Subject

Summary of the Outcomes of MSC 108

ClassNK
Technical Information

No. TEC-1335
Date 8 November 2024

To whom it may concern

The 108th session of the Maritime Safety Committee (MSC 108) was held from 15 to 24 May 2024. Since the minutes, resolutions and circulars of the meeting were recently released from the IMO, a summary of the decisions taken at MSC 108 is provided below for your information.

1. Adopted mandatory requirements
   Mandatory requirements adopted at MSC 108 are as follows:

   (1) Amendments to SOLAS regulation II-1/3-4 (See attachment 1)
   Amendments to SOLAS regulation II-1/3-4 to require emergency towing arrangements on ships, other than tankers, of not less than 20,000GT were adopted. In addition, guidelines specifying specific requirements for the arrangement are under consideration by the Sub-Committee on Ship Design and Construction (SDC) with a target completion in 2025.

   Applied: ships the keels of which are laid or which are at a similar stage of construction on or after 1 January 2028.

   (2) Amendments to IGF Code (See attachment 3, 11)
   Amendments to IGF Code regarding redundancy of pressure relief valves for liquefied gas fuel tanks, etc. were adopted as a part of the task for amendments to the IGF Code and development of guidelines for alternative fuels and related technologies. In addition, the MSC circular to invite a voluntary early implementation of 4.2.2, 8.4.1 through 8.4.3 of the amendments was also released.

   Applied: ships that fall under the following:
   1. for which the building contract is placed on or after 1 January 2026;
   2. in the absence of a building contract, the keels of which are laid or which are at a similar stage of construction on or after 1 July 2026; or
   3. the delivery of which is on or after 1 January 2030.

   However, the following requirements apply also to existing ships;

(To be continued)

1. An emergency release system (ERS) or equivalent means shall be provided for bunkering manifold, unless installed on the bunkering supply side of the bunkering line. In cases where connections other than a dry-disconnect/connect coupling are used, a bunkering arrangement risk assessment are required, and the fuel handling manual shall include documentation that special consideration was granted under 8.4.2 of IGF Code (4.2.2, 8.4.1 through 8.4.3) ;
2. The portable dry powder extinguisher of at least 5 kg capacity shall be provided in the fuel preparation room not later than the first survey on or after 1 January 2026. (11.6.2); and
3. Regarding the written agreement on bunkering transfer procedures, items such as transfer pressure and temperature are added (18.4.1).

(3) Amendments to International Code for the Safe Carriage of Grain in Bulk (Grain Code) (resolution MSC.23(59)) (See attachment 4)
Amendments to Grain Code, to add new loading condition of specially suitable compartments, partly filled in way of the hatch opening, with ends untrimmed, were adopted.

Applied: on or after 1 January 2026.

(4) Amendments to LSA Code (See attachment 6)
The following amendments to LSA Code and recommendation on testing of life-saving appliances (resolution MSC.81(70)) were adopted;

1. In-water performance requirement for lifejackets;
2. Requirements for single fall and hook systems with on-load release capability which is used for lifeboat launched by a fall or falls, except a free-fall lifeboat; and
3. Requirements for lifeboats to limit the minimum and maximum lowering speed of fully loaded survival craft and rescue boats.

Applied: life-saving appliances installed on or after 1 January 2026 means:

1. for ships for which the building contract is placed on or after 1 January 2026, or in the absence of the contract, the keels of which are laid or which are at a similar stage of construction on or after 1 January 2026, all installations of the specified type on board those ships; or
2. for ships other than those ships specified in 1. above, all installations of the specified type, having a contractual delivery date for the equipment or, in the absence of a contractual delivery date to the ship, actually delivered to the ship on or after 1 January 2026

(5) Amendments to SOLAS chapter II-2 and FSS Code (See attachment 2, 7)
The following amendments to SOLAS chapter II-2 and FSS Code on fire safety of ro-ro passenger ships, etc. were adopted;

1. Fire safety requirements on new/existing ro-ro passenger ships mainly shown as below;
   - Fixed fire detection and fire alarm systems;

(To be continued)

- Video monitoring in ro-ro spaces;
- Arrangement of openings in ro-ro and special category spaces;
- Arrangement of weather decks;
- Water monitors for protection of weather deck;
- Linear heat detectors; and
- Visual and audible fire signals

2. Amendments to SOLAS regulation II-2/7.5.5 concerning fire detection within control stations and cargo control rooms of cargo ships.

Applied: ships the keels of which are laid or which are at a similar stage of construction on or after 1 January 2026.
However, the following requirements apply also to existing passenger ships not later than the first survey on or after 1 January 2028;
1. a fixed fire detection and fire alarm system (20.4.1.6);
2. video monitoring in ro-ro spaces (20.4.4); and
3. a fixed water-based fire-extinguishing system based on monitor(s) in order to protect areas on weather decks intended for the carriage of vehicles (20.6.2.3).

2. Approved mandatory requirements
The following mandatory requirements were approved at this session and are expected to be adopted at MSC 109 to be held in December 2024.

(1) Amendments to IGF Code (See attachment 9)
Amendments to IGF Code regarding minimum distance from bottom for suction well, etc. were approved as a part of the task for amendments to the IGF Code and development of guidelines for alternative fuels and related technologies.

(2) Amendments to IGC Code (See attachment 10)
Amendments to the IGC Code to make cargos identified as toxic products conditionally usable as fuel, in view of the launch of ammonia-fueled vessels. It was also agreed that this amendment would be effective 18 months after adoption by MSC 109 and to invite a voluntary early implementation at that time.

3. Approved unified interpretations, etc.
The following unified interpretations (UIs), guidelines, guidance and etc. were approved during MSC 108.

3.1 Unified interpretations
(1) Amendments to unified interpretations of SOLAS chapters II-1 and XII, of the technical provisions for means of access for inspections (resolution MSC.158(78)) and of the performance standards for water level detectors on bulk carriers and single hold cargo ships other than bulk carriers (resolution MSC.188(79)) (MSC.1/Circ.1572/Rev.1) (See attachment 17)

(To be continued)

Amendments to unified interpretation to;

1. clarify the intervals and records for permanent means of access; and
2. amended title and application to meet the revised performance standards for water level detectors on ships subject to SOLAS regulations II-1/25, II-1/25-1 and XII/12 as well as bulk carrier (Resolution MSC. 188 (79)/Rev.2).

(2) Unified interpretation of SOLAS regulation XV/5.1 and paragraph 3.5 of part 1 of the International Code of Safety for Ships Carrying Industrial Personnel (IP Code) on the harmonization of the Industrial Personnel Safety Certificate with SOLAS safety certificates (See attachment 13)
Unified interpretation of SOLAS regulation XV/5.1 and paragraph 3.5 of part 1 of the IP Code to harmonize the Industrial Personnel Safety Certificate with various SOLAS safety certificates, in terms of their validity or date of endorsement

(3) Unified interpretation of Code on noise levels on board ships (See attachment 15)
Unified interpretation of section 2.1 and 2.2 of the Code to clarify requirements for the calibration of the sound level meter and its field calibrator.

(4) Amendments to unified interpretations of SOLAS regulations II-2/9 and II-2/13 (MSC.1/Circ.1511) (See attachment 16)
Amendments to unified interpretations of SOLAS regulations II-2/9 and II-2/13 (MSC.1/Circ.1511) to include steering gear spaces as "safe position" for the purpose of escape from the lower part of machinery spaces through a continuous fire shelter.

3.2 Guidelines and guidance etc.

(1) Amendments to revised guidelines on the application of high manganese austenitic steel for cryogenic service (MSC.1/Circ.1599/Rev.2) (See attachment 18)
Amendments to revised guidelines on the application of high manganese austenitic steel for cryogenic service (MSC.1/Circ.1599/Rev.2) to qualify high manganese austenitic steel for ammonia service and to add compatibility test requirements for ammonia service.

(2) Amendments to revised guidelines for the acceptance of alternative metallic materials for cryogenic service in ships carrying liquefied gases in bulk and ships using gases or other low-flashpoint fuels (MSC.1/Circ.1622) (See attachment 19)
Amendments to revised guidelines for the acceptance of alternative metallic materials for cryogenic service in ships carrying liquefied gases in bulk and ships using gases or other low-flashpoint fuels (MSC.1/Circ.1622) to add compatibility test requirements for ammonia service.

(3) Interim guidelines for use of LPG cargo as fuel (See attachment 12)
Interim guidelines for use of LPG cargo as fuel, as a part of the task for amendments to the IGF Code and development of guidelines for alternative fuels and related technologies.

(To be continued)

(4) Revised interim recommendations for carriage of liquefied hydrogen in bulk (resolution MSC.420(97)) (See attachment 8)
Revised interim recommendations for carriage of liquefied hydrogen in bulk, including the addition of cargo containment systems of independent cargo tanks using insulation materials and hydrogen gas in the inner insulation spaces.

(5) Amendments to revised guidelines on alternative design and arrangements for SOLAS chapters II-1 and III (MSC.1/Circ.1212/Rev.1) (See attachment 14)
Amendments to revised guidelines on alternative design and arrangements for SOLAS chapters II-1 and III (MSC.1/Circ.1212/Rev.1) to add the goals, functional requirements and expected performance criteria for alternative design and arrangements for SOLAS chapter II-1, Part C, D and E.

(6) Guidelines for the sampling of fuel oil for determination of compliance with MARPOL Annex VI and SOLAS Chapter II-2 (See attachment 20)
Guidelines for taking fuel oil samples during bunkering in order to establish a unified sampling regime under both the SOLAS and MARPOL Conventions.

4. Consideration of requirements for Maritime Autonomous Surface Ships (MASS)
In the recent development of MASS, it has been discussed at MSC on an international instrument of MASS (MASS Code).
At this session, based on the report of the Correspondence Group and the outcome of the meeting by the Joint Working Group 3 (JWG3), non-mandatory MASS Code mainly on goal and functional requirements for items such as safety, operation, security, etc. has been considered. As a result, it was agreed to establish a Correspondence Group, and hold an Intersessional Working Group meeting in September 2024 to proceed the work on development of the non-mandatory MASS Code. As a future work plan, it was agreed to finalize and adopt the non-mandatory MASS Code at MSC 110 scheduled to be held in June 2025, thereafter, to proceed the development of a mandatory MASS Code with a view to adoption by 2030(entry into force on 1 January 2032).

5. A safety regulatory framework to support the reduction of GHG emissions from ships using new technologies and alternative fuels
At the previous session, identification and updating a list of new technologies and alternative fuels to reduce greenhouse gas (GHG) emissions and their technical assessment, as well as a review of safety obstacles and gaps in the current IMO instruments that may impede the use of the alternative fuel or new technology, were initiated.
At this session, based on the report by the correspondence group, the work to update the list of new technologies and alternative fuels was progressed by the related working group, and it was decided that a correspondence group would continue to be established and work would proceed.

(To be continued)

6. Cyber risk management

In view of the growing importance of cyber security on board ships and the need for security risk countermeasures, the non-mandatory resolution MSC.428(98) on cyber risk management in the Safety Management System (SMS) has been developed. Additionally, the Guidelines on Maritime Cyber Risk Management (MSC-FAL.1/Circ.3/Rev.2) have been developed as a practical reference guidance for this Resolution.

At the previous session, it was agreed to carry out a review of the Guidelines in light of the increased use of cyber-connected systems in recent years.

At this session, a draft amendment to the Guidelines were approved that adds more maritime-specific functional requirements to be considered from organization, people, process and technological aspects based on the widely-recognized international and industry standards. The draft amendment to the guidelines will be approved by subsequent Facilitation Committee (FAL) and published as an MSC-FAL Circular.

For any questions about the above, please contact:

NIPPON KAIJI KYOKAI (ClassNK)
External Affairs Department, Administration Center Annex, Head Office
Address: 3-3 Kioi-cho, Chiyoda-ku, Tokyo 102-0094, Japan
Tel.: +81-3-5226-2038
Fax: +81-3-5226-2734
E-mail: xad@classnk.or.jp

(To be continued)

Attachment:

1. RESOLUTION MSC.549(108)
2. RESOLUTION MSC.550(108)
3. RESOLUTION MSC.551(108)
4. RESOLUTION MSC.552(108)
5. RESOLUTION MSC.553(108)
6. RESOLUTION MSC.554(108)
7. RESOLUTION MSC.555(108)
8. RESOLUTION MSC.565(108)
9. DRAFT AMENDMENTS TO THE IGF CODE
10. DRAFT AMENDMENTS TO THE IGC CODE
11. MSC.1/Circ.1677 Voluntary early implementation of the amendments to paragraphs 4.2.2 and 8.4.1 to 8.4.3 of the IGF code, adopted by resolution MSC.551(108)
12. MSC.1/Circ.1679 Interim guidelines for use of LPG cargo as fuel
13. MSC.1/Circ.1680 Unified interpretations of SOLAS regulation XV/5.1 and paragraph 3.5 of part 1 of the International Code of Safety for Ships Carrying Industrial Personnel (IP Code) on the harmonization of the Industrial Personnel Safety Certificate with SOLAS safety certificates
14. MSC.1/Circ.1212/Rev.2 Revised guidelines on alternative design and arrangements for SOLAS chapters II-1 and III
15. MSC.1/Circ.1509/Rev.1 Unified interpretations of the Code on Noise Levels on Board Ships (resolution MSC.337(91))
16. MSC.1/Circ.1511/Rev.1 Unified interpretations of SOLAS regulations II-2/9 and 13
17. MSC.1/Circ.1572/Rev.2 Unified interpretations of SOLAS chapters II-1 and XII, the technical provisions for means of access for inspections (resolution MSC.158(78)); and the Performance standards for water level detectors on ships subject to SOLAS regulations II-1/25 and 25-1, and XII/12 (resolution MSC.188(79)/Rev.2)
18. MSC.1/Circ.1599/Rev.3 Revised guidelines on the application of high manganese austenitic steel for cryogenic service
19. MSC.1/Circ.1622/Rev.1 Revised Guidelines for the acceptance of alternative metallic materials for cryogenic service in ships carrying liquefied gases in bulk and ships using gases or other low-flashpoint fuels
20. MSC-MEPC.2/Circ.18 Guidelines for the sampling of fuel oil for determination of compliance with MARPOL Annex VI and SOLAS chapter II-2

ANNEX 1

RESOLUTION MSC.549(108)
(adopted on 23 May 2024)

AMENDMENTS TO CHAPTER II-1 OF THE INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1974

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO article VIII(b) of the International Convention for the Safety of Life at Sea, 1974 ("the Convention"), concerning the amendment procedure applicable to the annex to the Convention, other than to the provisions of chapter I,

HAVING CONSIDERED, at its 108th session, amendments to the Convention proposed and circulated in accordance with article VIII(b)(i) of the Convention,

1 ADOPTS, in accordance with article VIII(b)(iv) of the Convention, amendments to the Convention, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the said amendments shall be deemed to have been accepted on 1 July 2027, unless, prior to that date, more than one third of the Contracting Governments to the Convention or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet have notified the Secretary-General of their objections to the amendments;

3 INVITES Contracting Governments to the Convention to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 January 2028 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, for the purposes of article VIII(b)(v) of the Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Contracting Governments to the Convention;

5 ALSO REQUESTS the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization which are not Contracting Governments to the Convention.

ANNEX

AMENDMENTS TO THE INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1974

CHAPTER II-1
CONSTRUCTION – STRUCTURE, SUBDIVISION AND STABILITY, MACHINERY AND ELECTRICAL INSTALLATIONS

Part A-1
Structure of ships

Regulation 3-4
Emergency towing arrangements and procedures

1 The following new section 2 is added after existing section 1 (Emergency towing arrangements on tankers) and the subsequent section and paragraphs therein are renumbered accordingly:

"**2 Emergency towing arrangements on ships other than tankers**

2.1 Emergency towing arrangements shall be fitted on ships, other than tankers, of not less than 20,000 gross tonnage, constructed on or after 1 January 2028.

2.2 For ships, other than tankers, constructed on or after 1 January 2028:

.1 the arrangements shall, at all times, be capable of rapid deployment in the absence of main power on the ship to be towed and easy connection to the towing ship; and

.2 emergency towing arrangements shall be of adequate strength taking into account the size of the ship, and the expected forces during bad weather conditions. The design and construction and prototype testing of emergency towing arrangements shall be approved by the Administration, based on the guidelines developed by the Organization.

***

ANNEX 2

RESOLUTION MSC.550(108)
(adopted on 23 May 2024)

AMENDMENTS TO CHAPTERS II-2 AND V OF THE INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1974

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO article VIII(b) of the International Convention for the Safety of Life at Sea, 1974 ("the Convention"), concerning the amendment procedure applicable to the annex to the Convention, other than to the provisions of chapter I,

HAVING CONSIDERED, at its 108th session, amendments to the Convention proposed and circulated in accordance with article VIII(b)(i) of the Convention,

1 ADOPTS, in accordance with article VIII(b)(iv) of the Convention, amendments to the Convention, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the said amendments shall be deemed to have been accepted on 1 July 2025, unless, prior to that date, more than one third of the Contracting Governments to the Convention or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet have notified the Secretary-General of their objections to the amendments;

3 INVITES Contracting Governments to the Convention to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 January 2026 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, for the purposes of article VIII(b)(v) of the Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Contracting Governments to the Convention;

5 ALSO REQUESTS the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization which are not Contracting Governments to the Convention.

ANNEX

AMENDMENTS TO THE INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1974

CHAPTER II-2
CONSTRUCTION – FIRE PROTECTION, FIRE DETECTION AND FIRE EXTINCTION

Part B
Prevention of fire and explosion

Regulation 4
Probability of ignition

1 At the end of paragraph 2.1.7, the word "and" is deleted and at the end of paragraph 2.1.8, "." is replaced by "; and".

2 The following new sub-paragraph is added after existing paragraph 2.1.8:

".9 oil fuel delivered to and used on board ships shall not jeopardize the safety of ships or adversely affect the performance of the machinery or be harmful to personnel."

Part C
Suppression of fire

Regulation 7
Detection and alarm

5 Protection of accommodation and service spaces and control stations

3 Paragraph 5.2 is replaced by the following:

"**5.2 Requirements for passenger ships carrying more than 36 passengers**

A fixed fire detection and fire alarm system shall be so installed and arranged as to provide smoke detection in service spaces, control stations and accommodation spaces, including corridors, stairways and escape routes within accommodation spaces. Smoke detectors need not be fitted in private bathrooms and galleys. Spaces having little or no fire risk such as voids, public toilets, carbon dioxide rooms and similar spaces need not be fitted with a fixed fire detection and fire alarm system. Detectors fitted in cabins, when activated, shall also be capable of emitting, or cause to be emitted, an audible alarm within the space where they are located."

4 Section 5.5 (Cargo ships) is replaced by the following:

"**5.5 Cargo ships**

(The requirements of paragraph 5.5 shall apply to ships constructed on or after 1 January 2026. Ships constructed before 1 January 2026 shall comply with the previously applicable requirements of paragraph 5.5.)

Accommodation and service spaces and control stations of cargo ships shall be protected by a fixed fire detection and fire alarm system and/or an automatic sprinkler, fire detection and fire alarm system as follows depending on a protection method adopted in accordance with regulation 9.2.3.1.

5.5.1 *Method IC*

A fixed fire detection and fire alarm system shall be so installed and arranged as to provide smoke detection in all corridors, stairways and escape routes within accommodation spaces and in all control stations and cargo control rooms.

5.5.2 *Method IIC*

An automatic sprinkler, fire detection and fire alarm system of an approved type complying with the relevant requirements of the Fire Safety Systems Code shall be so installed and arranged as to protect accommodation spaces, galleys and other service spaces, except spaces which afford no substantial fire risk such as void spaces, sanitary spaces, etc. In addition, a fixed fire detection and fire alarm system shall be so installed and arranged as to provide smoke detection in all corridors, stairways and escape routes within accommodation spaces and in all control stations and cargo control rooms.

5.5.3 *Method IIIC*

A fixed fire detection and fire alarm system shall be so installed and arranged as to detect the presence of fire in all accommodation spaces and service spaces providing smoke detection in corridors, stairways and escape routes within accommodation spaces, except spaces which afford no substantial fire risk such as void spaces, sanitary spaces, etc. In addition, a fixed fire detection and fire alarm system shall be so installed and arranged as to provide smoke detection in all corridors, stairways and escape routes within accommodation spaces and in all control stations and cargo control rooms."

Regulation 9
Containment of fire

6 Protection of cargo space boundaries

5 Paragraph 6.1 is deleted and the subsequent paragraphs are renumbered accordingly.

Part G
Special requirements

Regulation 20
Protection of vehicle, special category and ro-ro spaces

6 The title of regulation 20 is replaced by the following:

"**Regulation 20 Protection of vehicle, special category, open and closed ro-ro spaces, and weather decks intended for the carriage of vehicles**"

1 Purpose

7 Paragraph 1.1 is replaced by the following:

".1 fire protection systems shall be provided to adequately protect the ship from the fire hazards associated with vehicle, special category and ro-ro spaces, and weather deck intended for the carriage of vehicles;"

2 General requirements

2.1 Application

8 The following new paragraph 2.1.3 is added after existing paragraph 2.1.2:

"2.1.3 Passenger ships constructed before 1 January 2026, including those constructed before 1 July 2012, shall also comply with regulations 20.4.1.6, 20.4.4 and 20.6.2.3, as adopted by resolution MSC.550(108)."

3 Precaution against ignition of flammable vapours in closed vehicle spaces, closed ro-ro spaces and special category spaces

9 Paragraph 3.1.5 is replaced by the following:

"***3.1.5 Permanent openings***

In cargo ships, permanent openings in the side plating, the ends or deckhead of the space shall be so situated that a fire in the cargo space does not endanger stowage areas and embarkation stations for survival craft and accommodation spaces, service spaces and control stations in superstructures and deckhouses above the cargo spaces."

4 Detection and alarm

10 The following new paragraph is added under the existing title of section 4 (Detection and alarm):

"Passenger ships constructed before 1 January 2026, including those constructed before 1 July 2012, shall comply with the requirements of paragraph 4.1.6 not later than the first survey on or after 1 January 2028."

4.1 Fixed fire detection and fire alarm systems

11 Section 4.1 (Fixed fire detection and fire alarm systems) is replaced by the following:

"**4.1 Fixed fire detection and fire alarm systems**

The requirements of paragraphs 4.1.1 through 4.1.4 shall only apply to passenger ships constructed on or after 1 January 2026. Passenger ships constructed before 1 January 2026, including those constructed before 1 July 2012, shall comply with the requirements of paragraph 4.1.6 and the previously applicable requirements of paragraph 4.1. The requirements of paragraph 4.1.5 shall apply to cargo ships constructed on or after 1 January 2026. Cargo ships constructed before 1 January 2026 shall comply with the previously applicable requirements of paragraph 4.1.

4.1.1 In vehicle, special category and ro-ro spaces, there shall be provided an individually identifiable fixed fire detection and fire alarm system. The system shall comply with the requirements of the Fire Safety Systems Code.

4.1.1.1 The fixed fire detection and fire alarm system shall provide smoke and heat detection throughout vehicle, special category and ro-ro spaces. The Administration may accept linear heat detectors as the required system for heat detection. The system shall be capable of rapidly detecting the onset of fire. The location of detectors shall be to the satisfaction of the Administration, taking into account the effects of ventilation and other relevant factors. After being installed, the system shall be tested under normal ventilation conditions and shall give an overall response time to the satisfaction of the Administration.

4.1.2 If a fixed water-based deluge system is used for vehicle, special category and ro-ro spaces, then a fire detection and fire alarm system identifiable to the same sections of the deluge system shall be arranged.

4.1.3 The fire detection and fire alarm system shall be designed with a system interface which provides logical and unambiguous presentation of the information, to allow a quick and correct understanding and decision-making. In particular, section numbering of the alarm system shall coincide with that of other systems, such as a fixed water-based fire-extinguishing system or video monitoring system, if available.

4.1.4 There shall be provided a fixed fire detection and fire alarm system for the area on the weather deck intended for the carriage of vehicles. The fixed fire detection system shall be capable of rapidly detecting the onset of the fire anywhere on the area. The type of detectors and their spacing and location shall be to the satisfaction of the Administration, taking into account the effects of weather conditions, cargo obstruction and other relevant factors. Different settings may be used for specific operation sequences, such as during loading or unloading and during voyage, in order to reduce the false alarms.

4.1.5 In cargo ships, vehicle spaces, special category spaces and ro-ro spaces shall be provided with a fixed fire detection and fire alarm system complying with the requirements of the Fire Safety Systems Code. The fixed fire detection system shall be capable of rapidly detecting the onset of fire. The type of detectors and their spacing and location shall be to the satisfaction of the Administration, taking into account the effects of ventilation and other relevant factors. After being installed, the system shall be tested under normal ventilation conditions and shall give an overall response time to the satisfaction of the Administration.

4.1.6 For passenger ships constructed before 1 January 2026, including those constructed before 1 July 2012, a fixed fire detection and fire alarm system complying with the requirements of the Fire Safety Systems Code shall be provided in special category spaces, open and closed ro-ro and vehicle spaces. The fixed fire detection system shall be capable of rapidly detecting the onset of fire. The fixed fire detection and fire alarm system shall provide smoke and heat detection throughout vehicle, special category and ro-ro spaces. In this context, heat detectors shall comply with the spacing and coverage area requirements as applicable for smoke detectors. Heat detectors are only required where there is already a smoke detector."

4.3 Special category spaces

12 Paragraph 4.3.1 is replaced by the following:

"4.3.1 An efficient fire patrol system shall be maintained in special category spaces."

13 The following new section 4.4 is added after existing section 4.3 (Special category spaces):

"**4.4 Video monitoring**

The requirements of paragraphs 4.4.1 and 4.4.2 apply to ships constructed on or after 1 January 2026. Passenger ships with vehicle, special category or ro-ro spaces constructed before 1 January 2026, including those constructed before 1 July 2012, shall comply with the requirements of paragraphs 4.4.1 and 4.4.2 not later than the first survey on or after 1 January 2028.

4.4.1 For passenger ships, an effective video monitoring system shall be arranged in vehicle, special category and ro-ro spaces for continuous monitoring of these spaces. The system shall be provided with immediate playback capability to allow for quick identification of fire location, as far as practicable. Cameras shall be installed to cover the whole space, high enough to see over cargo and vehicles after loading.

4.4.2 The videos recorded by this monitoring system shall be available for replay at a continuously manned control station or at the safety centre for at least seven days for installation on ro-ro passenger ships constructed on or after 1 January 2026 and 24 hours for existing ro-ro passenger ships constructed before 1 January 2026, including those constructed before 1 July 2012. The correspondence between any one video camera and the section of the fixed water-based fire-extinguishing system protecting the space covered by this camera shall be clearly displayed close to the video monitor. Continuous monitoring of the video image by the crew is not required."

5 Structural fire protection

14 Section 5 (Structural fire protection) is replaced by the following, together with the associated footnote:

"**5 Structural fire protection and arrangement of openings**

This paragraph applies to passenger ships constructed on or after 1 January 2026. Passenger ships constructed before 1 January 2026 shall comply with the previously applicable requirements of paragraph 5.

5.1 Structural fire protection

5.1.1 In passenger ships carrying more than 36 passengers, the boundary bulkheads and decks of special category and ro-ro spaces shall be insulated to "A-60" class standard. However, where a category (5), (9) and (10) space, as defined in regulation 9.2.2.3, is on one side of the division, the standard may be reduced to "A-0". Where fuel oil tanks are below a special category space, the integrity of the deck between such spaces may be reduced to "A-0" standard.

5.1.2 Where a special category space or ro-ro space is subdivided with internal decks, the fire rating of these decks shall be determined based on the capacity and arrangement of the fixed water-based fire-extinguishing system. If the fixed water-based fire-extinguishing system cannot simultaneously cover the applicable area above and below a given deck, this deck shall be of "A-30" standard while any ramps and doors between decks shall be made of steel and of a design being as tight as practical.

5.2 Arrangement of openings in ro-ro spaces and special category spaces

5.2.1 Openings in the side plating, the ends or deckhead of the ro-ro space shall be situated and arranged so that a fire in the ro-ro space does not endanger:

.1 stowage areas for survival craft;

.2 embarkation stations and assembly stations, including access to such stations; and

.3 accommodation spaces, control stations and normally occupied service spaces in superstructures and deckhouses above the ro-ro space.

Openings are not permitted for all decks directly below these objects and within a safety distance of minimum 6.0 m measured horizontally.

5.2.2 This requirement does not apply to openings fitted with closing arrangements, such as ramps and doors. Ramps and doors shall be of steel for all decks directly below accommodation spaces, control stations and normally occupied service spaces, and minimum "A-0" for all decks directly below survival craft, embarkation stations and assembly stations.

5.2.3 Openings are, however, accepted in ro-ro spaces below accommodation spaces, control stations and normally occupied service spaces, when the fire integrity of the ship's side, including windows and doors, is "A-60" on boundaries in a rectangular area measured 6.0 m horizontally forward and aft of the openings and vertically minimum two deck levels above the deck level with the opening. "A-0" windows protected by a water-based system with an application rate of at least 5.0 L/min per square metre may be accepted as equivalent to "A-60" windows. Ventilation inlets shall be designed to minimize the risk of contamination.*

* Refer to regulations 5.2, 8.2, 9.7.1.5 and 20.3.1.4.

5.2.4 Openings for mechanical ventilation of ro-ro and special category spaces are permitted below accommodation spaces, service spaces and control stations in superstructures, if the opening is protected by a closing device, with a closing arrangement not likely to be cut off in case of a fire in the ro-ro spaces, capable of being closed from a readily accessible position. The closing device shall be made of steel or other fire-resistant material. Such openings are not permitted below survival craft, the emergency generator and air intakes for the engine-room(s).

5.2.5 Notwithstanding the above, air intakes serving machinery used for the ship's main propulsion, power generation and emergency power generation shall be in a position minimizing the risk of being contaminated by a fire in the ro-ro space or special category space.

5.3 Arrangement of weather deck intended for the carriage of vehicles

5.3.1 Appropriate arrangements shall be made so that a fully developed fire on weather decks intended for the carriage of vehicles does not endanger:

.1 stowage areas for survival craft;

.2 embarkation stations and assembly stations including access to these; and

.3 accommodation spaces, control stations and normally occupied service spaces in superstructures and deckhouses adjacent to the weather deck.

5.3.2 Appropriate arrangements shall be made providing a safety distance, measured horizontally, from the designated vehicle lanes of more than 6.0 m to accommodation spaces, control stations and normally occupied service spaces in superstructures and deckhouses adjacent to the weather deck.

5.3.3 The safety distance can be reduced to 3.0 m when boundaries, including windows and doors, within 6.0 m are of "A-60" integrity. Alternatively, "A-0" boundaries protected by a water-based system with an application rate of at least 5.0 L/min per square metre may be accepted as equivalent.

5.3.4 Survival craft and embarkation stations, including access to these, shall be protected with a safety distance of more than 12.0 m. Safety distances shall be measured horizontally.

5.3.5 Notwithstanding the above, air intakes serving machinery used for the ship's main propulsion, power generation and emergency power generation shall be in a position minimizing the risk of being contaminated by a fire on the weather deck intended for carriage of vehicles."

6 Fire extinction

6.1 Fixed fire-extinguishing systems

15 The explanatory paragraph under the title of existing section 6.1 (Fixed fire-extinguishing systems) is replaced by the following:

"(The requirements of paragraphs 6.1.1 and 6.1.2 shall apply to ships constructed on or after 1 July 2014. Ships constructed before 1 July 2014 shall comply with the previously applicable requirements of paragraphs 6.1.1 and 6.1.2. The requirements of paragraphs 6.2.1 and 6.2.2 shall apply to ro-ro passenger ships constructed on or after 1 January 2026. Passenger ships with vehicle, special category or ro-ro spaces constructed before 1 January 2026, including those constructed before 1 July 2012, shall comply with the requirements of paragraph 6.2.3 not later than the first survey on or after 1 January 2028.)"

16 The following new section 6.2 is inserted after existing section 6.1 (Fixed fire-extinguishing systems) and the subsequent section (Portable fire extinguishers) and its paragraphs are renumbered accordingly:

"**6.2 Fixed water-based fire-extinguishing system on weather decks intended for carriage of vehicles**

6.2.1 In passenger ships, a fixed water-based fire-extinguishing system based on monitor(s) shall be installed in order to cover weather decks intended for the carriage of vehicles. The monitor(s) shall comply with the provisions of the Fire Safety Systems Code.

6.2.2 In passenger ships, drainage shall be provided where a fixed water-based fire-extinguishing system is installed to cover weather decks intended for carriage of vehicles. The system shall be sized to remove no less than 125% of the combined capacity of both the monitor(s) and the required number of fire hose nozzles.

6.2.3 For passenger ships constructed before 1 January 2026, including those constructed before 1 July 2012, a fixed water-based fire-extinguishing system based on monitor(s) shall be installed in order to protect areas on weather decks intended for the carriage of vehicles. Monitors shall be located in positions which ensure unobstructed protection of vehicles in the area on the weather deck intended for carriage for vehicles, as far as practicable. Operation of monitors shall be ensured by safe access ways or remote control not to be impaired by a fire in the area protected by that monitor. Capacity of each monitor shall be at least 1,250 L/min. The Administration may permit lower flow rates when the required rate is not practical given the size and arrangement of the ship. The Administration may also permit alternative arrangements for ships that have already installed a fixed water-based fire-extinguishing system based on monitor(s) prior to 1 January 2026."

17 The following new section 7 is added after existing section 6 (Fire extinction) with the associated footnotes:

"**7 Decision-making**

(The requirements of paragraph 7 shall apply to passenger ships constructed on or after 1 January 2026.)

In passenger ships, vehicle, special category and ro-ro spaces, where fixed pressure water-spraying systems are fitted, shall be provided with suitable signage and marking on deckhead and bulkhead and on the vertical boundaries allowing easy identification of the sections of the fixed fire-extinguishing system. Suitable signage and markings shall be adapted to typical patterns of crew movement taking into consideration obstruction by cargo or fixed installations. Section number signs shall be of photoluminescent material.* The section numbering indicated inside the space shall be same as section valve identification and section identification at the safety centre or continuously manned control station.

* Refer to chapter 11 of the FSS Code for the evaluation and testing of photoluminescent material."

Regulation 23
Safety centre on passenger ships

6 Control and monitoring of safety systems

18 Paragraph 6.10 is replaced by the following:

".10 fire detection and fire alarm system;"

CHAPTER V
SAFETY OF NAVIGATION

Regulation 31
Danger messages

19 The following new paragraphs are inserted after existing paragraph 1, together with the associated footnote:

"2.1 The master of every ship involved in the loss of freight container(s), shall communicate the particulars of such an incident by appropriate means without delay and to the fullest extent possible to ships in the vicinity, to the nearest coastal State, and also to the flag State.

2.2 In the event of the ship referred to in paragraph 2.1 being abandoned, or in the event of a report from such a ship being incomplete or unobtainable, the company, as defined in regulation IX/1.2, shall, to the fullest extent possible, assume the obligations placed upon the master by this regulation.

2.3 The flag State, once informed in accordance with paragraph 2.1, shall report to the Organization on the loss of freight container(s).*

* Refer to *Notification and circulation through the Global Integrated Shipping Information System (GISIS)* (resolution A.1074(28)).

2.4 The master of every ship that observes freight container(s) drifting at sea, shall communicate the particulars of such an observation by appropriate means without delay and to the fullest extent possible to ships in the vicinity and to the nearest coastal State."

20 Existing paragraphs 2, 3 and 4 are renumbered as paragraphs 3, 4 and 5, respectively.

Regulation 32
Information required in danger messages

21 The following new paragraph is inserted after existing paragraph 2 (Tropical cyclones (storms)):

"3 Loss or observation of freight container(s)

.1 Loss of freight container(s) from a ship

It is recognized that at the time of the initial reporting, not all of the information elements may be available. Any subsequent and/or additional information shall be reported by the master at the earliest opportunity after the initial reporting. The report shall include:

.1 General information

- Type of report: Loss of freight container(s) from a ship
- Time (Universal Coordinated Time) and date
- Ship's identity (IMO number/name/call sign/MMSI)
- From: Master of the ship, or contact details of their representative reporting on master's behalf
- To: Nearest coastal State where the incident occurred and flag State
- The message number: In chronological order if other freight container loss messages are sent following the first one.

At the earliest, safe and practicable opportunity, a thorough inspection shall be conducted. The number or estimated number of lost freight container(s) shall be verified. A message containing this verified number shall be marked as "final" and sent to the same recipients.

.2 Position reporting*

Position in latitude and longitude, or true bearing and distance in nautical miles from a clearly identified landmark (where possible)

- Position of the ship when freight container(s) were lost; or
- If the position of the ship when the freight container(s) were lost is not known, the estimated position of the ship when the freight container(s) were lost; or
- If an estimated position of the ship when the freight container(s) were lost is not known or cannot be determined, the position of the ship upon discovery of the loss.

* Where available, a system of mechanical, electronic and/or visual aids can be used, allowing near real-time reporting of the drop point of the freight container(s).

.3 Total number or estimated number of freight container(s) lost, as appropriate:

.4 Type of goods in freight container(s):

- Dangerous goods: Yes/No
- UN number (if known)

.5 Description of freight container(s) lost as far as available and practicable:

.1 Dimension of freight container(s) (e.g. 20 foot);

.2 Type(s) of freight container(s) (e.g. reefer); and

.3 Number or estimated number of empty freight container(s).

