended use. The mechanical properties shall be in accordance with intended purpose and installation location. To meet the requirement of mechanical resistance, the equipment shall withstand the respective shock and vibration conditions given in the Tables 3 and 4.~~

   The equipment shall withstand the design parameters for vibration according to IEC 60092-101.

b) Luminaires shall be designed, dimensioned and equipped with mounting devices in such a way that they will present no hazard to persons, in particular during operation and maintenance work.

c) The minimum degrees of IP protection in accordance with IEC 60529 required in the different environmental conditions related to locations are given in IEC 60092-201~~:1994, Table 5~~.

d) Luminaires shall be so constructed as to provide for adequate dissipation of heat from lamps and related components. The temperature rise of terminals for connection of supply cables shall not exceed 40 °C above ambient temperature. The insulation material of internal parts shall be of a temperature class which corresponds to the maximum temperature within the luminaires.

e) The temperature of surface parts which can be touched during operation shall not exceed 60 °C. If this is not possible, for example in case of floodlights or discharge lamps, these luminaires shall be mounted in a way that they cannot be reached without the use of additional facilities.

f) Luminaires shall be constructed in such a way that they can be easily cleaned inside, if applicable.

g) ~~Lamps~~ Lighting units shall be easily replaceable, if applicable.

h) Luminaires used in hazardous areas shall comply with the ~~relevant part of~~ IEC 60079 series according to the type of protection. ~~Hazardous spaces of ships can be e. g. paint stores and battery rooms where, depending on ventilation arrangement, luminaires may be required to comply with relevant parts of IEC 60079.~~

i) Special consideration ~~shall~~ should be given to the design of luminaires for installation in areas where the ambient temperature is ≥ +45 °C or ≤ –25 °C.

4.2.2 Materials

In general, the requirements according to IEC 60092-101 shall be met. With respect to durability and resistance to environmental conditions, luminaires and lighting accessories shall meet the requirements specified in Clause 7. The materials shall additionally comply with the following requirements.

a) The materials used for the luminaires and their mounting parts shall be non-toxic and flame retardant. See 7.2 for design parameters.

b) Parts which require surface protection shall be designed in a way that functional and operational safety is ensured.

c) Non-metallic external parts of luminaires, enclosures and attachments shall withstand the exposure to UV and visible radiation and shall be halogen-free.

~~d) External parts and housings of luminaires intended for outdoor installation shall be of metal.~~

d) If coating of the luminaires or parts or enclosures is necessary to achieve corrosion resistance, it shall be in accordance with EN 12206-1 in case of aluminium and aluminium alloy or in accordance with EN 13438 in case of steel.

e) Sulphur containing materials, for example for sealing purposes, shall not be used.

Tests for requirements a) and c) are stated in 7.2.3.

4.3 Electrical requirements

4.3.1 Electrical safety

Electrical safety shall be ensured by compliance with the tests specified in 7.3.

4.3.2 ~~Luminaires for use on IT power~~ Distribution systems

~~Luminaires intended to be operated on on-board power supply systems shall be designed in such a way that they may be operated on a power distribution system which is not earthed (IT-system). Switches in luminaires intended for use on IT-systems shall be bipolar. If fuses are included in the luminaire, they shall be installed in each line conductor.~~

The luminaires shall be capable of being operated on secondary distribution systems. The types of AC and DC distribution systems, nominal voltages and frequencies used on ships are specified in IEC 60092-201.

4.3.3 Electromagnetic compatibility

~~In general, the requirements stated in IEC 60533 shall be met. Luminaires specified for use in the bridge area and radio room shall meet the requirements stated in IEC 60945.~~

The requirements of IEC 60533 and IEC 62742 shall be met.

Requirements to harmonic distortion shall comply with IEC 61000-3-2.

NOTE 1 IEC 61000-3-2 is developed for low voltage grid. However, it can also be used for ship installations.

NOTE 2 There are no specific requirements to LED as the requirements are the same for all types of lighting equipment. The same is applicable for IEC 60533 which applies to all types of electrical/electronic equipment, including LED.

4.4 ~~Illumination technology~~ Photometric data

Photometric data in accordance with EN 13032-1 in general, and EN 13032-4 for LED, shall be provided by the manufacturer in electronic format suitable for further electronic design and calculation.

Lamps, luminaires and light systems shall be in accordance with IEC 62471:2006 and IEC TR 62778 risk group 0 and risk group 1. Risk groups 2 and 3 applications are acceptable under the condition that it is documented on board with safety instructions and operating instructions. Risk group 2 and 3 areas shall have markings with warning labels.

NOTE 1 For flashing lights and other intense pulsed light sources, IEC TR 62471-3 provides requirements.

NOTE 2 For image projectors, IEC 62471-5 provides requirements.

NOTE 3 LED lights can have a high blue light content and other high intense light spectra.

4.5 Environmental conditions

4.5.1 General

Luminaires shall be so designed as to withstand the applicable environmental influences during storage and ship's operation. The recommendations of IEC TR 60721-4-6 should be taken into account. Guidance for environmental testing can be found in IEC 60068-1. The tests shall be carried out in accordance with 7.2.

