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**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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 15370 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 1, *Lifesaving and fire protection*.

This second edition cancels and replaces the first edition (ISO 15370:2001), which has been technically revised.

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## Introduction

This International Standard 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.

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

## 1 Scope

This International Standard 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 the IMO *International Code for Fire Safety Systems*.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3864-1:2002, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs in workplaces and public areas*

ISO 16069:2004, *Graphical symbols — Safety signs — Safety way guidance systems (SWGS)*

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

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 in 2000

## 3 Terms and definitions

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

### 3.1

#### approval

formal acceptance of the product and arrangement issued by the competent authority

### 3.2

#### assembly station

distinct, designated internal or external space for mustering passengers in the vicinity of, and permit ready access for the passengers to, the embarkation stations for survival craft unless in the same location as the embarkation station

**3.3  
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

**3.4  
competent authority**

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

**3.5  
dead-end corridor**

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

**3.6  
EP systems  
electrically powered systems**

LLL systems that require electrical power for their 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, constituted in general by corridors, lobbies and stairways, through which people are intended to move from an occupied space to the lifeboat and liferaft embarkation deck and/or to the assembly stations

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**3.8  
excitation**

effect of visible light in the appropriate spectrum which allows the materials to store energy

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**3.9  
installation plan**

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plan consisting of a ship's general arrangement showing the layout of the LLL system using different kinds of lines, colours, and various symbols, as appropriate

**3.10  
LLL systems  
low-location lighting systems**

electrically powered lighting or phosphorescent strips or indicators placed as continuous as practicable along the escape routes to readily identify such routes when the normal or emergency light is less effective due to smoke

**3.11  
PL system  
phosphorescent lighting system**

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

**3.12  
signs**

safety signs, as defined in ISO 3864-1, used in conjunction with LLL systems in corridors and stairwells, indicating the escape routes to the assembly stations or to the lifeboat embarkation stations, and the location of the fire-fighting equipment, such as fire hydrants, hoses, and fire extinguishers

**3.13  
visible delineation**

portrayal of the escape route by a series of continuous strips or indicators that can be clearly seen during egress



**3.14****normal condition**

internal ambient conditions of the ship when in service and not affected by a fire or smoke

**3.15****luminance**

luminous intensity per unit area of phosphorescent materials

NOTE The luminance is measured in millicandelas per square metre.

**3.16****luminescence**

emission, by atoms, molecules or ions in a material, of optical radiation that for certain wavelengths or regions of the spectrum is in excess of the radiation due to thermal emission from that material at the same temperature, as a result of these particles being excited by energy other than thermal agitation

**3.17****photoluminescence**

luminescence caused by absorption of optical radiation

**3.18****phosphorescence**

photoluminescence delayed by storage of energy in an intermediate energy level

NOTE SOLAS 74 (as amended), Chapter II-2, Regulation 13.3.2.5.1 uses the word “photoluminescent”. In this International Standard 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.

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**4 Performance requirements**

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**4.1 General**

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

**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 International Standard.

**4.1.3** The components of an LLL system comprise guidance lines at low-location, directional indicators, marking of the escape route doors and escape route signs.

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

**4.1.5** Escape route door frame marking shall comprise complete outlining of the door frame or vertical marking up to the height of the door opening device. The marking shall not be mounted on the door. The door frame marking shall be contiguous with the low-location line. See 6.3.3.

**4.1.6** Directional indicators shall be placed adjacent to or integrated in the low-location guidance lines.

**4.1.7** Interruption of the LLL system due to constructional practicalities (corridors, cabin doors, etc.) shall not exceed 1 m, with the exception described in 6.2.1.

**4.1.8** The LLL system shall function at all times for at least 60 min after its activation.

**4.1.9** LLL products shall not contain radioactive materials unless such materials are designated “sealed radioactive materials” tested in accordance with ISO 2919. However, materials containing radioactive radionuclides, as shown in ISO 2919:1999, Annex A, are considered as sealed radioactive materials which should be tested in accordance with ISO 2919.

**4.1.10** LLL systems shall not release toxic materials under normal conditions.

## 4.2 Phosphorescent systems

**4.2.1** Phosphorescent (PL) materials shall provide a luminance of at least 15 mcd/m<sup>2</sup> measured 10 min after the removal of all external illuminating sources. The system shall continue to provide luminance values greater than 2 mcd/m<sup>2</sup> 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 gives 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 strips should have a width of 75 mm or greater. PL strips 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 door frame marking of not less than 20 mm width shall be formed by continuation of the planar line source. The luminance performance of the phosphorescent material shall be the same as that of the guidance line.

**4.2.5** Directional indicators made of phosphorescent material shall use graphical symbols in accordance with Figure 1 of ISO 16069:2004 or with modified geometry if on the floor; see Figure 2 of ISO 16069:2004. The direction arrow graphical symbol can be used on its own. The minimum height of the directional indicator shall be 50 mm. The luminance performance of the phosphorescent material shall be the same as that of the guidance line.

