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# REVIEW AND, IF NECESSARY, AMENDMENT OF SOLAS REGULATIONS II-2/13.4.1.1 AND 13.4.2.1 TO CLARIFY THE REQUIREMENTS ON ESCAPE ARRANGEMENTS FROM THE LOWER PART OF MACHINERY SPACES

## Consideration of positive safety experience with the application of SOLAS regulations II-2/13.4.1.1 and 13.4.2.1

**Submitted by Marshall Islands, Türkiye, Republic of Korea, United Kingdom and IACS**

**SUMMARY**

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| *Executive summary:* | This document provides information on the approach to approval of arrangements in accordance with SOLAS regulations II-2/13.4.1.1 and 13.4.2.1, and their safe use over more than four decades. The document proposes that, in the absence of clear evidence of safety concerns, the regulations need not be revised. |
| *Strategic direction, if applicable:* | 7 |
| *Output:* | 7.33 |
| *Action to be taken:* | Paragraph 26 |
| *Related documents:* | SDC 11/10/3; MSC 110/11/2, MSC 110/21; SDC 12/INF.19 and SDC 12/INF.20 |


## Introduction

1 MSC 110, following consideration of experiences reported by some SOLAS Contracting Governments and international organizations, noted the existence and impact of divergence in the interpretations of SOLAS regulations II-2/13.4.1 and 13.4.2, in particular in the context of port State control (PSC) inspections, regarding the term "lower part" used in connection with the means of escape from spaces below the bulkhead deck for passenger ships, and from machinery spaces of category A for cargo ships (MSC.1/Circ.1689).

2 MSC 110 considered the report of SDC 11 which had confirmed that the term "lower part of the space" should be regarded as either the lowest deck level or a platform or passageway (SDC 11/17, paragraph 10.18).

3 As a short-term solution, MSC 110 approved MSC.1/Circ.1689 on *Escape arrangements from the lower part of machinery spaces*. In addition, as a long-term solution, a new output on "Review and, if necessary, amendment of SOLAS regulations II-2/13.4.1.1 and 13.4.2.1 to clarify the requirements on escape arrangements from the lower part of machinery spaces" was agreed.

4 MSC 110 agreed that the output envisaged the consideration by the SDC Sub-Committee of submissions addressing any safety concerns with the regulations and how they had been applied, and invited interested delegations to make substantive submissions to SDC 12 (MSC 110/21, paragraph 11.27 and 11.28).

**Background**

5 SOLAS regulation II-2/13.4.1.1 for passenger ships and regulation II-2/13.4.2.1 for cargo ships require each machinery space to have two widely separated means of escape. One of those means shall consist of a steel ladder leading to a door in the upper part of the space, and the other means shall either:

.1 be located within a protected enclosure; or

.2 consist of a steel door which provides access to a safe escape route outside the machinery space.

This document addresses the arrangement in sub-paragraph 5.1 where one of the means is located within a protected enclosure, commonly referred to as an "escape trunk".

6 SOLAS regulations II-2/13.4.1.1.1 and 13.4.2.1.1 require one of the two means of escape from machinery spaces to be located inside a protected enclosure from the lower part of the space, without the term "lower part of the space" being defined in the regulations.

7 MSC.1/Circ.1511/Rev.1 on *Unified interpretations of SOLAS regulations II-2/9 and 13*, originally approved by MSC 95 in 2015, provides guidance by clarifying that the term "lower part of the space" should be regarded as the lowest deck level, platform or passageway. This interpretation was reaffirmed by SDC 11 which confirmed that either the lowest deck level or a platform or passageway should be regarded as the "lower part of the space".

**Discussion**

***Wide separation of escape alternatives***

8 SOLAS regulations II-2/13.4.1.1.1 and 13.4.2.1.1 require "two sets of steel ladders, as widely separated as possible, leading to doors in the upper part of the space similarly separated…". One of these ladders is the emergency escape trunk and the other is the inclined stairs located inside the engine-room used for day-to-day access to the engine-room.