~~For environmental tests, the recommendations of IEC/TR 60721-4-6 should be taken into account.~~

4.5.2 Design parameters

For inclination, motion and vibration, the requirements and tests for general applications given in IEC 60092-504 shall be met.

4.6 Discharge lamp luminaires

4.6.1 General

The requirements for discharge lamp luminaires with voltages above 250 V, given in IEC 60092-201, apply.

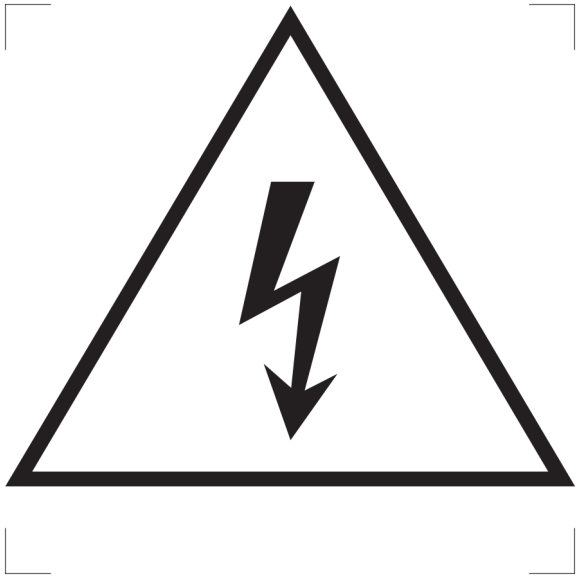
4.6.2 Special requirements ~~on discharge lamp luminaires~~

On discharge lamp luminaires, all ballasts, capacitors and other auxiliaries mounted separately from the luminaires shall be enclosed in an earthed metal casing.

Discharge lamps should be used only in fixed luminaires.

Discharge lamp installations shall be durably marked with the warning symbol given in ~~IEC 60598-1~~ Figure 1. The marking shall be of a suitable size.

~~Transformers should be located as close as possible to the luminaire installation but no more than 100 m apart from the luminaire's installation.~~



(IEC 60417-6042:2010-11)

Figure 1 – Warning symbol for discharge lamp installations

4.7 Component parts

Component parts of luminaires shall comply with their relevant standards and shall be in accordance with the requirements stated in 4.2 and the requirements stated in the documents given in Table 1.

Table 1 – Special requirements on component parts

Auxiliary, component, part	Requirement
Internal wiring, single core	Halogen-free, flame retardant and with low emission of smoke[a]
Starting devices (other than glow starters)	IEC 61347-2-1
Glow starters	IEC 60155
Devices for connection of luminaires (DCL)	IEC 61995-1 and IEC 61995-2
Cable glands	IEC 62444
[a] For details, see for example ~~HD 22.9 S2 [1] and HD 22.9 S2/A1 [2]~~ EN 50525-3-41 [1][2].	

4.8 Cables

Choice and installation of electrical cables ~~for external wiring~~ shall be carried out in accordance with IEC 60092-353, IEC 60092-360, IEC 60092-352 and IEC 60092-401, unless a specific requirement in this document is given.

4.9 Lampholders

Lampholders ~~allowed to be used in luminaires~~ shall comply with their relevant standard and shall be of a type listed in Table 2.

Lampholders shall be provided with effective means for locking the lamp in the holder.

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2 Figures in square brackets refer to the Bibliography.

Lampholders of different types have different ability to retain the lamp during vibration. The effectivity of this combination shall be checked together with the way of fixing the lamp holder in the luminaire during the tests in 7.2.3.

Table 2 – Standard types of lampholders

Lampholder for:	Designation	Maximum lamp ratings		
		Voltage V	Load power W	Current A
Screw cap lamps[a]	E40	250	3 000	16
	E39[e]	250	3 000	15
	E27	250	250	4
	E26[e]	300	200	6
	E14	250	60	2
Bayonet cap lamps[b]	B22	250	200	4
	B15d		250	4
	B15s	55	15	2
Tubular fluorescent lamps[c]	G13	250	115	–
	G5		80	–
	G24q		10 to 26	–
	GX24q		13 to 57	–
	GX24d		13 to 26	–
~~Tubular compact fluorescent lamps~~ [b]	~~G23~~	~~250~~	~~5 to 11~~	~~–~~
	~~2G7~~		~~5 to 11~~	~~–~~
	~~G24d~~		~~10 to 26~~	~~–~~
	~~G24q~~		~~10 to 26~~	~~–~~
	~~2G10~~		~~18 to 36~~	~~–~~
	~~2G11~~		~~18 to 55~~	~~–~~
	~~GX24q~~		~~13 to 57~~	~~–~~
	~~GX24d~~		~~13 to 26~~	~~–~~
Low voltage halogen lamps[d]	G4	12 and 24	5 to 20	–
	GU4	12	5 to 35	–
	GU5.3		10 to 50	–
	GY6.35		20 to 150	–
High voltage halogen lamps[d]	GU 10, GZ 10	250	35 to 50	–
	GY16[e]		2 000	20
	GY9.5[e]		1 000	20
	GX9.5[e]		650	20
	R7S		60 to 2 000	–
High intensity discharge lamps (HID)	E40[a]	750	1 000	–
	E27[a]		150	–
	RX7S[d]	1 000	400	–
	G38		400	
	Fc2[d]		400	
	G38[e]		3 000	40
	G8.5[d]	750	72	–

Lampholder for:	Designation	Maximum lamp ratings		
		Voltage V	Load power W	Current A
	G12[d]		150	–
	GY16[e]	500	2 000	20
	GY9.5[e]		650	10/20
Prefocus base lamp	P28s[e]	250	500	10

[a] In accordance with IEC 60238.

