
**Ships and marine technology — Low-
location lighting (LLL) on passenger
ships — Arrangement**

*Navires et technologie maritime — Éclairage situé en bas sur les
navires à passagers — Disposition*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 1, *Maritime safety*.

This third edition cancels and replaces the second edition (ISO 15370:2010), which has been technically revised.

The main changes compared to the previous edition are as follows:

- the Introduction has been clarified to better explain the purpose of the system;
- in [Clause 2](#), the normative references have been updated;
- in [Clause 3](#), definitions have been added, and some of the existing ones have been clarified;
- in [Clause 4](#), performance requirements for LLL system components have been reviewed and updated;
- in [Clause 6](#), clarification on how and where escape routes shall be marked by the LLL system has been made;
- in [6.5](#), further details have been provided for the LLL signage system for both arrangement and characteristics;
- in [Clause 8](#) and in [Annexes A, B, and E](#), maintenance and testing procedures have been clarified;
- in [Annexes F and G](#), the examples of installation have been reviewed; and
- in the Bibliography, the informative references have been updated.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is intended to supplement International Maritime Organization (IMO) requirements for low-location lighting used on passenger ships complying with the 1974 *Safety of Life at Sea Convention* (SOLAS 74), as amended.

The LLL system was made mandatory on passenger ships by IMO Resolution MSC.24(60), adopted on 10 April 1992, and by Resolution MSC.27(61), adopted on 11 December 1992, following the fire that occurred on the passenger ship *Scandinavian Star*, in 1990. Both resolutions require that the means of escape relevant to passenger and crew accommodation areas – including stairways and exits – be marked by lighting or phosphorescent strip indicators placed not more than 0,3 m above the deck. Following IMO Res. A.752(18), adopted on 4 November 1993, provided for relevant guidelines for its application.

The purpose of such a system is given by IMO resolutions A.752(18) and SOLAS regulation II-2/13.3.2.5: i.e. it shall enable passengers and crew to clearly identify the routes of escape and the relevant exits when the normal emergency lighting is less effective due to smoke.

This extensive revision of the standard has been prepared in order to provide more details and clarifications on the arrangement and performance of the LLL system so to better assist designers and manufacturers, as well as the representatives of the competent authority who are requested to verify the compliance of the on board system with this document.

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Ships and marine technology — Low-location lighting (LLL) on passenger ships — Arrangement

1 Scope

This document specifies the requirements for the approval, installation and maintenance of low-location lighting systems as defined in Chapter II-2, Regulation 13.3.2.5.1 of the *International Convention for the Safety of Life at Sea, 1974 (SOLAS 74)*, as amended in 2000, and detailed in Chapter 11 of the *International Code for Fire Safety Systems (FSS Code)*.

2 Normative references

The following referenced 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.

ISO 2919:2012, *Radiological protection — Sealed radioactive sources — General requirements and classification*

ISO 3795, *Road vehicles, and tractors and machinery for agriculture and forestry — Determination of burning behaviour of interior materials*

ISO 16069:2017, *Graphical symbols — Safety signs — Safety way guidance systems (SWGS)*

ISO 24409-1, *Ships and marine technology — Design, location and use of shipboard safety signs, fire control plan signs, safety notices and safety markings — Part 1: Design principles*

ISO 24409-2, *Ships and marine technology — Design, location, and use of shipboard safety signs, fire control plan signs, safety notices and safety markings — Part 2: Catalogue of shipboard safety signs and fire control plan signs*

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

IEC 60598-2-22, *Luminaires — Part 2-22: Particular requirements — Luminaires for emergency lighting*

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

IMO, *International Convention for the Safety of Life at Sea, 1974 (SOLAS 74)*, as amended

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

**3.1
accommodation spaces**

passenger and crew spaces used for public spaces, cabins, offices, hospitals, cinemas, lounges, barber shop, pantries containing no cooking appliances, corridors, toilets and similar spaces

Note 1 to entry: This definition is consistent with the one given by IMO SOLAS II-2/3.1.