.6 The master may provide additional information, if available and practicable, for example but not limited to:

- Cargo description according to the dangerous goods manifest (if applicable)
- Description of any cargo spill
- Wind direction and speed
- Sea current direction and speed
- Estimated drift direction and speed of lost freight container(s)
- Sea state and wave height

.2 Observation of freight container(s) drifting at sea

.1 General information

- Type of report: Observation of freight container(s) drifting at sea
- Time (Universal Coordinated Time) and date
- Ship's identity (IMO number/name/call sign/MMSI)
- From: Master of the ship
- To: Nearest coastal State to the position of observation

.2 Position reporting

Time (Universal Coordinated Time), date and position of the observed freight container(s) in latitude and longitude, or true bearing and distance in nautical miles from a clearly identified landmark (where possible)

.3 Total number of freight container(s) observed

.4 The master may provide additional information, if available and practicable, for example but not limited to:

- Dimension of freight container(s) (e.g. 20 foot)
- Type(s) of freight container(s) (e.g. reefer)
- Description of any cargo spill
- Wind direction and speed
- Sea current direction and speed
- Estimated drift direction and speed of observed freight container(s)
- Sea state and wave height "

22 Existing paragraphs 3, 4 and 5 are renumbered as paragraphs 4, 5 and 6, respectively.

***

ANNEX 3

RESOLUTION MSC.551(108)
(adopted on 23 May 2024)

AMENDMENTS TO THE INTERNATIONAL CODE OF SAFETY FOR SHIPS USING GASES OR OTHER LOW-FLASHPOINT FUELS (IGF CODE)

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

NOTING resolution MSC.391(95), by which it adopted the International Code of Safety for Ships using Gases or other Low-flashpoint Fuels (IGF Code), which has become mandatory under chapters II-1 and II-2 of the International Convention for the Safety of Life at Sea, 1974 ("the Convention"),

NOTING ALSO article VIII(b) and regulation II-1/2.28 of the Convention concerning the procedure for amending the IGF Code,

HAVING CONSIDERED, at its 108th session, amendments to the IGF Code proposed and circulated in accordance with article VIII(b)(i) of the Convention:

1 ADOPTS, in accordance with article VIII(b)(iv) of the Convention, amendments to the IGF Code, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the said amendments shall be deemed to have been accepted on 1 July 2025, unless, prior to that date, more than one third of the Contracting Governments to the Convention or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet have notified the Secretary-General of their objections to the amendments;

3 INVITES Contracting Governments to the Convention to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 January 2026 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, for the purposes of article VIII(b)(v) of the Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Contracting Governments to the Convention;

5 ALSO REQUESTS the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization which are not Contracting Governments to the Convention.

ANNEX

AMENDMENTS TO THE INTERNATIONAL CODE OF SAFETY FOR SHIPS USING GASES OR OTHER LOW-FLASHPOINT FUELS (IGF CODE)

Part A

2 General

2.2 Definitions

1 The following new paragraph 2.2.43 is added after existing paragraph 2.2.42:

"2.2.43 *Ship constructed on or after 1 January 2026* means:

.1 for which the building contract is placed on or after 1 January 2026; or

.2 in the absence of a building contract, the keels of which are laid or which are at a similar stage of construction on or after 1 July 2026; or

.3 the delivery of which is on or after 1 January 2030."

4 General requirements

4.2 Risk assessment

2 Paragraph 4.2.2 is replaced by the following:

"4.2.2 For ships to which part A-1 applies, the risk assessment required by 4.2.1 need only be conducted where explicitly required by paragraphs 5.10.5, 5.12.3, 6.4.1.1, 6.4.15.4.7.2, 8.3.1.1, 8.4.2, 13.4.1, 13.7 and 15.8.1.10 as well as by paragraphs 4.4 and 6.8 of the annex."

Part A-1
Specific requirements for ships using natural gas as fuel

5 Ship design and arrangement

5.3 Regulation - General

3 Paragraph 5.3.3.3 is replaced by the following:

"5.3.3.3 For independent tanks the protective distance shall be measured to the tank shell (the primary barrier of the fuel containment system). For membrane tanks the distance shall be measured to the bulkheads surrounding the tank insulation."

4 Paragraph 5.3.4.4 is replaced by the following:

"5.3.4.4 For independent tanks the protective distance shall be measured to the tank shell (the primary barrier of the fuel containment system). For membrane tanks the distance shall be measured to the bulkheads surrounding the tank insulation."

5.12 Regulations for airlocks

5 Paragraph 5.12.1 is replaced by the following:

"5.12.1 For ships constructed on or after 1 January 2026, an air lock is a space enclosed by gastight bulkheads with two substantially gastight doors spaced at least 1.5 m and not more than 2.5 m apart. Unless subject to the requirements of the International Convention on Load Line, the sill height of the door leading to the hazardous area shall not be less than 300 mm. The doors shall be self-closing without any holding back arrangements."

6 Fuel containment system

6.4 Regulations for liquefied gas fuel containment

6.4.15 Tank types

6.4.15.3 Type C independent tanks

6.4.15.3.1 Design basis

6 Paragraph 6.4.15.3.1.2 is replaced by the following:

"6.4.15.3.1.2 The design vapour pressure shall not be less than:

$P_0 = 0.2 + AC(\rho_r)^{1.5}$ (MPa)

where:

$A = 0.00185 (\sigma_m / \Delta\sigma_A)^2$

with:

σ_m = design primary membrane stress;

$\Delta\sigma_A$ = allowable dynamic membrane stress (double amplitude at probability level $Q = 10^{-8}$) and equal to:

- 55 N/mm^2 for ferritic-perlitic, martensitic and austenitic steel;

- 25 N/mm^2 for aluminium alloy (5083-O);

C = a characteristic tank dimension to be taken as the greatest of the following:

h, $0.75b$ or 0.45ℓ,

with:

h = height of tank (dimension in ship's vertical direction) (m);

b = width of tank (dimension in ship's transverse direction) (m);

ℓ = length of tank (dimension in ship's longitudinal direction) (m);

ρ_r = the relative density of the fuel ($\rho_r = 1$ for fresh water) at the design temperature."

6.7 Regulations for pressure relief system

6.7.3 Sizing of pressure relieving system

6.7.3.1 Sizing of pressure relief valves

7 The chapeau of paragraph 6.7.3.1.1 is replaced by the following:

"6.7.3.1.1 For ships constructed on or after 1 January 2026, the pressure relief system for each liquefied gas fuel tank shall be designed so that, regardless of the state of any one PRV, the capacity of the residual PRVs meets the combined relieving capacity requirements of the system. The combined relieving capacity shall be the greater of the following, with no more than 20% rise in liquefied gas fuel tank pressure above the MARVS. The tank shall not be loaded until the full relieving capacity is restored:"

8 Paragraph 6.7.3.1.1.2 is replaced by the following:

"6.7.3.1.1.2 vapours generated under fire exposure computed using the following formula:

$$Q = FGA^{0.82} \text{ (m}^3\text{/s)}$$

where:

Q = minimum required rate of discharge of air at standard conditions of 273.15 Kelvin (K) and 0.1013 MPa.

F = fire exposure factor for different liquefied gas fuel tank types:

F = 1.0 for tanks without insulation located on deck;

…"

6.9 Regulations for the maintaining of fuel storage condition

6.9.1 Control of tank pressure and temperature

9 The chapeau of paragraph 6.9.1.1 is replaced by the following:

"6.9.1.1 For ships constructed on or after 1 January 2026, with the exception of liquefied gas fuel tanks designed to withstand the full gauge vapour pressure of the fuel under conditions of the upper ambient design temperature, liquefied gas fuel tanks' pressure and temperature shall be maintained at all times within their design range by means acceptable to the Administration, e.g. by one or more of the following methods:"

7 Material and general pipe design

7.3 Regulations for general pipe design

7.3.2 Wall thickness

10 Paragraph 7.3.2.1 is replaced by the following:

"7.3.2.1 For ships constructed on or after 1 January 2026, the minimum wall thickness shall be calculated as follows:

$t = (t_0 + b + c) / (1 - |a|/100)$ (mm)

where:

t_0 = theoretical thickness

t_0 = $PD / (2.0Ke + P)$ (mm)

with:

P = design pressure (MPa) referred to in 7.3.3;

D = outside diameter (mm);

K = allowable stress (N/mm²) referred to in 7.3.4; and

e = efficiency factor equal to 1.0 for seamless pipes and for longitudinally or spirally welded pipes, delivered by approved manufacturers of welded pipes, that are considered equivalent to seamless pipes when non-destructive testing on welds is carried out in accordance with recognized standards. In other cases an efficiency factor of less than 1.0, in accordance with recognized standards, may be required depending on the manufacturing process;

b = allowance for bending (mm). The value of b shall be chosen so that the calculated stress in the bend, due to internal pressure only, does not exceed the allowable stress. Where such justification is not given, b shall be:

$b = D \cdot t_0 / 2.5r$ (mm)

with:

r = mean radius of the bend (mm);

c = corrosion allowance (mm). If corrosion or erosion is expected the wall thickness of the piping shall be increased over that required by other design regulations. This allowance shall be consistent with the expected life of the piping; and

a = negative manufacturing tolerance for thickness (%), i.e. where a is the manufacturing tolerance of -5%, $|a|$ is equal to 5 and shall be entered into the formula as 1- (5/100)."

8 Bunkering

8.4 Regulations for manifold

11 Paragraph 8.4.1 is replaced by the following, together with the associated footnotes:

"8.4.1 The bunkering manifold shall be designed to withstand the external loads during bunkering. The connections at the bunkering station shall be arranged in order to achieve a dry-disconnect operation in one of the followings ways:

.1 a dry-disconnect / connect coupling in accordance with a standard at least equivalent to those acceptable to the Organization;[1] or

.2 a manual connect coupler or hydraulic connect coupler, used to connect the bunker system to the receiving vessel bunkering manifold presentation flange;[2] or

.3 a bolted flange to flange assembly.[2]

---

1 Refer to the recommendations by the International Organization for Standardization, in particular publication: ISO 21593:2019, Ships and marine technology — Technical requirements for dry-disconnect/connect couplings for bunkering liquefied natural gas.

2 Refer to the recommendations by the International Organization for Standardization, in particular publication: ISO 20519:2021 - Ships and Marine Technology - Specification for Bunkering of Liquefied Natural Gas Fuelled Vessels.

12 The following new paragraphs are added after existing paragraph 8.4.1, together with the associated footnote:

"8.4.2 When intended to use either of the connections specified in paragraphs 8.4.1.2 and 8.4.1.3, these shall be combined with operating procedures that ensure a dry-disconnect is achieved. The arrangement shall be subject to special consideration informed by a bunkering arrangement risk assessment[2] conducted at the design stage and considering dynamic loads at the bunkering manifold connection to a recognized standard acceptable to the Administration, the safe operation of the ship and other hazards that may be relevant to the ship during bunkering operation. The fuel handling manual required by 18.2.3 shall include documentation that the bunkering arrangement risk assessment was conducted, and that special consideration was granted under this requirement."

"8.4.3 An emergency release coupler (ERC) / Emergency Release System (ERS) or equivalent means shall be provided, unless installed on the bunkering supply side of the bunkering line, and the said means shall be in accordance with a standard equivalent to those acceptable to the Organization;[2] it shall enable a quick physical disconnection "dry break-away" of the bunker system in an emergency event."

---

2 Refer to the recommendations by the International Organization for Standardization, in particular publication: ISO 20519:2021 - Ships and Marine Technology - Specification for Bunkering of Liquefied Natural Gas Fuelled Vessels.

9 Fuel supply to consumers

9.3 Regulations on redundancy of fuel supply

13 Paragraph 9.3.1 is replaced by the following:

"9.3.1 For ships constructed on or after 1 January 2026, for single fuel installations the fuel supply system shall be arranged with redundancy and segregation, so that a leakage in one system, or failure of one of the fuel supply essential auxiliaries, does not lead to an unacceptable loss of power. In the event of a leakage or failure, and in accordance with SOLAS regulation II-1/26.3, the Administration, having regard to overall safety considerations, may accept a partial reduction in propulsion capability from normal operation."

9.4 Regulations on safety functions of gas supply system

14 Paragraph 9.4.7 is replaced by the following:

"9.4.7 For ships constructed on or after 1 January 2026, in cases where the master gas fuel valve is automatically shut down when the safety system as required in 15.2.2 is activated, the complete gas supply pipe between this master gas fuel valve and the double block and bleed valves and between the double block and bleed valves and the consumer shall be automatically vented."

15 Paragraph 9.4.8 is replaced by the following:

"9.4.8 For ships constructed on or after 1 January 2026, there shall be one manually operated shutdown valve in the gas supply line to each gas consumer upstream of the double block and bleed valves to assure safe isolation during maintenance on the gas consumer."

9.6 Regulations for fuel supply to consumers in gas-safe machinery spaces

16 Paragraph 9.6.1.1 is replaced by the following:

"9.6.1 Gas fuel piping in gas-safe machinery spaces shall be completely enclosed by a double pipe or duct fulfilling one of the following conditions:

.1 the gas fuel piping shall be a double wall piping system with the gas fuel contained in the inner pipe. The space between the concentric pipes shall be pressurized with inert gas at a pressure greater than the gas fuel pressure. Suitable alarms shall be provided to indicate a loss of inert gas pressure between the pipes; or"

9.8 Regulations for the design of ventilated duct, outer pipe against inner pipe gas leakage

17 Paragraph 9.8.1 is replaced by the following:

"9.8.1 For ships constructed on or after 1 January 2026, the design pressure of the outer pipe or duct of fuel systems shall not be less than the maximum working pressure of the inner pipe. Alternatively, the design pressure of the outer pipe or duct may be calculated in accordance with 9.8.2."

18 The chapeau of paragraph 9.8.2 is replaced by the following:

"9.8.2 For ships constructed on or after 1 January 2026, alternatively to 9.8.1, the design pressure of the outer pipe or duct shall be taken as the higher of the following:"

19 Paragraph 9.8.4 is replaced by the following:

"9.8.4 For ships constructed on or after 1 January 2026, the duct shall be pressure-tested to show that it can withstand the expected maximum pressure at fuel pipe rupture."

11 Fire safety

11.3 Regulations for fire protection

20 Paragraph 11.3.1 is replaced by the following:

"11.3.1 For ships constructed on or after 1 January 2026, fuel preparation rooms shall, for the purpose of the application of SOLAS regulation II-2/9, be regarded as a machinery space of category A."

11.6 Regulations for dry chemical powder fire-extinguishing system

21 Paragraph 11.6.2 is replaced by the following:

"11.6.2 In addition to any other portable fire extinguishers that may be required elsewhere in IMO instruments, one portable dry powder extinguisher of at least 5 kg capacity shall be located near the bunkering station and in the fuel preparation room. For ships constructed before 1 January 2026, the portable dry powder extinguisher shall be provided in the fuel preparation room not later than the first survey on or after 1 January 2026."

12 Explosion prevention

12.5 Hazardous area zones

22 Paragraph 12.5.1 is replaced by the following:

"***12.5.1 Hazardous area zone 0***

For ships constructed on or after 1 January 2026, this zone includes, but is not limited to, the interiors of fuel tanks, any pipework for pressure relief or other venting systems for fuel tanks, pipes and equipment containing fuel, and interbarrier spaces as defined by paragraph 2.2.15.2."

12.5.2 Hazardous area zone 1

23 Paragraph 12.5.2.1 is replaced by the following:

".1 for ships constructed on or after 1 January 2026, tank connection spaces and fuel storage hold spaces[2]; …

[2] Fuel storage hold spaces for type C tanks are normally not considered as zone 1."

15 Control, monitoring and safety systems

15.4 Regulations for bunkering and liquefied gas fuel tank monitoring

15.4.1 Level indicators for liquefied gas fuel tanks

24 Paragraph 15.4.1.3 is replaced by the following:

".3 For ships constructed on or after 1 January 2026, liquefied gas fuel tank liquid level gauges may be of the following types:

.1 indirect devices which determine the amount of fuel by means such as weighing or in-line flow metering;

.2 closed devices which do not penetrate the liquefied gas fuel tank, such as devices using radioisotopes or ultrasonic devices; or

.3 closed devices which penetrate the liquefied gas fuel tank but which form part of a closed system and keep the gas fuel from being released. Such devices shall be considered as tank connections. If the closed gauging device is not mounted directly onto the tank, it shall be provided with a shutoff valve located as close as possible to the tank."

Part B-1

16 Manufacture, workmanship and testing

16.3 Welding of metallic materials and non-destructive testing for the fuel containment system

16.3.5 Production weld tests

25 Paragraph 16.3.5.1 is replaced by the following:

"16.3.5.1 For all fuel tanks and process pressure vessels except membrane tanks, production weld tests shall generally be performed for approximately each 50 m of butt-weld joints and shall be representative of each welding position. For secondary barriers, the same type production tests as required for primary barriers shall be performed, except that the number of tests may be reduced subject to agreement with the Administration. Tests, other than those specified in 16.3.5.2 to 16.3.5.5, may be required for fuel tanks or secondary barriers."

Part C-1

18 Operation

18.4 Regulations for bunkering operations

18.4.1 Responsibilities

26 Paragraph 18.4.1.1.1 is replaced by the following:

"18.4.1.1 Before any bunkering operation commences, the master of the receiving ship or their representative and the representative of the bunkering source (Persons In Charge, PIC) shall:

.1 agree in writing the transfer procedure, including cooling down and if necessary, gassing up; the maximum transfer rate at all stages; minimum and maximum limiting transfer pressure and temperature; bunkering line PRVs settings; and volume to be transferred;"

***

ANNEX 4

RESOLUTION MSC.552(108)
(adopted on 23 May 2024)

AMENDMENTS TO THE INTERNATIONAL CODE FOR THE SAFE CARRIAGE OF GRAIN IN BULK (RESOLUTION MSC.23(59))

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

NOTING resolution MSC.23(59), by which it adopted the International Code for the Safe Carriage of Grain in Bulk ("the Grain Code"), which has become mandatory under chapter VI of the International Convention for the Safety of Life at Sea, 1974 ("the Convention"),

NOTING ALSO article VIII(b) and regulation VI/8.1 of the Convention concerning the procedure for amending the Grain Code,

HAVING CONSIDERED, at its 108th session, amendments to the Grain Code proposed and circulated in accordance with article VIII(b)(i) of the Convention,

1 ADOPTS, in accordance with article VIII(b)(iv) of the Convention, amendments to the Grain Code, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the said amendments shall be deemed to have been accepted on 1 July 2025, unless, prior to that date, more than one third of the Contracting Governments to the Convention or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet have notified the Secretary-General of their objections to the amendments;

3 INVITES Contracting Governments to the Convention to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 January 2026 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, for the purposes of article VIII(b)(v) of the Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Contracting Governments to the Convention;

5 ALSO REQUESTS the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization which are not Contracting Governments to the Convention.

ANNEX

AMENDMENTS TO THE INTERNATIONAL CODE FOR THE SAFE CARRIAGE OF GRAIN IN BULK (RESOLUTION MSC.23(59))

Part A
Specific requirements

2 Definitions

1 The following new definition is added after existing paragraph 2.7:

"2.8 The term *specially suitable compartment, partly filled in way of the hatch opening, with ends untrimmed* refers to a specially suitable compartment which is not filled to the maximum extent possible in way of the hatch opening but is filled to a level equal with or above the bottom edge of the hatch end beams and has not been trimmed outside the periphery of the hatch opening by the provisions of A 10.4."

10 Stowage of bulk grain

2 The reference to "B 6" in paragraph 10.3.1 is replaced with "B 7".

3 The following new paragraph is inserted after existing paragraph 10.3 and the subsequent paragraphs are renumbered accordingly:

"10.4 In any "specially suitable compartment, partly filled in way of the hatch opening, with ends untrimmed", the bulk grain shall be filled to a level equal with or above the bottom edge of the hatch end beams but may be at its natural angle of repose outside the periphery of the hatch opening. A compartment may qualify for this classification if it is "specially suitable" as defined in A 2.7, in which case dispensation may be granted from trimming the ends of that compartment."

4 Renumbered paragraph 10.7 (existing paragraph 10.6) is replaced by the following:

"10.7 After loading, all free grain surfaces in partly filled compartments shall be level unless the compartment is partly filled in accordance with the provisions of A 10.4, in which case the free grain surface in way of the hatch opening only shall be level."

5 The reference to "B 5.2" in renumbered paragraph 10.10.3 (existing paragraph 10.9.3) is replaced with "B 6.2".

12 Divisions loaded on both sides

6 The reference to "A 12.1.3" in paragraph 12.3.3 is replaced with "A 12.1.2".

14 Saucers

7 The reference to "A 10.9" in paragraph 14.1 is replaced with "A 10.10".

Part B
Calculation of assumed heeling moments and general assumptions

1 General assumptions

8 The following new paragraph 1.1.5 is added after existing paragraph 1.1.4:

".5 In a "specially suitable compartment, partly filled in way of the hatch opening, with ends untrimmed" which is exempted from trimming under the provisions of A 10.4, it shall be assumed that the surface of the grain after loading will slope in all directions away from the filling area at an angle of 30° from the lower edge of the hatch end beam. However, if feeding holes are provided in the hatch end beams in accordance with table B 1-2 and the free grain surface in way of the hatch opening is above the level of the feeding holes, then the surface of the grain after loading shall be assumed to slope in all directions, at an angle of 30° from a line on the hatch end beam which is the mean of the peaks and valleys of the actual grain surface as shown in figure B-1."

9 The reference to "B 5" in paragraph 1.2 is replaced with "B 6".

10 Paragraph 1.5 is replaced by the following:

"1.5 In "partly filled compartments" and "specially suitable compartments, partly filled in way of the hatch opening, with ends untrimmed", the adverse effect of the vertical shift of grain surfaces shall be taken into account as follows:

Total heeling moment = 1.12 x calculated transverse heeling moment."

2 Assumed volumetric heeling moment of a filled compartment, trimmed

11 The reference to "A 10.9" in paragraph 2.6 is replaced with "A 10.10".

12 The reference to "A 10.9" in the Note (2) for figure B 2-1 in paragraph 2.8 is replaced with "A 10.10".

13 The reference to "A 10.9" in the Note (3) for figure B 2-3 in paragraph 2.9 is replaced with "A 10.10".

3 Assumed volumetric heeling moment of a filled compartment, untrimmed

14 In paragraph 3.1, the word "provision" is replaced with "provisions".

15 The following new section 4 is inserted after existing section 3 (Assumed volumetric heeling moment of a filled compartment, untrimmed) and the subsequent sections and paragraphs are renumbered accordingly:

"**4 Assumed volumetric heeling moment of a specially suitable compartment, partly filled in way of the hatch opening, with ends untrimmed**

4.1 All the provisions for "filled compartments, trimmed" set forth in B 2 shall also apply to "specially suitable compartments, partly filled in way of the hatch opening, with ends untrimmed" except as noted below.

4.2 In a "specially suitable compartment, partly filled in way of the hatch opening, with ends untrimmed" which is exempted from trimming under the provisions of A 10.4, the resulting grain surface in way of the hatch opening and the resulting grain surface in the ends, forward and aft of the hatchway, after shifting shall be assumed to be at an angle of 25° to the horizontal."

16 The references to "figure B 4" in renumbered section 5 (Assumed volumetric heeling moments in trunks) are replaced with "figure B 5".

***

ANNEX 5

RESOLUTION MSC.553(108)
(adopted on 23 May 2024)

AMENDMENTS TO THE INTERNATIONAL CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF BULK CARRIERS AND OIL TANKERS, 2011 (2011 ESP CODE)

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

NOTING resolution A.1049(27), by which the Assembly adopted the International Code on the Enhanced Programme of Inspections during Surveys of Bulk Carriers and Oil Tankers, 2011 ("the 2011 ESP Code"), which has become mandatory under chapter XI-1 of the International Convention for the Safety of Life at Sea, 1974 ("the Convention"),

NOTING ALSO article VIII(b) and regulation XI-1/2 of the Convention concerning the procedure for amending the 2011 ESP Code,

HAVING CONSIDERED, at its 108th session, amendments to the 2011 ESP Code, proposed and circulated in accordance with article VIII(b)(i) of the Convention:

1 ADOPTS, in accordance with article VIII(b)(iv) of the Convention, amendments to the 2011 ESP Code the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the said amendments shall be deemed to have been accepted on 1 July 2025, unless, prior to that date, more than one third of the Contracting Governments to the Convention or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet have notified the Secretary-General of their objections to the amendments;

3 INVITES Contracting Governments to the Convention to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 January 2026 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, for the purposes of article VIII(b)(v) of the Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Contracting Governments to the Convention;

5 ALSO REQUESTS the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization which are not Contracting Governments to the Convention.

ANNEX

AMENDMENTS TO THE INTERNATIONAL CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF BULK CARRIERS AND OIL TANKERS, 2011 (2011 ESP CODE)

ANNEX A
CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF BULK CARRIERS

Part A
Code on the enhanced programme of inspections during surveys of bulk carriers having single-side skin construction

Annex 5
Procedures for approval and certification of a firm engaged in thickness measurement of hull structures

2 Procedures for approval and certification

Auditing of the firm

1 Paragraph 2.2 is replaced by the following:

"2.2 Upon reviewing of the documents submitted with satisfactory results, the firm shall be audited by the Administration in order to ascertain that the firm is duly organized and managed in accordance with the documents submitted and is capable of conducting thickness measurement of the hull structure of ships."

Part B
Code on the enhanced programme of inspections during surveys of bulk carriers having double-side skin construction

Annex 5
Procedures for approval and certification of a firm engaged in thickness measurement of hull structures

2 Procedures for approval and certification

Auditing of the firm

2 Paragraph 2.2 is replaced by the following:

"2.2 Upon reviewing of the documents submitted with satisfactory results, the firm shall be audited by the Administration in order to ascertain that the firm is duly organized and managed in accordance with the documents submitted and is capable of conducting thickness measurement of the hull structure of ships."

ANNEX B
CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF OIL TANKERS

Part A
Code on the enhanced programme of inspections during surveys of double-hull oil tankers

Annex 8
Procedures for approval and certification of a firm engaged in thickness measurement of hull structures

2 Procedures for approval and certification

Submission of documents

3 The chapeau of paragraph 2.1 is replaced by the following:

"2.1 The following documents shall be submitted to the Administration for approval:"

Auditing of the firm

4 Paragraph 2.2 is replaced by the following:

"2.2 Upon reviewing of the documents submitted with satisfactory results, the firm shall be audited by the Administration in order to ascertain that the firm is duly organized and managed in accordance with the documents submitted and is capable of conducting thickness measurement of the hull structure of ships."

Part B
Code on the enhanced programme of inspections during surveys of oil tankers other than double-hull oil tankers

Annex 7
Procedures for approval and certification of a firm engaged in thickness measurement of hull structures

2 Procedures for approval and certification

Submission of documents

5 The chapeau of paragraph 2.1 is replaced by the following:

"2.1 The following documents shall be submitted to the Administration for approval:"

Auditing of the firm

6 Paragraph 2.2 is replaced by the following:

"2.2 Upon reviewing of the documents submitted with satisfactory results, the firm shall be audited by the Administration in order to ascertain that the firm is duly organized and managed in accordance with the documents submitted and is capable of conducting thickness measurement of the hull structure of ships."

***

ANNEX 6

RESOLUTION MSC.554(108)
(adopted on 23 May 2024)

AMENDMENTS TO THE INTERNATIONAL LIFE-SAVING APPLIANCE (LSA) CODE

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO resolution MSC.48(66), by which it adopted the International Life-Saving Appliance (LSA) Code ("the LSA Code"), which has become mandatory under chapter III of the International Convention for the Safety of Life at Sea (SOLAS), 1974 ("the Convention"),

RECALLING FURTHER article VIII(b) and regulation III/3.10 of the Convention concerning the procedure for amending the LSA Code,

HAVING CONSIDERED, at its 108th session, amendments to the LSA Code proposed and circulated in accordance with article VIII(b)(i) of the Convention,

1 ADOPTS, in accordance with article VIII(b)(iv) of the Convention, amendments to the LSA Code, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the amendments shall be deemed to have been accepted on 1 July 2025 unless, prior to that date, more than one third of the Contracting Governments to the Convention or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet have notified the Secretary-General of their objections to the amendments;

3 INVITES Contracting Governments to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 January 2026 upon their acceptance in accordance with paragraph 2 above;

4 ALSO INVITES Contracting Governments to note the amendments in the annex are to be applied to life-saving appliances installed on or after 1 January 2026 where the expression "installed on or after 1 January 2026" means:

(a) for ships for which the building contract is placed on or after 1 January 2026, or in the absence of the contract, the keels of which are laid or which are at a similar stage of construction on or after 1 January 2026, all installations of the specified type on board those ships; or

(b) for ships other than those ships specified in (a) above, all installations of the specified type, having a contractual delivery date for the equipment or, in the absence of a contractual delivery date to the ship, actually delivered to the ship on or after 1 January 2026;

5 REQUESTS the Secretary-General, in conformity with article VIII(b)(v) of the Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Contracting Governments to the Convention;

6 ALSO REQUESTS the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization which are not Contracting Governments to the Convention.

ANNEX

AMENDMENTS TO THE INTERNATIONAL LIFE-SAVING APPLIANCE (LSA) CODE

CHAPTER II
PERSONAL LIFE-SAVING APPLIANCES

2.2 Lifejackets

2.2.1 General requirements for lifejackets

1 Paragraph 2.2.1.6.2 is replaced by the following:

".2 turn the body of unconscious, face-down persons in the water to a face-up position where the nose and mouth are clear of the water in an average time not exceeding that of the RTD plus 1 s;"

CHAPTER IV
SURVIVAL CRAFT

4.4 General requirements for lifeboats

4.4.7 Lifeboat fittings

2 Paragraph 4.4.7.6.8 is replaced by the following:

".8 to prevent an accidental release during recovery of the boat, the hook shall not be able to support any load unless the hook is completely reset. In the case of a hook which is capable of releasing the lifeboat or rescue boat with a load on the hook when it is not fully waterborne, the handle or safety pins shall not be able to be returned to the reset (closed) position, and any indicators shall not indicate the release mechanism is reset, unless the hook is completely reset. Additional danger signs shall be posted at each hook station to alert crew members to the proper method of resetting;"

3 Paragraph 4.4.7.6.17 is replaced by the following:

".17 where a single fall and hook system is used for launching a lifeboat or rescue boat in combination with a suitable painter, the requirements of paragraphs 4.4.7.6.7 and 4.4.7.6.15 need not be applicable; provided that the single fall and hook system does not have the capability to release the lifeboat or rescue boat with a load on the hook when it is not fully waterborne.

CHAPTER VI
LAUNCHING AND EMBARKATION APPLIANCES

6.1.2 Launching appliances using falls and a winch

4 Paragraph 6.1.2.8 is replaced by the following:

"6.1.2.8 The speed at which the fully loaded survival craft or rescue boat is lowered to the water shall not be less than that obtained from the formula:

S = 0.4 + 0.02H, or 1.0, whichever is less where:

S is the lowering speed in metres per second and

H is the height in metres from the davit head to the waterline with the ship at the lightest sea-going condition."

5 Paragraph 6.1.2.10 is replaced by the following:

"6.1.2.10 The maximum lowering speed of a fully loaded survival craft or rescue boat shall be 1.3 m/s. The Administration may accept a maximum lowering speed other than 1.3 m/s, having regard to the design of the survival craft or rescue boat, the protection of its occupants from excessive forces, and the strength of the launching arrangements taking into account inertia forces during an emergency stop. Means shall be incorporated in the appliance to ensure that this speed is not exceeded."

***

ANNEX 7

RESOLUTION MSC.555(108)
(adopted on 23 May 2024)

AMENDMENTS TO THE INTERNATIONAL CODE FOR FIRE SAFETY SYSTEMS (FSS CODE)

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO resolution MSC.98(73), by which it adopted the International Code for Fire Safety Systems ("the FSS Code"), which has become mandatory under chapter II-2 of the International Convention for the Safety of Life at Sea, 1974 ("the Convention"),

RECALLING FURTHER article VIII(b) and regulation II-2/3.22 of the Convention concerning the procedure for amending the FSS Code,

HAVING CONSIDERED, at its 108th session, amendments to the FSS Code, proposed and circulated in accordance with article VIII(b)(i) of the Convention,

1 ADOPTS, in accordance with article VIII(b)(iv) of the Convention, amendments to the FSS Code, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the amendments shall be deemed to have been accepted on 1 July 2025 unless, prior to that date, more than one third of the Contracting Governments to the Convention, or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet have notified the Secretary-General of their objections to the amendments;

3 INVITES Contracting Governments to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 January 2026 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, in conformity with article VIII(b)(v) of the Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Contracting Governments to the Convention;

5 ALSO REQUESTS the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization which are not Contracting Governments to the Convention.

ANNEX

AMENDMENTS TO THE INTERNATIONAL CODE FOR FIRE SAFETY SYSTEMS (FSS CODE)

CHAPTER 7
Fixed pressure water-spraying and water mist fire-extinguishing systems

2 Engineering specifications

1 The following new section 2.5 is added after existing section 2.4 (Fixed water-based fire-fighting systems for ro-ro spaces, vehicle spaces and special category spaces):

"**2.5 Fixed water-based fire-extinguishing system on ro-ro passenger ships' weather decks intended for the carriage of vehicles**

This paragraph details the specification of fixed water-based fire-extinguishing system on ro-ro passenger ships having weather decks intended for the carriage of vehicles as required by chapter II-2 of the Convention. The requirements of this paragraph shall apply to ro-ro passenger ships constructed on or after 1 January 2026.

2.5.1 The protected area shall be the entire length and width of the weather deck intended for the carriage of vehicles. The fixed monitor(s) shall be capable of delivering water to:

.1 the area of weather decks intended for carriage of vehicles; and

.2 the area, including superstructure boundaries located up to 8.0 m, measured horizontally, from the area intended for vehicle storage, or the next vertical boundaries, whichever is less.

2.5.2 The combined capacity of all fixed monitors shall be minimum 2.0 L/min per square metre of the protected area, but in no case shall the output of any monitor be less than 1,250 L/min. Even distribution of water shall be ensured.

2.5.3 The distance from the monitor to the farthest extremity of the protected area forward of that monitor shall not be more than 75% of the monitor throw in still air conditions.

2.5.4 Each monitor shall be located outside the area which it protects, in a safe position, with access not likely to be cut off in case of fire.

Monitors shall be installed in positions which allow for unobstructed water coverage with vehicles stowed to maximum capacity of the weather deck. However, areas that cannot be covered by water monitors shall be protected by water nozzles. Nozzles shall be designed and installed taking into account weather conditions and provide 5.0 L/min per square metre for the area they cover and have release controls in a position being accessible in case of a fire.

2.5.5 The system shall be available for immediate use and capable of continuously supplying water. The water supply shall be capable of simultaneously supplying water at the required rate for the entire width of the weather deck intended for carriage of vehicles and a length of 40 m, or the entire length of the weather deck if this is less than 40 m. In no case shall the supply capacity be less than that required for the largest monitor.

2.5.6 The system may be supplied by the fire main, the pump(s) serving other fixed water-based fire-fighting systems or a dedicated pump providing a continuous supply of seawater.

Where the ship's fire pumps are used to feed the monitor(s):

.1 it shall be possible to segregate the ship's fire main from the monitor(s) by means of a valve in order to operate both systems separately or simultaneously; and

.2 the capacity of the pumps shall be sufficient to serve both systems simultaneously, including two jets of water at the required pressure from the fire main system. In case the weather deck shall also carry dangerous goods, capacity for four jets of water at the required pressure shall be provided.

Where another fixed water-based fire-fighting system is used to feed the monitor(s):

.3 it shall be possible to segregate the other fixed water-based fire-fighting system from the monitor(s) by means of a valve in order to operate both systems separately or simultaneously; and

.4 the capacity of the pump(s) shall, in case of open ro-ro spaces, be sufficient to serve both systems simultaneously, minimum two sections of the fixed water-based fire-fighting system being close to the openings facing weather deck and one monitor serving the weather deck. For closed ro-ro spaces and special category spaces, simultaneous operation is not required."

CHAPTER 9
Fixed fire detection and fire alarm systems

1 Application

2 Paragraph 1.1 is replaced by the following:

"1.1 This chapter details the specification of fixed fire detection and fire alarm systems as required by chapter II-2 of the Convention. Unless expressly provided otherwise, the requirements of this chapter shall apply to ships constructed on or after 1 July 2012. The requirements of 2.3.1.5 and 2.4.2.2 of this chapter shall apply to ships constructed on or after 1 January 2026."

2 Engineering specifications

2.3 Component requirements

3 Paragraphs 2.3.1.3 and 2.3.1.4 are replaced by the following:

"2.3.1.3 Heat detectors and linear heat detectors shall be certified to operate before the temperature exceeds 78ºC but not until the temperature exceeds 54ºC, when the temperature is raised to those limits at a rate less than 1ºC per min, when tested according to relevant parts of standards EN 54:2001 and IEC 60092-504. Alternative testing standards may be used as determined by the Administration. At higher rates of temperature rise, the heat detector and linear heat detector shall operate within temperature limits to the satisfaction of the Administration having regard to the avoidance of detector insensitivity or oversensitivity.

2.3.1.4 The operation temperature of heat detectors and linear heat detectors in drying rooms and similar spaces of a normal high ambient temperature may be up to 130ºC, and up to 140ºC in saunas."

4 The following new paragraph 2.3.1.5 is inserted after the existing paragraph 2.3.1.4 and subsequent paragraphs are renumbered accordingly:

"2.3.1.5 Linear heat detectors shall be tested according to standards EN 54-22:2015 and IEC 60092-504. Alternative testing standards may be used as determined by the Administration."

2.4 Installation requirements

2.4.2 Positioning of detectors

5 Paragraph 2.4.2.2 and the associated table 9.1 (Spacing of detectors) therein are replaced by the following:

"**2.4.2.2** The maximum spacing of detectors shall be in accordance with the table below:

Table 9.1 – Spacing of detectors

Type of detector	Maximum floor area per detector (m^2)	Maximum distance apart between centres (m)	Maximum distance away from bulkheads (m)
Heat	37	9	4.5
Smoke	74	11	5.5
Combined smoke and heat	74	9	4.5

2.4.2.2.1 The Administration may require or permit other spacing based upon test data which demonstrate the characteristics of the detectors. Detectors located below movable ro-ro decks shall be in accordance with the above.

2.4.2.2.2 The distance between two sensor cables of the linear heat detection system shall not be more than 9.0 m, while the distance between such cables and bulkheads shall not be more than 4.5 m."

2.5 System control requirements

2.5.1 Visual and audible fire signals

6 The following new paragraphs 2.5.1.2, 2.5.1.3 and 2.5.1.4 are inserted after paragraph 2.5.1.1 and the subsequent paragraphs are renumbered accordingly:

"**2.5.1.2** On ro-ro passenger ships constructed on or after 1 January 2026, alarm notifications shall follow a consistent alarm presentation scheme (wording, vocabulary, colour and position). Alarms shall be immediately recognizable on the navigation bridge and shall not be compromised by noise or poor placing.