[b] In accordance with IEC 61184.

[c] In accordance with IEC 60400.

[d] In accordance with IEC 60838-1.

[e] These types are used in Japan only.

4.10 Marking

Marking shall be in accordance with the provisions stated in IEC 60598-1.

Luminaires shall be marked for easy identification.

The marking shall at least include the following data:

– type identification;
– manufacturer or manufacturer's reference;
– degree of protection;
– supply voltage;
– indication of each device belonging to the luminaires, for example mounting parts;
– type and number of lamp/s;
– rated power of lamp/s.

The marking shall be durable and not removable as well in hazardous areas.

The marking language shall be English or English and additional language/s.

5 Requirements on lighting accessories

5.1 General

Lighting accessories shall comply with the requirements of IEC 60598-1 and with the additional or divergent requirements included in this document. Insulated conductors shall be installed in a way that stress cannot be applied by the conductors to any terminal to which the conductors may be connected. Lighting accessories shall be so designed as to withstand the appropriate environmental influences during storage and ship's operation.

5.2 Materials

5.2.1 Enclosures

In general, the requirements on materials according to IEC 60092-101 shall be met.

Enclosures shall preferably be made of cast brass, bronze or iron, or of welded sheet steel with corrosion-resistant finish, or of corrosion-resistant light alloys, or of flame-retardant and halogen-free ~~insulating material~~ plastics.

5.2.2 Ceiling roses

Ceiling roses shall be made of flame-retardant, non-conducting and moisture-resistant material. Materials for ceiling roses shall pass the tests stated in Table 5 and the humid heat test stated in ~~Table 6~~ Table 3.

5.3 Automated lighting controllers

Controllers for emergency lighting shall be independent and separated from controllers for main lighting.

Systems for automatic or remote switching or dimming of lighting shall have the following functions.

a) Switching to appropriate light intensity in case of:
   1) loss of main power
   2) loss of emergency power (main power is available)
   3) release of fire alarm
   4) release of general alarm, and
   5) failure in the lighting control system (power failure, hardware failure, communication failure).
b) Failure of lighting control system shall send an alert signal to the bridge alert system.
c) There shall be a setting for minimum light intensity for the purpose of emergency lighting.

NOTE 5.3 is not intended for local dimming of lights, such as for mess rooms or cabins.

6 ~~Requirements on~~ Socket-outlets and plugs for the luminaires' connection

Generally, the requirements according to the IEC 60309 series apply.

Socket-outlets and plugs shall be dimensioned in a way that they meet the additional requirements specified in Clause 7 and the following ~~requirements~~.

a) The electrical clearances and creepage distances of socket-outlets and plugs not interlocked with switches shall be such that a short-circuit arc cannot be initiated. This requirement is valid for the plug being normally withdrawn from the socket-outlet, while a current 50 % higher than the rated current flowing at rated voltage.
b) Where socket-outlets with earthing contacts are required, the socket-outlets and plugs shall be provided with an additional contact for earthing the casing or frame of appliance. The earthing contact shall connect in advance of the live contact pins when inserting the plug.
c) Socket-outlets and plugs with a specified degree of protection shall be provided with effective means to maintain the same degree of protection after the plug is removed from the socket-outlet. Where a loose cover is used for this purpose, it shall be anchored to its socket-outlet, for example by means of a chain.

7 Tests

7.1 General

~~In addition to the tests in accordance with IEC 60598-1,~~ The luminaires shall pass the tests listed in IEC 60598-1, as modified by Clause 7, and its additional tests as shown.

If not stated otherwise, a visual inspection and operational test shall be carried out before and after each test. At least three luminaires of any type shall be tested, and any additional number of items shall be agreed upon. Unless stated or agreed upon otherwise, proof shall be furnished in the form of an inspection certificate.

If applicable, luminaires shall be tested with their dedicated lamp(s) and lighting accessories. Before testing, they shall be fitted (equipped) and mounted for operation. If necessary, for example in case of vibration and shock test, an appropriate mounting fixture shall be used.

The manufacturer shall maintain a quality assurance system in accordance with ISO 9001.

7.2 Environmental tests

7.2.1 Vibration exposure

The luminaires shall be fitted with the respective lamp, if applicable. The luminaires will have passed the test if they are fully functional and free of damage during and after the test.

The luminaires shall be subjected to vibration for the given duration in the direction of each axis of the x, y, z coordinate system given in Table 3.