9 The wide separation of escape alternatives is particularly important in large engine-room spaces, where machinery and other ignition sources are present. In the event of a fire or flooding, access to one of the escape routes may be obstructed, creating challenges for the escaping personnel, such as poor visibility and compromised air quality. To ensure safe evacuation under such conditions, it is essential that the two required means of escape are positioned as far apart as practicable.

***Machinery space arrangements***

10 The forward section of the engine-room typically contains the main engine fore end where key components such as the cylinder heads, fuel injection systems and turbochargers are located. This part of the main engine, together with auxiliary machinery areas, represents a higher fire risk due to the concentrated heat sources, fuel systems and lubrication systems.

11 Statistics[1] indicate that most fires in machinery spaces originate from fuel leaks or sprays from the fuel piping system, particularly when flammable fuel comes into contact with hot surfaces near engines or exhaust components. Such fires are often caused by failures in fuel injection systems, inadequate insulation or insufficient protection of exhaust systems.

12 The aft section of the engine-room typically accommodates essential centerline equipment including stern tubes/shaft bearings, propeller shafts, CPP hydraulic/seal systems and shaft tunnels.

***Escape route configurations***

13 To achieve the required wide separation of escape routes, the following configurations are typically applied:

.1 aft and forward of the engine-room;

.2 port and starboard of the engine-room; or

.3 combination of paragraphs 13.1 and 13.2, e.g. aft and on one side of the engine-room.

14 The inclined ladders used for day-to-day access to the engine-room are often located forward, due to the structure and space required for these inclined ladders and the necessity for readily available access to accommodation areas.

15 The aft section of the engine-room, typically located above the shaft tunnel and forward of the steering gear compartment, provides maximum physical distance from primary ignition sources, thus enabling safer evacuation routes during fire incidents. The area above the shaft tunnel may also provide horizontal distance and compartment separation between forward and aft escape routes.

16 A case study[2] presented to the fourth session of the III Sub-Committee indicates that engine-rooms can fill with dense smoke within approximately four minutes after fire alarm activation. As visibility, temperature and toxic gas concentrations rapidly deteriorate, an emergency escape trunk installed in the aft section provides an evacuation route physically separated from the main ignition sources, thereby enhancing survival probability.

***Vertical extent of the escape trunk***

17 The hull form and presence of large equipment may impose constraints on the downward extension of the emergency escape trunk. The extent of the trunk should also be considered towards maintenance aspects, such as maintenance removal (shaft withdrawal) and shaft alignment accessibility, in addition to access for firefighting.

18 In essence, structural or technical limitations may affect the vertical extent of the escape trunk, as follows:

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1 USCG - Report of the Investigation into the Passenger Vessel SANDY GROUND (O.N. 1299657) Engine Room Fire in Upper New York Bay on December 22, 2022 (dco.uscg.mil)
GARD - Engine-room fires are still a major concern, February 2025 (gard.no)
DNV - Engine-room fires - causes, contributors and preventive measures, December 2023 (dnv.com)

2 III 4/15 (Canada), annex 1, Lessons learned from marine casualties (wwwcdn.imo.org)

.1 insufficient space due to any restrictions, e.g. ship's hull lines (see figure 1, below), side shell stiffening, structural design arrangements;

.2 equipment or machinery being in the way, e.g. shaft or stern seal equipment; and,

.3 maintenance envelope or access required to maintain equipment or withdraw shafts.