2.5.1.3 On ro-ro passenger ships constructed on or after 1 January 2026, the interface shall provide alarm addressability, allow the crew to identify the alarm history, the most recent alarm and the means to suppress alarms while ensuring the alarms with ongoing trigger conditions are still clearly visible.

2.5.1.4 On ro-ro passenger ships constructed on or after 1 January 2026, the smoke detector function in special category and ro-ro spaces may be disconnected during loading and unloading of vehicles. The time of disconnection shall be adapted to the time of loading/unloading and be automatically reset after this predetermined time. The central unit shall indicate whether the detector sections are disconnected or not. Disconnection of the heat detection function or manual call points shall not be permitted."

***

ANNEX 20

RESOLUTION MSC.565(108)
(adopted on 24 May 2024)

REVISED INTERIM RECOMMENDATIONS FOR CARRIAGE OF LIQUEFIED HYDROGEN IN BULK

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

NOTING that the International Convention for the Safety of Life at Sea ("the Convention"), 1974 and the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk ("the IGC Code") currently do not specifically provide requirements for carriage of liquefied hydrogen in bulk by sea,

NOTING ALSO that paragraph 5 of Preamble of the IGC Code states that requirements for new products and their conditions of carriage will be circulated as recommendations, on an interim basis, prior to the entry into force of the appropriate amendments,

RECOGNIZING a need for the development of the Revised interim recommendations for carriage of liquefied hydrogen in bulk,

ACKNOWLEDGING that, in the interim, there is an urgent need to provide recommendations to the Administrations on safe carriage of liquefied hydrogen in bulk,

ACKNOWLEDGING ALSO that the Revised Interim Recommendations are intended to facilitate establishment of a tripartite agreement for a pilot ship, which will be developed for the research and demonstration of safe long-distance overseas carriage of liquefied hydrogen in bulk,

HAVING CONSIDERED the Revised Interim Recommendations prepared by the Sub-Committee on Carriage of Cargoes and Containers at its ninth session,

1 ADOPTS the Revised interim recommendations for carriage of liquefied hydrogen in bulk, the text of which is set out in the annex to the present resolution;

2 INVITES Member States to apply the Revised Interim Recommendations to the pilot ship carrying liquefied hydrogen in bulk taking the explanatory notes into consideration;

3 AGREES to acquire information on safe carriage of liquefied hydrogen in bulk prior to amendment to the IGC Code for the inclusion of liquefied hydrogen;

4 ALSO AGREES that these Revised Interim Recommendations may need to be reviewed if they are to be applied to ships other than the pilot ship; and

5 URGES Member States and the industry to submit information, observations, comments and recommendations based on the practical experience gained through the application of the Revised Interim Recommendations and submit relevant safety analysis on ships carrying liquefied hydrogen in bulk.

6 REVOKES resolution MSC.420(97).

ANNEX

REVISED INTERIM RECOMMENDATIONS FOR CARRIAGE OF LIQUEFIED HYDROGEN IN BULK

1 INTRODUCTION

1.1 For the carriage of liquefied gases in bulk by ships, the ships should comply with the relevant requirements in the IGC Code, as amended ("the Code"). The scope of the Code provided in paragraph 1.1.1 is:

> "The Code applies to ships regardless of their size, including those of less than 500 gross tonnage, engaged in the carriage of liquefied gases having a vapour pressure exceeding 0.28 MPa absolute at a temperature of 37.8°C, and other products, as shown in chapter 19, when carried in bulk".

1.2 A ship carrying liquefied hydrogen in bulk (hereinafter called "liquefied hydrogen carrier") should comply with the Code.

1.3 The Code requires that a gas carrier should comply with the minimum requirements for the cargo listed in chapter 19. However, the requirements for liquefied hydrogen are not specified in the Code.

1.4 This annex provides the Revised Interim Recommendations, as referred to in paragraph 5 of the preamble of the Code, for the carriage of liquefied hydrogen in bulk, which are intended to provide the basis for the future minimum requirements for the carriage of this cargo. The Revised Interim Recommendations are intended to facilitate the establishment of a tripartite agreement among the relevant Administrations for the carriage of liquefied hydrogen in bulk. However, they are not intended to prohibit the adoption of designs and arrangements other than those specified in the Code or in these Recommendations, at the discretion of the Administrations.

1.5 These recommendations have been developed under the assumption that a liquefied hydrogen carrier does not carry liquefied gases other than liquefied hydrogen. These recommendations, therefore, are not applicable to liquefied hydrogen carriers carrying gases other than liquefied hydrogen.

1.6 In the Code, reference is made to paragraph 5 of the Preamble; paragraph 1.1.6.1; and Note No.8 on completion of certificate in "model form of international certificate of fitness for the carriage of liquefied gases in bulk" in appendix 2 to the Code.

1.7 These Revised Interim Recommendations consist of the following parts. Part A is applicable to ships with any type of cargo containment system. Part B and subsequent part(s) prescribe additional special requirements for cargo containment systems of specific types.

Part A: General (applicable to ships with any type of cargo containment system);

Part B: Cargo containment systems of independent cargo tanks using vacuum insulation; and

Part C: Cargo containment systems of independent cargo tanks using insulation materials and hydrogen gas in the inner insulation spaces.

1.8 Part A of this document was developed based on the design of parts B and C. If subsequent part(s) are added, the special requirements prescribed in part A may be reviewed.

Part A
General
(Applicable to ships with any type of cargo containment system)

2 GENERAL

2.1 Definition

2.1.1 The following definition should apply for the purpose of these Revised Interim Recommendations.

Permeation is flow of a fluid through another material by diffusion without a defect or opening of the latter.[8]

2.2 Requirements for carriage of liquefied hydrogen in bulk

2.2.1 The requirements for the carriage of liquefied hydrogen in bulk have been developed based on the results of a comparison study of similar cargoes listed in chapter 19 of the Code, e.g. liquefied natural gas.

2.2.2 Chapter 19 of the Code governs the application of general requirements for respective cargoes. Selections of the general requirements for respective cargoes are expressed in columns 'c' to 'g'. In addition to general requirements, special requirements may apply to specific cargoes depending on the properties/hazards of the cargoes.

2.2.3 Tables 1 and 2 specify the proposed selection of the general requirements and the special requirements, respectively, for liquefied hydrogen. In addition to table 2, special requirements for cargo containment systems of specific types are prescribed in part B or subsequent part(s).

[1] See paragraph 3.79 of ISO/TR 15916:2015.

Table 1: Requirements for carriage of liquefied hydrogen in bulk

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
Product name		***Ship type***	***Independent tank type C required***	***Control of vapour space within cargo tanks***	***Vapour detection***	***Gauging***		***Special requirements***
Hydrogen		2G	-	-	F	C		See table 2 and, either corresponding table 4 or table 5, as appropriate for the type of cargo containment systems

Table 2: Special requirements for carriage of liquefied hydrogen in bulk

No.	Special requirement	Related hazard
A-1	Requirements for materials whose design temperature is lower than -165°C should be agreed with the Administration, paying attention to appropriate standards. Where minimum design temperature is lower than -196°C, property testing for insulation materials should be carried out with the appropriate medium, over a range of temperatures expected in service.	Low temperature (see 4.2.1)
A-2	Materials of construction and ancillary equipment such as insulation should be resistant to the effects of high oxygen concentrations caused by condensation and enrichment at the low temperatures attained in parts of the cargo system (refer to the requirement for nitrogen). This special requirement is applied to all locations where contact with condensed oxygen is anticipated under normal conditions and foreseeable single failure scenarios.	Low temperature (see 4.2.2)
A-3	For cargo pipes containing liquid hydrogen and cold hydrogen vapour, measures should be taken to prevent the exposed surfaces from reaching -183°C. For places where preventive measures against low temperature are not sufficiently effective, such as cargo manifolds, other appropriate measures such as ventilation which avoids the formation of highly enriched oxygen and the installation of trays recovering liquid air may be permitted in lieu of the preventive measures. Insulation on liquid hydrogen piping systems exposing to air should be of non-combustible material and should be designed to have a seal in the outer covering to prevent the condensation of air and subsequent oxygen enrichment within the insulation.	Low temperature (see 4.2.2)
A-4	Appropriate means, e.g. filtering, should be provided in cargo piping systems to remove impure substances condensed at low temperature.	Low temperature (see 4.2.3)

No.	Special requirement	Related hazard
A-5	Pressure relief systems should be suitably designed and constructed to prevent blockage due to formation of water or ice.	Low temperature (see 4.2.4)
A-6	At places where contact with hydrogen is anticipated, suitable materials should be used to prevent any structural deterioration owing to hydrogen embrittlement and degradation of strength and fatigue properties due to continual exposure to hydrogen, as necessary.	Hydrogen embrittlement (see 4.3)
A-7	Double tube structures ensuring no leakage, or fixed hydrogen detectors being capable of detecting a hydrogen leak, should be provided for confined places where leakage of hydrogen may occur, such as cargo valves, flanges and seals.	Susceptibility to leakage (see 4.4.2)
A-8	Helium or a mixture of 5% hydrogen and 95% nitrogen should be used as the tightness test medium for cargo tank and cargo piping.	Susceptibility to leakage (see 4.4.3)
A-9	The amount of carbon dioxide carried for a carbon dioxide fire-extinguishing system should be sufficient to provide a quantity of free gas equal to 75% or more of the gross volume of the cargo compressor and pump rooms in all cases.	Fire by Hydrogen (see 4.7.3) Wide range of flammability limits (see 4.10)
A-10	When deterioration of insulation capability by single damage is possible, appropriate safety measures should be adopted taking into account the deterioration.	High pressure (see 4.8)
A-11	Appropriate measures should be provided to prevent vents becoming blocked by accumulations of ice formed from moisture in the air.	Low temperature (see 4.2.2)
A-12	Due consideration should be given to means for handling boil-off gas.	High pressure (see 4.8)
A-13	Due consideration should be given to static electricity associated with rotating or reciprocating machinery including the installation of conductive machinery belts and precautionary measures incorporated in operating and maintenance procedures, in addition to the bonding of tanks, piping and equipment required by paragraph 5.7.4 of the Code. Anti-static clothing and footwear, and a portable hydrogen detector should be provided for each crew member working in the cargo area.	Static electricity (see 4.9.2)
A-14	The cargo operation manuals required in paragraph 18.2 of the Code should include limitations of various operations in relation to environmental conditions.	Wide range of flammability limits (see 4.10)

No.	Special requirement	Related hazard
A-15	An appropriate procedure should be established for warm-up, inert gas purge, gas-free, hydrogen purge and pre-cooling. The procedure should include: .1 selection of inert gas in relation to temperature limit; .2 measurement of gas concentration; .3 measurement of temperature; .4 rates of supply of gases; .5 conditions for commencement, suspension, resuming and termination of each operation; .6 treatment of return gases; and .7 discharge of gases.	Prevention of dangerous purging operation (see 4.11)
A-16	Only almost pure para-hydrogen (i.e. more than 95%) should be loaded in order to avoid excessive heating by ortho- to para-hydrogen conversion.	General (see 4.1)
A-17	Fire detectors for detecting hydrogen fire should be selected, taking into account the features of hydrogen fire, to the satisfaction of the Administration.	Features of hydrogen fire and fire hazard (see 4.7.4)
A-18	At the design stage, dispersion of hydrogen from vent outlets should be analysed in order to minimize risk of ingress of flammable gas into accommodation spaces, service spaces, machinery spaces and control stations. Extension of hazardous areas should be considered based on the results of the analysis.	Low density and high diffusivity (see 4.5)
A-19	Due consideration should be given to appropriate safety measures to prevent formation of explosive mixture in the case of a leakage and permeation of hydrogen, including: .1 installation of hydrogen detectors in order to detect a possible ground-level travel of low temperature hydrogen gas, and at high points in spaces where warm hydrogen gas can be trapped; and .2 application of "best practice" for land-based liquid hydrogen storage taking into account appropriate guidance such as "Cryogenics Safety Manual – Fourth Edition (1998)"[8)].	General (see 4.1)
A-20	In the case that fusible elements are used as a means of fire detection required by paragraph 18.10.3.2 of the Code, flame detectors suitable for hydrogen flames should be provided in addition at the same locations. Appropriate means should be adopted to prevent the activation of ESD system owing to false alarm of flame detectors, e.g. avoiding activation of ESD system by single sensor (voting method).	Fire hazard (see 4.7.4)

No.	Special requirement	Related hazard
A-21	Consideration should be given to enhance the ventilation capacity of the enclosed spaces subject to liquefied hydrogen leakage and permeation, taking into account the latent heat of vaporization, specific heat and the volume of hydrogen gas in relation to temperature and heat capacity of adjacent spaces.	Low density and high diffusivity (see 4.5)
A-22	Liquid and gas hydrogen pipes should not pass through enclosed spaces in addition to other than those referred to in paragraph 5.2.2.1.2 of the Code, unless: .1.1 the spaces are equipped with gas detection systems which activate the alarm at not more than 20% LFL and shut down the isolation valves, as appropriate, at not more than 40% LFL (see sections 16.4.2 and 16.4.8 of the Code); and .1.2 the spaces are adequately ventilated; or .2 the spaces are maintained in an inert condition.	Susceptibility to leakage (see 4.4)
A-23	A risk assessment should be conducted to ensure that risks arising from liquefied hydrogen cargo affecting persons on board, the environment, the structural strength or the integrity of the ship are addressed. Consideration should be given to the hazards associated with properties of liquefied hydrogen and hydrogen gas, physical layout, operation and maintenance, following any reasonably foreseeable failure. For the risk assessment, appropriate methods, e.g. HAZID, HAZOP, FMEA/FMECA, what-if analysis, etc., should be adopted taking into account IEC/ISO 31010:2019 "Risk management – Risk assessment techniques"[7)] and SAE ARP 5580-2001 "Recommended failure modes and effects analysis (FMEA) practices for non-automobile applications"[9)].	General (see 4.1)
A-24	Relief valve sizing should be undertaken for the most onerous scenario. The evaluation should include the fire scenario and should consider the resulting magnitude of the heat flux on the cargo containment system.	High pressure hazard (see 4.8)
A-25	A filling limit exceeding 98% at reference temperature should not be permitted.	High pressure hazard (see 4.8)
A-26	Bolted flange connections of hydrogen piping should be avoided where welded connections are feasible.	Susceptibility to leakage (see 4.4.2)
A-27	Due consideration should be given to the invisible nature of hydrogen fire from the viewpoint of safety of ships and especially personnel in case of fire.	Fire hazard (see 4.7.1)

3 EXPLANATION ON GENERAL REQUIREMENTS

3.1 Properties of liquefied hydrogen

The application of general requirements in the Code for liquefied hydrogen has been considered based on a comparison study on the physical properties of liquefied hydrogen and LNG. LNG and liquefied hydrogen are cryogenic liquids, non-toxic, and generate flammable high pressure gas. For reference, table 3 shows the comparison of physical properties of hydrogen and methane, the major component of LNG.

Table 3: Comparison of physical properties of Hydrogen and Methane

	Hydrogen	Methane	References
Boiling temperature (K)*	20.3	111.6	ISO[1)], Annex A, Table A.3
Liquid density (kg/m^3)*	70.8	422.5	ISO[1)], Annex A, Table A.3
Gas density (kg/m^3)** (Air: 1.198)	0.084	0.668	NIST RefProp[10)]
Viscosity (g/cm•s x 10^{-6}) Gas Liquid	 8.8 13.49	 10.91 116.79	 NIST RefProp[10)] NIST RefProp[10)]
Flame temperature in air (°C)	2396	2230	Calculated using Cantera and GRI 3.0 mechanism
Maximum burning velocity (m/s)	3.15	0.385	Calculated using Cantera and GRI 3.0 mechanism
Heat of vaporization (J/g)*	454.6	510.4	ISO[1)], Annex A, Table A.3
Lower flammability limit (% vol. fraction)***	4	5.3	ISO[1)], Annex B, Table B.2
Upper flammability limit (% vol. fraction)***	77	17.0	ISO[1)], Annex B, Table B.2
Minimum ignition energy (mJ)***	0.017	0.274	ISO[1)], Annex B, Table B.2
Auto-ignition temperature***	858	810	ISO[1)], Annex B, Table B.2
Toxicity	Non	Non	Orange book[5)]
Temperature at critical point (K)	33.19****	190.55	Hydrogen: ISO[1)], Annex A, Table A.1 Methane: The Japan Society of Mechanical Engineers, Data Book, Thermophysical Properties of Fluids (1983)
Pressure at critical point (kPaA)	1315****	4595	Hydrogen: ISO[1)], Annex A, Table A.1 Methane: The Japan Society of Mechanical Engineers, Data Book, Thermophysical Properties of Fluids (1983)

Remarks:
- * At their normal boiling points for comparison purpose.
- ** At normal temperature and pressure.
- *** Ignition and combustion properties for air mixtures at 25°C and 101.3 kPaA.
- **** Normal Hydrogen.

3.2 Explanation on respective requirements

3.2.1 Ship type (column 'c')

As the hazard associated with hydrogen cargo is flammability but not toxicity, the ship type is considered 2G.

3.2.2 Independent tank type C required (column 'd')

Independent tank type C is allocated only to dangerous goods of class 2.3 whose vapour density is heavier than air. Independent tank type C is considered not to be required for liquefied hydrogen.

3.2.3 Control of vapour space within cargo tank (column 'e')

Special environment controls such as drying and inerting are generally required for liquid chemical products in consideration of the reactivity of cargo vapour and air. As is the case for LNG, it is considered not to be necessary to apply such requirements for liquefied hydrogen.

3.2.4 Vapour detection (column 'f')

Because hydrogen is flammable and non-toxic, it is appropriate to require Flammable (F) as vapour detection for liquefied hydrogen.

3.2.5 Gauging (column 'g')

On the grounds that Closed (C) gauging is required, in principle, for flammable or toxic cargoes, such as methane, it is considered to be appropriate to require Closed (C) gauging for hydrogen, taking into account that hydrogen has high ignitability and a wide flammable range in air and that closed gauging is effective to prevent leakage of gases into air.

4 SPECIAL REQUIREMENTS AGAINST HAZARDS OF LIQUEFIED HYDROGEN

4.1 Hazards of liquefied hydrogen to be considered

4.1.1 The hazards related to liquefied hydrogen are low ignition energy, a wide range of flammability limits, low visibility of flames in case of fire, high flame velocity which may lead to the detonation with shockwave, low temperature and liquefaction/solidification of inert gas and constituents of air which may result in an oxygen-enriched atmosphere, high permeation, low viscosity, and hydrogen embrittlement including weld metals. Where vacuum insulation is adopted, due consideration should be given to the possibility of untimely deterioration of insulation properties at the envisaged carriage temperatures of liquid hydrogen. The vacuum insulation evaluation should be specified for the normal range or upper limit of cold vacuum pressure (CVP), and loss of vacuum should be defined with respect to this value. Accordingly, effect of vacuum pressure should be taken into account at the time of design and testing of piping with vacuum insulation. Supporting structure and adjacent hull structure should be designed taking into account the cooling owing to loss of vacuum insulation.

4.1.2 Hydrogen is essentially a mixture of ortho- and para-hydrogen, with an equilibrium concentration of 75% ortho-hydrogen and 25% para-hydrogen at ambient temperature. When liquefied at 20K, there is a slow but continuous transformation of ortho-hydrogen to para-hydrogen. The exothermic conversion of the nuclear spin isomers of hydrogen (ortho- to para-hydrogen) may take place and the effect of the conversion may have an impact on the cooling capacity and relief valve capacity of the vessel's equipment.

4.1.3 Trace amounts of air will condense or solidify in an environment with liquid hydrogen possibly resulting in an unstable and explosive mixture. Precautions should be taken to assure that the possibility of condensed air is accounted within properly secured hazard areas.

4.2 Low temperature hazard

4.2.1 Selection of appropriate material

4.2.1.1 Tables 6.3 and 6.4 in the Code prescribe material selection for piping or cargo tanks whose design temperature is -165°C or higher. According to Note 2 of table 6.3 and Note 3 of table 6.4 of the Code, the requirements for materials whose design temperatures are lower than -165°C should be specially agreed with the Administration. In this regard, the publication by AIAA[2)] introduces some appropriate materials corresponding to the design temperature and the Administration should take into account such references for the material selection.

4.2.1.2 Although paragraph 4.19.3 in the Code requires testing of materials used for thermal insulation for various properties adequate for the intended service temperature, the minimum test temperature is -196°C. The requirements in the Code do not refer to the normal boiling point of hydrogen, being -253°C. In case of carriage of liquefied hydrogen, special requirements should be provided to consider the lower design temperature.

4.2.2 Measures for condensed air

4.2.2.1 In the case of nitrogen whose normal boiling point is -196°C, for which air condensation and oxygen enrichment are concerns, the following special requirement has already been included in paragraph 17.17 in the Code:

> "Material of construction and ancillary equipment such as insulation shall be resistant to the effect of high oxygen concentrations caused by condensation and enrichment at the low temperatures attained in parts of the cargo system. Due consideration shall be given to ventilation in such areas where condensation might occur to avoid the stratification of oxygen-enriched atmosphere."

A similar special requirement is applicable to hydrogen.

4.2.2.2 A vent may be blocked by accumulation of ice formed from moisture in the air, which may result in excessive pressure leading to rupture of the vent and relevant piping (see paragraph 4.2.4).

4.2.3 Removal of impure substances condensed

The removal of impure substances, such as those contained in condensate in pipes, should be separately considered. Installation of filters can be an appropriate measure and should be stipulated as a special requirement.

4.2.4 Prevention of blockage due to formation of water or ice

Pressure relief systems may become blocked due to formation of water or ice, depending on the temperature and humidity of air, resulting from the low temperature of the cargo and its vapour (see paragraph 4.2.2). Appropriate means should be provided to prevent such phenomena.

4.3 Hydrogen embrittlement

4.3.1 Selection of appropriate materials should be required to prevent failures owing to hydrogen embrittlement. The publication by AIAA[2)] introduces some appropriate materials resistant to hydrogen embrittlement, and concludes that aluminium is the material least affected.

4.3.2 International or national standards should be followed for the selection of materials for the design of liquefied and gaseous hydrogen installations in a marine environment.

4.4 Susceptibility to leakage

4.4.1 Prevention of leakage from pipes

To mitigate undetected accumulation of hydrogen in a confined space, effective measures should be employed to reduce the possibility of leakage of hydrogen, taking its leakage characteristics into account. Effective measures can be double tube structures, or fixed hydrogen leak detectors in areas assessed as being highly hazardous with regard to hydrogen leakage. Hydrogen leakage through welds, joints and seals is an important consideration for the design of hydrogen systems and an important operational issue.

4.4.2 Implementation of effective tightness test

4.4.2.1 Tightness tests for cargo tanks and cargo pipes/valves are required by paragraphs 4.20.3.2, 5.13.1 and 5.13.2.3 in the Code respectively. Helium or a mixture of 5% hydrogen and 95% nitrogen should be used as the medium for tightness tests, instead of air, because hydrogen is highly susceptible to leakage.

4.4.2.2 For a hydrogen installation, the pipework should be pressure-tested at its design pressure. Consideration should be given to using oxygen-free nitrogen with a small molecule tracer gas, such as helium as the test medium and an electronic leak detector for identifying leaks.

4.4.3 Confirmation of appropriate operating procedure

Instructions/manuals containing the operating procedures for the prevention of leakage during transport, methods for early detection in case of leakage, and appropriate measures after such events, should be provided. For this, paragraph 18.3 of the Code requires that the information shall be on board and available to all concerned, giving the necessary data for the safe carriage of cargo. In detail, the Code requires such information on action to be taken in the event of spills or leak, countermeasures against accidental personal contact, procedures for cargo transfer, and emergency procedures to be on board. With regard to the manuals on procedures for liquefied hydrogen during carriage and transfer operations, the requirements in the Code are applicable and no special requirement is necessary.

4.5 Low density and high diffusivity

Though low density and high diffusivity of hydrogen may reduce the possibility of formation of a flammable atmosphere in open spaces, adequate ventilation is necessary for enclosed spaces in cargo areas where formation of hydrogen-oxygen/air mixture may occur. Paragraph 12.2 of the Code requires fixed ventilation systems or portable mechanical ventilation for such enclosed spaces. These requirements in the Code are applicable to liquefied hydrogen carriers and no special requirement is necessary in this regard.

4.6 Ignitability

4.6.1 The Code requires electrical bonds of the piping and the cargo tanks in paragraph 5.7.4, exclusion of all sources of ignition in paragraph 11.1.2, electrical installations to minimize the risk of fire and explosion from flammable products in paragraph 10.2.1 and so on, in order to prevent ignition of flammable cargoes.

4.6.2 The Code requires compliance with the relevant standards issued by the International Electrotechnical Commission (IEC) and the IEC standards specify the details of such safety measures depending on the respective properties of flammable gases including hydrogen. No special requirement is necessary with regard to ignitability of hydrogen.*

4.7 Fire hazard

4.7.1 Safety of personnel in case of fire

To avoid the effects of flame and UV radiation produced by a hydrogen fire, it is effective to use fire-fighter's outfits and protective equipment. The Code already requires fire-fighter's outfits for ships carrying flammable products in paragraph 11.6.1 and safety equipment in paragraph 14.3. This issue should be considered as the matter of cargo information required by paragraph 18.3 of the Code. Due consideration should be given to the invisible nature of hydrogen fire.

4.7.2 Compatibility of fire-extinguishing systems

Dry chemical powder fire-extinguishing or carbon dioxide fire-extinguishing systems are considered to be effective in case of hydrogen fire and such fire-extinguishing systems are already required by paragraphs 11.4 and 11.5 of the Code. Special requirements for installation of other types of fire-extinguishing systems are considered unnecessary, except with regard to the increased of amount of carbon dioxide required, as mentioned in the next paragraph in this document.

4.7.3 Increase of the amount of gas for carbon dioxide fire-extinguishing systems

4.7.3.1 Paragraph 11.5.1 of the Code requires as follows:

> "Enclosed spaces meeting the criteria of cargo machinery spaces in 1.2.10, and the cargo motor room within the cargo area of any ship, shall be provided with a fixed fire-extinguishing system complying with the provisions of the FSS Code and taking into account the necessary concentrations/application rate required for extinguishing gas fires."

4.7.3.2 Chapter 5 of the FSS Code, i.e. Fixed gas fire-extinguishing systems, requires that the quantity of carbon dioxide for cargo spaces, unless otherwise provided, shall be sufficient to give a minimum volume of free gas equal to 30% of the gross volume of the largest cargo space to be protected in the ship, in paragraph 2.2.1.1.

4.7.3.3 On the other hand, NFPA 12[3)] requires that the design quantity of carbon dioxide for hydrogen fire should be 75% or more of the gross volume of the protected space. The special requirement for an increased amount of carbon dioxide should be provided for carbon dioxide fire-extinguishing systems.

4.7.4 Features of hydrogen fire

Hydrogen burns at high temperature, but generally gives off less radiant heat than propane or other hydrocarbons (e.g. only about 10% of that radiated by an equal-sized propane flame). Although the heat radiated by a hydrogen flame is also relatively low compared to hydrocarbons, it is important to take into account the differences in heats of combustion,

* Electrical equipment used in hydrogen/air mixture should be, at least, the type of "II-C" and "T-1" as the group based on the maximum experimental safe gap for flameproof enclosures and the temperature class based on maximum surface temperature, respectively, according to ISO/IEC 80079-20-1[4)].

burning rate and flame size. Hydrogen flames are colourless or nearly colourless. Both of these characteristics make it more difficult to detect a hydrogen fire. Even relatively small hydrogen fires are very difficult to extinguish. The only reliable approach to extinguish a fire is to shut off the source of hydrogen supply.

4.8 High pressure hazard

4.8.1 High pressure is a hazard common to hydrogen and other flammable gases listed in the Code. To prevent overpressure, the Code requires various measures such as pressure control and pressure design. Specifically, paragraph 8.2, in regard to the provision of pressure control of cargo tanks, requires fittings of pressure relief valves to the cargo tanks. Furthermore, paragraph 7.1.1 requires temperature control by the use of mechanical refrigeration and/or design to withstand possible increases of temperature and pressure. In addition, paragraph 15.2 specifies the filling limit of cargo tanks taking into account cargo volume increase by its thermal expansion. These requirements are applicable for hydrogen and no special requirement is considered necessary in this regard.

4.8.2 Boil-off may be a more significant issue for hydrogen than for LNG in particular when insulation properties have deteriorated. Means of handling boil-off gas should be carefully considered taking into account the following issues:

.1 Re-liquefaction of hydrogen involves very specific and costly equipment. Cargo cooling in order to avoid boil-off shows the same kind of issues; and

.2 Notwithstanding the provision in paragraph 7.4.1 of the Code, thermal oxidation of hydrogen may be permitted in accordance with paragraph 1.3 of the Code.

4.8.3 The special requirements in these aspects are considered necessary.

4.9 Health hazard

4.9.1 Human safety concern under low temperature

With regard to the influences of cold hydrogen on persons' bodies, suitable protective equipment is effective. In this aspect, paragraph 14.1 of the Code requires suitable protective equipment taking into account the character of the products, therefore, no special requirement is considered necessary.

4.9.2 Static electricity

Hydrogen ignition energy is very low and hydrogen can be easily ignitable by static electricity and due consideration should be given to this issue, in accordance with the requirement in the Code on suitable protective equipment.

4.9.3 Oxygen depletion and asphyxiation

Leakage of hydrogen may cause low level of oxygen and associated asphyxiation.

4.10 Wide range of flammable limits

4.10.1 Extinguishing hydrogen fire

4.10.1.1 As mentioned in paragraph 4.6, for flammable products the Code already requires elimination of sources of ignition, including use of electrical installations of appropriate types in order to minimize the risk of fire and explosion. No special requirement is considered necessary with regard to ignitability of hydrogen.

4.10.1.2 Furthermore, with regard to the wide range of flammable limits of hydrogen, the increased quantities of carbon dioxide as a fire-extinguishing medium should be specified as mentioned in paragraph 4.7. No additional special requirement is considered to be necessary with regard to the wide range of flammable limits of hydrogen.

4.10.2 Disposal of cold hydrogen gas

The wide flammability range makes disposal of cold hydrogen gas a major hazard. Cold plumes of released hydrogen may impede adequate dilution of hydrogen down to below 4% and may lead to flash-back to the vent from distant ignition sources outside safety-controlled areas. The low ignition energy and wide flammable range may present significant challenges.

4.11 Prevention of dangerous purging operation

4.11.1 During cargo operations for maintenance, pipes and tanks should be purged with an inert gas or inert gases as illustrated in the figure below. For safety, due consideration should be given to temperature and boiling points of the inert gases. Residual pockets of hydrogen or the purge gas will remain in the enclosure if the purging rate, duration, or extent of mixing is too low. Therefore, reliable gas concentration measurements should be obtained at a number of different locations within the system for suitable purges. Temperature should also be measured at a number of locations. Oxidizing agents may exist in a hydrogen containing equipment, specifically: air, cold box atmospheres containing air diluted with nitrogen, or oxygen-enriched air that can be condensed on process pipe work within the cold box in special circumstances.

4.11.2 There are special measures that may need to be put in place in order to mitigate the hazards, e.g. air should be eliminated by nitrogen purge prior to introduction of hydrogen into cargo piping or processing equipment. Nitrogen should then be eliminated by hydrogen purge, where there is a possibility of its solidification in the subsequent process.

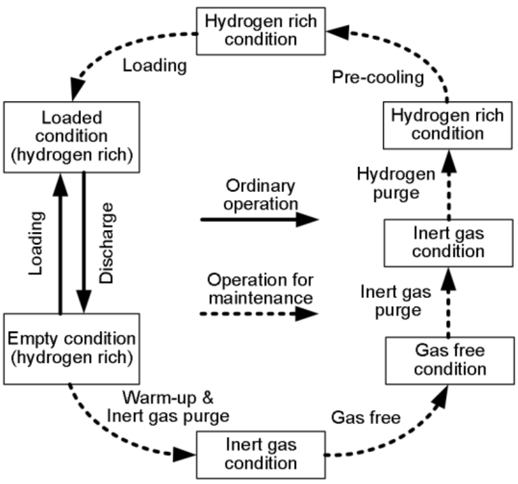


Figure 1

References in part A

1 ISO/TR 15916:2015, Basic consideration for the safety of hydrogen systems (ISO)

2 American Institute of Aeronautics and Astronautics, "Safety Standard for Hydrogen and Hydrogen Systems (Guide to Safety of Hydrogen and Hydrogen Systems)", 2005 (AIAA)

3 NFPA 12: Standard on Carbon Dioxide Extinguishing Systems 2020 Edition (NFPA)

4 ISO/IEC 80079-20-1:2017 Explosive atmospheres – Part 20-1: Material characteristics for gas and vapour classification – Test methods and data

5 UN Recommendations on the Transport of Dangerous Goods – Model Regulations, twenty-second revised edition

6 NFPA 2: Hydrogen Technologies Code 2016 Edition (NFPA)

7 IEC/ISO 31010: 2019 Risk management – Risk assessment techniques

8 Cryogenics Safety Manual – Fourth Edition (1998)

9 SAE ARP 5580-2001 "Recommended failure modes and effects analysis (FMEA) practices for non-automobile applications"

10 National Institute of Standards and Technology (NIST) RefProp database

Part B
Cargo containment systems of independent cargo tanks using vacuum insulation

5 Additional requirements

5.1 Additional special requirements for cargo containment systems of independent cargo tanks using vacuum insulation are prescribed in table 4 and these special requirements should apply in addition to the requirements in table 2.

Table 4: Special requirements for cargo containment systems of independent cargo tanks using vacuum insulation

No.	Special requirement	Related hazard
B-1	The insulation performance of vacuum insulation of cargo containment system should be evaluated to the satisfaction of the Administration based on experiments, as necessary.	General (see 4.1 and 6.1)
B-2	Notwithstanding special requirement A-22, liquid and gas hydrogen pipes may pass through spaces constituting a part of a cargo containment system using vacuum insulation where the degree of vacuum is monitored.	Susceptibility to leakage (see 4.4)
B-3	When selecting the most onerous scenario stipulated in special requirement A-24, the evaluation should include fire or loss of vacuum from the overall insulation system and should also consider the resulting magnitude of the heat flux in case of a single failure on the cargo containment system in each case.	High pressure hazard (see 4.8 and 6.2)

6 Additional special requirements to mitigate hazards of liquefied hydrogen

6.1 Hazards of liquefied hydrogen to be considered

6.1.1 In addition to 4.1.1, due consideration should be given to the possibility of untimely deterioration of insulation properties at the envisaged carriage temperatures of liquid hydrogen. The vacuum insulation evaluation should be specified for the normal range or upper limit of cold vacuum pressure (CVP), and loss of vacuum should be defined with respect to this value. Accordingly, effect of vacuum pressure should be taken into account at the time of design and testing of cargo containment systems. Supporting structure and adjacent hull structure should be designed taking into account the cooling owing to loss of vacuum insulation.

6.1.2 For consideration on the special requirements for this part, bibliographic studies were conducted using the references at the end of this document, in particular, ISO/TR 15916[1)], "High Pressure Gas Safety Act" (Japanese law), "Safety standard for hydrogen and hydrogen system" by AIAA[2)] and NFPA 2 "Hydrogen Technologies Code"[3)]. The majority of special requirements for liquefied hydrogen carriers are provided based on ISO/TR 15916. This standard refers to liquefied hydrogen tank storage facilities on shore, tank trucks and so on, and includes basic viewpoints when discussing the properties of liquefied hydrogen.

6.2 High pressure hazard

In addition to 4.8, vacuum insulation systems are likely to be used for liquefied hydrogen containment systems and the insulation capability of such systems may be adversely affected by damage to the system, depending on the design of the system. If a rapid deterioration of the insulation system took place, rapid increase of temperature in the cargo tank would occur and/or the rate of vaporization of liquefied hydrogen might exceed the capacity of pressure relief valves. To prevent such dangerous deterioration of insulation, appropriate safety measures should be taken.

References in part B

1 ISO/TR 15916:2015, Basic consideration for the safety of hydrogen systems (ISO)

2 American Institute of Aeronautics and Astronautics, "Safety Standard for Hydrogen and Hydrogen Systems (Guide to Safety of Hydrogen and Hydrogen Systems)", 2005 (AIAA)

3 NFPA 2: Hydrogen Technologies Code 2016 Edition (NFPA)

Part C
Cargo containment systems of independent cargo tanks using insulation materials and hydrogen gas in the inner insulation spaces

7 Application of the requirements in this part

7.1 Design of cargo containment systems

The safety measures set out in this part should apply to cargo containment systems of independent cargo tanks using insulation materials and hydrogen gas in the inner insulation spaces as described below.

Figure 2 illustrates a cargo containment system of independent cargo tanks using insulation materials and hydrogen gas in the inner insulation spaces. In this cargo containment system, an inner shell corresponds to a cargo tank. An insulation structure is installed outside of the inner shell. The insulation structure consists of an inner insulation space, an outer shell and an outer insulation layer from the inside. The inner insulation layer, which is located outside the inner shell, is a part of the inner insulation space. The inner insulation space needs to be filled with the appropriate gas to prevent condensation and/or solidification of a large amount of gas caused by the low temperature of the inner shell surface, which will be almost equal to the boiling point of hydrogen. Thus, the inner insulation space is filled with hydrogen gas and no liquid.