Table 3 – Vibration exposure

Exposure	Test	Frequency change	Displacement amplitude	Acceleration	Duration	Frequency range
		Octave per min	mm	m/s^2	min	Hz
General vibration	In accordance with IEC 60068-2-6	≤1,0	±1,0	–	90	$2\ ^{+3}_{-0}$ to 13,2
			–	7,0		13,2 to 100

7.2.2 Shock exposure

If the luminaires shall be operated aboard a ship, usually no requirements as regards shock resistance apply. Exceptions shall be stipulated by the customer.

If shock requirements are stipulated, for example for luminaires to be operated aboard highspeed watercraft (HSC), the luminaires fitted for operation shall additionally be resistant to the stipulated number of shocks in both the positive and negative direction of each axis of the x, y, z coordinate system.

The test may be carried out in accordance with IEC 60068-2-27. The luminaires shall be fitted with the respective lamp, if applicable. The luminaires will have passed the test, if they are fully functional and free of damage during and after the test. For each test, the impulse duration and impulse form, acceleration and number of shocks per axis direction shall be stated. An example is given in Table 4. The given values are in accordance with IEC/TR 60721-4-6.

Table 4 – Shock exposure

Exposure	Test	Acceleration	Impulse form	Impulse duration	Number
		ms^{-2}		ms	per axis direction
Recommended shock	In accordance with IEC 60068-2-27	250	Half sine	6	100

7.2 Design parameters

7.2.1 Climatic exposure, operation

The luminaires shall be fitted with the respective lamp, if applicable, and operated at the specified operating voltage. The luminaires will have passed the test, if they are fully functional and free of damage during and after the test. Climatic conditions are given in Table 3.

Table 3 – Climatic conditions, operation

Exposure	Test	Requirement, remark
Cold	In accordance with IEC 60068-2-1, test Ad	Minimum temperature for outdoor luminaires: –25 °C Minimum temperature for indoor luminaires: 0 °C Test duration: 16 h
Dry heat	In accordance with IEC 60068-2-2, test ~~Bd~~ Be	Maximum temperature for outdoor luminaires: +70 °C Maximum temperature for indoor luminaires: +55 °C Test duration: 16 h
Damp heat	In accordance with ~~IEC 60068-2-78, Test Cab, steady state~~ IEC 60068-2-30, test Db, cyclic	Applicable only for indoor luminaires Temperature ~~40~~: 55 °C ± 2 °C Relative humidity value: ~~93~~ 95 $^{+2}_{-3}$ % Test duration: ~~48 h~~ two cycles (12 h + 12 h)
Salt mist	In accordance with IEC 60068-2-52, test Kb	Applicable only for outdoor luminaires Severity ~~degree~~ 1: 4 cycles of a 2 h spraying period followed by a 7 days storage duration at humid heat.

7.2.2 ~~Storage during~~ Climatic exposure, storage

~~Divergent from the requirements stated in 7.2.3~~ The test shall be carried out with the packaged luminaires and shall be regarded as passed~~,~~ if the luminaires are fully functional and free of damage after each test stated in Table 4.

Table 4 – ~~Exposure to~~ Climatic conditions, storage

Exposure	Test	Requirement, remark
Cold	In accordance with IEC 60068-2-1, test ~~Ae~~ Ab	Minimum temperature: –30 °C Test duration: 48 h
Dry heat	In accordance with IEC 60068-2-2, test ~~Be~~ Bb	Maximum temperature: +60 °C Test duration: 48 h
Humid heat	In accordance with IEC 60068-2-78, test Cab, steady state	Temperature: 40 °C ± 2 °C Relative humidity value: 93 $^{+2}_{-3}$ % Test duration: 4 days

7.2.3 Special chemical and physical attributes

The tests stated in Table 5 shall be performed and evaluated to confirm the required attributes given in 4.2.2 a) and c).

Table 5 – Special chemical and physical attributes ~~of non-metallic materials~~

Characteristic/test criterion	Test method	Test result
Halogen concentration	Amount of chlorine: For materials (e.g. housings, parts), in accordance with IEC 60684-2; for cables, in accordance with IEC 60754-1	Mass fractions: Chlorine ≤ 0,5 % Fluorine ≤ 0,1 %
	Amount of fluorine: For materials including cables, in accordance with IEC 60684-2	
UV resistance	In accordance with ISO 4892-3 or ISO 4892-2	No changes of surface or colour
Toxicity	In accordance with ~~Def. Stan. 02-713~~ IEC 60695-7-2	Toxicity index ≤ 5
~~Burning behaviour~~ Fire hazard	For materials of end-products ~~(e. g.~~ incorporating housings~~,~~ and parts~~)~~: in accordance with IEC 60695-2-11	In accordance with IEC 60695-2-11, temperature 850 °C
Flame spread	For cables: in accordance with IEC 60332-1-2	In accordance with IEC 60332-1-2:2004, Annex A

7.3 Electrical tests

7.3.1 High voltage test

~~The high voltage test shall be carried out before and after each environmental test. The requirements are stated in Table 8. Carrying out of the test procedure is described in IEC 60598-1.~~

The requirements shall be in accordance with IEC 60092-504 and as stated in Table 6. The duration of application of the test voltage shall be 1 min. Printed circuits with electronic components, for example LEDs, which could potentially be damaged should be removed during the test.