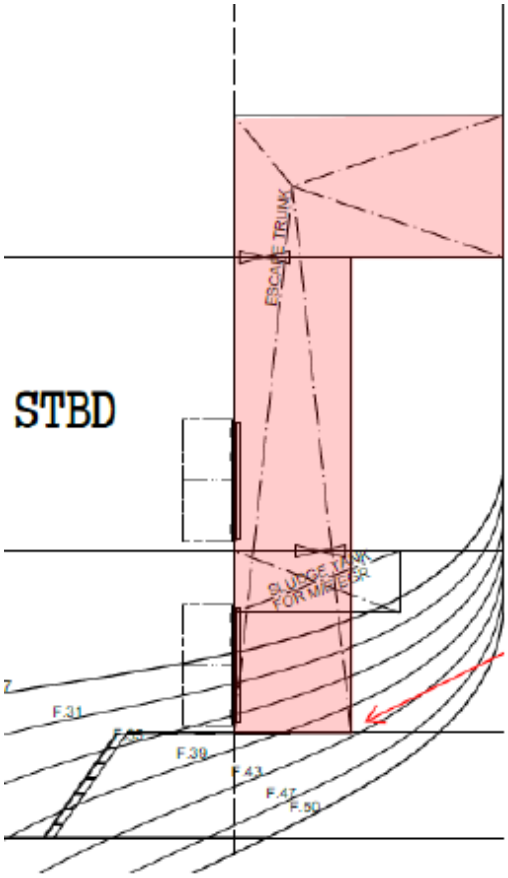


**Figure 1: Example of typical practical constrains or limitations in the lower part of the space**

19 These structural or technical limitations are, however, not new; it is reasonable to assume that they were present and taken into consideration as early as 1981, when the requirement for the escape trunk to extend from the "lower part of the space" was introduced in SOLAS regulations II-2/28.3.1.1.1 and II-2/45.3.1 of the 1981 Amendments to SOLAS.

20 Industry practice involves using an inclined ladder from the lowest deck level of the engine-room to a platform above the deck, providing direct access to the escape trunk. This arrangement is often necessary due to the hull shape, structural elements and technical installations which prevent the escape trunk from extending to the lowest deck level of the engine-room. This is in line with MSC.1/Circ.1511/Rev.1, which also addresses inclined ladders/stairways in machinery spaces being part of, or providing access to, escape routes, but not located within a protected enclosure.

***Absence of documented safety concerns***

21 Document SDC 12/INF.19 (IACS) provides a comparison of the calculated evacuation travel time in accordance with the *Revised Guidelines on evacuation analysis for new and existing passenger ships* (MSC.1/Circ.1533). While the guidelines are strictly applicable to passenger ships, the methodology has been used to indicate the relative time equivalent. The calculations indicate that an emergency escape trunk which does not extend to the lowest deck level provides equivalent or shorter evacuation times to a safe location than an escape trunk extending to the lowest deck level.

22 Document SDC 12/INF.20 (IACS) provides a series of computational fluid dynamics (CFD) analysis simulating various fire scenarios, and associated smoke dispersion, in the engine-room of a container ship. The analysis did not identify any measurable impact of an emergency escape trunk with inclined ladder on the crew's ability to evacuate safely and swiftly during a fire, i.e.:

.1 no safety issues have been identified for emergency escape trunks with access doors located above the lowest deck level, as compared to escape trunks leading to the lowest deck; and

.2 in an emergency situation, the time required to reach an elevated escape trunk door via an inclined ladder does not account for a significant portion of the overall evacuation time.

23 The co-sponsors note that SOLAS regulations II-2/13.4.1 and 13.4.2 have been in existence since 1981, i.e. for 44 years. Over those years, thousands of ships have been built with the arrangements discussed in this document and successfully operated. Over the course of those 44 years, the Committee considered the text of the regulation on two occasions. The first time with the 2000 revision of chapter II-2 and next with 2014 amendments to the same regulation, with no issues raised or suggestions of amendments to the phrase "lower part of the space".

24 It is noted that requiring the entrance of the escape trunk to extend to the lowest deck level could, for some designs, compromise the requirement to widely separate escape routes. Reducing the separation of the escape routes is considered to have far more impact on safety than accessing the entrance to the escape trunk by means of an inclined ladder.

**Proposal**

25 The co-sponsors have not identified any evidence of safety concerns with SOLAS regulations II-2/13.4.1.1 and 13.4.2.1 and with the application of these requirements. On the contrary, as outlined in paragraphs 8 to 24 above, these arrangements have been approved and implemented safely over several decades. Based on these detailed considerations, the co-sponsors propose that, in the absence of clear evidence of safety concerns, SOLAS regulations need not be revised.

**Action requested of the Sub-Committee**

26 The Sub-Committee is invited to consider the foregoing, the conclusion and proposal in paragraph 25 and to take action, as appropriate.