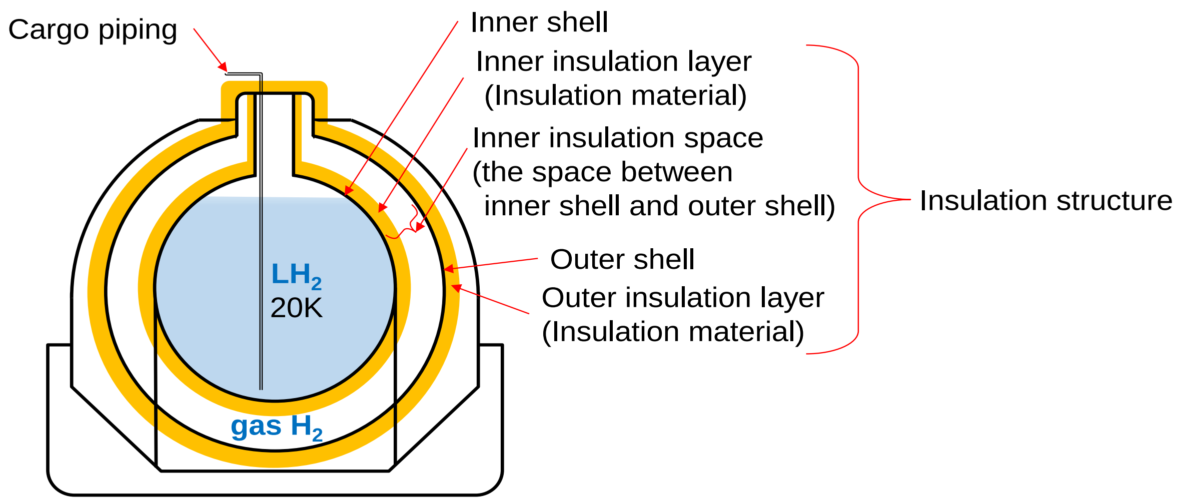


Figure 2 Illustration of cargo containment system

7.2 Conditions for the application of the requirements in this part

The safety requirements set out in this part should apply under the following conditions of use:

.1 the inner shell satisfies the requirements of the Code for a cargo tank; and

Note: This part focuses on the safety measures for the inner insulation space and the outer shell, as a part of the insulation structure for which no specific requirements are specified in the Code.

.2 appropriate measures are adopted to prevent leakage of gas from the inner insulation space to ensure the reliability of the insulation structure, taking into account that the space is filled with flammable gas.

8 Additional requirements

Special requirements for the cargo containment systems are prescribed in table 5 and these special requirements should apply in addition to the requirements in table 2.

Table 5: Special requirements for cargo containment systems of independent cargo tanks using insulation materials and hydrogen gas in the inner insulation spaces

No.	Special requirement	Explanation
C-1	The outer shell of the cargo containment system should be located at the distance from the ship's outer shell, as required in paragraphs 2.4.1 and 2.4.2 of the Code for cargo tanks of type 2G ship.	
C-2	Strength of the outer shell should be determined by analyses and tests considering safety principles, all applicable design conditions, materials used, and construction processes in reference to chapter 4 of the Code, and should be approved by the Administration.	
C-3	Notwithstanding special requirement C-2, the temperature of the outer shell should be determined by a temperature calculation, under the assumption that the inner shell is at the cargo temperature.	

No.	Special requirement	Explanation
C-4	The following special requirements should be applied to the outer shell: .1 All joints of the outer shell should be welded and of full penetration type. All joints of the outer shell should be of in-plane butt weld, as far as practicable. Tee welds of full penetration type may be used depending on the results of the test carried out at the approval of the welding procedure where the in-plane butt weld is not practicable due to the construction process and structure of the outer shell. .2 If a manhole is sealed by welding using backing rings, backing rings may be left after welding without removal, provided that they do not cause any significant harmful effects.	see 9.1
C-5	The outer shell should be subjected to pneumatic pressure testing to check its strength.	see 9.2
C-6	Appropriate thermal insulation should be provided to keep the temperature of the outer shell and outer insulation layer above the boiling point of oxygen. The insulation performance should be evaluated to the satisfaction of the Administration based on experiments, as necessary. When applying paragraph 4.19.1.1.5 of the Code, the degradation of insulation performance caused by hydrogen atmosphere should be considered. Means should be provided for monitoring the condition of the insulation for detection of failures.	
C-7	The pressure of the inner insulation space should be monitored taking into account the requirement for a cargo tank in paragraph 13.4 of the Code.	see 9.3
C-8	Under normal conditions, appropriate measures should be taken to maintain the pressure of the inner insulation space within the design limits.	see 9.3
C-9	Pressure and vacuum relief valves should be provided for inner insulation space which may be subject to pressures beyond their design capabilities, taking into account the requirements for pressure relief systems of cargo tanks in paragraphs 8.2 and 8.3 of the Code. The appropriate capacity of vacuum relief valves should be provided taking into account the expected rate of pressure drop in the inner insulation space of the cargo tanks of the ship under normal cargo operations, which replaces the requirements of paragraph 8.3.1.2 of the Code. When applying 8.3.2 of the Code, the vacuum relief valves should not admit air to the inner insulation space. In the event that the pressure relief valve for the inner insulation space is activated, the hydrogen gas release should be vented to a safe location.	see 9.3

No.	Special requirement	Explanation
C-10	The requirements in chapter 5 other than 5.3 and 5.10 of the Code, i.e. the requirements for cargo piping outside the cargo areas, should be applied for piping handling hydrogen for the inner insulation space.	
C-11	Appropriate measures should be taken for atmosphere control of the inner insulation space, e.g. inerting, gas freeing, aerating and purging, etc. (see also A-15).	
C-12	The special requirement A-8 should be applied to the tightness test of outer shell.	
C-13	The special requirements A-3 and A-4 should be applied to piping handling hydrogen for the inner insulation space.	
C-14	The special requirements A-8 and A-26 should be applied to exposed parts of piping handling hydrogen for the inner insulation space.	
C-15	Special requirement A-7 need not be applied to piping handling hydrogen for the inner insulation space, other than piping penetrating the inner shell, located inside the inner insulation space.	see 9.4
C-16	Notwithstanding special requirement A-22, piping handling hydrogen for an inner insulation space may pass through other inner insulation spaces.	
C-17	The requirements for type C independent tank should be applied to the inner shell.	
C-18	Manholes for access from or to the inner insulation space through the inner shell should not be permitted.	
C-19	Cargo piping connected to the inside of the inner shell should be led directly from the weather deck. No pipe should penetrate the inner shell from or to the inner insulation space.	

9 Explanation of special requirements

9.1 Welding of the outer shell

9.1.1 As mentioned in 7.2, the outer shell is a part of the insulation structure that has the function to contain hydrogen gas in the inner insulation space, but not to contain liquefied hydrogen.

9.1.2 Due to the high leakage of hydrogen, which is filled in inner insulation space, it is essential to ensure the reliability of tightness of the outer shell. This reliability is subject to evaluation and approval by the Administration. To ensure the tightness of the outer shell, equivalent welding requirements for the inner shell, i.e. cargo tank, should be applied to the outer shell as far as practicable. Therefore, all joints of the outer shell should be of the in-plane butt weld full penetration type, referring to paragraph 4.20.1 of the Code. On the other hand, it may not be practicable to use in-plane butt weld for the outer shell due to the construction procedure and structure. Considering that only gas is filled in the inner insulation space, no liquid pressure is applied on the outer shell. Therefore, using tee welds of the full penetration type is deemed acceptable for those areas, depending on the results of the test carried out at the approval of the welding procedure.

9.1.3 A manhole, when installed on the outer shell, can be sealed by gaskets or by welding. Welding is deemed to be a more reliable method to prevent hydrogen leakage, and removal of the backing rings is typically not possible due to the construction procedure. Considering that no liquid pressure is applied on manholes and backing rings, there is no significant concern from strength point of view. Therefore, not removing backing rings is deemed acceptable, unless any conceivable harmful effects, such as fatigue strength, are identified.

9.2 Testing of outer shell

While pressure testing is to be conducted on the outer shell to check for strength, filling the inner insulation space with water is unrealistic because the insulation materials are installed in the inner insulation space. In addition, it is assumed that only gas is stored in the inner insulation space, therefore, a pneumatic pressure test is sufficient to reproduce the operational condition of the outer shell. This special requirement is related to paragraphs 4.20.3.1 and 4.23.6.7 of the Code.

9.3 Pressure of the inner insulation space

Keeping an appropriate pressure of the inner insulation space is essential for preventing the inner and the outer shell from rupturing and buckling.

9.4 Leak detection for piping handling hydrogen for the inner insulation space located inside the inner insulation space

The purpose of special requirement A-7 is to avoid forming flammable atmosphere. Because the inner insulation space is filled with hydrogen, no additional risk is created by leakage of hydrogen from the places, located inside the inner insulation space, where leakage of hydrogen may occur such as valves, flanges and seals of piping handling hydrogen for the inner insulation space. Thus, special requirement A-7 does not contribute to improve safety for such piping, which is different from the piping for cargo handling. Provision C-15 is necessary to enable the design for control to change atmosphere or for maintenance.

References in part C

1 ISO/TR 15916:2015, Basic consideration for the safety of hydrogen systems (ISO)

2 American Institute of Aeronautics and Astronautics, "Safety Standard for Hydrogen and Hydrogen Systems (Guide to Safety of Hydrogen and Hydrogen Systems)", 2005 (AIAA)

3 NFPA 2: Hydrogen Technologies Code 2016 Edition (NFPA)

ANNEX 21

DRAFT AMENDMENTS TO THE IGC CODE

CHAPTER 16
USE OF CARGO AS FUEL

1 Paragraph 16.9 is amended as follows:

16.9 Alternative fuels and technologies

16.9.1 If acceptable to the Administration, other cargo gases may be used as fuel, providing that the same level of safety as natural gas in this Code is ensured.

16.9.2 The use of cargoes ~~identified as toxic products~~ requiring carriage in type 1G ships, as identified in column "c" in the table of chapter 19, shall not be permitted.

16.9.3 If acceptable to the Administration, the use of cargoes identified as toxic products in column "f" which are required to be carried in type 2G/2PG ships in column "c" in the table of chapter 19 may be used as fuel, provided that the same level of safety as natural gas (methane) is ensured in accordance with the relevant provisions of this Code, including those in 1.3, and taking into account the guidelines developed by the Organization,* after special consideration has been given by the Administration.

16.9.~~3~~4 For cargoes other than LNG, the fuel supply system shall comply with the requirements of 16.4.1, 16.4.2, 16.4.3 and 16.5, as applicable, and shall include means for preventing condensation of vapour in the system.

16.9.~~4~~5 Liquefied gas fuel supply systems shall comply with 16.4.5.

16.9.~~5~~6 In addition to the requirements of 16.4.3.2, both ventilation inlet and outlet shall be located outside the machinery space. The inlet shall be in a non-hazardous area and the outlet shall be in a safe location.

* Refer to the guidelines to be developed by the Organization.

***

ANNEX 19[7]

DRAFT AMENDMENTS TO THE IGF CODE

PART A

2 General

2.2 Definitions

1 The following new paragraph 2.2.44 is added after existing paragraph 2.2.43:

"2.2.44 *Ship constructed on or after 1 January 2028* means:

.1 for which the building contract is placed on or after 1 January 2028; or

.2 in the absence of a building contract, the keels of which are laid or which are at a similar stage of construction on or after 1 July 2028; or

.3 the delivery of which is on or after 1 January 2032."

PART A-1
SPECIFIC REQUIREMENTS FOR SHIPS USING NATURAL GAS AS FUEL

5 Ship design and arrangement

5.3 Regulations – General

2 The following new paragraph is inserted after paragraph 5.3.3.5 and before paragraph 5.3.3.6:

"5.3.3.5.1 For vessels with suction wells installed in fuel tanks, the bottom of the suction well may protrude into the vertical extent of the minimum distance specified in 5.3.3.5, provided that such wells are as small as practicable and the protrusion below the inner bottom plating does not exceed 25% of the depth of the double bottom or 350 mm, whichever is less."

3 In sub-paragraph 5.3.4.2, the definition of "*H*" is replaced by the following:

"*H* is the distance from baseline, in metres, to the lowermost boundary of the fuel tank excluding the pump well, if installed;"

[1] Tracked changes are created using "strikeout" for deleted text and "grey shading" to highlight all modifications and new insertions, including deleted text, based on resolution MSC.391(95).

7 Material and general pipe design

7.3 Regulations for general pipe design

4 The following new paragraph is inserted after paragraph 7.3.1.3 and the subsequent paragraphs 7.3.1.4 and 7.3.1.5 are renumbered as 7.3.1.5 and 7.3.1.6 accordingly:

"7.3.1.4 For ships constructed on or after 1 January 2028, pressure relief valves discharging liquid or gas from the piping system shall discharge into the fuel tanks whenever the tank MARVS pressure is lower than the setting of the pressure relief valves in accordance with the arrangements in 9.4.2, and shall be designed to ensure that the required discharge capacity is met. Alternatively, they may discharge to the vent mast, if means are provided to detect and dispose of any liquid that may flow into the vent system."

9 Fuel supply to consumers

9.4 Regulations on safety functions of gas supply system

5 The following new paragraph is inserted after paragraph 9.4.1 and the subsequent paragraphs 9.4.2 to 9.4.10 are renumbered as 9.4.3 to 9.4.11 accordingly:

"9.4.2 For ships constructed on or after 1 January 2028, fuel tank inlets from safety relief valve discharge lines, protecting the piping system according to 7.3.1.4, shall be provided with non-return valves in lieu of valves that are automatically operated when the safety system required in 15.2.2 is activated. Safe means for tank isolation during maintenance shall be available according to 18.3 without affecting proper operation of safety relief valves."

11 Fire safety

11.3 Regulations for fire protection

6 In paragraph 11.3.2, after the last sentence ending with "considered a class 2.1 package.", the following new text is added:

"For ships constructed on or after 1 January 2028, any boundary facing the fuel tank on the open deck which is separated by a minimum distance, as determined to the satisfaction of the Administration through a heat analysis to provide protection equivalent to an A-60 class division, shall be considered acceptable. Intermediate structures providing heat protection to the above spaces may also be considered acceptable."

7 In paragraph 11.3.2, the following new sub-paragraphs are added:

".1 For oil tankers and chemical tankers constructed on or after 1 January 2028, A-60 insulation, required by SOLAS regulation II-2/9.2.4.2.5, shall be considered to meet the requirements of 11.3.2 provided that the fuel tank is located in the cargo area forward of accommodation spaces, service spaces, control stations, escape routes and machinery spaces. Consideration for the protection of accommodation block sides may be necessary.

.2 Fuel tanks shall be segregated from cargo in accordance with the requirements of the International Maritime Dangerous Goods (IMDG) Code where fuel tanks are regarded as bulk packaging. For the purposes of stowage and segregation requirements of the IMDG Code, a fuel tank on the open deck shall be considered as a class 2.1 package.

.3 For ships constructed on or after 1 January 2028 and notwithstanding the requirements of 11.3.2, where no source of gas release from the fuel containment system is considered possible, e.g. a type C tank in which tank connections are in a tank connection space, A-60 class shielding is not required."

8 Paragraph 11.3.3.1 is replaced by the following:

"11.3.3.1 Notwithstanding the last sentence in paragraph 11.3.3, for ships constructed on or after 1 January 2028 ~~4~~, the fuel storage hold space may be considered as a cofferdam provided that:

.1 the type C tank is not located directly above machinery spaces of category A or other rooms with high fire risk; and

.2 the minimum distance to the A-60 boundary from the outer ~~shell~~ surface of the insulation system of ~~the~~ a type C tank or the boundary of the tank connection space, if any, is not less than 900 mm. For the vacuum insulated type C tank, outer surface of the insulation system means outer surface of the outer shell."

12 Explosion prevention

12.5 Hazardous area zones

12.5.2 Hazardous area zone 1

9 Sub-paragraph 12.5.2.3 is replaced by the following:

"12.5.2.3 For ships constructed on or after 1 January 2028, areas on open deck, or semi-enclosed spaces on deck, within 3 m of any fuel tank outlet, gas or vapour outlet,* bunker manifold valve, other fuel valve, fuel pipe flange, ~~fuel preparation room~~ ventilation outlets from zone 1 spaces and fuel tank openings for pressure release provided to permit the flow of small volumes of gas or vapour mixtures caused by thermal variation;

* Such areas are, for example, all areas within 3 m of fuel tank hatches, ullage openings or sounding pipes for fuel tanks located on open deck and gas vapour outlets."

10 The following new sub-paragraph is inserted after sub-paragraph 12.5.2.3 and the subsequent sub-paragraphs 12.5.2.4 to 12.5.2.9 are renumbered as 12.5.2.5 to 12.5.2.10 accordingly.

".4 for ships constructed on or after 1 January 2028, areas on open deck, or semi-enclosed spaces on open deck above and in the vicinity of fuel tank vent mast outlet within a vertical cylinder of unlimited height and 6 m radius centred upon the centre of the outlet, and within a hemisphere of 6 m radius below the outlet. Where due to the size and layout of the vessel it is not possible to maintain the above distances, a reduced zone can be accepted based on a dispersion analysis, based on 50% LEL criteria. The zone dimensions shall never be less than those given in 12.5.2.3, and shall include a surrounding zone 2 hazardous area meeting the dimensions given in 12.5.3.1."

12.5.3 Hazardous area zone 2

11 The following new paragraph is added after paragraph 12.5.3.2:

12.5.3.3 In lieu of 12.5.3.1, for ships constructed on or after 1 January 2028, this zone includes spaces 4 m beyond the cylinder and 4 m beyond the hemisphere defined in 12.5.2.4".

13 Ventilation

13.3 Regulations – General

12 Paragraph 13.3.5 is replaced by the following:

"13.3.5 For ships constructed on or after 1 January 2028, ~~A~~air inlets for hazardous enclosed spaces shall be taken from areas that, ~~in the absence of the considered~~ except for the inlets, would be non-hazardous. ~~Air inlets for non-hazardous enclosed spaces shall be taken from non-hazardous areas at least 1.5 m away from the boundaries of any hazardous area. Where the inlet duct passes through a more hazardous space, the duct shall be gas-tight and have over-pressure relative to this space.~~ Air inlets for non-hazardous enclosed spaces shall be taken from non-hazardous areas at least 1.5 m away from the boundaries of any hazardous area."

13 The following new paragraph is inserted after paragraph 13.3.7 and the subsequent paragraphs 13.3.8 to 13.3.10 are renumbered as 13.3.9 to 13.3.11:

"13.3.8 For ships constructed on or after 1 January 2028:

.1 where the ventilation ducts serving non-hazardous spaces pass through a hazardous space, the ducts shall be gastight and have overpressure relative to that hazardous space; and

.2 where the ventilation ducts serving hazardous spaces pass through less hazardous spaces, the ducts shall be gastight and have underpressure relative to less hazardous or non-hazardous spaces. Ventilation pipes serving hazardous spaces that pass through non-hazardous spaces, and that are fully welded and designed in accordance with chapter 7, are acceptable without the need for underpressure."

APPENDIX

CHECK/MONITORING SHEET FOR THE PROCESS OF AMENDING THE CONVENTION AND RELATED MANDATORY INSTRUMENTS (PROPOSAL/DEVELOPMENT)

Part III – Process monitoring to be completed during the work process at the Sub-Committee and checked as part of the final approval process by the Committee (refer to paragraph 3.2.1.3)

1	The Sub-Committee, at an initial engagement, has allocated sufficient time for technical research and discussion before the target completion date, especially on issues needing to be addressed by more than one Sub-Committee and for which the timing of relevant Sub-Committee meetings and exchanges of the result of consideration needed to be carefully examined.	Yes
2	The scope of application agreed at the proposal stage was not changed without the approval of the Committee.	Yes
3	The technical base document/draft amendment addresses the proposal's issue(s) through the suggested instrument(s); where it does not, the Sub-Committee offers the Committee an alternative method of addressing the problem raised by the proposal.	Yes
4	Due attention is to be paid to the *Interim Guidelines for the systematic application of the grandfather clause* (MSC/Circ.765).	Yes
5	All references have been examined against the text that will be valid if the proposed amendment enters into force.	Yes
6	The location of the insertion or modified text is correct for the text that will be valid when the proposed text enters into force on a four-year cycle of entry into force, as other relevant amendments adopted might enter into force on the same date.	Yes
7	There are no inconsistencies in respect of scope of application between the technical regulation and the application statement contained in regulation 1 or 2 of the relevant chapter, and application is specifically addressed for existing and/or new ships, as necessary.	Yes
8	Where a new term has been introduced into a regulation and a clear definition is necessary, the definition is given in the article of the Convention or at the beginning of the chapter.	Yes
9	Where any of the terms "fitted", "provided", "installed" or "installation" are used, consideration has been given to clarifying the intended meaning of the term.	Yes
10	All necessary related and consequential amendments to other existing instruments, including non-mandatory instruments, in particular to the forms of certificates and records of equipment required in the instrument being amended, have been examined and included as part of the proposed amendment(s).	Yes
11	The forms of certificates and records of equipment have been harmonized, where appropriate, between the Convention and its Protocols.	N/A

12	It is confirmed that the amendment is being made to a currently valid text and that no other bodies are concurrently proposing changes to the same text.	Yes
13	All entry-into-force criteria (building contract, keel laying and delivery) have been considered and addressed.	Yes
14	Other impacts of the implementation of the proposed/approved amendment have been fully analysed, including consequential amendments to the "application" and "definition" regulations of the chapter.	Yes
15	The amendments presented for adoption clearly indicate changes made with respect to the original text, so as to facilitate their consideration.	Yes
16	For amendments to mandatory instruments, the relationship between the Convention and the related instrument has been observed and addressed, as appropriate.	Yes
17	The related record format has been completed or updated, as appropriate.	Yes

RECORD FORMAT

The following records should be created and kept updated for each regulatory development.

The records can be completed by providing references to paragraphs of related documents containing the relevant information, proposals, discussions and decisions.

1 Title (number and title of regulation(s))
IGF Code chapters 2, 5, 7, 9, 11, 12 and 13
2 Origin of the requirement (original proposal document)
It's a continuous agenda item and see section 5 (history of discussion) for more information.
3 Main reason for the development (extract from the proposal document)
"Amendments to the IGF Code and development of guidelines for alternative fuels and related technologies" is a continuous agenda item and those draft amendments could not be completed at CCC 8, were finalized at CCC 9. The amendments include a variety of issues, including pump suction wells, safety relief valve discharge, fuel preparation rooms, structural fire protection and hazardous zones.
4 Related output
Amendments to the IGF Code and development of guidelines for alternative fuels and related technologies (2.3)

5	**History of the discussion (approval of work programmes, sessions of sub-committees, including CG/DG/WG arrangements)**
CCC 6 endorsed the new work plan for the next phase of the development of the IGF Code, and endorsed the change of status of the existing output on "Amendments to the IGF Code and development of guidelines for low-flashpoint fuels to be "continuous" to avoid requesting constant extensions. **CCC 8** developed amendments, which were approved at MSC 107 for adoption at MSC 108. **CCC 9** developed additional amendments, which had not been agreed upon at CCC 8, with a view to entry into force on 1 January 2028.	
6	**Impact on other instruments (codes, performance standards, guidance circulars, certificates/records format, etc.)**
Not applicable	
7	**Technical background**
7.1	***Scope and objective (to cross-check with items 4 and 5 in part II of the checklist)***
The amendments include a variety of issues, including pump suction wells, safety relief valve discharge, fuel preparation rooms, structural fire protection and hazardous zones.	
7.2	***Technical/operational background and rationale (e.g. summary of FSA study, if available, or engineering challenge posed)***
Not applicable	
7.3	***Source/derivation of requirement (non-mandatory instrument, industry standard, national/regional requirement)***
Not applicable	
7.4	***Short summary of requirement (what is the new requirement – in short and lay terms)***
The amendments will enhance safety by regulating a variety of issues, including pump suction wells, safety relief valve discharge, fuel preparation rooms, structural fire protection and hazardous zones.	
7.5	***Points of discussions (controversial points and conclusion)***
Not applicable	

***

that no liquid pressure is applied on manholes and backing rings, there is no significant concern from strength point of view. Therefore, not removing backing rings is deemed acceptable, unless any conceivable harmful effects, such as fatigue strength, are identified.

9.2 Testing of outer shell

While pressure testing is to be conducted on the outer shell to check for strength, filling the inner insulation space with water is unrealistic because the insulation materials are installed in the inner insulation space. In addition, it is assumed that only gas is stored in the inner insulation space, therefore, a pneumatic pressure test is sufficient to reproduce the operational condition of the outer shell. This special requirement is related to paragraphs 4.20.3.1 and 4.23.6.7 of the Code.

9.3 Pressure of the inner insulation space

Keeping an appropriate pressure of the inner insulation space is essential for preventing the inner and the outer shell from rupturing and buckling.

9.4 Leak detection for piping handling hydrogen for the inner insulation space located inside the inner insulation space

The purpose of special requirement A-7 is to avoid forming flammable atmosphere. Because the inner insulation space is filled with hydrogen, no additional risk is created by leakage of hydrogen from the places, located inside the inner insulation space, where leakage of hydrogen may occur such as valves, flanges and seals of piping handling hydrogen for the inner insulation space. Thus, special requirement A-7 does not contribute to improve safety for such piping, which is different from the piping for cargo handling. Provision C-15 is necessary to enable the design for control to change atmosphere or for maintenance.

References in part C

1 ISO/TR 15916:2015, Basic consideration for the safety of hydrogen systems (ISO)

2 American Institute of Aeronautics and Astronautics, "Safety Standard for Hydrogen and Hydrogen Systems (Guide to Safety of Hydrogen and Hydrogen Systems)", 2005 (AIAA)

3 NFPA 2: Hydrogen Technologies Code 2016 Edition (NFPA)

ANNEX 21

DRAFT AMENDMENTS TO THE IGC CODE

CHAPTER 16
USE OF CARGO AS FUEL

1 Paragraph 16.9 is amended as follows:

16.9 Alternative fuels and technologies

16.9.1 If acceptable to the Administration, other cargo gases may be used as fuel, providing that the same level of safety as natural gas in this Code is ensured.

16.9.2 The use of cargoes ~~identified as toxic products~~ requiring carriage in type 1G ships, as identified in column "c" in the table of chapter 19, shall not be permitted.

16.9.3 If acceptable to the Administration, the use of cargoes identified as toxic products in column "f" which are required to be carried in type 2G/2PG ships in column "c" in the table of chapter 19 may be used as fuel, provided that the same level of safety as natural gas (methane) is ensured in accordance with the relevant provisions of this Code, including those in 1.3, and taking into account the guidelines developed by the Organization,* after special consideration has been given by the Administration.

16.9.~~3~~4 For cargoes other than LNG, the fuel supply system shall comply with the requirements of 16.4.1, 16.4.2, 16.4.3 and 16.5, as applicable, and shall include means for preventing condensation of vapour in the system.

16.9.~~4~~5 Liquefied gas fuel supply systems shall comply with 16.4.5.

16.9.~~5~~6 In addition to the requirements of 16.4.3.2, both ventilation inlet and outlet shall be located outside the machinery space. The inlet shall be in a non-hazardous area and the outlet shall be in a safe location.

___

* Refer to the guidelines to be developed by the Organization.

***

INTERNATIONAL MARITIME ORGANIZATION

E

4 ALBERT EMBANKMENT
LONDON SE1 7SR
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

MSC.1/Circ.1677
3 October 2024

VOLUNTARY EARLY IMPLEMENTATION OF THE AMENDMENTS TO PARAGRAPHS 4.2.2 AND 8.4.1 TO 8.4.3 OF THE IGF CODE, ADOPTED BY RESOLUTION MSC.551(108)

1 The Maritime Safety Committee, at its 108th session (15 to 24 May 2024), adopted amendments to the IGF Code by resolution MSC.551(108).

2 The entry-into-force date of the aforementioned amendments is 1 January 2026.

3 In adopting the amendments to paragraphs 4.2.2 and 8.4.1 to 8.4.3 of the IGF Code, the Committee, having considered the need for their voluntary early implementation, in accordance with the *Guidelines on the voluntary early implementation of amendments to the 1974 SOLAS Convention and related mandatory instruments* (MSC.1/Circ.1565), agreed to invite the Contracting Governments to the International Convention for the Safety of Life at Sea, 1974, to implement them prior to the entry-into-force date.

4 Voluntary early implementation should be communicated by a Contracting Government to the Organization for dissemination through GISIS (module on survey and certification).

5 In addition to the aforementioned communication, a Contracting Government may also consider the use of the existing provisions for equivalent arrangements under SOLAS regulation I/5 to cover the interim period between the date of the voluntary early implementation and the entry-into-force date of the amendments.

6 A Contracting Government, in line with paragraph 1.2.4 of the *Procedures for Port State Control, 2023* (resolution A.1185(33)), as may be amended, when acting as a port State, should refrain from enforcing its decision to voluntarily early implement the amendments to paragraphs 4.2.2 and 8.4.1 to 8.4.3 of the IGF Code to ships entitled to fly the flag of other Contracting Governments, calling at its ports.

7 The Contracting Governments, when undertaking port State control activities, should take into account the present invitation and any subsequent notifications communicated by other Contracting Governments through GISIS.

8 Contracting Governments are invited to be guided accordingly and to bring the contents of this circular to the attention of all concerned, especially port State control authorities and recognized organizations.

___

INTERNATIONAL MARITIME ORGANIZATION

E

4 ALBERT EMBANKMENT
LONDON SE1 7SR
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

MSC.1/Circ.1679
1 July 2024

INTERIM GUIDELINES FOR USE OF LIQUEFIED PETROLEUM GAS (LPG) CARGO AS FUEL

1 The Maritime Safety Committee (MSC), at its 108th session (15 to 24 May 2024), having considered a proposal made by the Sub-Committee on Carriage of Cargoes and Containers at its ninth session (20 to 29 September 2023), approved the *Interim guidelines for use of liquefied petroleum gas (LPG) cargo as fuel*, as set out in the annex, with a view to providing guidance for safe use of LPG cargo as fuel in relation to the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code), as amended.

2 The Committee agreed to keep the Interim guidelines under review and to amend them in view of the experience gained with their application and/or as and when the circumstances so warrant.

3 Member States are invited to bring the annexed Interim guidelines to the attention of all parties concerned.

***

ANNEX

INTERIM GUIDELINES FOR USE OF LIQUEFIED PETROLEUM GAS (LPG) CARGO AS FUEL

1 PREAMBLE

1.1 Chapter 16 of the IGC Code provides specific provisions for use of liquefied natural gas (LNG) cargo as fuel. For other cargo gases including liquefied petroleum gas (LPG), section 16.9 (Alternative fuels and technologies) of the IGC Code requires that the same level of safety as natural gas is ensured.

1.2 For the purpose of section 16.9 of the IGC Code, the safety level of the design for each ship should be demonstrated as specified in SOLAS regulation II-1/55 for use of LPG cargo as fuel.

1.3 The purpose of these Interim Guidelines is to provide unified specific guidance for ships using LPG cargo as fuel until such provisions are incorporated in the IGC Code, with a view to responding to the industry's urgent need for such guidance.

1.4 The provisions in the Interim Guidelines take into account the goal-based approach (MSC.1/Circ.1394/Rev.2), as they reference existing provisions of the IGC Code, which is a goal-based instrument. Therefore, goals and functional requirements were specified forming the basis for the design, construction and operation.

2 GUIDANCE

2.1 Application

2.1.1 These Interim Guidelines apply to gas carriers as defined in SOLAS regulation VII/11.2 complying with the requirements of the IGC Code using LPG cargoes as fuel, as a supplement to the existing provisions of chapter 16 of the IGC Code.

2.1.2 LPG as provided in chapter 16 of the IGC Code, is composed of propane (C_3H_8), butane (C_4H_{10}), or a propane-butane mixture as listed in chapter 19 of the IGC Code and may contain small amounts of other hydrocarbons and impurities. It can be in either a liquefied or gaseous state. LPG in the liquefied state is referred to as LPG liquid, and LPG in the gaseous state is referred to as LPG vapour.

2.1.3 A gas fuel consumer is any unit within the ship using cargo vapour or liquid as a fuel.

2.2 Goal

2.2.1 The goal of these Interim Guidelines is to ensure safe and reliable operation of fuel supply systems and consumers for use of LPG cargo as fuel.

2.3 Functional provisions

2.3.1 Single failure should not cause leakage of fuel into the space where fuel consumers are installed.

2.3.2 Effectiveness of the ventilation and detection for LPG leakage should be ensured taking into account characteristics of LPG.

2.3.3 Since LPG has different properties depending on the composition ratio of propane and butane, the composition ratio of fuel should be suitable for normal operation of the fuel consumer.

2.3.4 Fuel supply systems should be designed to prevent fuel from unintended phase changes in processing of fuel supply to consumers considering vapour pressure at the working temperature, as follows:

.1 where fuel is supplied in the gaseous state, measures should be taken so that the temperature of fuel is not lowered to the dew point at the working pressure; and

.2 where fuel is supplied in the liquid state, measures should be taken so that the pressure of fuel is not lowered to the vapour pressure at the working temperature.

2.3.5 Vent, purging and bleed lines of fuel supply systems should be designed to prevent LPG liquid from being released into the atmosphere.

2.4 Supplementary guidance to the provisions of chapter 16*

2.4.1 In accordance with the principles of paragraph 16.9 of the IGC Code, LPG cargoes may be utilized in machinery spaces of category A. In these spaces, it may be utilized only in systems such as boilers, inert gas generators, internal combustion engines, gas combustion units and gas turbines.

2.4.2 The LPG fuel supply systems and LPG fuel consumers should be designed for operation with the possible range of composition of the intended fuel. Information about the range of acceptable compositions should be provided on board.

2.4.3 The fuel supply system should comply with the requirements of paragraphs 16.4.1, 16.4.2, 16.4.3 and 16.5 of the IGC Code.

2.4.4 LPG fuel consumers should exhibit no external visible flame and should maintain the uptake exhaust temperature sufficiently below the auto-ignition temperature of the fuel. In a mixture of gases, the component with the lowest auto-ignition temperature should be the appropriate reference.

2.4.5 LPG vapour or liquid may be used as fuel in systems referenced in paragraph 2.4.1.

2.4.6 Provision should be made for inerting and venting to a safe location the gas fuel piping systems located in the machinery space. For permanent installations, the inert gas piping connected to the fuel piping should be fitted with double block and bleed valves. In addition, a non-return valve should be installed in the inert gas piping upstream of the double block and bleed valves. For liquid fuel supply systems, consideration should be given to draining the piping without release of liquid to the atmosphere.

2.4.7 The supply and return piping of each gas consumer unit should be provided with fuel isolation by automatic double block and bleed, vented to a safe location, under both normal and emergency operation. The automatic valves should be arranged to fail to the closed position on loss of actuating power. In a space containing multiple consumers, the shutdown of one should not affect the gas fuel supply to the others. For liquid fuel supply systems, the piping should be drained without release of liquid to the atmosphere.

* See sections 16.1 to 16.6 of chapter 16 of the IGC Code based on which the supplementary guidance has been provided for use of LPG cargo as fuel.

2.4.8 Gas nozzles and the burner control system should be configured such that gas fuel can only be ignited by an established oil fuel flame, unless the boiler and combustion equipment is designed and approved by the Administration or recognized organization acting on their behalf, to ignite on gas fuel.

2.5 Additional provisions

2.5.1 Risk assessment

2.5.1.1 A risk assessment should be conducted of the LPG fuel arrangements to document an equivalent level of safety to utilizing LNG as fuel. Consideration should be given to the hazards associated with the arrangement, operation and maintenance of the fuel system, considering reasonably foreseeable failures.

2.5.1.2 The risk assessment should address the consequences of fuel leakage, considering the properties of LPG gas and its accumulation or escape into another space.

2.5.2 Arrangements of spaces containing gas fuel consumers

2.5.2.1 A single failure of fuel systems in the machinery space should not lead to a gas release in the machinery space. Fuel piping should be of double wall design or ducted and the outer boundary should be continuous in the space. Non-continuous double barriers should not be used under the circumstances described in paragraph 16.4.6.2 of the IGC Code.

2.5.2.2 The air inlet of the annular space should not be in the machinery space. In addition, the air inlet of the annular space should be in a location which would be safe in the absence of the air inlet. Consideration should be given to the risk of liquid carry-over resulting from a liquid leak.

2.5.3 Fuel supply

2.5.3.1 Where fuel supply systems supply LPG liquid, vent and purging should lead to a fuel tank, gas-liquid separator or similar device. Heating of the gas-liquid separator may be required for ships operating in cold areas.

2.5.3.2 Fuel supply systems referenced in paragraph 2.5.3.1 and vent masts should be fitted with an inert gas purging interface and should include a means for preventing condensation of vapour in the system.

2.5.3.3 In application of paragraph 16.4.3.2 of the IGC Code, the ventilation inlets for the double wall piping and ducts should be in a non-hazardous area, away from ignition sources. Ventilation outlets for the double wall piping and ducts should be in the cargo area.

2.5.4 Fuel plant ventilation and gas detection

2.5.4.1 In addition to the requirements of paragraphs 16.3.1 and 16.5.1 of the IGC Code, special consideration should be given to the density and lower explosion limit (LEL) of LPG vapour. Ventilation capacity, including ventilation inlet and outlet location, should be supported by numerical calculations, such as a computational fluid dynamics (CFD) analysis. Notwithstanding, for spaces within the cargo area, on the open deck and containing LPG fuel conditioning equipment, the requirements of paragraph 12.1.3 of the IGC Code should apply.

2.5.4.2 In addition to the requirements of paragraph 13.6.12 of the Code, gas detection heads should be fitted in spaces where LPG vapour may accumulate particularly where air circulation is reduced or near the bottom of the space. The suitability of their location should be supported by numerical calculations, such as a CFD analysis or physical smoke test.

2.5.5 Combustion equipment

2.5.5.1 Gas fuel consumer exhaust gas temperature should be continuously monitored.

2.5.5.2 Gas turbines should be fitted with a gas-tight enclosure unless fuel supply piping meets the requirements of paragraph 16.4.3 of the IGC Code. The consequences of gas leakage should be evaluated based on the risk assessment in paragraph 2.5.1.

___

INTERNATIONAL MARITIME ORGANIZATION

E

4 ALBERT EMBANKMENT
LONDON SE1 7SR
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

MSC.1/Circ.1680
14 June 2024

UNIFIED INTERPRETATIONS OF SOLAS REGULATION XV/5.1 AND PARAGRAPH 3.5 OF PART 1 OF THE INTERNATIONAL CODE OF SAFETY FOR SHIPS CARRYING INDUSTRIAL PERSONNEL (IP CODE) ON THE HARMONIZATION OF THE INDUSTRIAL PERSONNEL SAFETY CERTIFICATE WITH SOLAS SAFETY CERTIFICATES

1 The Maritime Safety Committee, at its 108th session (15 to 24 May 2024), approved the *Unified interpretation of SOLAS regulation XV/5.1 and paragraph 3.5 of part 1 of the International Code of Safety for Ships Carrying Industrial Personnel (IP Code) Code on the harmonization of the Industrial Personnel Safety Certificate with SOLAS safety certificates,* with a view to providing more specific guidance on the initial and maintenance surveys as required in SOLAS regulations XV/3.2, 3.3 and 5.1, as set out in the annex.