Table 6 – High voltage test

Rated voltage U_n V	Test voltage AC 50 Hz or 60 Hz V
Up to and including 65	2 × U_n + 500
66 up to and including 250	1 500
251 up to and including 500	2 000
501 up to and including 690	2 500
691 up to and including 1 000	3 000

Period of application of test voltage: 1 min.

7.3.2 Insulation resistance test

The measuring of the insulation resistance value shall be carried out before and after ~~each environmental test given in Table 3 and Table 5~~ high voltage test, damp heat test and cold test. The requirements are in accordance with IEC 60092-504 and stated in Table 7.

Table 7 – Insulation resistance test

Rated supply voltage U_n V	Test voltage U_n V	Minimum insulation resistance	
		Before test MΩ	After test MΩ
U_n ~~<~~≤ 65	2 × U_n min. 24	10	1~~,0~~
U_n > 65	500	100	10

~~**7.4 Coating thickness**~~

~~The coating thickness shall be at least 40 µm. The coating thickness shall be determined by manually operated measurement in accordance with ISO 2409. An equivalent test method (non-destructive method) in accordance with ISO 3882 is permissible. The manufacturer shall state which of the ISO test methods has been used. The test procedure is described in IEC 60598-1.~~

8 Packaging and marking

Packaging and marking shall be carried out as customary in the trade. The text on the packaging label shall at least correspond to the contents of the marking according to 4.10.

Annex A
(informative)

EMC considerations for system integrators

A.1 General

Annex A is informative, with the purpose to provide background for EMC for system integrators.

A.2 Background

Modern luminaires can possess a number of risks from EMC point of view that shall be considered in the selection process of these luminaires. For that reason, the requirements in one of the following documents should be met: IEC 60533, IEC 62742, IEC 60945. Luminaires intended for use in the bridge area and radio room or on the outer deck (near antenna/s) shall meet the requirements stated in IEC 60945. However, since it may not always be feasible to obtain lights compliant with either of these standards, it is acceptable to deviate from Clause A.2 as long as the EMC related risks are mitigated in the design process. Clauses A.3 and A.4 give additional requirements when deviation from the above-mentioned standards is required.

A.3 Immunity requirements

With respect to immunity requirements, it is acceptable to replace the standards listed in Clause A.2 by IEC 61000-6-2.

IEC 61547 may be used for lights below decks, although there is a higher risk that lights will fail when exposed to high field strengths from for example handheld transmitters of severe switching transients. If lights are applied complying with IEC 61547, instead of complying with the standards listed in Clause A.2, a documented risk assessment shall be carried out and made available to the ship owner. This risk assessment shall consider the risk of losing the required amount of light to safely navigate through the respective space. In this assessment, the following risks will be considered: transients and high field strengths.

A.4 Emission requirements

Some types of luminaires are known for their ability to interfere with wireless communication. Lights complying with the emission limits of IEC 61000-6-3 or CISPR 15 can be considered to be used on board in case the use of luminaires compliant with the standards listed in Clause A.2 is not feasible. However, since IEC 61000-6-3 or CISPR 15 do not consider the special requirements required to operate maritime radio communication, checks shall be performed to ensure that the luminaires do not increase the noise floor or reduce the operability of radio systems operating below 30 MHz or in the VHF band (156 MHz to 165 MHz). This shall be done by assessing the noise levels in the frequency bands in use by the ship with ship's antennas comparing the measurement results when the luminaires are switched on and off.

A.5 Harmonic distortion

Some types of luminaires can produce high levels of harmonic currents. Since these luminaires have a relative low power rating, their influence on the THD levels in the voltage on the supply grid is in general acceptable. However, if the load of a power supply (for example transformer, converter, etc.) primarily exists out of similar luminaires, this power source shall be derated to prevent temperature problems. The total THD levels in the voltage on dedicated power grids intended for luminaires only shall not exceed 8 % in accordance with IEC 61000-2-4, class 2.

Bibliography

~~HD 22.9 S2, *Rubber insulated cables of rated voltages up to and including 450/750 V – Part 9: Single core non-sheathed cables for fixed wiring having low emission of smoke and corrosive gases*~~

~~HD 22.9 S2/A1, *Rubber insulated cables of rated voltages up to and including 450/750 V – Part 9: Single core non-sheathed cables for fixed wiring having low emission of smoke and corrosive gases; Amendment A1*~~

[1] EN 50525-3-41, *Electric cables – Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U) – Part 3-41: Cables with special fire performance – Single core non-sheathed cables with halogen-free crosslinked insulation, and low emission of smoke*

[2] IEC 60092-502, *Electrical installations in ships – Part 502: Tankers – Special features*

[3] ISO 19009, *Small craft – Electric navigation lights – Performance of LED lights*

[4] ISO 17884, *Ships and marine technology – Searchlights for high-speed craft*

[5] ISO 25861, *Ships and marine technology – Navigation – Daylight signalling lamps*