**4.2.6** The minimum height of the exit sign, as defined by ISO 3864-1, shall be 50 mm. The luminance performance of the phosphorescent material shall be the same as that of the guidance line.

**NOTE** Symbols to be used on exit signs made of phosphorescent material will be specified in a future International Standard (ISO 24409-2).

**4.2.7** PL materials shall be flame-retardant in accordance with IEC 60092-101.

**4.2.8** PL materials shall be tested in accordance with Annex A.

## 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, provided independent batteries provide a backup of at least 60 min and are charged from the main lighting system. Performance of the system while powered by batteries shall meet all the requirements given in 4.3.

**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 luminance of planar line sources used for low-location lines shall be  $\geq 20$  cd/m<sup>2</sup>. 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** Escape door frame marking of not less than 20 mm width shall be formed by continuation of the planar line source. The luminance shall be the same as that of the guidance line.

**4.3.5** Directional indicators made of planar light sources shall use graphical symbols in accordance with Figure 1 of ISO 16069:2004 or with modified geometry if on the floor; see Figure 2 of ISO 16069:2004. The minimum height of the directional indicator shall be 30 mm. The minimum luminance of the green colour shall be 20 cd/m<sup>2</sup>. 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.

NOTE The black contrast colour automatically provides a contrast to the green colour.

**4.3.6** The luminous intensity of point sources used for low-location 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  $\geq 100$  mcd, the direction of peak intensity pointing normally into the corridor. The spacing between the point sources shall be  $\leq 200$  mm.

**4.3.8** Directional indicators made of point sources may be used to outline the graphical symbol of the directional indicators in accordance with Figure 1 of ISO 16069:2004, or with a modified geometry if on the floor; see Figure 2 of ISO 16069:2004. The direction arrow graphical symbol can be used on its own. 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 directional indicator shall be  $\geq 100$  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.

NOTE This requirement can be achieved by using at least two battery power supplies in each single main vertical fire zone or by using fire-resistant cables, in accordance with IEC 60331, from the emergency switchboard to the input of the LLL system.

**4.3.10** 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.

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

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

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

**4.3.14** Entire systems, including those that are automatically activated or continuously operating shall be capable of being manually activated by a single action either from the continuously manned central control station or from the safety centre. Deactivation of the system shall only be possible from the continuously manned central control station.

4.3.15 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, which should include the wiring layout and a general arrangement;
- list of items depicted in the installation plan;
- description of installation;
- maintenance specifications.

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 Positioning of the LLL system and of the relevant signs in corridors, lobbies and stairways shall be such that persons can readily identify all escape routes and exits. Therefore, LLL is not intended for installation in public spaces, cabins, offices, toilets, changing rooms, beauty salons, gym rooms and in similar enclosed accommodation spaces and along open deck escape routes.

6.1.2 To prevent escaping persons from having to cross LLL strips, lighting need not be fitted along thresholds or across stairway landings, except as prescribed in 6.4.3. In order to provide a continuous and visible delineation of the escape route, LLL strips can be fitted along door thresholds of cabin doors. However, LLL systems need not be fitted along escape routes relevant to small isolated accommodation spaces not normally manned or manned by not more than two persons, such as small offices in provision or galley areas; see Figure G.1.

6.1.3 Lobbies used to separate accommodation spaces from stairways, other accommodation spaces or open decks need not be marked by LLL systems; see Figure G.3.

6.1.4 When fitted on bulkheads, the arrangement shall be such that the fire boundary of divisions is not impaired.

NOTE This does not imply a requirement to test LLL arrangements to Annex 1, Part 5, of the IMO's FTP Code<sup>[11]</sup>, rather that the installation of the LLL arrangement through possibly cutting holes, removing/altering insulation, etc. on a deck or bulkhead forming part of a fire boundary does not have an impact on the effectiveness of that fire boundary.

6.1.5 LLL systems shall be fitted in accordance with the manufacturer's specification. When the LLL system is installed on decks, it shall be arranged in such a way that the LLL strips do not constitute a danger for the free circulation of people. Generally, LLL strips should be flush with the walking surface.

6.1.6 Combinations of PL and EP systems may be used. However, only one system shall be applied for each deck or stairway enclosure unless the deck or stairway enclosure is separated by normally closed doors or by doors which can be remotely closed in case of emergency; see Figure G.2 for an example. In addition, signs and directional indicators made of PL materials may be used with EP systems.

6.1.7 Escape routes in main vertical zones (MVZs) or watertight zones (WTZs) not containing accommodation spaces but that are adjacent to similar zones containing accommodation spaces and for which these constitute a means of escape need not be marked by LLL systems. When not adjacent to a WTZ or MVZ containing accommodation spaces, LLL shall be installed; see Figure G.4 for an example.