2 Member States are invited to use the annexed unified interpretations as guidance when applying SOLAS regulations XV/3.2, 3.3 and 5.1 and to bring them to the attention of all parties concerned.

***

ANNEX

UNIFIED INTERPRETATIONS OF SOLAS REGULATION XV/5.1 AND PARAGRAPH 3.5 OF PART 1 OF THE INTERNATIONAL CODE OF SAFETY FOR SHIPS CARRYING INDUSTRIAL PERSONNEL (IP CODE) ON THE HARMONIZATION OF THE INDUSTRIAL PERSONNEL SAFETY CERTIFICATE WITH SOLAS SAFETY CERTIFICATES

The implementation of initial and maintenance surveys as required in SOLAS regulations XV/3.2, 3.3 and 5.1 (resolution MSC.521(106)) and paragraph 3 of part I of the International Code of Safety for Ships Carrying Industrial Personnel (IP Code) (resolution MSC.527(106)) should be interpreted as indicated in the following table:

Initial and maintenance surveys pertaining to SOLAS chapter XV and the IP Code

1 SHIPS UNDER HARMONIZED SYSTEM OF SURVEY AND CERTIFICATION (HSSC) SCHEME			
Type of ship	Initial survey for issuance of the Industrial Personnel Safety Certificate	Surveys for the maintenance of the Industrial Personnel Safety Certificate	Surveys for renewal of the Industrial Personnel Safety Certificate
Cargo ship	First Safety Construction intermediate survey or renewal survey, as required by SOLAS regulation I/10, whichever occurs first after 1 July 2024.	a) Aligned with maintenance survey (annual or intermediate) related to the Cargo Ship Safety Certificate. The Industrial Personnel Safety Certificate should be endorsed upon satisfactory results of the maintenance survey related to the IP Code and Cargo Ship Safety; or b) Aligned with maintenance survey (annual or intermediate) related to the Cargo Ship Safety Construction Certificate. The Industrial Personnel Safety Certificate should be endorsed upon satisfactory results of the maintenance survey (annual or intermediate) related to the IP Code and Safety Construction, provided that valid Cargo Ship Safety Equipment Certificate is held by a ship.	a) Aligned with renewal survey related to the Cargo Ship Safety Certificate. The Industrial Personnel Safety Certificate should be issued upon satisfactory results of the renewal survey related to the IP Code and Cargo Ship Safety; or b) Aligned with renewal Survey of Safety Construction. The Industrial Personnel Safety Certificate should be issued upon satisfactory results of the renewal survey related to the IP Code and Safety Construction, provided that valid Cargo Ship Safety Equipment Certificate is held by a ship.
High-speed cargo craft	The third periodical or first renewal survey, as required by the 2000 HSC Code, paragraph 1.5, whichever occurs first after 1 July 2024.	Aligned with periodical survey related to the High-Speed Craft Safety Certificate. The Industrial Personnel Safety Certificate should be endorsed upon satisfactory results of the periodical survey related to the IP Code and High-Speed Craft Safety.	Aligned with renewal survey related to the High-Speed Craft Safety Certificate. The Industrial Personnel Safety Certificate should be issued upon satisfactory results of the renewal survey related to the IP Code and High-Speed Craft Safety.

2 SHIPS NOT UNDER THE HSSC SCHEME			
Type of ship	Initial Survey for issuance of the Industrial Personnel Safety Certificate	Surveys for the maintenance of the Industrial Personnel Safety Certificate	Surveys for renewal of the Industrial Personnel Safety Certificate
Cargo ship	First Safety Construction renewal survey as required by SOLAS regulation I/10, which occurs after 1 July 2024 but, in any case, not later than 30 September 2027.	Aligned with maintenance survey (annual or intermediate) related to the Cargo Ship Safety Construction Certificate. The Industrial Personnel Safety Certificate should be endorsed upon satisfactory results of maintenance survey (annual or intermediate) related to the IP Code and Safety Construction, provided that valid Cargo Ship Safety Equipment Certificate is held by a ship.	Aligned with renewal Survey of Safety Construction. The Industrial Personnel Safety Certificate should be issued upon satisfactory results of the renewal survey related to the IP Code and Safety Construction, provided that valid Cargo Ship Safety Equipment Certificate is held by a ship.
High-speed cargo craft	The third periodical or first renewal survey, as required by the 2000 HSC Code, paragraph 1.5, whichever occurs first after 1 July 2024.	Aligned with periodical survey related to the High-Speed Craft Safety Certificate. The Industrial Personnel Safety Certificate should be endorsed upon satisfactory results of the periodical survey related to the IP Code and High-Speed Craft Safety.	Aligned with renewal survey related to the High-Speed Craft Safety Certificate. The Industrial Personnel Safety Certificate should be issued upon satisfactory results of the renewal survey related to the IP Code and High-Speed Craft Safety.

___

E

INTERNATIONAL MARITIME ORGANIZATION

4 ALBERT EMBANKMENT
LONDON SE1 7SR
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

MSC.1/Circ.1212/Rev.2
26 June 2024

REVISED GUIDELINES ON ALTERNATIVE DESIGN AND ARRANGEMENTS FOR SOLAS CHAPTERS II-1 AND III

1 The Maritime Safety Committee, at its eighty-second session (29 November to 8 December 2006), approved *Guidelines on alternative design and arrangements for SOLAS chapters II-1 and III* (MSC.1/Circ.1212), developed to provide further guidance on SOLAS regulations II-1/55 and III/38, which were adopted by resolution MSC.216(82) and entered into force on 1 January 2009.

2 The Guidelines serve to outline the methodology for the engineering analysis required by SOLAS regulations II-1/55 and III/38 on Alternative design and arrangements, applying to a specific engineering or life-saving system, design or arrangements for which the approval of an alternative design deviating from the prescriptive requirements of SOLAS chapters II-1 and III is sought.

3 The Maritime Safety Committee, at its 101st session (5 to 14 June 2019), approved amendments to the *Revised guidelines on alternative design and arrangements for SOLAS chapters II-1 and III* (MSC.1/Circ.1212/Rev.1), prepared by the Sub-Committee on Ship Systems and Equipment, at its sixth session.

4 The Maritime Safety Committee, at its 108th session (15 to 24 May 2024), approved amendments to the *Revised guidelines on alternative design and arrangements for SOLAS chapters II-1 and III* (MSC.1/Circ.1212/Rev.2), prepared by the Sub-Committee on Ship Design and Construction, at its tenth session.

5 Member Governments are invited to bring the revised Guidelines set out in the annex to the attention of shipowners, shipbuilders and designers for the facilitation of design within the framework of SOLAS regulations II-1/55 and III/38.

6 This circular revokes MSC.1/Circ.1212 and MSC.1/Circ.1212/Rev.1.

***

ANNEX

REVISED GUIDELINES ON ALTERNATIVE DESIGN AND ARRANGEMENTS FOR SOLAS CHAPTERS II-1 AND III

1 Application

1.1 These Guidelines are intended for application of safe engineering design to provide technical justification for alternative design and arrangements to SOLAS chapters II-1 (parts C, D and E) and III. The Guidelines serve to outline the methodology for the engineering analysis required by part F (Alternative design and arrangements) of SOLAS chapter II-1 and part C (Alternative design and arrangements) of SOLAS chapter III, applying to a specific safety system, design or arrangements for which the approval of an alternative design deviating from the prescriptive requirements of SOLAS chapters II-1 and III is sought.

1.2 These Guidelines are not intended to be applied to the type approval of individual materials, components or portable equipment.

1.3 These Guidelines are not intended to serve as a stand-alone document, but should be used in conjunction with the appropriate engineering design guides and other literature.

1.4 For the application of these Guidelines to be successful, all interested parties, including the Administration or its designated representative, owners, operators, designers and classification societies, should be in continuous communication from the onset of a specific proposal to utilize these Guidelines. This approach usually requires significantly more time in calculation and documentation than a typical regulatory prescribed design because of increased engineering rigour. The potential benefits include more options, cost effective designs for unique applications and an improved knowledge of loss potential.

2 Definitions

For the purpose of these Guidelines, the following definitions apply:

2.1 *Alternative design and arrangements* means measures which deviate from the prescriptive requirement(s) of SOLAS chapters II-1 or III, but are suitable to satisfy the intent of that chapter. The term includes a wide range of measures, including alternative shipboard structures and systems based on novel or unique designs, as well as traditional shipboard structures and systems that are installed in alternative arrangements or configurations.

2.2 *Design casualty* means an engineering description of the development and severity of a casualty for use in a design scenario.

2.3 *Design casualty scenario* means a set of conditions that defines the development and severity of a casualty within and through ship space(s) or systems and describes specific factors relevant to a casualty of concern.

2.4 *Functional requirements* explain, in general terms, what function the system under consideration should provide to meet the safety objectives of SOLAS.

2.5 *Performance criteria* are measurable quantities to be used to evaluate the adequacy of trial designs.

2.6 *Prescriptive based design or prescriptive design* means a design of safety measures which comply with the regulatory requirements set out in parts C, D and E of SOLAS chapter II-1 and/or chapter III, as applicable.

2.7 *Safety margin* means adjustments made to compensate for uncertainties in the methods and assumptions used to evaluate the alternative design, e.g. in the determination of performance criteria or in the engineering models used to assess the consequences of a casualty.

2.8 *Sensitivity analysis* means an analysis to determine the effect of changes in individual input parameters on the results of a given model or calculation method.

2.9 *SOLAS* means the International Convention for the Safety of Life at Sea, 1974, as amended.

3 Engineering analysis

3.1 The engineering analysis used to show that the alternative design and arrangements provide the equivalent level of safety to the prescriptive requirements of SOLAS chapters II-1 and III should follow an established approach to safety design. This approach should be based on sound science and engineering practice incorporating widely accepted methods, empirical data, calculations, correlations and computer models as contained in engineering textbooks and technical literature.

3.2 Other safety engineering approaches recognized by the Administration may be used.

4 Design team

4.1 A design team acceptable to the Administration should be established by the owner, builder or designer and may include, as the alternative design and arrangements demand, a representative of the owner, builder or designer, and expert(s) having the necessary knowledge and experience in safety, design and/or operation as necessary for the specific evaluation at hand. Other members may include marine surveyors, ship operators, safety engineers, equipment manufacturers, human factors experts, naval architects and marine engineers.

4.2 The level of expertise that individuals should have to participate in the team may vary depending on the complexity of the alternative design and arrangements for which approval is sought. Since the evaluation, regardless of complexity, will have some effect on a particular field of safety, at least one expert with knowledge and experience in that appropriate safety field should be included as a member of the team.

4.3 The design team should:

.1 appoint a coordinator serving as the primary contact;

.2 communicate with the Administration for advice on the acceptability of the engineering analysis of the alternative design and arrangements throughout the entire process;

.3 determine the safety margin at the outset of the design process and review and adjust it as necessary during the analysis;

.4 conduct a preliminary analysis to develop the conceptual design in qualitative terms. This includes a clear definition of the scope of the alternative design and arrangements and the regulations which affect the design; a clear understanding of the intent requirements of the relevant regulations; the development of appropriate casualty scenarios, if necessary, and trial alternative designs. This portion of the process is documented in the form of a report that is reviewed and agreed by all interested parties and submitted to the Administration before the quantitative portion of the analysis is started;

.5 conduct a quantitative analysis to evaluate possible trial alternative designs using quantitative engineering analysis. This consists of the specification of design thresholds, development of performance criteria based upon the performance of an acceptable prescriptive design and evaluation of the trial alternative designs against the agreed performance criteria. From this step the final alternative design and arrangements are selected and the entire quantitative analysis is documented in a report; and

.6 prepare documentation, specifications and a life-cycle maintenance programme. The alternative design and arrangements should be clearly documented and approved by the Administration and a comprehensive report describing the alternative design and arrangements and required maintenance programme should be kept on board the ship. An operations and maintenance manual should be developed for this purpose. The manual should include an outline of the design conditions that should be maintained over the life of the ship to ensure compliance with the approved design.

5 Preliminary analysis in qualitative terms

5.1 *Definitions of scope*

5.1.1 The ship, ship system(s), component(s), space(s) and/or equipment subject to the analysis should be thoroughly defined. This includes the ship or system(s) representing both the alternative design and arrangements and the regulatory prescribed design. Depending on the extent of the desired deviation from prescriptive requirements, some of the information that may be required includes: detailed ship plans, drawings, equipment information and drawings, test data and analysis results, ship operating characteristics and conditions of operation, operating and maintenance procedures, material properties, etc.

5.1.2 The regulations affecting the proposed alternative design and arrangements, along with their functional requirements, should be clearly understood and documented in the preliminary analysis report (see paragraph 5.5). This should form the basis for the evaluation referred to in paragraph 6.4.

5.2 *Development of casualty or operational scenarios*

Casualty or operational scenarios should provide the basis for analysis and trial alternative design evaluation and, therefore, are the backbone of the alternative design process. Proper casualty or operational scenario development is essential and, depending on the extent of deviation from the prescribed design, may require a significant amount of time and resources. This phase should outline why an alternative design may be beneficial. For life-saving arrangements, this may focus on casualty scenarios where an alternative design or arrangement will provide an equivalent (or greater) level of safety. Mechanical or electrical arrangements may focus on an operational scenario that will provide an equivalent level of safety, but may increase efficiencies or reduce cost to the operator.

5.3 *Casualty scenario development*

5.3.1 *General*

Casualty scenario development can be broken down into four areas:

.1 identification of hazards;

.2 enumeration of hazards;

.3 selection of hazards; and

.4 specification of design casualty scenarios.

5.3.2 *Identification of hazards*

This step is crucial in the casualty scenario development process as well as in the entire alternative design methodology. If a particular hazard or incident is omitted, then it will not be considered in the analysis and the resulting final design may be inadequate. Hazards may be identified using historical and statistical data, expert opinion and experience and hazard evaluation procedures. There are many hazard evaluation procedures available to help identify the hazards including Hazard and Operability Study (HAZOP), Process Hazard Analysis (PHA), Failure Mode and Effects Analysis (FMEA), "what-if", etc. As a minimum, the following conditions and characteristics should be identified and considered:

.1 pre-casualty situation: ship, platform, compartment, available potential and kinetic energy, environmental conditions;

.2 potential initiating events, causes;

.3 detailed technical information and properties of potential hazards;

.4 secondary hazards that might be subject to effects of initial hazard;

.5 extension potential: beyond compartment, structure, area (if in open);

.6 target locations: note target items or areas associated with the performance parameters;

.7 critical factors relevant to the hazard: ventilation, environment, operational, time of day, etc.; and

.8 relevant statistical data: past casualty history, probability of failure, frequency and severity rates, etc.

5.3.3 *Enumeration of hazards*

All of the hazards identified above should be grouped into one of three incident classes: localized, major or catastrophic. A localized incident consists of a casualty with a localized effect zone, limited to a specific area. A major incident consists of a casualty with a medium effect zone, limited to the boundaries of the ship. A catastrophic incident consists of a casualty with a large affect zone, beyond the ship and affecting surrounding ships or communities. In the majority of cases, only localized and/or major incidents need to be considered. Examples where the catastrophic incident class may be considered would include transport and/or offshore production of petroleum products or other hazardous materials where the incident effect zone is very likely to be beyond the ship vicinity. The hazards should be tabulated for future selection of a certain number of each of the incident classes.

5.3.4 *Selection of hazards*

The number and type of hazards that should be selected for the quantitative analysis is dependent on the complexity of the trial alternative design and arrangements. All of the hazards identified should be reviewed for selection of a range of incidents. In determining the selection, frequency of occurrence does not need to be fully quantified, but it can be utilized in a qualitative sense. The selection process should identify a range of incidents which cover the largest and most probable range of enumerated hazards. Because the engineering evaluation relies on a comparison of the proposed alternative design and arrangements with prescriptive designs, demonstration of equivalent performance during the major incidents should adequately demonstrate the design's equivalence for all lesser incidents and provide the commensurate level of safety. In selecting the hazards it is possible to lose perspective and to begin selecting highly unlikely or inconsequential hazards. Care should be taken to select the most appropriate incidents for inclusion in the selected range of incidents.

5.3.5 *Specification of design casualty scenarios*

Based on the hazards selected, the casualty scenarios to be used in the quantitative analysis should be clearly documented. The specification should include a qualitative description of the design casualty (e.g. initiating and subsequent chain of events, location, etc.), description of the vessel, compartment or system of origin, safeguard systems installed, number of occupants, physical and mental status of occupants and available means of escape. The casualty scenarios should consider possible future changes to the hazards (increased or decreased) in the affected areas. The design casualty or casualties will be characterized in more detail during the quantitative analysis for each trial alternative design. Operational scenario development for a mechanical or electrical alternative design or arrangement should include the operating scenarios under which the alternative will be utilized.

5.4 *Development of trial alternative designs*

At this point in the analysis, one or more trial alternative designs should be developed so that they can be compared against the developed performance criteria. The trial alternative design should also take into consideration the importance of human factors, operations and management. It should be recognized that well defined operations and management procedures may play a big part in increasing the overall level of safety.

5.5 *Preliminary analysis report*

5.5.1 A report of the preliminary analysis should include clear documentation of all steps taken to this point, including identification of the design team, their qualifications, the scope of the alternative design analysis, the functional requirements to be met, the description of the casualty scenarios and trial alternative designs selected for the quantitative analysis.

5.5.2 The preliminary analysis report should be submitted to the Administration for formal review and agreement prior to beginning the quantitative analysis. The report may also be submitted to the port State for informational purposes, if the intended calling ports are known during the design stage. The key results of the preliminary analysis should include:

.1 a secured agreement from all parties to the design objectives and engineering evaluation;

.2 specified design casualty scenario(s) acceptable to all parties; and

.3 trial alternative design(s) acceptable to all parties.

6 Quantitative analysis

6.1 *General*

6.1.1 The quantitative analysis is the most labour intensive from an engineering standpoint. It consists of quantifying the design casualty scenarios, developing the performance criteria, verifying the acceptability of the selected safety margins and evaluating the performance of trial alternative designs against the prescriptive performance criteria.

6.1.2 The quantification of the design casualty scenarios may include calculating the effects of casualty detection systems, alarm and mitigation methods, generating timelines from initiation of the casualty until control of the casualty or evacuation, and estimating consequences in terms of damage to the vessel, and the risk of harm to passengers and crew. This information should then be utilized to evaluate the trial alternative designs selected during the preliminary analysis.

6.1.3 Risk assessment may play an important role in this process. It should be recognized that risk cannot ever be completely eliminated. Throughout the entire performance based design process, this fact should be kept in mind. The purpose of performance design is not to build a fail-safe design, but to specify a design with reasonable confidence that it will perform its intended function(s) when necessary and in a manner equivalent to or better than the prescriptive requirements of SOLAS chapters II-1 and III.

6.2 *Quantification of design casualty scenarios*

6.2.1 After choosing an appropriate range of incidents, quantification of the casualties should be carried out for each of the incidents. Quantification will require specification of all factors that may affect the type and extent of the hazard. The casualty scenarios should consider possible future changes to the affected systems and areas. This may include calculation of specific casualty parameters, ship damage, passenger exposure to harm, time-lines, etc. It should be noted that, when using any specific tools, the limitations and assumptions of these models should be well understood and documented. This becomes very important when deciding on and applying safety margins. Documentation of the alternative design should explicitly identify the models used in the analysis and their applicability. Reference to the literature alone should not be considered as adequate documentation. The general procedure for specifying design casualties includes casualty scenario development completed during the preliminary analysis, timeline analysis and consequence estimation which is detailed below.

6.2.2 For each of the identified hazards, a range of casualty scenarios should be developed. Because the alternative design approach is based on a comparison against the regulatory prescribed design, the quantification can often be simplified. In many cases, it may only be necessary to analyse one or two scenarios if this provides enough information to evaluate the level of safety of the alternative design and arrangements against the required prescriptive design.

6.2.3 A timeline should be developed for each of the casualty scenarios beginning with initiation. Timelines should include the entire chain of relevant events up to and including escape times (to assembly stations, evacuation stations and lifeboats, as appropriate). This timeline should include personnel response, activation of damage control systems or active damage control measures, untenable conditions, etc. The timeline should include a description of the extent of the casualty throughout the scenario, as determined by using the various correlations, models and data from the literature or actual tests.

6.2.4 Consequences of various casualty scenarios should be quantified in relevant engineering terms. This can be accomplished by using existing correlations and calculation procedures for determining the characteristics of a casualty. In certain cases, full scale testing and experimentation may be necessary to properly predict the casualty characteristics. Regardless of the calculation procedures utilized, a sensitivity analysis should be conducted to determine the effects of the uncertainties and limitations of the input parameters.

6.3 *Development performance criteria*

6.3.1 Performance criteria are quantitative expressions of the intent of the requirements of the relevant SOLAS regulations. The required performance of the trial alternative designs are specified numerically in the form of performance criteria. Performance criteria may include tenability limits or other criteria necessary to ensure successful alternative design and arrangements.

6.3.2 Compliance with the prescriptive regulations is one way to meet the stated functional requirements. The performance criteria for the alternative design and arrangements should be determined, taking into consideration the intent of the regulations.

6.3.3 If the performance criteria for the alternative design and arrangements cannot be determined directly from the prescriptive regulations because of novel or unique features, they may be developed from an evaluation of the intended performance of a commonly used acceptable prescriptive design, provided that an equivalent level of safety is maintained. In the case of life-saving appliances and arrangements according to SOLAS chapter III, the goals, functional requirements and expected performance criteria, as set out in appendix 5, should be taken into account. In the case of machinery installations, electrical installations and additional requirements for periodically unattended machinery spaces according to SOLAS chapter II-1 parts C, D and E, the goals, functional requirements and expected performance criteria, as set out in appendix 6, should be taken into account.

6.3.4 Before evaluating the prescriptive design, the design team should agree on what specific performance criteria and safety margins should be established. Depending on the prescriptive requirements to which the approval of alternative design or arrangements is sought, these performance criteria could fall within one or more of the following areas:

.1 Life safety criteria – These criteria address the survivability of passengers and crew and may represent the effects of flooding, fire, etc.

.2 Criteria for damage to ship structure and related systems – These criteria address the impact that casualty might have on the ship structure, mechanical systems, electrical systems, fire protection systems, evacuation systems, propulsion and manoeuvrability, etc. These criteria may represent physical effects of the casualty.

.3 Criteria for damage to the environment – These criteria address the impact of the casualty on the atmosphere and marine environment.

6.3.5 The design team should consider the impact that one particular performance criterion might have on other areas that might not be specifically part of the alternative design. For example, the failure of a particular safeguard may not only affect the life safety of passengers and crew in the adjacent space, but it may result in the failure of some system affecting the overall safety of the ship.

6.3.6 Once all of the performance criteria have been established, the design team can then proceed with the evaluation of the trial alternative designs (see section 6.4).

6.4 *Evaluation of trial alternative designs*

6.4.1 All of the data and information generated during the preliminary analysis and specification of design casualty should serve as input to the evaluation process. The evaluation process may differ depending on the level of evaluation necessary (based on the scope defined during the preliminary analysis), but should generally follow the process illustrated in figure 6.4.1.

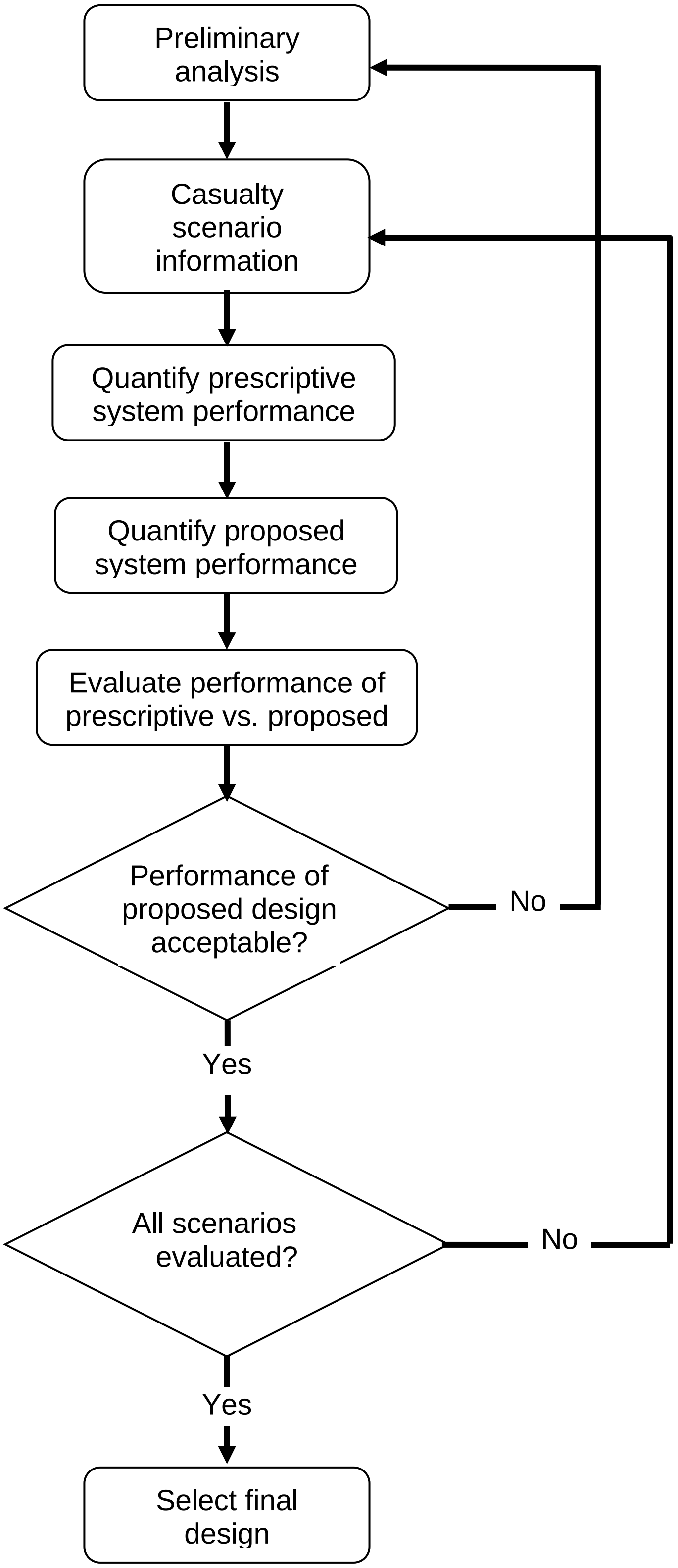


Figure 6.4.1 Alternative design and arrangements process flowchart

6.4.2 Each selected trial alternative design should be analysed against the selected design casualty scenarios to demonstrate that it meets the performance criteria with the agreed safety margin, which in turn demonstrates equivalence to the prescriptive design.

6.4.3 The level of engineering rigour required in any particular analysis will depend on the level of analysis required to demonstrate equivalency of the proposed alternative design and arrangements to the prescriptive requirements. Obviously, the more components, systems, operations and parts of the ship that are affected by a particular alternative design, the larger the scope of the analysis.

6.4.4 The final alternative design and arrangements should be selected from the trial alternative designs that meet the selected performance criteria and safety margins.

7 Documentation

7.1 Because the alternative design process may involve substantial deviation from the regulatory prescribed requirements, the process should be thoroughly documented. This provides a record that will be required if future design changes to the ship are proposed or the ship transfers to the flag of another State and will also provide details and information that may be adapted for use in future designs. The following information should be provided for approval of the alternative design or arrangements:

.1 scope of the analysis or design;

.2 description of the alternative design(s) or arrangements(s), including drawings and specifications;

.3 results of the preliminary analysis, to include:

.3.1 members of the design team (including qualifications);

.3.2 description of the trial alternative design and arrangements being evaluated;

.3.3 discussion of affected SOLAS regulations and their requirements;

.3.4 hazard identification;

.3.5 enumeration of hazards;

.3.6 selection of hazards; and

.3.7 description of design casualty scenarios;

.4 results of quantitative analysis:

.4.1 design casualty scenarios:

.4.1.1 critical assumptions;

.4.1.2 initial conditions;

.4.1.3 engineering judgements;

.4.1.4 calculation procedures;

.4.1.5 test data;

.4.1.6 sensitivity analysis; and

.4.1.7 timelines;

.4.2 performance criteria;

.4.3 evaluation of trial alternative designs against performance criteria;

.4.4 description of final alternative design and arrangements;

.4.5 test, inspection and maintenance requirements; and

.4.6 references.

7.2 Documentation of approval by the Administration and the following information should be maintained onboard the ship at all times:

.1 scope of the analysis or design, including the critical design assumptions and critical design features;

.2 description of the alternative design and arrangements, including drawings and specifications;

.3 listing of affected SOLAS regulations;

.4 summary of the results of the engineering analysis and basis for approval; and

.5 test, inspection and maintenance requirements.

7.3 *Reporting and approval forms*

7.3.1 When the Administration approves alternative design and arrangements under these guidelines, pertinent technical information about the approval should be summarized on the reporting form given in appendixes 1 or 2, as appropriate, and should be submitted to the Organization for circulation to the Member Governments.

7.3.2 When the Administration approves alternative design and arrangements under these guidelines, documentation should be provided as indicated in appendixes 3 or 4, as appropriate. The documentation should be in the language or languages required by the Administration. If the language is neither English, French nor Spanish, a translation into one of those languages should be included.

APPENDIX 1

REPORT ON THE APPROVAL OF ALTERNATIVE DESIGN AND ARRANGEMENTS FOR MACHINERY AND ELECTRICAL INSTALLATIONS

The Government of ………………………. has approved on ………………… an alternative design and arrangement in accordance with provisions of regulation II-1/55 of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, as described below:

Name of ship ....

Port of registry ....

Ship type ....

IMO Number ....

1. Scope of the analysis or design, including the critical design assumptions and critical design features:

2. Description of the alternative design and arrangements:

3. Conditions of approval, if any:

4. Listing of affected SOLAS chapter II-1 regulations in parts C, D and E:

5. Summary of the result of the engineering analysis and basis for approval, including performance criteria and design casualty scenarios:

6. Test, inspection and maintenance requirements:

APPENDIX 2

REPORT ON THE APPROVAL OF ALTERNATIVE DESIGN AND ARRANGEMENTS FOR LIFE-SAVING APPLIANCES AND ARRANGEMENTS

The Government of ………………………. has approved on ………………… an alternative design and arrangement in accordance with provisions of regulation III/38 of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, as described below:

Name of ship	....
Port of registry	....
Ship type	....
IMO Number	....

1. Scope of the analysis or design, including the critical design assumptions and critical design features:

2. Description of the alternative design and arrangements:

3. Conditions of approval, if any:

4. Listing of affected SOLAS chapter III regulations:

5. Summary of the result of the engineering analysis and basis for approval, including performance criteria and design casualty scenarios:

6. Test, inspection and maintenance requirements:

APPENDIX 3

DOCUMENT OF APPROVAL OF ALTERNATIVE DESIGN AND ARRANGEMENTS FOR MACHINERY AND ELECTRICAL INSTALLATIONS

Issued in accordance with provisions of regulation II-1/55.4 of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, under the authority of the Government of ....……………………………….. by ………..………………………………..……….

(Name of State) (Person or organization authorized)

Name of ship ....

Port of registry ....

Ship type ....

IMO Number ....

THIS IS TO CERTIFY that the following alternative design and arrangements applied to the above ship have been approved under the provisions of SOLAS regulation II-1/55:

1. Scope of the analysis or design, including the critical design assumptions and critical design features:

2. Description of the alternative design and arrangements:

3. Conditions of approval, if any:

4. Listing of affected SOLAS chapter II-1 regulations:

5. Summary of the result of the engineering analysis and basis for approval, including performance criteria and design casualty scenarios:

6. Test, inspection and maintenance requirements:

7. Drawings and specifications of the alternative design and arrangement:

Issued at .... on ....

....
(Signature of authorized official issuing the certificate)

(Seal or stamp of issuing authority, as appropriate)

APPENDIX 4

DOCUMENT OF APPROVAL OF ALTERNATIVE DESIGN AND ARRANGEMENTS FOR LIFE-SAVING APPLIANCES AND ARRANGEMENTS

Issued in accordance with provisions of regulation III/38.4 of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, under the authority of the Government of ....…………………………………. by ……...………………………………………...

(Name of State) (Person or organization authorized)

Name of ship ....

Port of registry ....

Ship type ....

IMO Number ....

THIS IS TO CERTIFY that the following alternative design and arrangements applied to the above ship have been approved under the provisions of SOLAS regulation III/38.

1. Scope of the analysis or design, including the critical design assumptions and critical design features:

2. Description of the alternative design and arrangements:

3. Conditions of approval, if any:

4. Listing of affected SOLAS chapter III regulations:

5. Summary of the result of the engineering analysis and basis for approval, including performance criteria and design casualty scenarios:

6. Test, inspection and maintenance requirements:

7. Drawings and specifications of the alternative design and arrangement:

Issued at .... on ....

....
(Signature of authorized official issuing the certificate)

(Seal or stamp of issuing authority, as appropriate)

APPENDIX 5

GOALS, FUNCTIONAL REQUIREMENTS AND EXPECTED PERFORMANCE CRITERIA FOR SOLAS CHAPTER III

Goal: To save and maintain human life during and after an emergency situation

FR 1: All life-saving appliances should be in a state of readiness for immediate use. This will be accomplished by ensuring:

EP 1: All life-saving appliances should be easily accessible (e.g. not obstructed and not locked).

EP 2: All life-saving appliances should be stowed securely in a sheltered position and protected from damage by fire and explosion.

EP 3: All life-saving appliances should be maintainable to ensure reliability for the specified service cycle.

EP 4: All life-saving appliances should be designed considering uncertainty in material properties, loads, deterioration and consequences of failure in operating environment.

EP 5: Descriptions and instructions for operation, inspection, maintenance and functional testing should be provided for all life-saving appliances.

EP 6: All life-saving appliances should be able to withstand environmental exposure of the ship including sunlight, ozone, seawater (wash, heavy seas), icing, wind, humidity, oil, air temperature (-30°C to +65°C), water temperature (at least -1°C to +30°C if it is likely to be immersed in seawater), fungus and marine atmosphere.

EP 7: All life-saving appliances should be usable and operational under adverse vessel conditions, i.e. list and trim.

EP 8: Deployment of life-saving appliances should be possible without depending upon any means other than gravity or stored power which is independent of the ship's power supplies to launch the survival craft.

EP 9: The number of crew members on board should be sufficient for operating the life-saving appliance and launching arrangements required for abandonment by the total number of persons on board. This should include substitutes for key persons and crew members on board operating survival craft and launching arrangements are assigned and trained appropriately.

FR 2: Training and drills should be sufficient to ensure that all passengers and crew are familiar with their responsibilities in an emergency. This will be accomplished by ensuring:

EP 1: All life-saving appliances and arrangements should be designed and installed to facilitate training and drills.

EP 2: Training and drills should be routinely conducted to ensure crew are in a state of readiness and are competent with the operation of life-saving appliances and their assigned emergency duties.

EP 3: Every crew member should participate in drills. These should be conducted, as far as practicable, as if there were an actual emergency.

EP 4: Drills should be planned and conducted in a safe manner.

EP 5: Drills should be planned in such a way that due consideration is given to regular practice in the various emergencies that may occur depending on the type of ship and cargo.

FR 3: Before proceeding to sea, all crew and passengers should be provided with information and instructions of the actions to be taken in an emergency. This will be accomplished by ensuring:

EP 1: Safety information and instructions should be presented in a manner that is easily understood by passengers, in language, illustration and/or demonstration.

EP 2: Information should be distributed and displayed in appropriate conspicuous places accessible under all conditions, e.g. emergency lighting.

EP 3: All ships should clearly indicate and highlight the stowage location of all life-saving appliances, display directions to places designated for assembling all persons in the event of an emergency, display assignment to life-saving appliances and display how to operate life-saving appliances.

EP 4: The number and type of life-saving appliances should be marked at each stowage location.

FR 4: All ships should have an effective emergency management system. A copy of the emergency management system should be readily available to crew. This will be accomplished by ensuring:

EP 1: The emergency management system should clearly identify roles and responsibilities during an emergency.

EP 2: Assembly locations, muster stations and escape routes should be identified on all ships.

EP 3: All passenger ships should establish a decision support system.

EP 4: The emergency management system should include the consideration of physical characteristics and capabilities of embarked persons.

EP 5: All ships should have the means to account for all persons on board.

EP 6: The emergency management system should have a uniform structure, be easy to use and be provided on board in an appropriate conspicuous location.

FR 5: All ships should be provided with means of external communications with shore, ships and aircraft. This will be accomplished by ensuring:

EP 1: All ships should have the means to indicate their position visually in an emergency, which makes it possible to detect and locate the ship from an altitude of at least 3,000 m at a range of at least 10 miles under clear daytime and night-time conditions for a period of at least 40 s.

EP 2: All ships should be provided with means for two-way on-scene communication between survival craft, between survival craft and ship, and between survival craft and rescue craft.

EP 3: All ships should carry search and rescue locating devices that are designed to automatically activate and operate continuously and can be rapidly placed into any survival craft from their place of storage on the ship.

FR 6: All ships should be able to internally communicate emergency messages and instructions to all crew and passengers. This will be accomplished by ensuring:

EP 1: Emergency alerts, messages and instructions to all crew and passengers should be received regardless of an individual's location on the ship.

EP 2: Emergency alerts, messages and instructions should be communicated in appropriate languages expected to be understood by all those on board.

EP 3: Two-way communications should be possible between emergency control stations, places designated for assembling and/or embarkation to survival craft and strategic positions on board.