[6] EN 14744, *Inland navigation vessels and sea-going vessels – Navigation light*

[7] IEC 60050-845, *International Electrotechnical Vocabulary (IEV) – Part 845: Lighting*, available at www.electropedia.org

[8] IEC TR 62471-3, *Photobiological safety of lamps and lamp systems – Part 3: Guidelines for the safe use of intense pulsed light source equipment on humans*

[9] IEC 62471-5, *Photobiological safety of lamps and lamp systems – Part 5: Image projectors*

[10] IEC 60068-1, *Environmental testing – Part 1: General and guidance*

[11] IEC 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*

[12] IEC TR 60721-4-6, *Classification of environmental conditions – Part 4-6: Guidance for the correlation and transformation of environmental condition classes of IEC 60721-3 to the environmental tests of IEC 60068 – Ship environment*

[13] IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments*

[14] IEC 61000-6-3, *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for equipment in residential environments*

[15] CISPR 15, *Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment*

[16] IEC 61547, *Equipment for general lighting purposes – EMC immunity requirements*

[17] IEC 61000-2-4, *Electromagnetic compatibility (EMC) – Part 2-4: Environment – Compatibility levels in industrial plants for low-frequency conducted disturbances*

IEC 60092-306

Edition 5.0 2022-10

INTERNATIONAL STANDARD

Electrical installations in ships –
Part 306: Equipment – Luminaires and lighting accessories

IEC 60092-306:2022-10(en)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTRICAL INSTALLATIONS IN SHIPS –

Part 306: Equipment – Luminaires and lighting accessories

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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IEC 60092-306 has been prepared by IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 2009. This edition constitutes a technical revision.

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

a) additional technical and environmental requirements have been included;
b) Table 2 "Standard types of lamp holders" has been amended;
c) Subclause 4.3.2 has been amended with a new title "Distribution systems" and a reference to IEC 60092-201 has been added;
d) environmental requirements and tests, especially regarding shock and vibration have been changed, and references to IEC 60092-101 and IEC 60092-504 have been added;
e) requirements on coating thickness have been deleted, material requirements in 4.2.2 being sufficient;

f) the high voltage test has been amended with regard to electronic parts.

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

Draft	Report on voting
18/1786/FDIS	18/1790/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 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 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.

INTRODUCTION

IEC 60092 (all parts) forms a series of international standards for electrical installations in sea-going ships, incorporating good practice and coordinating, as far as possible, existing rules.

These standards form a code of practical interpretation and amplification of the requirements of the International Convention for the Safety of Life at Sea, a guide for future regulations which may be prepared and a statement of practice for use by shipowners, shipbuilders and appropriate organizations.

ELECTRICAL INSTALLATIONS IN SHIPS –

Part 306: Equipment – Luminaires and lighting accessories

1 Scope

This part of IEC 60092 applies to luminaires and lighting accessories for use in ships. It applies primarily to luminaires for illumination purposes.

This document also applies to lighting accessories associated with the wiring and current consuming appliance of an installation.

This document does not apply to portable luminaires, navigation lights, search lights, daylight signalling lamps, signal lights including the relevant control and monitoring equipment and other lights used for navigation in channels, harbours, etc.

Annex A provides EMC considerations for system integrators.

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 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-30, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-52, *Environmental testing – Part 2-52: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60079 (all parts), *Explosive atmospheres*

IEC 60092-101, *Electrical installations in ships – Part 101: Definitions and general requirements*

IEC 60092-201, *Electrical installations in ships – Part 201: System design – General*

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

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

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 60092-504, *Electrical installations in ships – Part 504: Automation, control and instrumentation*

IEC 60155, *Glow-starters for fluorescent lamps*

IEC 60238, *Edison screw lampholders*

IEC 60309 (all parts), *Plugs, fixed or portable socket-outlets and appliance inlets for industrial purposes*

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 60400, *Lampholders for tubular fluorescent lamps and starterholders*

IEC 60417, *Graphical symbols for use on equipment, available at http://www.graphical-symbols.info/equipment*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60533, *Electrical and electronic installations in ships – Electromagnetic compatibility (EMC) – Ships with a metallic hull*

IEC 60598-1, *Luminaires – Part 1: General requirements and tests*

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

IEC 60695-7-2, *Fire hazard testing – Part 7-2: Toxicity of fire effluent – Summary and relevance of test methods*

IEC 60695-2-11, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products (GWEPT)*

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

IEC 60838-1, *Miscellaneous lampholders – Part 1: General requirements and tests*

IEC 60945, *Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results*

IEC 61184, *Bayonet lampholders*

IEC 61300-3-2, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-2: Examination and measurements – Polarization dependent loss in a single-mode fibre optic device*

IEC 61347-2-1, *Lamp controlgear – Part 2-1: Particular requirements for starting devices (other than glow starters)*

IEC 61995-1, *Devices for the connection of luminaires for household and similar purposes – Part 1: General requirements*

IEC 61995-2, *Devices for the connection of luminaires for household and similar purposes – Part 2: Standard sheets for DCL*