**3.2
approval**

formal acceptance of the product and arrangement issued by the *competent authority* (3.4)

**3.3
assembly station**

distinct and designated internal or external space for mustering and marshalling passengers and crew arranged in the vicinity of, and permitting ready access for the passengers and crew to, the embarkation stations

Note 1 to entry: The assembly station can also be the embarkation station.

**3.4
competent authority**

administration whose flag the ship is entitled to fly, or an organization authorized by that administration to perform functions required by this document

**3.5
dead-end corridor**

corridor, or part of a corridor, whose depth is greater than its width, and from which there is only one *escape route* (3.7)

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**3.6
EP system**

electrically powered system ISO 15370:2021
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LLL system (3.12) that requires electrical power for its operation, such as systems using incandescent bulbs, light-emitting diodes, electroluminescent strips or lamps, electrofluorescent lamps, or other electrically powered light-emitting material

**3.7
escape route**

designated route, principally along corridors, stairways and through exits, by which people can be directed to an *assembly station* (3.3) and/or to a lifesaving appliances embarkation station

Note 1 to entry: The escape routes are shown on the approved escape plan.

**3.8
excitation**

effect of UV and visible light in the absorption spectrum that allows the materials to be activated and store energy

**3.9
exit**

egress along the *escape route* (3.7) that can lead into a safe space, or to another escape route, not affected by smoke

**3.10
fire-fighting equipment**

fixed or portable manually operated equipment that can be used to suppress fire

Note 1 to entry: Smoke detectors and fire-fighters' outfit are not part of the fire-fighting equipment for the purposes of this document.

EXAMPLE Fire hydrants and hoses, portable fire extinguishers.

3.11 installation plan

plan consisting of a ship's general arrangement showing the layout of the *LLL system* (3.12) using different kinds of lines, colours, and various symbols

3.12 LLL system low-location lighting system

electrically powered lighting or phosphorescent guidance lines or indicators and relevant *signs* (3.17) placed as continuous as practicable along the *escape routes* (3.7) relevant to passenger and crew *accommodation spaces* (3.1) to readily identify such routes when the normal or the emergency light is less effective due to smoke

3.13 luminance

luminous intensity per unit area of phosphorescent materials

Note 1 to entry: The luminance is measured in millicandelas per square metre.

3.14 maintenance

measures for the preservation and/or restoration of the original conditions of the technical elements of a system as well as all measures for the determination and evaluation of the actual conditions

3.15 PL system phosphorescent lighting system

LLL system (3.12) based on material incorporating phosphors that, if excited by UV or visible radiation, store energy that is emitted as light over a period of time

3.16 phosphorescent PL

photoluminescent delayed by storage of energy in an intermediate energy level

Note 1 to entry: SOLAS 74 (as amended), Chapter II-2, Regulation 13.3.2.5.1, uses the word "photoluminescent". In this document, the word phosphorescent is used in place of photoluminescent and should be considered synonymous for the purpose of applying this standard to SOLAS 74, as amended.

3.17 sign

safety sign used in conjunction with *LLL systems* (3.12), indicating the *escape routes* (3.7) to the *assembly stations* (3.3) and/or to embarkation stations, and the location of the *fire-fighting equipment* (3.10)

Note 1 to entry: These safety signs are defined in ISO 24409-1 and ISO 24409-2.

3.18 visible delineation

identification of the boundaries of the *escape route* (3.7) by a series of conspicuous, continuous lighting lines

4 Performance requirements

4.1 General

4.1.1 The competent authority shall ensure that LLL systems and their components meet the requirements set out in this document, as verified through the presentation of relevant documents issued by laboratories recognized by the competent authority.

4.1.2 The supplementary emergency lighting for ro-ro passenger ships required by Chapter II-1, Regulation 42-1 of SOLAS 74, as amended, may be accepted to form partly or wholly the LLL system, provided that such a system complies with the requirements of this document.