FR 7: All ships should provide means for a safe abandonment for all persons. This will be accomplished by ensuring:

EP 1: Means should be available to embark survival craft from both the embarkation deck and the waterline in the lightest seagoing condition and under adverse conditions of list and trim.

EP 2: Means of evacuation should be distributed on the ship considering access of persons and areas where persons may become isolated.

EP 3: Each davit-launched, self-propelled survival craft boarded from the embarkation deck should be capable of being launched from two positions by one crew member: from a position in the survival craft and from a position on deck.

EP 4: All survival and rescue craft should be stowed as near the water surface as is safe and practicable.

EP 5: All ships should provide for safe unobstructed launching of each survival craft, for example, by avoiding interference with fixed structures, fixtures, fittings, equipment and other life-saving appliances.

EP 6: Embarkation platforms should provide for protection from the seaway and the effects of hazardous cargo, if carried.

EP 7: Relative movement and gaps between the survival craft and ship during embarkation should be minimized.

EP 8: All life-saving appliances should enable safe abandonment of all persons on board regardless of their physical condition, age and mobility, including those needing evacuation by stretcher or other means.

EP 9: All ships should provide for safe launching of survival craft both in a seaway and when the ship is adrift.

EP 10: Passenger ships should provide float free survival craft capacity for at least 25% of the total number of persons on board and cargo ships should provide 100% float free survival craft capacity for the total number of persons on board.

EP 11: All ships should provide adequate space to muster and provide instructions for all persons on board.

EP 12: Abandonment of all persons on board should take no more than 30 minutes after mustering on passenger ships, and 10 minutes on cargo ships.

EP 13: Each survival craft should be prepared for boarding and launching by no more than two crew members in less than 5 minutes.

EP 14 Life-saving appliances and the craft they launch should operate as a system.

FR 8: All ships should provide means for the safety and survivability of all persons after abandonment for the time until expected rescue. This will be accomplished by ensuring:

EP 1: Survival craft should provide a habitable environment for all persons on board.

EP 2: Survival craft should provide adequate ventilation and protection for its complement against wind, rain and spray at all ambient temperatures between -15 and 30 degrees C.

EP 3: Each survival craft shall have sufficient buoyancy when loaded with its full complement of persons and when punctured in any one location.

EP 4: All passenger ships must have sufficient self-propelled craft capable of marshalling all non-self-propelled survival craft sufficient for the total number of persons on board.

EP 5: Self-propelled survival and rescue craft should be capable of proceeding ahead in calm water at least at 2 knots when towing the largest passive survival craft carried on the ship loaded with its full complement of persons and equipment.

EP 6: Survival craft should be able to reach a safe distance from the ship in a timely manner, either by its own propulsion or by assistance from other survival craft or rescue craft.

EP 7: Each survival craft should have sufficient first aid supplies, anti-seasickness medication, and supply of food and water for the number of persons on board.

EP 8: Survival craft should be approved for the maximum number of persons it is permitted to accommodate, as decided by practical seating tests afloat and based upon the number of adult persons wearing individual buoyancy equipment who can be seated without, in any way, interfering with the normal operation of its equipment or means of propulsion.

EP 9: All life-saving appliances and arrangements should be designed to reflect the expected capabilities and characteristics of persons on board.

EP 10: All survival craft should provide means for persons in the water to cling to the survival craft, and permit persons to board the survival craft from the water when wearing individual buoyancy equipment.

FR 9: Each person should be provided with means to facilitate survival in the water until rescued into a survival craft or rescue unit. This will be accomplished by ensuring:

EP 1: Each person on a cargo ship and each crew member assigned to operate the life-saving appliances on any ship should be provided with individual garments for protection against hypothermia.

EP 2: Each person on board should have ready access to a physically suitable personal life-saving appliance, regardless of their location on the vessel.

EP 3: All ships must ensure individual wearable buoyancy equipment are available for persons on watch and at remote locations on the ship so that they are readily accessible in an emergency.

EP 4: All ships shall ensure that each adult on board has a suitable individual wearable buoyancy equipment considering their weight and girth.

EP 5: Passenger ships shall ensure that each infant and child on board has a suitable individual wearable buoyancy equipment, as appropriate, for the duration of the voyage and the type of service.

EP 6: Throwable personal flotation devices are distributed so that they are readily available on both sides of the ship and as far as practicable on all open decks extending to the ship's side or to the stern.

EP 7: Throwable personal flotation devices are stowed so as to be capable of being rapidly cast loose and not permanently secured in any way.

EP 8: Personal life-saving appliances should be provided with adequate spare capacity.

FR 10: Each survival craft should provide active and passive means of detection by other survival and rescue craft. This will be accomplished by ensuring:

EP 1: Survival craft should have active and passive means of detection which makes it possible to visually locate or detect the survival craft in a seaway from a ship or an aircraft.

EP 2: Visual means of detection for survival craft should make it possible for an aircraft at an altitude of up to 3,000 meters to detect the survival craft at a range of at least 10 miles; and for a ship to detect the survival craft in a seaway in clear conditions at a range of at least 2 miles.

FR 11: All ships should provide active and passive means for detection of persons in the water by survival units and by rescue craft.

EP 1: Visual means of detection for persons in the water should make it possible for a ship to detect the person in a seaway in clear daytime conditions at a range of at least 0.2 miles; and in clear night-time conditions at a range of at least 0.5 miles for a duration of at least 8 hours.

EP 2: Individual wearable buoyancy equipment should have a manually controlled active means of detection which makes it possible to detect a person in a seaway audibly at a range of at least 0.2 miles in calm weather.

EP 3: Buoyancy equipment intended to support and enable the detection of persons in the water should be provided on board. The buoyancy equipment should have passive means of detection, which makes it possible to detect the buoyancy equipment in a seaway visually and, have active means of detection attached which is automatically activated when the buoyancy equipment is deployed.

FR 12: All ships should provide for the search, rescue and retrieval of persons in the water. This will be accomplished by ensuring:

EP 1: Rescue craft should be stowed in such a way that they are kept in a state of continuous readiness and can be launched within 5 minutes and neither the rescue craft nor its stowage arrangements interfere with the operation of any survival craft at any other launching station.

EP 2: Launching arrangements for rescue craft should provide safe launching from the ship in a seaway with the ship making way at speeds of up to 5 knots.

EP 3: Rescue craft should be capable of maintaining a speed of at least 6 knots for at least 4 hours in a seaway.

EP 4: Rescue craft should be capable of being towed at speeds of up to 5 knots and be capable of towing other survival craft.

EP 5: Rescue craft should have sufficient mobility and manoeuvrability in a seaway to enable retrieval of persons from the water. Ro-ro passenger ships should be equipped with effective means for rapidly recovering survivors from the water and transferring survivors from rescue or survival craft to the ship.

EP 6: The full complement of occupants for which the rescue craft is approved to carry must be recovered to a position where they can disembark to the deck of the ship.

EP 7: Rescue craft should be capable of carrying at least five persons seated and at least one person lying down.

APPENDIX 6

GOALS, FUNCTIONAL REQUIREMENTS AND EXPECTED PERFORMANCE CRITERIA FOR SOLAS CHAPTER II-1, PARTS C, D AND E

GOALS, FUNCTIONAL REQUIREMENTS AND EXPECTED PERFORMANCE CRITERIA FOR SOLAS CHAPTER II-1 (PART C) (MACHINERY INSTALLATIONS)

Goal: To ensure adequate design, construction and availability of machinery installations for safe operation of the ship and safeguard of the persons on board from associated hazards in expected operating conditions

FR 1: Sufficient availability and capacity of propulsion to avoid navigational hazards should be ensured. Sufficient design and construction to reduce, to a minimum, any danger to persons on board should be ensured. This will be accomplished by ensuring:

EP 1-1: Special consideration should be given to the reliability of single essential propulsion components, and a separate source of propulsion power may be required to give the ship a navigable speed.

EP 1-2: Means should be provided whereby normal operation of propulsion machinery can be sustained or restored even though one of the essential auxiliaries becomes inoperative.

EP 1-3: Means should be provided to ensure that the machinery can be brought into operation from the dead ship condition without external aid.

EP 1-4: All machineries should be subjected to appropriate tests before being put into service for the first time. Machineries subject to internal pressure should be pressure tested prior to being put into service.

EP 1-5: Machinery essential to the propulsion and manoeuvring and safety of the ship should be designed to operate when the ship is upright and when inclined at certain angles in both static and dynamic conditions.

EP 1-6: Provision should be made to facilitate cleaning, inspection and maintenance of essential machinery including boilers, internal combustion engines, and pressure vessels.

EP 1-7: Any mode of the vibrations raised by machineries should not cause undue stresses in the machineries in the normal operating conditions.

EP 1-8: The design and installation of vent pipes for fuel oil settling and service tanks and lubricating oil tanks should not lead to the risk of ingress of seawater or rainwater.

EP 1-9: Means should be provided to protect against hazards originating from the machinery, such as moving parts and hot surfaces.

FR 2: It should be ensured that machinery (main and auxiliary; both reciprocating engines and turbine engines, gears and shafts) should be capable of maintaining optimal operational conditions for safe voyages. This will be accomplished by ensuring:

EP 2-1: Means should be provided to keep the machinery in safe and stable operating speed.

EP 2-2: Machinery subject to internal pressure should be protected against excessive pressure.

EP 2-3: Machinery and the parts for transmission of power should be designed and constructed to withstand the maximum working stress.

EP 2-4: Machinery should be provided with automatic shut-off arrangements in the case of failures which could lead to breakdown or serious damage.

FR 3: Adequate means of reversing the direction of thrust should be provided. This will be accomplished by ensuring:

EP 3-1: The thrust can be reversed and be sufficient to stop the ship within a reasonable distance.

EP 3-2: The test results and information on means of going astern should be available on board.

FR 4: Sufficient steering availability and capacity in normal and under failure conditions should be provided to ensure sufficient manoeuvring capabilities and to avoid navigational hazards. This functional requirement is also applicable to electrical and electrohydraulic steering gear. This will be accomplished by ensuring:

EP 4-1: The steering performance should not be lost owing to a single failure in the steering gear or the control system.

EP 4-2: The steering gears and their components should have sufficient strength and overload of the steering gears should be avoided.

EP 4-3: The steering system should have capability to redirect the steering force in sufficient time.

EP 4-4: The steering gear should be controlled from the location where lookout and conning function take place. The steering gear should also be capable of being controlled from the steering gear compartment with sufficient communication capability to the navigation bridge.

EP 4-5: Electrical and electrohydraulic steering power systems and steering control systems should be provided with sufficient redundancy and safeguards.

FR 5: Machinery essential for the propulsion and safe control of the ship should be provided with effective means for its operation and control. This will be accomplished by ensuring:

EP 5-1: Where remote control of propulsion machinery from the navigation bridge is provided and the machinery control rooms are intended to be continuously attended:

5-1.1: the speed, direction of thrust and, if applicable, the pitch of the propeller should be fully controllable from the navigation bridge;

5-1.2: the means of remote control should be provided, for each independent propeller;

5-1.3: the propulsion machinery should be provided with an emergency stopping device on the navigation bridge;

5-1.4: propulsion machinery orders from the navigation bridge should be indicated in the machinery control room;

5-1.5: control of the propulsion machinery should be possible only from one location at a time;

5-1.6: it should be possible to control the propulsion machinery in the case of failure of remote control;

5-1.7: indicators should be fitted on the navigation bridge for propeller speed and direction of rotation, and pitch position if applicable; and

5-1.8: an audible and visible alarm should be provided on the navigation bridge and in the machinery control room to indicate a malfunction or failure of the control system.

EP 5-2: Where machinery is provided with automatic or remote control from an attended control room, the control should be designed and installed such that the machinery operation is as safe and effective as if it were under direct supervision.

EP 5-3: Automatic starting, operational and control systems should include provisions for manual override.

EP 5-4: Failure of any part of automatic or remote-control systems should not prevent the use of the manual override.

FR 6: Means for safe operation of steam boilers, boiler feed system and steam piping system should be provided. This will be accomplished by ensuring:

EP 6-1: Means should be provided to prevent the steam pressure from exceeding the design pressure.

EP 6-2: All pressure components for steam and feed water systems should be designed and installed with an adequate safety margin.

EP 6-3: Steam piping system should have sufficient strength and safety means to avoid over-pressure and water hammer actions.

FR7: Sufficient air supply to machinery spaces should be provided for operation of machinery and crew comfort. This will be accomplished by ensuring:

EP 7-1: Ventilation systems in machinery space should be designed with sufficient capacity for all the machinery operations and crew in the space.

FR 8: An efficient bilge pumping system capable of pumping from and draining any watertight compartment under all conditions should be provided. This will be accomplished by ensuring:

EP 8-1: Sufficient capacity of system (pump, piping), redundancy of system (pump) should be provided.

EP 8-2: Unnecessary discharging/intaking/ingress of bilge from one compartment to another compartment should be avoided.

EP 8-3: For passenger ships, the bilge system should be operable when any one compartment is flooded or damaged.

FR 9: Sufficient and non-interrupted means of communication should be provided between machinery control room and the location where lookout and conning function take place. Sufficient means for calling engineers should be provided. This will be accomplished by ensuring:

EP 9-1: Two independent means of communication between machinery control room and the location where lookout and conning function take place should be provided.

EP 9-2: An engineer's alarm should be provided from the machinery control position.

FR 10: Emergency power installation in passenger ships should be located in a safe position. This will be accomplished by ensuring:

EP 10-1: Machineries for use in emergency in passenger ships should be located in a safe position.

GOALS, FUNCTIONAL REQUIREMENTS AND EXPECTED PERFORMANCE CRITERIA FOR SOLAS CHAPTER II-1 (Part D) (ELECTRICAL INSTALLATIONS)

Goal: To ensure adequate availability of electrically-powered services for the safe operation of the ship and to protect the persons on board from hazards of electrical origin in normal and emergency conditions.

FR 1: Sufficient power supply to electrical loads in normal and emergency conditions should be provided and maintained. This will be accomplished by ensuring:

EP 1-1: Sufficient power supply to essential services and to maintain habitable conditions should be provided and maintained.

EP 1-2: Adequate power supply to emergency services should be ensured.

EP 1-3: Power supply for essential services should be maintained regardless of speed and direction of rotation of propulsion machinery or shafting.

EP 1-4: Means for monitoring availability of emergency source of electrical power and its distribution system should be provided.

EP 1-5: Power supply to emergency services should be ensured for at least the time duration as required by SOLAS chapter II-1 part D.

EP 1-6: For passenger ships, steady and uninterrupted power supply to emergency services should be ensured.

EP 1-7: Power supply for normal operation of propulsion, steering gear, illumination and other essential systems for overall safety and minimum habitability should be provided even in case of malfunction of one power source.

EP 1-8: Adequate power supply should be provided to recover from dead ship condition within a time duration not more than 30 minutes after blackout.

EP 1-9: Power supply to emergency services should be provided in at least the following conditions:

A) inclined at any angle of list up to 22.5°;

B) inclined up to 10° either in the force or aft direction; and

C) any combination of above angles within those limits.

EP 1-10: Power supply to emergency services should not be impaired by malfunction in non-essential services.

EP 1-11: A single failure in the distribution system should not result in an unacceptable loss of electrical power in essential systems.

FR 2: Electrical power supply should be restored after malfunction. This will be accomplished by ensuring:

EP 2-1: Power should be made available automatically within 45 seconds to emergency services.

EP 2-2: Emergency services should be automatically connected to available electrical power supply.

EP 2-3: For emergency services for which an interruption to electrical power supply is unacceptable, means of transitional electrical power supply should be provided with sufficient capacity and duration (a minimum time of 30 minutes).

EP 2-4: Reliable and quick starting arrangement for electrical power supply for emergency services should be provided.

EP 2-5: Emergency services should be available in case of any single failure of the main electrical supply.

FR 3: Impact of incidents that are not originated from electrical systems should be limited. This will be accomplished by ensuring:

EP 3-1: Availability of emergency power supply in case of flooding of any one compartment should be maintained.

EP 3-2: Impact of heat, fire and mechanical or accidental damage should be minimized.

EP 3-3: Main and emergency cabling should be separated.

EP 3-4: Means to prevent spread of fire through cables and cable entries should be provided.

EP 3-5: Power supply to emergency services should be maintained in case of fire in any one compartment which contains a main source of electrical power.

EP 3-6: Risk of malfunction due to the impact of Electromagnetic Interference (EMI) should be minimized.

EP 3-7: Appropriate degree of ingress protection (IP Class) should be provided.

FR 4: Shock, fire and other hazards of electrical origin should be prevented. This will be accomplished by ensuring:

EP 4-1: Protection against sustained electrical overloads should be provided.

EP 4-2: Protection against short circuit should be provided.

EP 4-3: Means to prevent short circuit should be provided.

EP 4-4: Means to detect abnormal condition of emergency source of electrical power and distribution system should be provided.

EP 4-5: Means to protect against and isolate faulty circuit should be provided.

EP 4-6: Suitable arrangements for the safe installation, application and maintenance of energy storage devices should be provided.

EP 4-7: Means to prevent electrical leakage and earth fault should be provided.

EP 4-8: Means to detect earth fault should be provided.

EP 4-9: Means to prevent ignition of flammable or combustible materials should be provided.

EP 4-10: Means to prevent explosion should be provided.

EP 4-11: Means to prevent persons from contacting live electrical circuits should be provided.

EP 4-12: Appropriate signs for dangerous voltage warning purposes should be provided.

EP 4-13: Battery energy storage system for essential systems should be designed to recognized standards and, where appropriate, a battery management system should be provided.

FR 5: Adequate illumination for normal and emergency conditions should be provided and maintained. This will be accomplished by ensuring:

(Illumination for normal condition)
EP 5-1: Illumination with sufficient intensity (LUX) should be provided in all areas normally accessible by passengers and crew.

EP 5-2: Sufficient illumination intensity (LUX) with redundancy should be provided in all essential areas normally accessible by passengers and crew.

(Illumination for emergency condition)
EP 5-3: Sufficient illumination intensity (LUX) with redundancy should be provided in all essential locations on the ship for safe emergency operations.

EP 5-4: For passenger ships, illumination in cabins should be provided to indicate the exit for at least 30 minutes when power to normal cabin lighting is lost.

EP 5-5: Means to check the conditions of all lighting systems for emergency use should be provided.

EP 5-6: For ro-ro passenger ships, illumination for escape of passengers should be provided with independent power supply for at least three hours.

GOALS, FUNCTIONAL REQUIREMENTS AND EXPECTED PERFORMANCE CRITERIA FOR SOLAS CHAPTER II-1 (Part E) (ADDITIONAL REQUIREMENTS FOR PERIODICALLY UNATTENDED MACHINERY SPACES)

Goal: Ensure adequate design, construction and availability of machinery installations in periodically unattended machinery spaces so that the safety of the ship in expected operating conditions, including manoeuvring, is equivalent to that of a ship having continuously attended machinery spaces.

FR 1: Measures should be taken to ensure that the equipment is functioning in a reliable manner and that satisfactory arrangements are made for regular inspections and routine tests to ensure continuous reliable operation. This will be accomplished by ensuring:

EP 1-1: The systems and equipment for remote or automatic control of systems in periodically unattended machinery spaces should be adequately designed and installed.

EP 1-2: The systems and equipment for remote or automatic control of systems installed in periodically unattended machinery spaces should be tested and inspected regularly.

FR 2: The ship should be provided with documentary evidence of its fitness to operate with periodically unattended machinery spaces. This will be accomplished by ensuring:

EP 2-1: Documentary evidence of fitness of the system and equipment for periodically unattended machinery spaces should be provided.

FR 3: A fail-safe alarm system should be provided indicating any fault requiring attention. This will be accomplished by ensuring:

EP 3-1: Alarm systems should be adequately designed, constructed and installed.

EP 3-2: Machinery system faults should be detected and adequately informed to person in charge on board. Alarms should activate audible and visible signals in machinery control room, the location where lookout and conning function take place and places where engineers are on watch.

EP 3-3: Means to detect and alarm conditions that may result in crankcase fire or explosion should be provided.

FR 4: The propulsion machinery including manoeuvring capability should be adequately monitored and controlled from the navigation bridge, and the control should be indicated in the machinery control room. This will be accomplished by ensuring:

EP 4-1: Adequate monitoring and control of the propulsion system from the navigation bridge should be ensured.

EP 4-2: The monitoring and control system for periodically unattended machinery control room should be single failure tolerant.

EP 4-3: Local manual control of propulsion machinery should be provided in the event of failure of the remote-control system. The remote control of the propulsion machinery should be possible only from one location at a time, and at each location there should be an indicator showing which location is in control of the propulsion machinery.

EP 4-4: Means independent of navigating bridge control system should be provided for emergency stopping of propulsion machinery.

FR 5: The communication between navigation bridge and machinery control room should be ensured at all times. This will be accomplished by ensuring:

EP 5-1: Adequate communication means between the machinery control room, the navigation bridge, engineer's public rooms and engineer's cabins are provided.

FR 6: A safety system should be provided to ensure that serious malfunction in machinery or boiler operations initiates an alarm and automatic shutdown of that part of the plant. This will be accomplished by ensuring:

EP 6-1: The complete shutdown of the propulsion system should not be automatically activated except in cases which could lead to serious damage, complete breakdown, or explosion.

EP 6-2: Shutdown of the propulsion system should be controlled effectively, and results in continuity of safe operation of the ship.

EP 6-3: Automatic controls of valves should be designed to fail-safe in the event of a loss of power supply.

FR 7: Electric power should be provided to all essential components in order to ensure the integrity of power supply to those services required for propulsion and steering as well as the safety of the ship. This will be accomplished by ensuring:

EP 7-1: Special consideration should be given for system overloads and load shedding.

EP 7-2: Electric power system should be adequately designed, constructed and installed.

EP 7-3: Electric power system should provide adequate power to machineries including propulsion, essential auxiliaries and steering systems.

FR 8: Periodically unattended machinery spaces should be provided with adequate means for protection against flooding. This will be accomplished by the following:

EP 8-1: Bilge wells in periodically unattended machinery spaces should be provided with means to detect accumulation of liquids at normal angles of trim and heel with a visual and audible alarm on the navigation bridge and machinery control room.

EP 8-2: For a bilge pumping system having arrangement to start automatically, means should be provided to indicate that the influx of water is exceeding the pumping capacity.

EP 8-3: The control of any valves serving a sea inlet and discharge below waterline should be designed and arranged to remain accessible in case of excessive influx of water into unattended machinery space.

____

INTERNATIONAL MARITIME ORGANIZATION

E

4 ALBERT EMBANKMENT
LONDON SE1 7SR
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

MSC.1/Circ.1509/Rev.1
17 June 2024

UNIFIED INTERPRETATIONS OF THE CODE ON NOISE LEVELS ON BOARD SHIPS (RESOLUTION MSC.337(91))

1 The Maritime Safety Committee, at its ninety-fifth session (3 to 12 June 2015), in order to facilitate its global and consistent implementation of the *Code on Noise Levels on Board Ships*, as adopted by resolution MSC.337(91), approved *Unified interpretations of the Code on Noise Levels on Board Ships* (resolution MSC.337(91))(MSC.1/Circ.1509), as prepared by the Sub-Committee on Ship Design and Construction, at its second session (16 to 20 February 2015).

2 The Maritime Safety Committee, at its 108th session (15 to 24 May 2024), with a view to providing more specific guidance on calibration for sound level meters and calibrators, approved the amendments to the unified interpretation of section 2 of the Code on Noise Levels on Board Ships (resolution MSC.337(91)), prepared by the Sub-Committee on Ship Design and Construction, at its tenth session (22 to 26 January 2024), which should be applied at their next calibration due date, but not later than 1 June 2026.

3 Member Governments are invited to use the annexed unified interpretations as guidance when applying Code on Noise Levels on Board Ships and to bring them to the attention of all parties concerned.

4 This circular revokes MSC.1/Circ.1509.

***

ANNEX

UNIFIED INTERPRETATIONS OF THE CODE ON NOISE LEVELS ON BOARD SHIPS (RESOLUTION MSC.337(91))

CHAPTER 1 – GENERAL

Paragraph 1.3.8

Passenger spaces where they are also occupied by crew such as recreation rooms and open recreation areas should be considered as "other passenger spaces", and therefore are not subject to the Code. However, bulkhead and decks of crew cabins and hospitals adjacent to such rooms/areas should have the weighted sound reduction index (Rw) in compliance with paragraph 6.2 of chapter 6.

Paragraph 1.4.21

Navigating bridge wings include enclosed navigating bridge spaces.

CHAPTER 2 – MEASURING EQUIPMENT

"2.1 Equipment specifications

2.1.1 Sound level meters

Measurement of sound pressure levels shall be carried out using precision integrating sound level meters subject to the requirements of this chapter. Such meters shall be manufactured to IEC 61672-1(2002-05)[1] type/class 1 standard as applicable, or to an equivalent standard acceptable to the Administration[2].

[1] Recommendation for sound level meters.

[2] Sound level meters class/type 1 manufactured according to IEC 651/IEC 804 may be used until 1 July 2016."

"2.2 Use of equipment

2.2.1 Calibration

Sound calibrators shall comply with the standard IEC 60942 (2003-01) and shall be approved by the manufacturer of the sound level meter used.

2.2.2 Check of measuring instrument and calibrator

Calibrator and sound level meter shall be verified at least every two years by a national standard laboratory or a competent laboratory accredited according to ISO 17025 (2005) as corrected by (Cor 1:2006)."

Interpretation

The calibration should be carried out in accordance with IEC 61672-3 for sound level meters and IEC 60942 Appendix B for field calibrators. The edition of the calibration standard should correspond with the edition of the manufacturing standard for the instruments. The measurement company should provide documentation about the standard which has been met if not clearly marked on the sound level meter or field calibrator. The documentation or marking should include a clear statement of the results of the periodic tests and which performance class the instrument meets after calibration.

CHAPTER 3 – MEASUREMENT

Paragraph 3.3.5

Air conditioning vents should be kept open during the taking of noise measurements on board, unless they are designed to be kept closed in the normal operating condition.

Paragraph 3.3.6

Closing devices of ventilation grilles/louvres of cabin doors should be kept open during the taking of noise measurements on board, unless they are designed to be kept closed in the normal operating condition.

Paragraph 3.3.9

The wording "40% of maximum thruster power" means exactly "40% of maximum" and does not mean "40% of 80% as required by paragraph 3.3.2 of the Code".

Paragraph 3.9

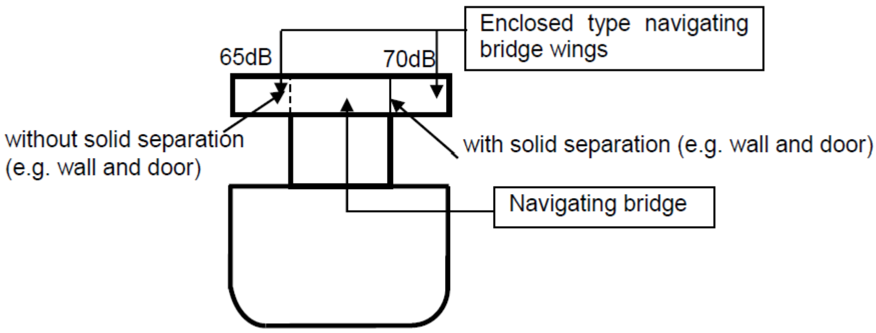
This provision only "acknowledges" the uncertainty; it does not represent any "allowance".

CHAPTER 4 – MAXIMUM ACCEPTABLE SOUND PRESSURE LEVELS

Paragraph 4.2

1 A navigating bridge provided with radio equipment should be regarded as a "navigating bridge" (65dB(A))."Radio rooms" mean separate rooms dedicated for sending/receiving radio messages.

2



3 If a cabin is completely separated by more than one bulkhead from the airborne sound source, those bulkheads are not required to have the airborne sound insulation properties as required in chapter 6. For this purpose, bathroom/toilet/lavatory is not regarded as a cabin but regarded as the origin of airborne sound to another cabin.

4 A room consisting of day-room and bedroom should be regarded as a single "cabin" (60dB(A)/55dB(A)) in cases where the room is for single occupancy. For this purpose, partitions (panel and door) between day-room and bedroom need not have the airborne sound insulation properties as required in chapter 6.

CHAPTER 6 – ACOUSTIC INSULATION BETWEEN ACCOMMODATION SPACES

Paragraph 6.2.1

1 The requirements regarding airborne sound insulation properties for bulkheads also apply to components installed in bulkheads (e.g. corridors to cabin doors).

2 In applying this requirement to bulkheads including components as mentioned in the above, the following may apply:

.1 In cases of bulkheads consisting of acoustic insulation panels and doors, this requirement is considered satisfactory where each component forming the surface of bulkheads (acoustic insulation panels and doors, etc.) has at least the required Rw.

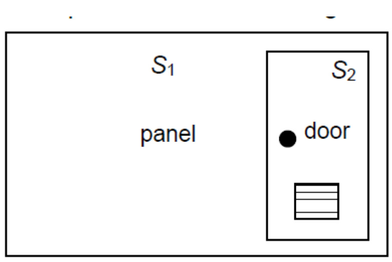
.2 In cases where either acoustic insulation panels or doors forming part of bulkheads have weighted sound reduction index inferior to that required by section 6.2.1 of the Code, this requirement is considered satisfactory provided that the Rw of bulkheads is not inferior to the required value, i.e. the Rw of bulkhead calculated using both the airborne sound insulation properties of the doors and those of the panels is not inferior to the required value. As guidance on evaluation of the Rw of bulkheads, the following formulae can be used:

$$\overline{R} = 10\log_{10}\left[S / \sum_{i=1}^{n} \left(S_i \cdot 10^{-R_i/10} \right) \right]$$

where S: the area of the concerned bulkhead
n: the number of components forming the concerned bulkhead
R_i: the sound reduction index of the component number i
S_i: the area of single component

Note: R_i has frequency elements in frequency range from 100 to 5000 [Hz]

Example: bulkhead consisting of acoustic insulation panels and doors:



$n = 2$
S_1: the area of the panel
S_2: the area of the door
S: the area of concerned bulkhead ($S = S_1 + S_2$)
R_1: the sound reduction index of the panel
R_2: the sound reduction index of the door

3 The requirements regarding airborne sound insulation properties for decks should also apply to decks together with coverings and should, therefore, be tested in laboratory as in the onboard arrangement. However, they need not apply to ceiling panels.

Paragraph 6.2.2

1 Closing devices of ventilation grilles/louvres of cabin doors should be kept open during laboratory tests.

2 Doors should be tested together with the associated door frame. In cases where there is no sill being part of the door frame, the doors should be tested with the gap specified by manufacturers and with sealing materials, if fitted.

___

INTERNATIONAL MARITIME ORGANIZATION

4 ALBERT EMBANKMENT
LONDON SE1 7SR
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

E

MSC.1/Circ.1511/Rev.1
26 June 2024

UNIFIED INTERPRETATIONS OF SOLAS REGULATIONS II-2/9 AND 13

1 The Maritime Safety Committee, at its ninety-fifth session (3 to 12 June 2015), with a view to providing more specific guidance on the application of SOLAS regulations II-2/9 and 13, approved *Unified interpretations of SOLAS regulations II-2/9 and 13* (MSC.1/Circ.1511), as prepared by the Sub-Committee on Ship Design and Construction, at its second session (16 to 20 February 2015).

2 The Maritime Safety Committee, at its 108th session (15 to 24 May 2024), with a view to providing more specific guidance on "safe position" in SOLAS regulation II-2/13.4, approved amendments to the unified interpretation, prepared by the Sub-Committee on Ship Design and Construction, at its tenth session (22 to 26 January 2024), as set out in the annex.

3 Member Governments are invited to apply the Unified interpretations of SOLAS regulations II-2/9 and 13 and to bring them to the attention of all parties concerned.

4 This circular revokes MSC.1/Circ.1511.

***

ANNEX

UNIFIED INTERPRETATIONS OF SOLAS REGULATIONS II-2/9 AND 13

REGULATION II-2/9 – CONTAINMENT OF FIRE

Tables 9.5 and 9.6:

1 Decks and bulkheads

Decks and bulkheads to be insulated to "A-30" fire integrity are those boundaries of single spaces protected by their own fire-extinguishing system.

2 Hatches

Class "A" fire integrity respectively does not apply to hatches fitted on open deck adjacent to ro-ro/vehicle spaces and on decks separating ro-ro/vehicle spaces, provided that such hatches are constructed of steel.

3 Access doors

"A-0" fire integrity does not apply to access doors to ro-ro/vehicle spaces fitted on open decks, provided that such access doors are constructed of steel.

4 Movable ramps

Movable ramps installed on decks referred to in Interpretation1 above which form boundaries of "A-30" fire integrity shall be constructed of steel and shall be insulated to "A-30" fire integrity, except for the "working parts" of such movable ramps (e.g. hydraulic cylinders, associated pipes/accessories) and members supporting such fittings which do not contribute to the structural strength of the boundary. Such movable ramps need not be subject to fire test. This is applicable to non-watertight doors used for loading/unloading of vehicles.

5 Ventilation ducts

Where ducts for a ro-ro/vehicle spaces pass through other ro-ro/vehicle spaces without serving those spaces, each duct shall be insulated all along itself to "A-30" fire integrity in ways of other ro-ro/vehicle spaces unless the sleeves and fire dampers in compliance with SOLAS regulation II-2/9.7.3.1 in order to prevent spread of fire through the ducts are fitted.

6 Ventilators

"A-0" fire integrity does not apply to ventilators constructed of steel fitted on open decks adjacent to ro-ro/vehicle spaces.

REGULATION II-2/13 – MEANS OF ESCAPE

Regulations 13.3.3.2 and 13.3.3.3

The "Lowest open deck" should be a category (10) "Open deck" (as defined in SOLAS regulations II-2/9.2.3.3.2.2 and II-2/9.2.4.2.2.2) at the lowest height from baseline in way of accommodation spaces.

Regulations 13.4.1.4, 13.4.1.6, 13.4.2.5 and 13.4.2.6

1 Main workshop

A "main workshop" means a compartment enclosed on at least three sides by bulkheads or gratings, usually containing welding equipment, metal working machinery and workbenches.

2 Machinery control rooms

A "machinery control room" means a space which serves for control and/or monitoring of machinery used for ship's main propulsion.

3 Continuous fire shelter

A "continuous fire shelter" means a route from a main workshop, or from a machinery control room, which allows safe escape, without entering the machinery space, to a location outside the machinery space. Such a continuous fire shelter need not be a protected enclosure as envisaged by SOLAS regulation II-2/13.4.1.1 or II-2/13.4.2.1.1. The boundaries of the continuous fire shelter shall be at least "A-0" class divisions and be protected by self-closing "A-0" class doors. The continuous fire shelter shall have minimum internal dimensions of at least 800 mm x 800 mm for vertical trunks and 600 mm in width for horizontal trunks, and shall have emergency lighting provisions. The figures below represent typical arrangements of the continuous fire shelters through trunks or through spaces/rooms to a location outside the machinery space, which should be considered as effective.

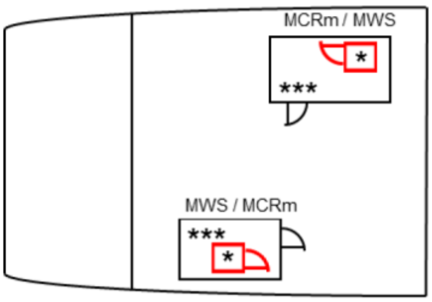


Figure 1 – Single room escape via trunk

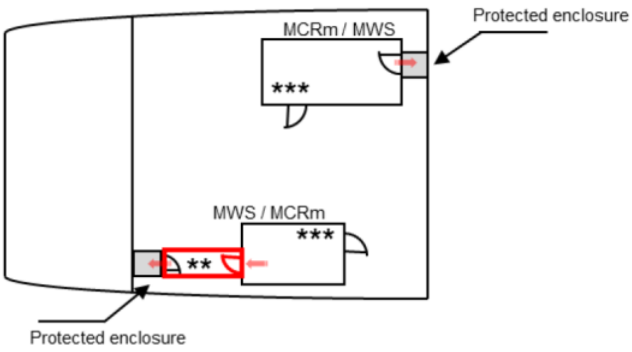


Figure 2 – Single room escape via protected enclosure

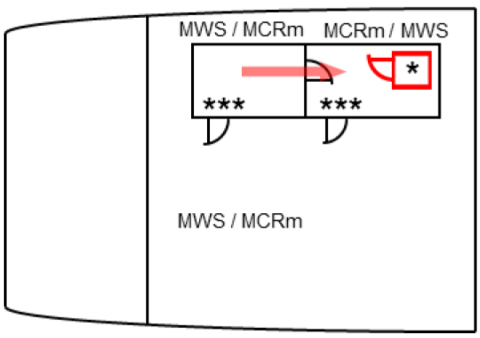


Figure 3 – Room to room escape via trunk

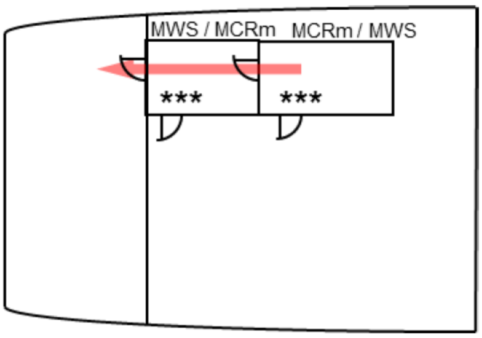


Figure 4 – Room to room direct escape

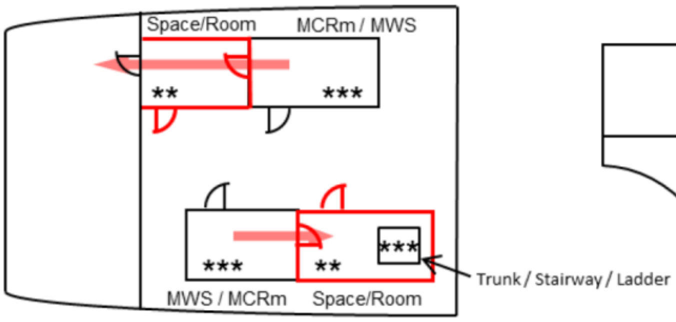


Figure 5 – Room to room escape via other space/room

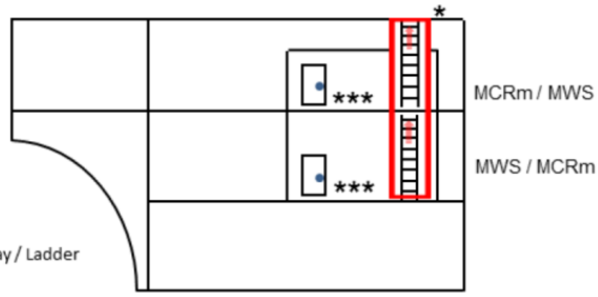


Figure 6 – Room to room escape via trunk (different decks)

MCRm: Machinery Control Room
MWS: Main Workshop

*	Vertical trunk (minimum dimensions: 800 mm x 800 mm) enclosing ladders or stairways to be at least "A-0" class divisions and to be protected by self-closing "A-0" class doors
**	Horizontal trunk (minimum width: 600 mm) to be at least "A-0" class divisions and to be protected by self-closing "A-0" class doors
***	Fire integrity not required

Regulation 13.4.1

1 A "safe position" can be any space, such as steering gear spaces where hydraulic oils for the steering gear equipment are stowed, and special category spaces and ro-ro spaces, from which access is provided and maintained clear of obstacles to the embarkation decks. This excludes lockers and storerooms, cargo spaces and spaces where flammable liquids are stowed.