IEC 62444, *Cable glands for electrical installations*

IEC 62471:2006, *Photobiological safety of lamps and lamp systems*

IEC 62742, *Electrical and electronic installations in ships – Electromagnetic compatibility (EMC) – Ships with a non-metallic hull*

IEC TR 62778, *Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires*

ISO 4892-2, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps*

ISO 4892-3, *Plastics – Methods of exposure to laboratory light sources – Part 3: Fluorescent UV lamps*

EN 12206-1, *Paints and varnishes – Coating of aluminium and aluminium alloys for architectural purposes – Part 1: Coatings prepared from thermosetting coating powder*

EN 13032-1, *Light and lighting – Measurement and presentation of photometric data of lamps and luminaires – Part 1: Measurement and file format*

EN 13438, *Paints and varnishes – Powder organic coatings for hot dip galvanized or sherardised steel products for construction purposes*

EN 13032-4, *Light and lighting – Measurement and presentation of photometric data of lamps and luminaires – Part 4: LED lamps, modules and luminaires*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60598-1 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
luminaire
apparatus which distributes, filters or transforms the light transmitted from one or more lamps and which includes all the parts necessary for supporting, fixing and protecting the lamps, but not the lamps themselves, and where necessary, circuit auxiliaries together with the means for connecting them to the supply

[SOURCE: IEC 60598-1:2020, 1.2.1, modified – The note to entry has been deleted.]

3.2
lamp
electric light source provided with at least one cap

Note 1 to entry: For products that have the same physical characteristics as electric lamps for general lighting, but that are built to emit optical radiation mainly in the IR or UV spectrum, the term "IR lamp" or "UV lamp" is often used.

Note 2 to entry: This entry was numbered 845-07-03 in IEC 60050-845:1987.

[SOURCE: IEC 60050-845:2020, 845-27-008, modified – In the term, the word "electric" has been deleted, as well as the second note to entry.]

3.3
lighting accessories
additional parts which are needed for mounting or for electrical connection and which are usually delivered together with the luminaire

EXAMPLE Ceiling rose, cable gland, plug, socket-outlet, fixing material.

3.4
continuous operation
operation for an unlimited period without interruption within the specified environmental conditions without the specified limits of temperature being exceeded

4 Requirements on luminaires

4.1 General

Luminaires shall comply with the requirements of IEC 60598-1 and with the additional or divergent requirements included in this document. Luminaires in accordance with this document shall be suitable for continuous operation.

4.2 Mechanical requirements

4.2.1 Design

The design of luminaires shall comply with the requirements of IEC 60092-101 and with the following additional requirements.

a) The equipment shall withstand the design parameters for vibration according to IEC 60092-101.

b) Luminaires shall be designed, dimensioned and equipped with mounting devices in such a way that they will present no hazard to persons, in particular during operation and maintenance work.

c) The minimum degrees of IP protection in accordance with IEC 60529 required in the different environmental conditions related to locations are given in IEC 60092-201.

d) Luminaires shall be so constructed as to provide for adequate dissipation of heat from lamps and related components. The temperature rise of terminals for connection of supply cables shall not exceed 40 °C above ambient temperature. The insulation material of internal parts shall be of a temperature class which corresponds to the maximum temperature within the luminaires.

e) The temperature of surface parts which can be touched during operation shall not exceed 60 °C. If this is not possible, for example in case of floodlights or discharge lamps, these luminaires shall be mounted in a way that they cannot be reached without the use of additional facilities.

f) Luminaires shall be constructed in such a way that they can be easily cleaned inside, if applicable.

g) Lighting units shall be easily replaceable, if applicable.

h) Luminaires used in hazardous areas shall comply with the IEC 60079 series according to the type of protection.

i) Special consideration should be given to the design of luminaires for installation in areas where the ambient temperature is ≥ +45 °C or ≤ –25 °C.

4.2.2 Materials

In general, the requirements according to IEC 60092-101 shall be met. With respect to durability and resistance to environmental conditions, luminaires and lighting accessories shall meet the requirements specified in Clause 7. The materials shall additionally comply with the following requirements.

a) The materials used for the luminaires and their mounting parts shall be non-toxic and flame retardant. See 7.2 for design parameters.

b) Parts which require surface protection shall be designed in a way that functional and operational safety is ensured.

c) Non-metallic external parts of luminaires, enclosures and attachments shall withstand the exposure to UV and visible radiation and shall be halogen-free.

d) If coating of the luminaires or parts or enclosures is necessary to achieve corrosion resistance, it shall be in accordance with EN 12206-1 in case of aluminium and aluminium alloy or in accordance with EN 13438 in case of steel.

e) Sulphur containing materials, for example for sealing purposes, shall not be used.

Tests for requirements a) and c) are stated in 7.2.3.

4.3 Electrical requirements

4.3.1 Electrical safety

Electrical safety shall be ensured by compliance with the tests specified in 7.3.

4.3.2 Distribution systems

The luminaires shall be capable of being operated on secondary distribution systems. The types of AC and DC distribution systems, nominal voltages and frequencies used on ships are specified in IEC 60092-201.