4.1.3 The LLL system consists of the following components: the guidance lines at low-location, the marking of exit doors, and the signs at low-location relevant to escape routes and fire-fighting equipment.

4.1.4 For EP systems, the colour of the line sources or point sources of light shall be green, white or yellow.

4.1.5 Escape route signs shall be placed adjacent to, or integrated in, the low-location guidance lines.

4.1.6 LLL guidance lines shall be as continuous as practicable in order to provide a visible delineation of the escape routes. Interruption of the LLL system due to constructional practicalities such as corridors, doors, small protrusions, as well as to the ship's plants and systems (ducts, cables, pipes, etc.), fixed furniture or artworks shall be permitted provided that they neither exceed 2 m in length nor impair the visible delineation of the escape route.

4.1.7 The LLL system shall function continuously for at least 60 min after its activation.

4.1.8 LLL products shall not contain radioactive materials unless such materials are designated "sealed radioactive materials" and are tested in accordance with ISO 2919. Materials containing radionuclides as given in ISO 2919:2012, Annex A, are considered sealed radioactive materials that should be tested in accordance with ISO 2919.

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4.2 Phosphorescent systems

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4.2.1 Phosphorescent (PL) materials shall provide a luminance of at least 15 mcd/m² measured 10 min after the removal of all external illuminating sources. The system shall continue to provide luminance values greater than 2 mcd/m² for 60 min. The luminance shall be measured at the surface of the materials.

4.2.2 For excitation from an 8 W tubular fluorescent lamp of standard F2 cool white with a colour temperature of 4 100 °K, [Annex A](#) specifies the method of test for determining the minimum illuminance, measured at the surface of the phosphorescent material, which would enable the phosphorescent material to meet the minimum luminance requirements at 10 min and 60 min. For a different excitation lamp and luminaire, the test procedure of [Annex A](#) can be used to determine the minimum illuminance for the particular lamp and luminaire.

4.2.3 PL guidance lines shall have a width of 75 mm or greater. PL guidance lines having a width less than 75 mm shall only be used if the luminance is increased to compensate for the reduced width in accordance with [Annex D](#).

4.2.4 Escape route signs shall have minimum height of 50 mm or the width of guidance line if greater, and be made of phosphorescent material, and use graphical symbols in accordance with ISO 24409-1 and ISO 24409-2.

A supplementary direction arrow graphical symbol cannot be used on its own; it shall be in combination with a safety sign (e.g. exit, lifeboat, assembly station, as given in ISO 24409-2).

4.2.5 PL materials shall be flame-retardant in accordance with ISO 3795 with the contact of 38 mm flame for 15 s and classified as F1.

4.2.6 [Annex A](#) specifies testing methods on phosphorescent low-location lighting materials.

4.3 Electrically powered systems

4.3.1 Electrically powered systems shall be connected to the emergency switchboard as required by Regulation II-1/42 of SOLAS 74, as amended, so as to be powered by the main source of electrical power under normal circumstances and also by the emergency source(s) of electrical power (as identified by Regulation II-1/42.3) when the latter is in operation. Alternatively, for passenger ships carrying more than 36 passengers and built before 1994-10-01, EP systems may be connected to the main lighting system so that independent batteries provide a backup of at least 60 min and are charged from the main lighting system.

4.3.2 The components of EP LLL systems can consist of planar light sources or point light sources or a combination of both.

4.3.3 The minimum luminance of planar line sources used for LLL guidance lines shall be 20 cd/m². The minimum width of the line source shall be 10 mm. The ratio of the maximum luminance to the minimum luminance along a line source shall not be greater than 2:1.

The 10 mm line width may be realized by two lines of 5 mm with a separation no greater than 1 mm.

Where the line source is horizontal bulkhead mounted, the perceived width of the line may be increased by sloping the horizontal line slightly out at its base so that it faces upwards and inwards towards the line of sight of an escapee. The minimum width of the line source shall remain 10 mm.