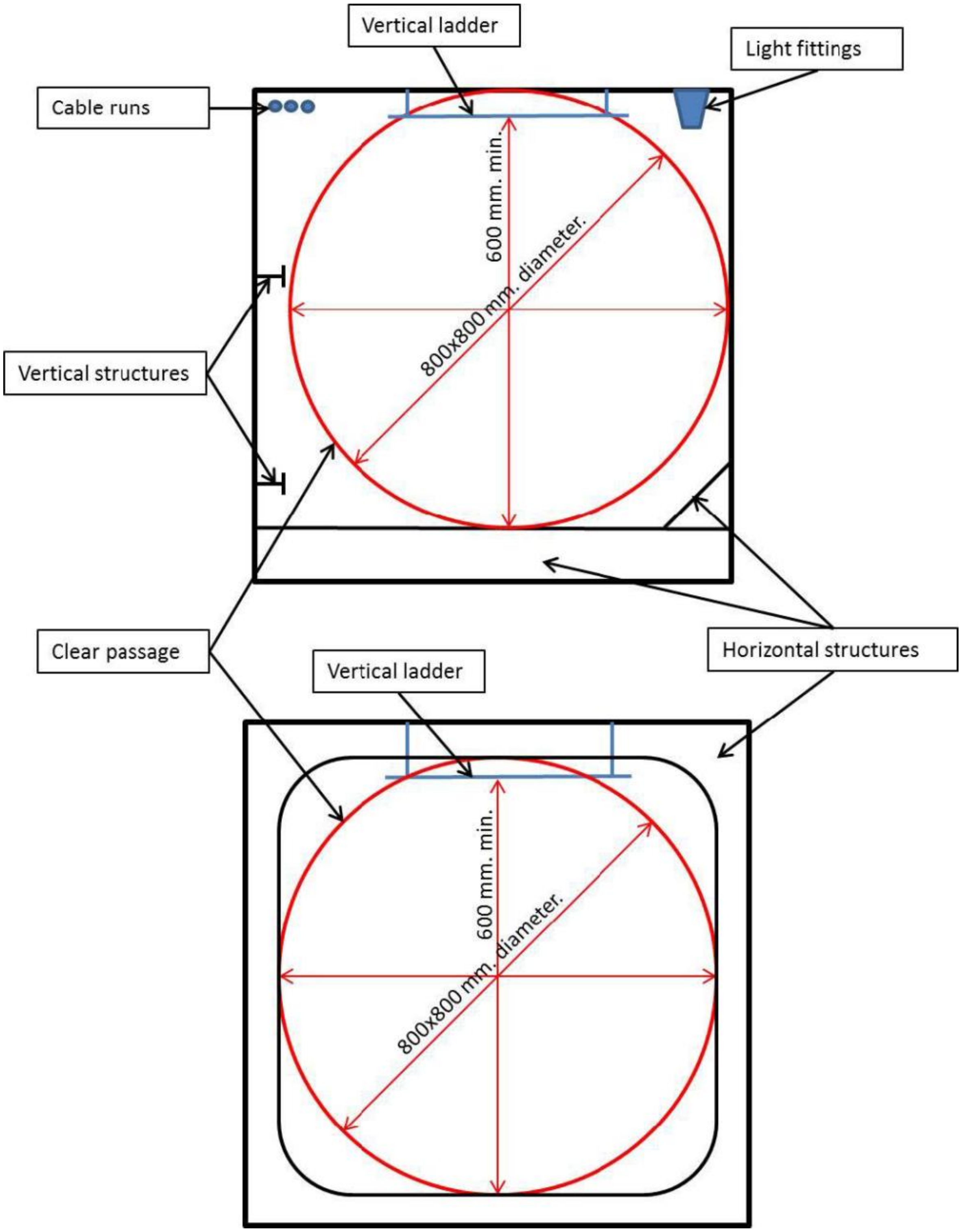
2 Inclined ladders/stairways in machinery spaces being part of, or providing access to, escape routes but not located within a protected enclosure should not have an inclination greater than 60° and should not be less than 600 mm in clear width. Such requirement need not be applied to ladders/stairways not forming part of an escape route, only provided for access to equipment or components, or similar areas, from one of the main platforms or deck levels within such spaces (regulation II-2/13.4.1).

3 Machinery spaces may include working platforms and passageways, or intermediate decks at more than one deck level. In such case, the lower part of the space should be regarded as the lowest deck level, platform or passageway within the space. At deck levels, other than the lowest one, where only one means of escape other than the protected enclosure is provided, self-closing fire doors should be fitted in the protected enclosure at that deck level. Smaller working platforms in-between deck levels, or only for access to equipment or components, need not be provided with two means of escape (regulation II-2/13.4.1.1).

4 A protected enclosure providing escape from machinery spaces to an open deck may be fitted with a hatch as means of egress from the enclosure to the open deck. The hatch should have minimum internal dimensions of 800 mm x 800 mm (regulation II-2/13.4.1.1.1).

5 Internal dimensions should be interpreted as clear width, so that a passage having diameter of 800 mm is available throughout the vertical enclosure, as shown in figure 7, clear of ship's structure, with insulation and equipment, if any. The ladder within the enclosure can be included in the internal dimensions of the enclosure. When protected enclosures include horizontal portions their clear width should not be less than 600 mm. Figure 7 is given as example of some possible arrangements which may be in line with the above interpretation (regulation II-2/13.4.1.1.1).

Figure 7



Regulation 13.4.2

1 A "safe position" can be any space, such as steering gear spaces where hydraulic oils for the steering gear equipment are stowed, and vehicle and ro-ro spaces, from which access is provided and maintained clear of obstacles to the open deck. This excludes cargo spaces, lockers and storerooms, cargo pump-rooms and spaces where flammable liquids are stowed.

2 Inclined ladders/stairways in machinery spaces being part of, or providing access to, escape routes, but not located within a protected enclosure should not have an inclination greater than 60° and should not be less than 600 mm in clear width. Such requirement need not be applied to ladders/stairways not forming part of an escape route, only provided for access to equipment or components, or similar areas, from one of the main platforms or deck levels within such spaces (regulation II-2/13.4.2.1).

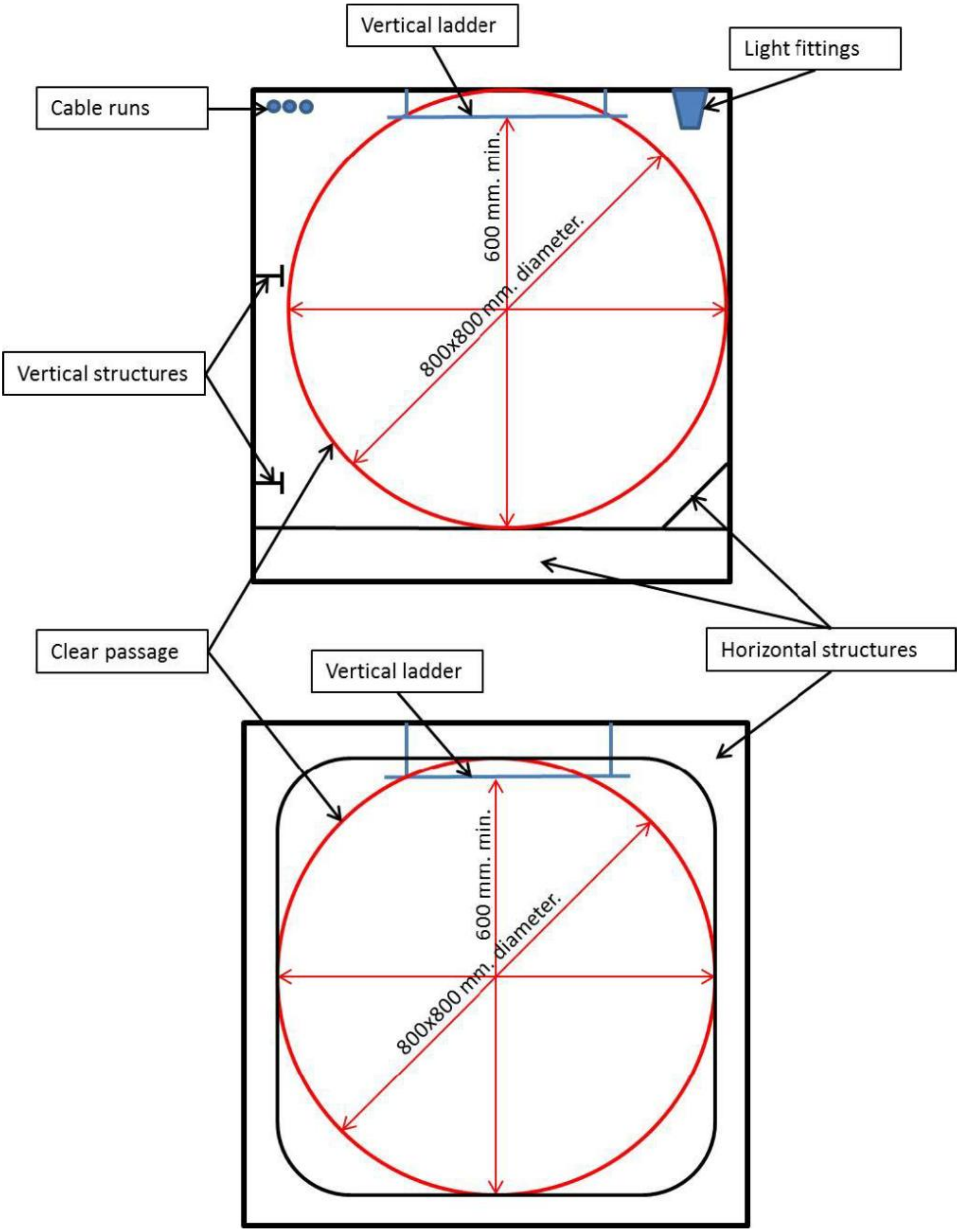
3 Machinery spaces of category A may include working platforms and passageways, or intermediate decks at more than one deck level. In such case, the lower part of the space should be regarded as the lowest deck level, platform or passageway within the space. At deck levels, other than the lowest one, where only one means of escape other than the protected enclosure is provided, self-closing fire doors should be fitted in the protected enclosure at that deck level. Smaller working platforms in-between deck levels, or only for access to equipment or components, need not be provided with two means of escape (regulation II-2/13.4.2.1).

4 A protected enclosure providing escape from machinery spaces of category A to an open deck may be fitted with a hatch as means of egress from the enclosure to the open deck. The hatch should have minimum internal dimensions of 800 mm x 800 mm (regulation II-2/13.4.2.1.1).

5 Internal dimensions should be interpreted as clear width, so that a passage having diameter of 800 mm is available throughout the vertical enclosure, as shown in figure 8, clear of ship's structure, with insulation and equipment, if any. The ladder within the enclosure can be included in the internal dimensions of the enclosure. When protected enclosures include horizontal portions their clear width should not be less than 600 mm. Figure 8 is given as example of some possible arrangements which may be in line with the above interpretation (regulation II-2/13.4.2.1.1).

6 In Machinery spaces other than those of category A, which are not entered only occasionally, the travel distance should be measured from any point normally accessible to the crew, taking into account machinery and equipment within the space (regulation II-2/13.4.2.3).

Figure 8


Vertical ladder
Light fittings
Cable runs
600 mm. min.
800x800 mm. diameter.
Vertical structures
Clear passage
Vertical ladder
Horizontal structures
600 mm. min.
800x800 mm. diameter.

INTERNATIONAL MARITIME ORGANIZATION

E

4 ALBERT EMBANKMENT
LONDON SE1 7SR
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

MSC.1/Circ.1572/Rev.2
17 June 2024

UNIFIED INTERPRETATIONS OF SOLAS CHAPTERS II-1 AND XII, OF THE TECHNICAL PROVISIONS FOR MEANS OF ACCESS FOR INSPECTIONS (RESOLUTION MSC.158(78)) AND OF THE PERFORMANCE STANDARDS FOR WATER LEVEL DETECTORS ON SHIPS SUBJECT TO SOLAS REGULATIONS II-1/25 AND 25-1, AND XII/12 (RESOLUTION MSC.188(79)/REV.2)*

1 The Maritime Safety Committee, at its ninety-second session (12 to 21 June 2013), approved unified interpretations of the provisions of SOLAS chapters II-1 and XII, of the *Technical provisions for means of access for inspections* (resolution MSC.158(78)) and of the *Performance standards for water level detectors on bulk carriers and single hold cargo ships other than bulk carriers* (resolution MSC.188(79)), as set out in MSC.1/Circ.1464/Rev.1 and Corr.1, following the recommendations made by the Sub-Committee on Ship Design and Equipment at its fifty-seventh session, with a view to ensuring a uniform approach towards the application of the provisions of SOLAS chapters II-1 and XII.

2 The Maritime Safety Committee, at its ninety-fifth session (3 to 12 June 2015), with a view to providing more specific guidance on the application of SOLAS regulation II-1/3-6.3.1, as amended, and the revised *Technical provisions for means of access for inspections* (resolution MSC.158(78)), approved amendments to the *Unified interpretations of the provisions of SOLAS chapters II-1 and XII, of the Technical provisions for means of access for inspections (resolution MSC.158(78)) and of the Performance standards for water level detectors on bulk carriers and single hold cargo ships other than bulk carriers (resolution MSC.188(79))* (MSC.1/Circ.1464/Rev.1), as prepared by the Sub-Committee on Ship Design and Construction, at its second session (16 to 20 February 2015), as set out in MSC.1/Circ.1507.

3 The Maritime Safety Committee, at its ninety-sixth session (11 to 20 May 2016), approved the unified interpretations relating to the application of SOLAS regulation II-1/3-6, as amended, and the *Revised technical provisions for means of access for inspections* (resolution MSC.158(78)), prepared by the Sub-Committee on Ship Design and Construction, at its third session (18 to 22 January 2016), as set out in MSC.1/Circ.1545, with a view to ensuring a uniform approach towards the application of the provisions of SOLAS regulation II-1/3-6. Having approved MSC.1/Circ.1545 and having considered the need to amend MSC.1/Circ.1464/Rev.1 and Corr.1 consequentially, as amended by MSC.1/Circ.1507, the Committee requested the Secretariat to prepare a consolidated MSC circular containing the provisions of MSC.1/Circ.1464/Rev.1 and Corr.1, as amended by MSC.1/Circ.1507 and MSC.1/Circ.1545.

* MSC.1/Circ.1572/Rev.1 remains valid for the interpretations in section 9 for ships not meeting the conditions of paragraph 9 and, until 1 January 2025, for section 1.4.

4 The Maritime Safety Committee, at its ninety-eighth session (7 to 16 June 2017), approved the unified interpretations of the provisions of SOLAS chapters II-1 and XII, of the *Revised technical provisions for means of access for inspections* (resolution MSC.158(78)) and of the *Performance standards for water level detectors on bulk carriers and single hold cargo ships other than bulk carriers* (resolution MSC.188(79)), containing the provisions of MSC.1/Circ.1464/Rev.1 and Corr.1, as amended by MSC.1/Circ.1507, and MSC.1/Circ.1545.

5 The Maritime Safety Committee, at its 102nd session (4 to 11 November 2020), approved amendments to section 3, prepared by the Sub-Committee on Ship Design and Construction, at its seventh session (3 to 7 February 2020).

6 The Maritime Safety Committee, at its 108th session (15 to 24 May 2024), approved amendments to sections 1 and 9, prepared by the Sub-Committee on Ship Design and Construction, at its tenth session (22 to 26 January 2024).

7 Except for sections 1 and 9, Member States are invited to use the annexed interpretations when applying relevant provisions of SOLAS chapters II-1 and XII to ships constructed on or after 9 June 2017.

8 The interpretations in section 1.4 should apply to inspections conducted by the crew or competent inspectors on or after 1 January 2025.

9 The interpretations in section 9 should apply to detectors which are installed on:

(a) new ships for which the building contract is placed on or after 1 January 2025, or in the absence of the contract, the keel of which is laid or which are at a similar stage of construction on or after 1 January 2025; or

(b) ships other than those ships prescribed in (a), with a contractual delivery date for the equipment to the ship on or after 1 January 2025, or in the absence of a contractual delivery date to the ship, actually delivered to the ship on or after 1 January 2025.

10 Member States are invited to bring the interpretations to the attention of all parties concerned.

***

ANNEX

UNIFIED INTERPRETATIONS OF SOLAS CHAPTERS II-1 AND XII, OF THE TECHNICAL PROVISIONS FOR MEANS OF ACCESS FOR INSPECTIONS (RESOLUTION MSC.158(78)) AND OF THE PERFORMANCE STANDARDS FOR WATER LEVEL DETECTORS ON SHIPS SUBJECT TO SOLAS REGULATIONS II-1/25 AND 25-1, AND XII/12 (RESOLUTION MSC.188(79)/REV.2)

TABLE OF CONTENTS

1 SOLAS REGULATION II-1/3-6 – ACCESS TO AND WITHIN SPACES IN, AND FORWARD OF, THE CARGO AREA OF OIL TANKERS AND BULK CARRIERS

1.1 SOLAS REGULATION II-1/3-6, SECTION 1

Interpretation

Oil tankers

This regulation is only applicable to oil tankers having integral tanks for carriage of oil in bulk, which is contained in the definition of oil in Annex I of MARPOL. Independent oil tanks can be excluded. SOLAS regulation II-1/3-6 should not normally be applied to FPSO or FSU unless the Administration decides otherwise.

Technical background

Means of access specified in the Technical provisions contained in resolution MSC.158(78) are not specific with respect to the application to integral cargo oil tanks or also to independent cargo oil tanks. Enhanced survey programme (ESP) requirements of oil tankers have been established assuming the target cargo oil tanks are integral tanks. The means of access regulated under SOLAS regulation II-1/3-6 is for overall and close-up inspections as defined in SOLAS regulation IX/1. Therefore, it is assumed that the target cargo oil tanks are those of ESP, i.e. integral cargo tanks. Regulation II-1/3-6 is applicable to new purpose-built FPSO or FSU, if they are subject to the scope of the 2011 ESP Code (resolution A.1049(27), as amended). Considering that the principles of the *Technical provisions for means of access for inspections* (resolution MSC.158(78)) recognize that permanent means of access should be considered and provided for at the design stage so that, to the maximum extent possible, they can be made an integral part of the designed structural arrangement, SOLAS regulation II-1/3-6 is not considered applicable to an FPSO/FSU that is converted from an existing tanker.

Reference

SOLAS regulation IX/1 and the 2011 ESP Code, as amended.

1.2 SOLAS REGULATION II-1/3-6, PARAGRAPH 2.1

Interpretation

Each space for which close-up inspection is not required such as fuel oil tanks and void spaces forward of cargo area, may be provided with a means of access necessary for overall survey intended to report on the overall conditions of the hull structure.

1.3 SOLAS REGULATION II-1/3-6, PARAGRAPH 2.2

Interpretation

Some possible alternative means of access are listed under paragraph 3.9 of the Technical provisions for means of access for inspections. Always subject to acceptance as equivalent by the Administration, alternative means such as an unmanned robot arm, ROVs and dirigibles with necessary equipment of the permanent means of access for overall and close-up inspections and thickness measurements of the deck head structure such as deck transverses and deck longitudinals of cargo oil tanks and ballast tanks, should be capable of:

.1 safe operation in ullage space in gas-free environment; and

.2 introduction into the place directly from a deck access.

Technical background

Innovative approaches, in particular the development of robots in place of elevated passageways, are encouraged and it is considered worthwhile to provide the functional requirement for the innovative approach.

1.4 SOLAS REGULATION II-1/3-6, PARAGRAPH 2.3

Interpretation

Inspection

The means of access arrangements, including portable equipment and attachments, should be annually inspected by the crew or competent inspectors and the inspections should be recorded in Part 2 of the Ships Structure Access Manual. In addition, prior to any space examinations that utilized the permanent means of access, an inspection to confirm the condition of the permanent means of access should be recorded for each space.

Procedures

1 Any Company authorized person using the means of access should assume the role of inspector and check for obvious damage prior to using the access arrangements. Whilst using the means of access, the inspector should verify the condition of the sections used by close-up examination of those sections and note any deterioration in the provisions. Should any damage or deterioration be found, the effect of such deterioration including loss of coating and wastage should be assessed as to whether the damage or deterioration affects the safety for continued use of the access. Deterioration found that is considered to affect safe use should be determined as "substantial damage" and measures should be put in place to ensure that the affected section(s) are not to be further used prior to effective repair. Substantial damage should be reported in Part 2 of the Ship Structure Access Manual.

2 Statutory survey of any space that contains means of access should include verification of the continued effectiveness of the means of access in that space. Survey of the means of access should not be expected to exceed the scope and extent of the survey being undertaken. If the means of access is found deficient the scope of survey should be extended if this is considered appropriate.

3 Records of all inspections should be established based on the requirements detailed in the ship's Safety Management System. The records should be readily available to persons using the means of access and a copy attached to the Ship Structure Access Manual. The latest record for the portion of the means of access inspected should include as a minimum the date of the inspection, the name and title of the inspector, a confirmation signature, the sections of means of access inspected, verification of continued serviceable condition or details of any deterioration or substantial damage found and repairs carried out. A file of permits issued should be maintained for verification. Inspection records of permanent means of access should be made available to classification society surveyors prior to survey.

Technical background

It is recognized that means of access may be subject to deterioration in the long term due to corrosive environment and external forces from ship motions and sloshing of liquid contained in the tank, and mechanical damage in cargo hold. Means of access therefore should be inspected at every opportunity of tank/space entry, but at a minimum annually. The above interpretation should be contained in a section of the Ship Structure Access Manual.

1.5 SOLAS REGULATION II-1/3-6, PARAGRAPH 3.1

Interpretation

1 Access to a double-side skin space of bulk carriers may be either from a topside tank or double-bottom tank or from both.

2 The wording "not intended for the carriage of oil or hazardous cargoes" applies only to "similar compartments", i.e. safe access can be through a pump-room, deep cofferdam, pipe tunnel, cargo hold or double-hull space.

Technical background

Unless used for other purposes, the double-side skin space should be designed as a part of a large U-shaped ballast tank and such space should be accessed through the adjacent part of the tank, i.e. topside tank or double-bottom/bilge hopper tank. Access to the double-side skin space from the adjacent part rather than direct from the open deck is justified. Any such arrangement should provide a directly routed, logical and safe access that facilitates easy evacuation of the space.

1.6 SOLAS REGULATION II-1/3-6, PARAGRAPH 3.2

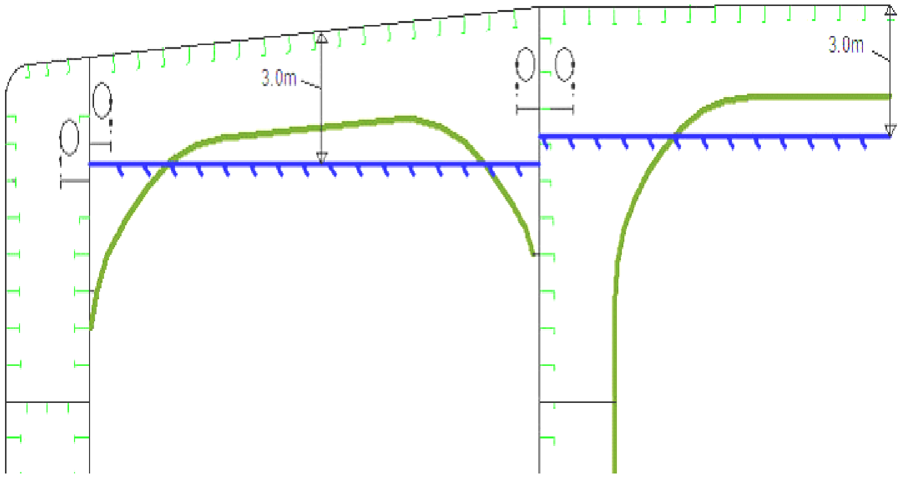
Interpretation

1 A cargo oil tank of less than 35 m length without a swash bulkhead requires only one access hatch.

2 Where rafting is indicated in the ship structures access manual as the means to gain ready access to the under-deck structure, the term "*similar obstructions*" referred to in the regulation includes internal structures (e.g. webs > 1.5 m deep) which restrict the ability to raft (at the maximum water level needed for rafting of under-deck structure) directly to the nearest access ladder and hatchway to deck. When rafts or boats alone, as an alternative means of access, are allowed under the conditions specified in the 2011 ESP Code, permanent means of access are to be provided to allow safe entry and exit. This means:

.1 access direct from the deck via a vertical ladder and small platform fitted approximately 2 m below the deck in each bay; or

.2 access to the deck from a longitudinal permanent platform having ladders to the deck in each end of the tank. The platform should, for the full length of the tank, be arranged in level with, or above, the maximum water level needed for rafting of the under-deck structure. For this purpose, the ullage corresponding to the maximum water level should not be assumed more than 3 m from the deck plate measured at the midspan of deck transverses and in the middle length of the tank (see figure below). A permanent means of access from the longitudinal permanent platform to the water level indicated above should be fitted in each bay (e.g. permanent rungs on one of the deck webs inboard of the longitudinal permanent platform).



1.7 SOLAS REGULATION II-1/3-6, PARAGRAPH 4.1

Interpretation

1 The access manual should address spaces listed in paragraph 3 of SOLAS regulation II-1/3-6. As a minimum the English version should be provided. The ship structure access manual should contain at least the following two parts:

Part 1: Plans, instructions and inventory required by paragraphs 4.1.1 to 4.1.7 of SOLAS regulation II-1/3-6. This part should be approved by the Administration or the organization recognized by the Administration.

Part 2: Form of record of inspections and maintenance, and change of inventory of portable equipment due to additions or replacement after construction. This part should be approved for its form only at new building.

2 The following matters should be addressed in the ship structure access manual:

.1 the access manual should clearly cover scope as specified in the regulations for use by crews, surveyors and port State control officers;

.2 approval/re-approval procedure for the manual, i.e. any changes of the permanent, portable, movable or alternative means of access within the scope of the regulation and the Technical provisions are subject to review and approval by the Administration or by the organization recognized by the Administration;

.3 verification of means of access should be part of the safety construction survey for continued effectiveness of the means of access in that space which is subject to the statutory survey;

.4 inspection of means of access by the crew and/or a competent inspector of the company as a part of regular inspection and maintenance (see interpretation of paragraph 2.3 of SOLAS regulation II-1/3-6);

.5 actions to be taken if means of access is found unsafe to use; and

.6 in case of use of portable equipment plans showing the means of access within each space indicating from where and how each area in the space can be inspected.

1.8 SOLAS REGULATION II-1/3-6, PARAGRAPH 4.2

Interpretation

1 Critical structural areas should be identified by advanced calculation techniques for structural strength and fatigue performance, if available, and feedback from the service history and design development of similar or sister ships.

2 Reference should be made to the following publications for critical structural areas, where applicable:

.1 oil tankers: Guidance Manual for Tanker Structures by the Tanker Structure Cooperative Forum (TSCF);

.2 bulk carriers: Bulk Carriers Guidelines for Surveys, Assessment and Repair of Hull Structure by IACS; and

.3 oil tankers and bulk carriers: the 2011 ESP Code (resolution A.1049(27), as amended).

Technical background

These documents contain the relevant information for the present ship types. However, identification of critical areas for new double-hull tankers and double-side skin bulk carriers of improved structural design should be made by structural analysis at the design stage, this information should be taken into account to ensure appropriate access to all identified critical areas.

1.9 SOLAS REGULATION II-1/3-6, PARAGRAPH 5.1

Interpretation

The minimum clear opening of 600 mm x 600 mm may have corner radii up to 100 mm maximum. The clear opening is specified in MSC/Circ.686/Rev.1 to keep the opening fit for passage of personnel wearing a breathing apparatus. In such a case where, as a consequence of structural analysis of a given design the stress should be reduced around the opening, it is considered appropriate to take measures to reduce the stress such as making the opening larger with increased radii, e.g. 600 x 800 with 300 mm radii, in which a clear opening of 600 x 600 mm with corner radii up to 100 mm maximum fits.

Technical background

The interpretation is based upon the established Guidelines in MSC/Circ.686/Rev.1.

Reference

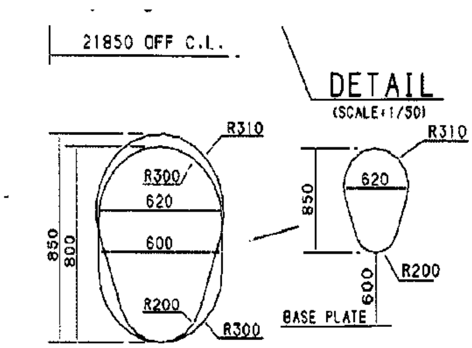
Paragraph 9 of the annex to MSC/Circ.686/Rev.1.

1.10 SOLAS REGULATION II-1/3-6, PARAGRAPH 5.2

Interpretation

1 The minimum clear opening of not less than 600 mm x 800 mm may also include an opening with corner radii of 300 mm. An opening of 600 mm in height x 800 mm in width may be accepted as access openings in vertical structures where it is not desirable to make large openings in the structural strength aspects, i.e. girders and floors in double-bottom tanks.

2 Subject to verification of easy evacuation of an injured person on a stretcher the vertical opening 850 mm x 620 mm with wider upper half than 600 mm, while the lower half may be less than 600 mm with the overall height not less than 850 mm is considered an acceptable alternative to the traditional opening of 600 mm x 800 mm with corner radii of 300 mm.



3 If a vertical opening is at a height of more than 600 mm steps then handgrips should be provided. In such arrangements it should be demonstrated that an injured person can be easily evacuated.

Technical background

The interpretation is based upon the established Guidelines in MSC/Circ.686/Rev.1 and an innovative design is considered for easy access by humans through the opening.

Reference

Paragraph 11 of the annex to MSC/Circ.686/Rev.1.

2 TECHNICAL PROVISIONS FOR MEANS OF ACCESS FOR INSPECTIONS (RESOLUTION MSC.158(78))

2.1 PARAGRAPH 1.3

Interpretation

A "combined chemical/oil tanker complying with the provisions of the IBC Code" is a tanker that holds both a valid IOPP certificate as a tanker and a valid certificate of fitness for the carriage of dangerous chemicals in bulk, i.e. a tanker that is certified to carry both oil cargoes under MARPOL Annex I and Chemical cargoes in chapter 17 of the IBC Code either as full or part cargoes. The Technical provisions should be applied to ballast tanks of combined chemical/oil tankers complying with the provisions of the IBC Code.

2.2 PARAGRAPH 1.4

Interpretation

1 In the context of the above requirement, the deviation should be applied only to distances between integrated permanent means of access that are the subject of paragraph 2.1.2 of table 1.

2 Deviations should not be applied to the distances governing the installation of under-deck longitudinal walkways and dimensions that determine whether permanent access is required or not, such as height of the spaces and height to elements of the structure (e.g. cross-ties).

2.3 PARAGRAPH 3.1

Interpretation

The permanent means of access to a space can be credited for the permanent means of access for inspection.

Technical background

The Technical provisions specify means of access to a space and to hull structure for carrying out overall and close-up surveys and inspections. Requirements of means of access to hull structure may not always be suitable for access to a space. However, if the means of access to a space can also be used for the intended surveys and inspections such means of access can be credited for the means of access for use for surveys and inspections.

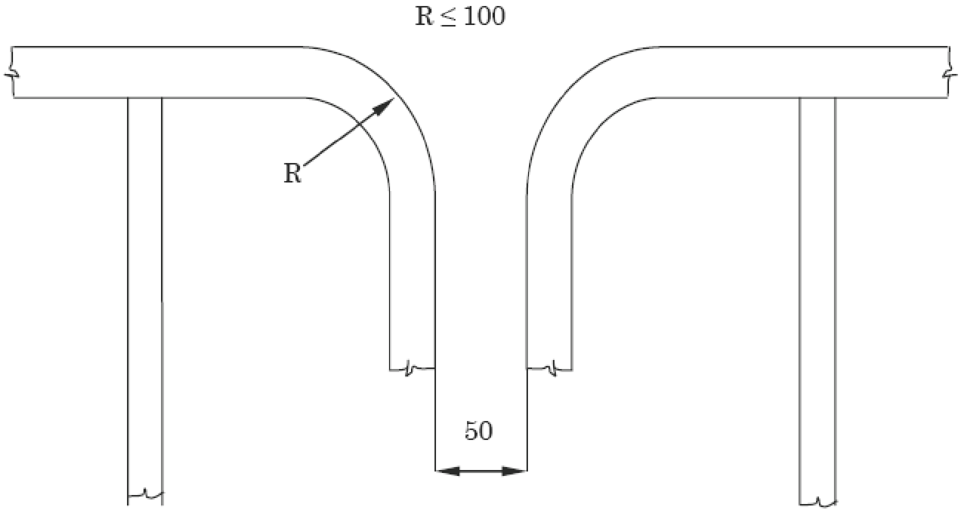
2.4 PARAGRAPH 3.3

Interpretation

1 Sloping structures are structures that are sloped by 5 or more degrees from horizontal plane when a ship is in an upright position at even-keel.

2 Guard rails should be fitted on the open side and should be at least 1,000 mm in height. For stand-alone passageways guard rails should be fitted on both sides of these structures. Guardrail stanchions are to be attached to the permanent means of access. The distance between the passageway and the intermediate bar and the distance between the intermediate bar and the top rail should not be more than 500 mm.

3 Discontinuous top handrails are allowed, provided the gap does not exceed 50 mm. The same maximum gap is to be considered between the top handrail and other structural members (i.e. bulkhead, web frame, etc.). The maximum distance between the adjacent stanchions across the handrail gaps is to be 350 mm where the top and mid handrails are not connected together and 550 mm when they are connected together. The maximum distance between the stanchion and other structural members is not to exceed 200 mm where the top and mid handrails are not connected together and 300 mm when they are connected together. When the top and mid handrails are connected by a bent rail, the outside radius of the bent part is not to exceed 100 mm (see figure below).



4 Non-skid construction is such that the surface on which personnel walks provides sufficient friction to the sole of boots even if the surface is wet and covered with thin sediment.

5 "Substantial construction" is taken to refer to the as-designed strength as well as the residual strength during the service life of the vessel. Durability of passageways together with guard rails should be ensured by the initial corrosion protection and inspection and maintenance during services.

6 For guard rails, use of alternative materials such as GRP should be subject to compatibility with the liquid carried in the tank. Non-fire resistant materials should not be used for means of access to a space with a view to securing an escape route at a high temperature.

7 Requirements for resting platforms placed between ladders should be equivalent to those applicable to elevated passageways.

Reference

Paragraph 10 of the annex to MSC/Circ.686/Rev.1.

2.5 PARAGRAPH 3.4

Interpretation

Where the vertical manhole is at a height of more than 600 mm above the walking level, it should be demonstrated that an injured person can be easily evacuated.

2.6 PARAGRAPH 3.5

Interpretation

Means of access to ballast tanks, cargo tanks and spaces other than fore peak tanks:

For oil tankers:

1 Tanks and subdivisions of tanks having a length of 35 m or more with two access hatchways:

First access hatchway: Inclined ladder or ladders should be used.
Second access hatchway:

.1 A vertical ladder may be used. In such a case where the vertical distance is more than 6 m, vertical ladders should comprise one or more ladder-linking platforms spaced not more than 6 m apart vertically and displaced to one side of the ladder.

The uppermost section of the vertical ladder, measured clear of the overhead obstructions in the way of the tank entrance, should not be less than 2.5 m but not exceed 3.0 m and should comprise a ladder-linking platform which should be displaced to one side of a vertical ladder. However, the vertical distance of the uppermost section of the vertical ladder may be reduced to 1.6 m, measured clear of the overhead obstructions in the way of the tank entrance, if the ladder lands on a longitudinal or athwartship permanent means of access fitted within that range. Adjacent sections of the ladder should be laterally offset from each other by at least the width of the ladder (see paragraph 20 of MSC/Circ.686/Rev.1 and refer to the interpretation of paragraphs 3.13.2 and 3.13.6 of the Technical provisions (resolution MSC.158(78))); or

.2 Where an inclined ladder or combination of ladders is used for access to the space, the uppermost section of the ladder, measured clear of the overhead obstructions in the way of the tank entrance, should be vertical for not less than 2.5 m but not exceed 3.0 m and should comprise a landing platform continuing with an inclined ladder. However, the vertical distance of the uppermost section of the vertical ladder may be reduced to 1.6 m, measured clear of the overhead obstructions in the way of the tank entrance, if the ladder lands on a longitudinal or athwartship permanent means of access fitted within that range. The flights of the inclined ladders are normally to be not more than 6 m in vertical height. The lowermost section of the ladders may be vertical for the vertical distance not exceeding 2.5 m.

2 Tanks less than 35 m in length and served by one access hatchway: an inclined ladder or combination of ladders should be used to the space as specified in 1.2 above.