4.3.3 Electromagnetic compatibility

The requirements of IEC 60533 and IEC 62742 shall be met.

Requirements to harmonic distortion shall comply with IEC 61000-3-2.

NOTE 1 IEC 61000-3-2 is developed for low voltage grid. However, it can also be used for ship installations.

NOTE 2 There are no specific requirements to LED as the requirements are the same for all types of lighting equipment. The same is applicable for IEC 60533 which applies to all types of electrical/electronic equipment, including LED.

4.4 Photometric data

Photometric data in accordance with EN 13032-1 in general, and EN 13032-4 for LED, shall be provided by the manufacturer in electronic format suitable for further electronic design and calculation.

Lamps, luminaires and light systems shall be in accordance with IEC 62471:2006 and IEC TR 62778 risk group 0 and risk group 1. Risk groups 2 and 3 applications are acceptable under the condition that it is documented on board with safety instructions and operating instructions. Risk group 2 and 3 areas shall have markings with warning labels.

NOTE 1 For flashing lights and other intense pulsed light sources, IEC TR 62471-3 provides requirements.

NOTE 2 For image projectors, IEC 62471-5 provides requirements.

NOTE 3 LED lights can have a high blue light content and other high intense light spectra.

4.5 Environmental conditions

4.5.1 General

Luminaires shall be so designed as to withstand the applicable environmental influences during storage and ship's operation. The recommendations of IEC TR 60721-4-6 should be taken into account. Guidance for environmental testing can be found in IEC 60068-1. The tests shall be carried out in accordance with 7.2.

4.5.2 Design parameters

For inclination, motion and vibration, the requirements and tests for general applications given in IEC 60092-504 shall be met.

4.6 Discharge lamp luminaires

4.6.1 General

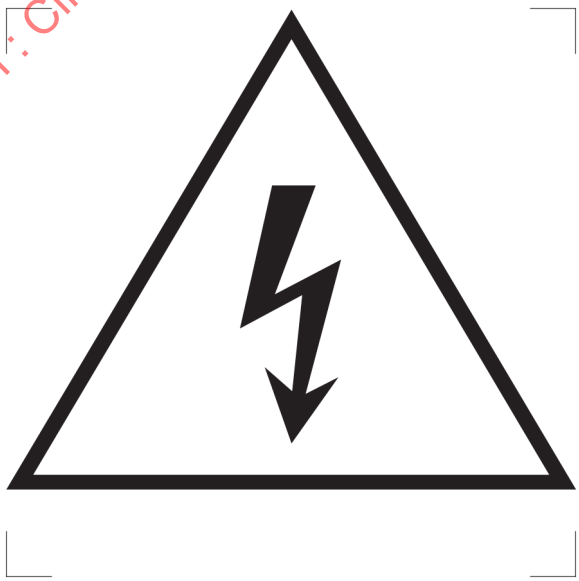
The requirements for discharge lamp luminaires with voltages above 250 V, given in IEC 60092-201, apply.

4.6.2 Special requirements

On discharge lamp luminaires, all ballasts, capacitors and other auxiliaries mounted separately from the luminaires shall be enclosed in an earthed metal casing.

Discharge lamps should be used only in fixed luminaires.

Discharge lamp installations shall be durably marked with the warning symbol given in Figure 1. The marking shall be of a suitable size.



(IEC 60417-6042:2010-11)

Figure 1 – Warning symbol for discharge lamp installations

4.7 Component parts

Component parts of luminaires shall comply with their relevant standards and shall be in accordance with the requirements stated in 4.2 and the requirements stated in the documents given in Table 1.

Table 1 – Special requirements on component parts

Auxiliary, component, part	Requirement
Internal wiring, single core	Halogen-free, flame retardant and with low emission of smoke[a]
Starting devices (other than glow starters)	IEC 61347-2-1
Glow starters	IEC 60155
Devices for connection of luminaires (DCL)	IEC 61995-1 and IEC 61995-2
Cable glands	IEC 62444
[a] For details, see for example EN 50525-3-41 [1][1].	

4.8 Cables

Choice and installation of electrical cables shall be carried out in accordance with IEC 60092-353, IEC 60092-360, IEC 60092-352 and IEC 60092-401, unless a specific requirement in this document is given.

4.9 Lampholders

Lampholders shall comply with their relevant standard and shall be of a type listed in Table 2.

Lampholders shall be provided with effective means for locking the lamp in the holder.

Lampholders of different types have different ability to retain the lamp during vibration. The effectivity of this combination shall be checked together with the way of fixing the lamp holder in the luminaire during the tests in 7.2.3.

Table 2 – Standard types of lampholders

Lampholder for:	Designation	Maximum lamp ratings		
		Voltage V	Load power W	Current A
Screw cap lamps[a]	E40	250	3 000	16
	E39[e]	250	3 000	15
	E27	250	250	4
	E26[e]	300	200	6
	E14	250	60	2
Bayonet cap lamps[b]	B22	250	200	4
	B15d		250	4
	B15s	55	15	2

[1] Figures in square brackets refer to the Bibliography.