4.3.4 The luminance performance of the components of the LLL system, as described in 4.1.3, shall be the same as that of the guidance line.

4.3.5 Escape route signs made of electrically powered planar light sources shall use graphical symbols in accordance with Figure 1 of ISO 16069:2017, or with modified geometry if on the floor; see Figure 2 of ISO 16069:2017. The minimum height of the escape route sign shall be 30 mm. The minimum luminance of the green colour shall be 20 cd/m². The contrast colour shall be either white with a luminance at least five times greater than the luminance of the green colour, or be black.

4.3.6 The luminous intensity of point sources used for LLL guidance lines shall be not less than 30 mcd. The spacing between the point sources shall be no greater than 200 mm. The luminous intensity of a point source can be produced by a cluster of point sources. Where the line source is horizontal bulkhead mounted, the direction of peak intensity of the point light sources shall be pointing upwards and inwards towards the line of sight of an escapee.

4.3.7 Escape door frame marking shall be formed by continuation of the point source line. The luminous intensity of point sources used for door frame marking shall be 100 mcd or greater; the direction of peak intensity pointing normally into the corridor. The spacing between the point sources shall be no greater than 200 mm.

4.3.8 Escape route signs made of point sources can be used to outline the graphical symbol of the escape route signs in accordance with Figure 1 of ISO 16069:2017, or with a modified geometry if on the floor; see Figure 2 of ISO 16069:2017. The colour of the outlining point sources shall be green. The height of the graphical symbols shall be in accordance with 6.5.2. The maximum spacing between the point sources shall be 5 mm. The luminous intensity of every single point source used for the escape route sign shall be ≥ 100 mcd.

4.3.9 The power-supply arrangements to the EP system shall be arranged so that a single break in the cabling does not result in the system becoming ineffective. This can be achieved by using at least two battery power supplies in each single main vertical fire zone.

4.3.10 Entire systems, including those that are automatically activated, shall be capable of being manually activated by a single action either from the continuously manned central control station or from the safety centre.

4.3.11 EP systems shall meet the relevant requirements for emergency luminaires in accordance with IEC 60598-2-22 when tested at a reference temperature of 40 °C.

4.3.12 EP systems shall meet the requirements for vibration and electromagnetic interference in accordance with IEC 60945.

4.3.13 EP systems shall provide a minimum degree of ingress protection of at least IP 55 in accordance with IEC 60529.

4.3.14 EP materials shall be flame-retardant in accordance with IEC 60092-101.

4.3.15 The luminance of the EP materials shall be tested in accordance with [Annex E](#).

5 Technical product documentation

5.1 The technical product documentation for LLL systems shall comprise the following documents:

- installation plan, or plans, which should include the wiring layout and a general arrangement;
- list of items depicted in the legend on the installation plan;
- description of installation;
- material certificates;
- measurement reports of the installed system in accordance with [Annex C](#);
- measurement record; and
- maintenance requirements.

5.2 Approval documentation for PL materials shall include test data showing the type and minimum level of incident light that, when illuminated for 24 h, is required to charge the PL material to meet the required luminance specified in [4.2](#) or to meet the requirements for narrower width specified in [Annex D](#).

6 Installation on board

6.1 General

6.1.1 The LLL system shall be installed along the escape routes in accommodation spaces as described in the approved escape plan for movement to leave individual zones to exits, assembly stations and/or embarkation stations. Other accommodation spaces, unless forming part of the escape route described by the approved escape plan, are not considered as part of the escape routes.

6.1.2 To enhance the effectiveness of the LLL system to guide people to any exit, the arrangement shall be made such that people do not cross over LLL guidance lines. This applies particularly to door thresholds or across stairway landings. In order to provide for a continuous and visible delineation of the escape route along corridors, LLL guidance lines can be fitted on the deck at, or in way of, cabin door thresholds.