3 In spaces of less than 2.5 m in width the access to the space may be by means of vertical ladders that comprise one or more ladder-linking platforms spaced not more than 6 m apart vertically and displaced to one side of the ladder. The uppermost section of the vertical ladder, measured clear of the overhead obstructions in the way of the tank entrance, should not be less than 2.5 m but not exceed 3.0 m and should comprise a ladder-linking platform which should be displaced to one side of a vertical ladder. However, the vertical distance of the uppermost section of the vertical ladder may be reduced to 1.6 m, measured clear of the overhead obstructions in the way of the tank entrance, if the ladder lands on a longitudinal or athwartship permanent means of access fitted within that range. Adjacent sections of the ladder should be laterally offset from each other by at least the width of the ladder (see paragraph 20 of MSC/Circ.686/Rev.1 and refer to the interpretation of paragraphs 3.13.2 and 3.13.6 of the Technical provisions (resolution MSC.158(78))).

4 Access from the deck to a double-bottom space may be by means of vertical ladders through a trunk. The vertical distance from deck to a resting platform, between resting platforms, or a resting platform and the tank bottom should not be more than 6 m, unless otherwise approved by the Administration.

Means of access for inspection of the vertical structure of oil tankers:

Vertical ladders provided for means of access to the space may be used for access for inspection of the vertical structure.

Unless stated otherwise in table 1 of the Technical provisions, vertical ladders that are fitted on vertical structures for inspection should comprise one or more ladder-linking platforms spaced not more than 6 m apart vertically and displaced to one side of the ladder. Adjacent sections of ladder should be laterally offset from each other by at least the width of the ladder (see paragraph 20 of MSC/Circ.686/Rev.1 and refer to the interpretation of paragraphs 3.13.2 and 3.13.6 of the Technical provisions (resolution MSC.158(78))).

Obstruction distances

The minimum distance between the inclined ladder face and obstructions, i.e. 750 mm and, in the way of openings, 600 mm specified in paragraph 3.5 of the Technical provisions, should be measured perpendicular to the face of the ladder.

Technical background

It is common practice to use a vertical ladder from the deck to the first landing to clear overhead obstructions before continuing to an inclined ladder or a vertical ladder displaced to one side of the first vertical ladder.

Reference

For vertical ladders: paragraph 20 of the annex to MSC/Circ.686/Rev.1.

2.7 PARAGRAPH 3.6

Interpretation

1 The vertical height of handrails should not be less than 890 mm from the centre of the step and two course handrails need only be provided where the gap between the stringer and the top handrail is greater than 500 mm.

2 The requirement of two square bars for treads specified in paragraph 3.6 of the Technical provisions is based upon the specification of the construction of ladders in paragraph 3(e) of annex 1 of resolution A.272(VIII), which addresses inclined ladders. Paragraph 3.4 of the Technical Provisions allows for single rungs fitted to vertical surfaces, which is considered a safe grip. For vertical ladders, when steel is used, the rungs should be formed of single square bars of not less than 22 mm by 22 mm for the sake of safe grip.

3 The width of inclined ladders for access to a cargo hold should be at least 450 mm to comply with the Australian AMSA Marine Orders part 32, appendix 17.

4 The width of inclined ladders other than an access to a cargo hold should be not less than 400 mm.

5 The minimum width of vertical ladders should be 350 mm and the vertical distance between the rungs should be equal and should be between 250 mm and 350 mm.

6 A minimum climbing clearance in width should be 600 mm other than the ladders placed between the hold frames.

7 The vertical ladders should be secured at intervals not exceeding 2.5 m apart to prevent vibration.

Technical background

1 Paragraph 3.6 of the Technical provisions is a continuation of paragraph 3.5 of the Technical Provisions, which addresses inclined ladders. Interpretations for vertical ladders are needed based upon the current standards of IMO, AMSA or the industry.

2 Interpretations 2 and 5 address vertical ladders based upon the current standards.

3 Double square bars for treads become too large for a grip for vertical ladders and single rungs facilitate a safe grip.

4 Interpretation 7 is introduced consistently with the requirement and the interpretation of paragraph 3.4 of the Technical provisions.

Reference

1 Annex 1 of resolution A.272(VIII).

2 Australian AMSA Marine Orders part 32, appendix 17.

3 ILO Code of Practice *Safety and health in dock work* – section 3.6, Access to ship's hold.

2.8 PARAGRAPH 3.9.6

Interpretation

A mechanical device such as hooks for securing at the upper end of a ladder should be considered as an appropriate securing device if a movement fore/aft and sideways can be prevented at the upper end of the ladder.

Technical background

Innovative design should be accepted if it fits the functional requirement with due consideration for safe use.

2.9 PARAGRAPHS 3.10 AND 3.11

Interpretation

See interpretation for paragraphs 5.1 and 5.2 of SOLAS regulation II-1/3-6.

2.10 PARAGRAPH 3.13.1

Interpretation

1 Either a vertical or an inclined ladder or a combination of them may be used for access to a cargo hold where the vertical distance is 6 m or less from the deck to the bottom of the cargo hold.

2 Deck is defined as "weather deck".

2.11 PARAGRAPHS 3.13.2 AND 3.13.6

Adjacent sections of vertical ladder should be installed so that the following provisions are complied with:

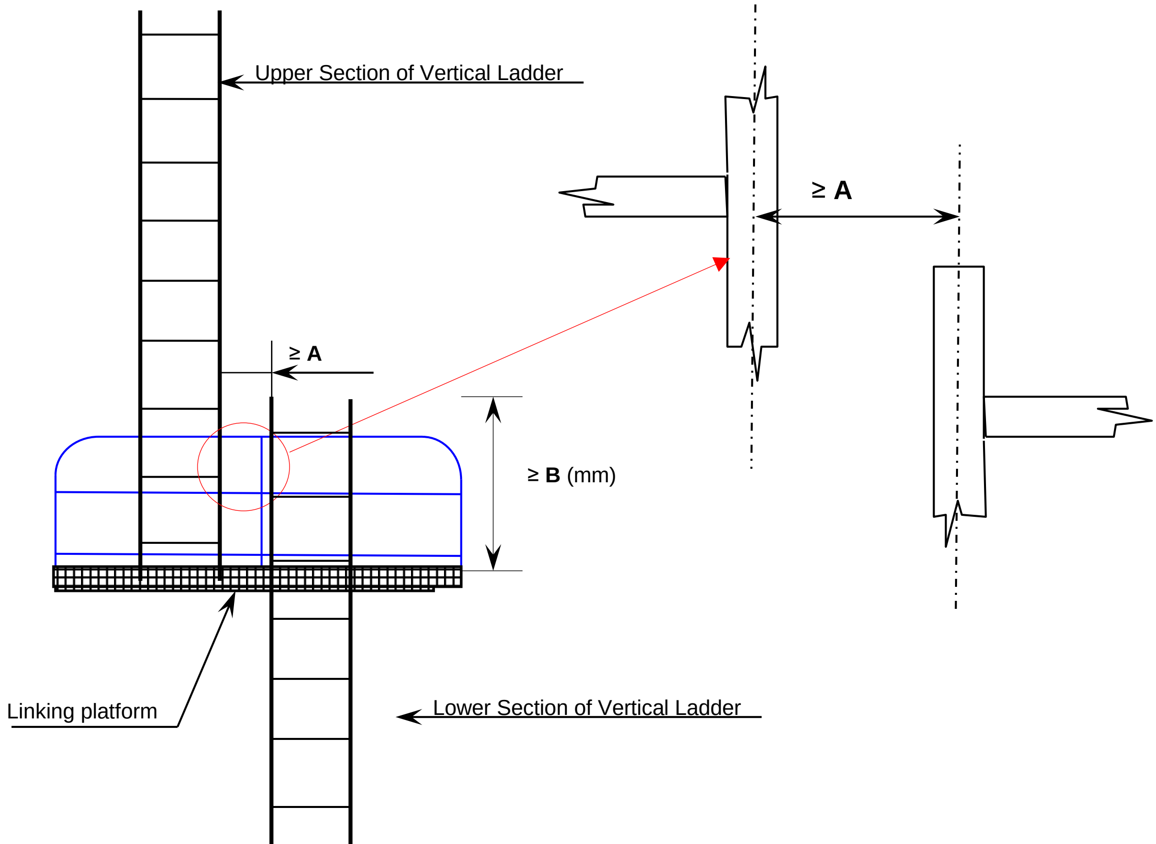
- the minimum "lateral offset" between two adjacent sections of vertical ladder, is the distance between the sections, upper and lower, so that the adjacent stringers are spaced of at least 200 mm, measured from half thickness of each stringer;

- adjacent sections of vertical ladder should be installed so that the upper end of the lower section is vertically overlapped, in respect to the lower end of the upper section, to a height of 1,500 mm in order to permit a safe transfer between ladders; and

- no section of the access ladder should be terminated directly or partly above an access opening.

Figure "A"

Vertical Ladder – Ladder through the linking platform



Dimension		
A	Horizontal separation between two vertical ladders, stringer to stringer	≥ 200 mm
B	Stringer height above landing or intermediate platform	≥ 1,500* mm
C	Horizontal separation between ladder and platform	100 mm ≤ C < 300 mm
*	The minimum height of the handrail of resting platform is 1,000 mm (paragraph 3.3 of the Technical provisions (resolution MSC.158(78)))	

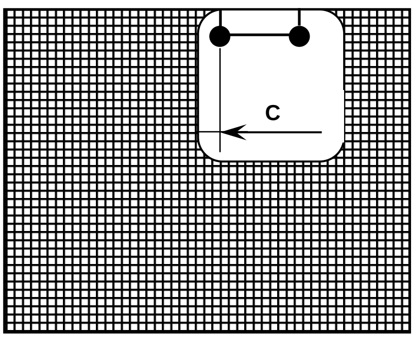
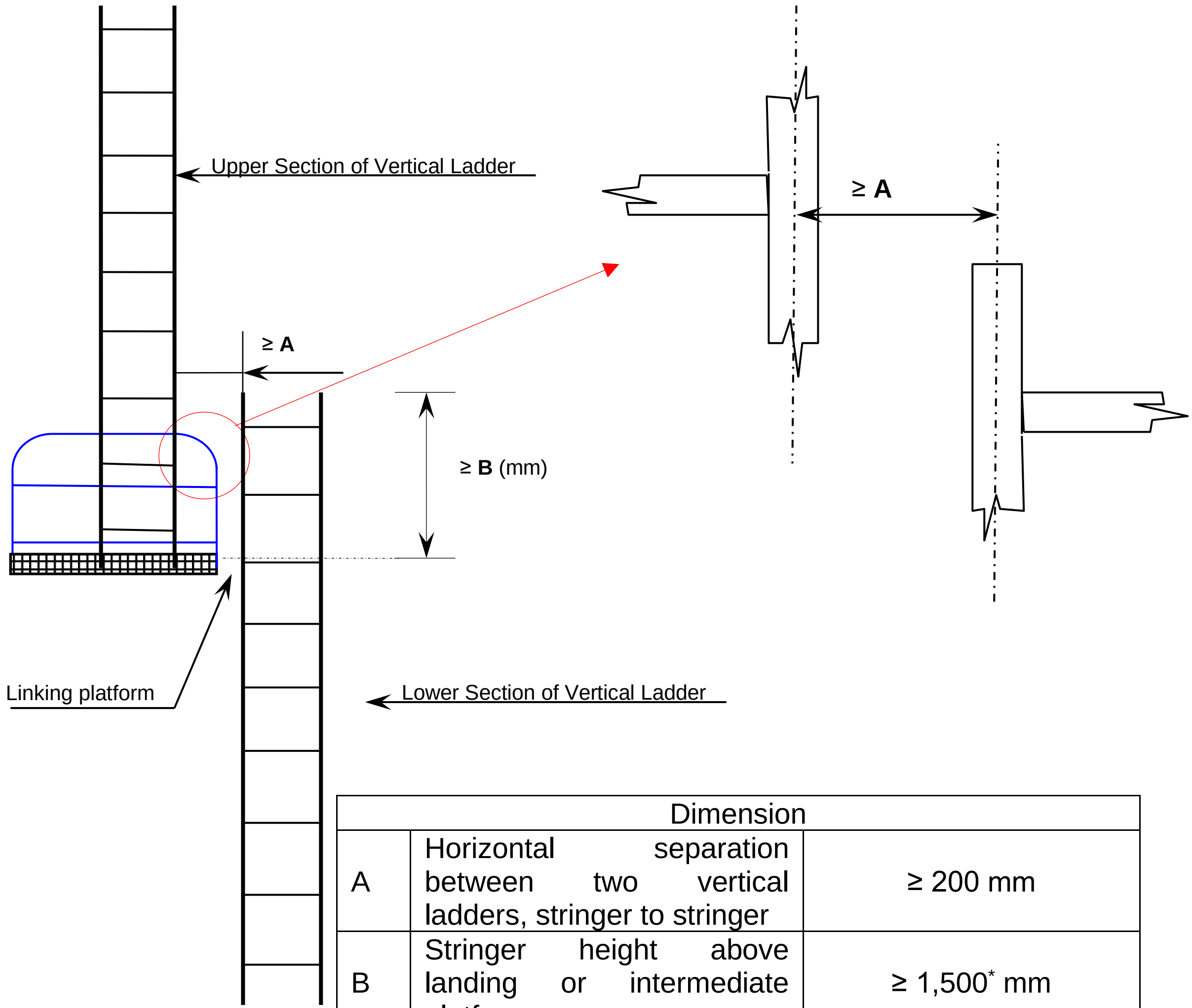
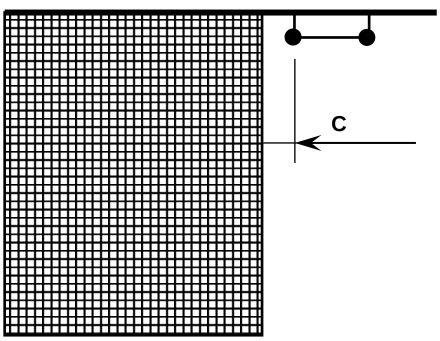


Figure "B"

Vertical Ladder – Side mount



Dimension		
A	Horizontal separation between two vertical ladders, stringer to stringer	≥ 200 mm
B	Stringer height above landing or intermediate platform	≥ 1,500* mm
C	Horizontal separation between ladder and platform	100 mm ≤ C < 300 mm
*	The minimum height of the handrail of resting platform is 1,000 mm (paragraph 3.3 of the Technical provisions, (resolution MSC.158(78)))	



2.12 TABLE 1 – MEANS OF ACCESS FOR BALLAST AND CARGO TANKS OF OIL TANKERS, PARAGRAPH 1.1

Interpretation

1 Sub-paragraphs .1 to .3 define access to under-deck structures, access to the uppermost sections of transverse webs and connection between these structures.

2 Sub-paragraphs .4 to .6 define access to vertical structures only and are linked to the presence of transverse webs on longitudinal bulkheads.

3 If there are no under-deck structures (deck longitudinals and deck transverses) but there are vertical structures in the cargo tank supporting transverse and longitudinal bulkheads, access in accordance with sub-paragraphs .1 to .6 should be provided for inspection of the upper parts of vertical structure on transverse and longitudinal bulkheads.

4 If there is no structure in the cargo tank, section 1.1 of table 1 should not be applied.

5 Section 1 of table 1 should also be applied to void spaces in the cargo area, comparable in volume to spaces covered by SOLAS regulation II-1/3-6, except those spaces covered by section 2.

6 The vertical distance below the overhead structure should be measured from the underside of the main deck plating to the top of the platform of the means of access at a given location.

7 The height of the tank should be measured at each tank. For a tank the height of which varies at different bays, item 1.1 should be applied to such bays of a tank that have a height of 6 m and over.

Technical background

Interpretation 7, if the height of the tank is increasing along the length of a ship, the permanent means of access should be provided locally where the height is above 6 m.

Reference

Paragraph 10 of the annex to MSC/Circ.686/Rev.1.

2.13 TABLE 1 – MEANS OF ACCESS FOR BALLAST AND CARGO TANKS OF OIL TANKERS, PARAGRAPH 1.1.2

Interpretation

There is a need to provide a continuous longitudinal permanent means of access when the deck longitudinals and deck transverses are fitted on deck but supporting brackets are fitted under the deck.

2.14 TABLE 1 – MEANS OF ACCESS FOR BALLAST AND CARGO TANKS OF OIL TANKERS, PARAGRAPH 1.1.3

Interpretation

Means of access to tanks may be used for access to the permanent means of access for inspection.

Technical background

As a matter of principle, in such a case where the means of access can be utilized for the purpose of accessing structural members for inspection there is no need of duplicated installation of the means of access.

2.15 TABLE 1 – MEANS OF ACCESS FOR BALLAST AND CARGO TANKS OF OIL TANKERS, PARAGRAPH 1.1.4

Interpretation

The permanent fittings required to serve alternative means of access such as wire lift platform, that should be used by crew and surveyors for inspection should provide at least an equal level of safety as the permanent means of access stated by the same paragraph. These means of access should be carried on board the ship and be readily available for use without filling of water in the tank. Therefore, rafting should not be acceptable under this provision. Alternative means of access should be part of the Ship Structure Access Manual which should be approved on behalf of the flag State. For water ballast tanks of 5 m or more in width, such as on an ore carrier, side shell plating should be considered in the same way as "longitudinal bulkhead".

2.16 TABLE 1 – MEANS OF ACCESS FOR BALLAST AND CARGO TANKS OF OIL TANKERS, PARAGRAPH 2.1

Interpretation

Section 2 of table 1 should also be applied to wing tanks designed as void spaces. Paragraph 2.1.1 represents requirements for access to under-deck structures, while paragraph 2.1.2 is a requirement for access for survey and inspection of vertical structures on longitudinal bulkheads (transverse webs).

Technical background

SOLAS regulation II-1/3-6.2.1 requires each space to be provided with means of access. Though void spaces are not addressed in the technical provisions contained in resolution MSC.158(78), it is arguable whether means of access are not required in void spaces. Means of access or portable means of access are necessary arrangements to facilitate inspection of the structural condition of the space and the boundary structure. Therefore, the requirements of section 2 of table 1 should be applied to double-hull spaces even when designed as void spaces.

2.17 TABLE 1 – MEANS OF ACCESS FOR BALLAST AND CARGO TANKS OF OIL TANKERS, PARAGRAPH 2.1.1

Interpretation

1 For a tank, the vertical distance between horizontal upper stringer and deck head of which varies at different sections, paragraph 2.1.1 should be applied to such sections that fall under the criteria.

2 The continuous permanent means of access may be a wide longitudinal, which provides access to critical details on the opposite side by means of platforms as necessary on web frames. In case the vertical opening of the web frame is located in the way of the open part between the wide longitudinal and the longitudinal on the opposite side, platforms should be provided on both sides of the web frames to allow safe passage through the web frame.

3 Where two access hatches are required by SOLAS regulation II-1/3-6.3.2, access ladders at each end of the tank should lead to the deck.

Technical background

Interpretation 1: The interpretation of varied tank height in column 1 of table 1 is applied to the vertical distance between horizontal upper stringer and deck head for consistency.

2.18 TABLE 1 – MEANS OF ACCESS FOR BALLAST AND CARGO TANKS OF OIL TANKERS, PARAGRAPH 2.1.2

Interpretation

The continuous permanent means of access may be a wide longitudinal, which provides access to critical details on the opposite side by means of platforms as necessary on web frames. In case the vertical opening of the web is located in the way of the open part between the wide longitudinal and the longitudinal on the opposite side, platforms should be provided on both sides of the web to allow safe passage through the web. A "reasonable deviation", as noted in paragraph 1.4 of the Technical provisions, of not more than 10% may be applied where the permanent means of access is integral with the structure itself.

2.19 TABLE 1 – MEANS OF ACCESS FOR BALLAST AND CARGO TANKS OF OIL TANKERS, PARAGRAPH 2.2

Interpretation

1 Permanent means of access between the longitudinal continuous permanent means of access and the bottom of the space should be provided.

2 The height of a bilge hopper tank located outside of the parallel part of the ship should be taken as the maximum of the clear vertical distance measured from the bottom plating to the hopper plating of the tank.

3 The foremost and aftmost bilge hopper ballast tanks with raised bottom, of which the height is 6 m and over, a combination of transverse and vertical means of access to the upper knuckle point for each transverse web, should be accepted in place of the longitudinal permanent means of access.

Technical background

Interpretation 2: The bilge hopper tanks at fore and aft of cargo area narrow due to raised bottom plating and the actual vertical distance from the bottom of the tank to hopper plating of the tank is more appropriate to judge if a portable means of access could be utilized for the purpose.

Interpretation 3: In the foremost or aftmost bilge hopper tanks where the vertical distance is 6 m or over but installation of longitudinal permanent means of access is not practicable, permanent means of access of combination of transverse and vertical ladders provides an alternative means of access to the upper knuckle point.

2.20 TABLE 2 – MEANS OF ACCESS FOR BULK CARRIERS, PARAGRAPH 1.1

Interpretation

1 Means of access should be provided to the cross-deck structures of the foremost and aftermost part of each cargo hold.

2 Interconnected means of access under the cross deck for access to three locations at both sides and in the vicinity of the centreline should be acceptable as the three means of access.

3 Permanent means of access fitted at three separate locations accessible independently, one at each side and one in the vicinity of the centreline, should be acceptable.

4 Special attention should be paid to the structural strength where any access opening is provided in the main deck or cross deck.

5 The requirements for a bulk carrier cross-deck structure should also be considered applicable to ore carriers.

Technical background

Pragmatic arrangements of the means of access are provided.

2.21 TABLE 2 – MEANS OF ACCESS FOR BULK CARRIERS, PARAGRAPH 1.3

Interpretation

Particular attention should be paid to preserve the structural strength in way of access opening provided in the main deck or cross deck.

2.22 TABLE 2 – MEANS OF ACCESS FOR BULK CARRIERS, PARAGRAPH 1.4

Interpretation

"Full upper stools" are understood to be stools with a full extension between topside tanks and between hatch end beams.

2.23 TABLE 2 – MEANS OF ACCESS FOR BULK CARRIERS, PARAGRAPH 1.5

Interpretation

1 The movable means of access to the under-deck structure of cross deck need not necessarily be carried on board the ship. It should be sufficient if it is made available when needed.

2 The requirements for a bulk carrier cross-deck structure should also be considered applicable to ore carriers.

2.24 TABLE 2 – MEANS OF ACCESS FOR BULK CARRIERS, PARAGRAPH 1.6

Interpretation

The maximum vertical distance of the rungs of vertical ladders for access to hold frames should be 350 mm. If a safety harness is to be used, means should be provided for connecting the safety harness in suitable places in a practical way.

Technical background

The maximum vertical distance of the rungs of 350 mm is applied with a view to reducing trapping cargoes.

2.25 TABLE 2 – MEANS OF ACCESS FOR BULK CARRIERS, PARAGRAPH 1.7

Interpretation

Portable, movable or alternative means of access should also be applied to corrugated bulkheads.

2.26 TABLE 2 – MEANS OF ACCESS FOR BULK CARRIERS, PARAGRAPH 1.8

Interpretation

Readily available means able to be transported to location in cargo hold and safely erected by ships' crew.

2.27 TABLE 2 – MEANS OF ACCESS FOR BULK CARRIERS, PARAGRAPH 2.3

Interpretation

If the longitudinal structures on the sloping plate are fitted outside of the tank, a means of access should be provided.

2.28 TABLE 2 – MEANS OF ACCESS FOR BULK CARRIERS, PARAGRAPH 2.5

Interpretation

1 The height of a bilge hopper tank located outside of the parallel part of the vessel should be taken as the maximum of the clear vertical height measured from the bottom plating to the hopper plating of the tank.

2 It should be demonstrated that portable means for inspection can be deployed and made readily available in the areas where needed.

2.29 TABLE 2 – MEANS OF ACCESS FOR BULK CARRIERS, PARAGRAPH 2.5.2

Interpretation

A wide longitudinal frame of at least 600 mm clear width may be used for the purpose of the longitudinal continuous permanent means of access. The foremost and aftermost bilge hopper ballast tanks with raised bottom, of which the height is 6 m and over, a combination of transverse and vertical means of access to the sloping plate of hopper tank connection with side shell plating for each transverse web can be accepted in place of the longitudinal permanent means of access.

2.30 TABLE 2 – MEANS OF ACCESS FOR BULK CARRIERS, PARAGRAPH 2.6

Interpretation

The height of web frame rings should be measured in way of side shell and tank base.

Technical background

In the bilge hopper tank the sloping plating is above the opening, while the movement of the surveyor is along the bottom of the tank. Therefore, the measurement of 1 m should be taken from the bottom of the tank.

3 SOLAS CHAPTER II-1, PARTS B-2 – SUBDIVISION, WATERTIGHT AND WEATHERTIGHT INTEGRITY AND B-4 – STABILITY MANAGEMENT

DOORS IN WATERTIGHT BULKHEADS OF PASSENGER SHIPS AND CARGO SHIPS

Interpretation

This interpretation pertains to doors[1] located in way of the internal watertight subdivision boundaries and the external watertight boundaries necessary to ensure compliance with the relevant subdivision and damage stability regulations.

This interpretation does not apply to doors located in external boundaries above equilibrium or intermediate waterplanes.

The design and testing requirements for watertight doors vary according to their location relative to the 1) equilibrium waterplane or intermediate waterplane at any stage of assumed flooding, and/or 2) bulkhead deck or freeboard deck.

1 DEFINITIONS

For the purpose of this interpretation the following definitions apply:

1.1 Watertight: Capable of preventing the passage of water in any direction under a design head. The design head for any part of a structure should be determined by reference to its location relative to the bulkhead deck or freeboard deck, as applicable, or to the most unfavourable equilibrium/intermediate waterplane, in accordance with the applicable subdivision and damage stability regulations, whichever is the greater. A watertight door is thus one that will maintain the watertight integrity of the subdivision bulkhead in which it is located.

1.2 Equilibrium waterplane: The waterplane in still water when, taking account of flooding due to an assumed damage, the weight and buoyancy forces acting on a ship are in balance. This relates to the final condition when no further flooding takes place or after cross flooding is completed.

1.3 Intermediate waterplane: The waterplane in still water, which represents the instantaneous floating position of a ship at some intermediate stage between commencement and completion of flooding when, taking account of the assumed

[1] Doors in watertight bulkheads of small cargo ships, not subject to any statutory subdivision and damage stability requirements, may be hinged quick-acting doors arranged to open out of the major space protected. They should be constructed in accordance with the requirements of the Administration and have notices affixed to each side stating: "To be kept closed at sea".

instantaneous state of flooding, the weight and buoyancy forces acting on a ship are in balance.

1.4 Sliding door or rolling door: A door having a horizontal or vertical motion generally parallel to the plane of the door.

1.5 Hinged door: A door having a pivoting motion about one vertical or horizontal edge.

2 STRUCTURAL DESIGN

Doors and their frames should be of approved design and substantial construction in accordance with the requirements of the Administration and should preserve the strength of the subdivision bulkheads in which they are fitted.

3 OPERATION MODE, LOCATION AND OUTFITTING

Doors should be fitted in accordance with all requirements regarding their operation mode, location and outfitting, i.e. provision of controls, means of indication, etc., as shown in table 1 below. This table should be read in conjunction with paragraphs 3.1 to 5.4 below.

3.1 Frequency of use while at sea

3.1.1 Normally closed: Kept closed at sea but may be used if authorized. To be closed again after use.

3.1.2 Permanently closed: The time of opening such doors in port and of closing them before the ship leaves port should be entered in the logbook. Should such doors be accessible during the voyage, they should be fitted with a device to prevent unauthorized opening.

3.1.3 Used: Kept closed but may be opened during navigation when authorized by the Administration to permit the passage of passengers or crew, or when work in the immediate vicinity of the door necessitates it being opened. The door should be immediately closed after use.

3.2 Type

Power operated, sliding or rolling[2]	POS
Power operated, hinged	POH
Sliding or rolling	S
Hinged	H

3.3 Control

3.3.1 Local

3.3.1.1 All doors, except those which should be permanently closed at sea, should be capable of being opened and closed by hand (and by power, where applicable) locally[3] from both sides of the doors, with the ship listed to either side.

2 Rolling doors are technically identical to sliding doors.

3 Arrangements should be in accordance with SOLAS regulations II-I/13.7.1.4 and 13.7.1.5 for passenger ships and 13-1.2 for cargo ships.

3.3.1.2 For passenger ships, the angle of list at which operation by hand should be possible is 15 degrees.

3.3.1.3 For cargo ships, the angle of list at which operation by hand should be possible is 30 degrees.

3.3.2 Remote

Where indicated in table 1, doors should be capable of being remotely closed by power from the bridge[4] for all ships, and also by hand from a position above the bulkhead deck for passenger ships, as required by SOLAS regulation II-1/13.7.1.4. Where it is necessary to start the power unit for operation of the watertight door, means to start the power unit should also be provided at remote control stations. The operation of such remote control should be in accordance with SOLAS regulations II-1/13.8.1 to 13.8.3. For tankers, where there is a permanent access from a pipe tunnel to the main pump room, in accordance with regulation SOLAS II-2/4.5.2.4 the watertight door should be capable of being manually closed from outside the main pump-room entrance in addition to the requirements above.

3.4 Indication[5]

3.4.1 Where shown in table 1, position indicators should be provided at all remote operating positions for all ships and provided locally on both sides of the internal doors for cargo ships, to show whether the doors are open or closed and, if applicable, with all dogs/cleats fully and properly engaged.

3.4.2 The door position indicating system should be of self-monitoring type and the means for testing of the indicating system should be provided at the position where the indicators are fitted.

3.4.3 A diagram showing the location of the door and an indication to show its position should be provided at the central operating console located at the navigation bridge. A red light should indicate the door is in the open position and a green light should indicate the door is in the closed position. When the door is closed from this remote position, the red light should flash when the door is in an intermediate position. This applies to passenger ships and cargo ships.

3.4.4 Special care should be taken in order to avoid potential danger when passing through the door. Signboard/instructions should be placed in way of the door advising how to act when the door is in "doors closed" mode.

3.5 Alarms[6]

3.5.1 For passenger ships, failure of the normal power supply of the required alarms should be indicated by an audible and visual alarm at the central operating console at the navigation bridge. For cargo ships, failure of the normal power supply of the required alarms should be indicated by an audible and visual alarm at the navigation bridge.

---

4 Arrangements should be in accordance with SOLAS regulation II-1/13.7.1.5 for passenger ships and 13-1.2 for cargo ships.

5 Refer to SOLAS regulations II-I/13, 13-1, 15 1 and 17-1, IEC 60092-504, and the Code on Alerts and Indicators, 2009 (resolution A.1021(26)).

6 Refer to SOLAS regulations II-I/13, 13-1, 15 1 and 17-1, IEC 60092-504, and the Code on Alerts and Indicators, 2009 (resolution A.1021(26)).

3.5.2 All door types, including power-operated sliding watertight doors, which are capable of being remotely closed should be provided with an audible alarm, distinct from any other alarm in the area, which will sound whenever such a door is remotely closed. For passenger ships the alarm should sound for at least 5 seconds but not more than 10 seconds before the door begins to move and should continue sounding until the door is completely closed. In the case of remote closure by hand operation, an alarm should sound only while the door is actually moving.

3.5.3 In passenger areas and areas of high ambient noise, the audible alarms should be supplemented by visual signals at both sides of the doors.

3.5.4 All watertight doors, including sliding doors, operated by hydraulic door actuators, either a central hydraulic unit or an independent hydraulic unit for each door should be provided with a low fluid level alarm or low gas pressure alarm, as applicable, or some other means of monitoring loss of stored energy in the hydraulic accumulators. For passenger ships, this alarm should be both audible and visible and should be located at the central operating console at the navigation bridge. For cargo ships, this alarm should be both audible and visible and should be located at the navigation bridge.

3.6 Notices

As shown in table 1, doors which are normally closed at sea, but are not provided with means of remote closure, should have notices fixed to both sides of the doors stating: "To be kept closed at sea". Doors which should be permanently closed at sea should have notices fixed to both sides stating: "Not to be opened at sea".

3.7 Location

For passenger ships the watertight doors and their controls should be located in compliance with SOLAS regulations II-1/13.5.3 and 13.7.1.2.2.

4 FIRE DOORS

4.1 Watertight doors may also serve as fire doors but need not be fire-tested if fitted on cargo ships or if fitted below the bulkhead deck on passenger ships. However, such doors fitted above the bulkhead deck on passenger ships should be tested to the Fire Test Procedures (FTP) Code in accordance with the fire rating of the division they are fitted in. These doors should also comply with the means of escape provisions of regulation II-2/13. If it is not practicable to ensure self-closing, means of indication on the bridge showing whether these doors are open or closed and a notice stating "To be kept closed at sea" can be an alternative to self-closing.

4.2 Where a watertight door is located adjacent to a fire door, both doors should be capable of independent operation, remotely if required by SOLAS regulations II-1/13.8.1 to 13.8.3 and from both sides of each door.

5 TESTING

5.1 Doors which become immersed by an equilibrium or intermediate waterplane or are below the freeboard or bulkhead deck should be subjected to a hydrostatic pressure test.

5.2 For large doors intended for use in the watertight subdivision boundaries of cargo spaces, structural analysis may be accepted in lieu of pressure testing. Where such doors utilize gasket seals, a prototype pressure test to confirm that the compression of the gasket material is capable of accommodating any deflection, revealed by the structural analysis, should be carried out.

5.3 Doors above freeboard or bulkhead deck, which are not immersed by an equilibrium or intermediate waterplane but become intermittently immersed at angles of heel in the required range of positive stability beyond the equilibrium position, should be hose tested.

5.4 Pressure testing

5.4.1 The head of water used for the pressure test should correspond at least to the head measured from the lower edge of the door opening, at the location in which the door should be fitted in the ship, to the bulkhead deck or freeboard deck, as applicable, or to the most unfavourable damage waterplane, if that be greater. Testing may be carried out at the factory or other shore-based testing facility prior to installation in the ship.

5.4.2 Leakage criteria

5.4.2.1 The following acceptable leakage criteria should apply:

Doors with gaskets	No leakage
Doors with metallic sealing	Maximum leakage 1 litre/min

5.4.2.2 Limited leakage may be accepted for pressure tests on large doors located in cargo spaces employing gasket seals or guillotine doors located in conveyor tunnels, in accordance with the following:[7]

$$\text{Leakage rate (litre/min)} = \frac{(P+4.572)\,h^3}{6568}$$

where P = perimeter of door opening (metres)
h = test head of water (metres)

5.4.2.3 However, in the case of doors where the water head taken for the determination of the scantling does not exceed 6.1 m, the leakage rate may be taken equal to 0.375 *litre*/min if this value is greater than that calculated by the above-mentioned formula.

5.4.3 For doors of passenger ships which are used at sea and which become submerged by the equilibrium or intermediate waterplane, a prototype test should be conducted, on each side of the door, to check the satisfactory closing of the door against a force equivalent to a water height of at least 1 m above the sill on the centre line of the door.[8]

5.5 Hose testing after installation

All watertight doors should be subject to a hose test[9] after installation in a ship. Hose testing should be carried out from each side of a door unless, for a specific application, exposure to

---

[7] Published in the ASTM F 1196, Standard Specification for Sliding Watertight Door Assemblies and referenced in the Title 46 US Code of Federal Regulations 170.270 Door design, operation installation and testing.

[8] Arrangements for passenger ships should be in accordance with SOLAS regulation II-1/13.5.2.

[9] Refer to IACS URS 14.2.3 IACS Reg. 1996/Rev.2, 2001.

floodwater is anticipated only from one side. Where a hose test is not practicable because of possible damage to machinery, electrical equipment insulation, or outfitting items, it may be replaced by means such as an ultrasonic leak test or an equivalent test.

Table 1 – Doors in internal watertight bulkheads and external watertight boundaries in passenger ships and cargo ships

A. Doors in internal watertight bulkheads

Position relative to bulkhead or freeboard deck	1 SOLAS regulation	2 Frequency of use while at sea	3 Type	4 Remote closure	5 Remote indication	6 Audible or visual alarm	7 Notice	8 Comments
I. Passenger ships								
A. Below	II-1/10, 13.4, 13.5.1, 13.5.2, 13.6, 13.7.1, 13.8.1, 13.8.2, 16.2, 22.1, 22.3 and 22.4	Used	POS	Yes	Yes	Yes (local)	No	For doors that are used, see II-1/22.3 and MSC.1/Circ.1564
	II-1/10, 13.9.1, 13.9.2, 14.2, 16.2, 22.2 and 22.5	Permanently Closed	S, H	No	No	No	Yes	See Notes 2 + 3 + 4
B. At or above	II-1/10, 16.2, 17.1 and 22.3	Used	POS, POH	Yes	Yes	Yes (local)	No	See Note 5
			S, H	No	Yes	No	Yes	See Note 1
	II-1/17-1.1.1, 17-1.1.2, 17-1.1.3, 23.6 and 23.8		S, H	No	Yes	Yes (remote)	Yes	Doors giving access to below the ro-ro deck
	II-1/17-1.1.1, 17-1.1.2, 17-1.1.3, 22.7 and 23.3 to 23.5	Permanently Closed	S, H	No	Yes	Yes (remote)	Yes	See Notes 1 + 2 + 3
II. Cargo ships								
A. Below	II-1/10, 13-1.2, 16.2 and 22.3	Used	POS	Yes	Yes	Yes (local)	No	
	II-1/10, 13-1.3, 16.2, 22.3 and 24.4	Normally closed	S, H	No	Yes	No	Yes	See Note 1
	II-1/10, 13-1.4, 16.2, 24.3, and 24.4	Permanently closed	S, H	No	No	No	Yes	See Notes 2 + 3
	II-1/10, 13-1.4, 13-1.5, 16.2, 22.2, 24.3 and 24.4							
B. At or above	II-1/10, 13-1.2, 16.2 and 22.3	Used	POS	Yes	Yes	Yes (local)	No	
	II-1/10, 13-1.3, 16.2, 22.3 and 24.4	Normally closed	S, H	No	Yes	No	Yes	See Note 1
	II-1/10, 13-1.4, 13-1.5, 16.2, 24.3 and 24.4	Permanently closed	S, H	No	No	No	Yes	See Notes 2 + 3

Notes:

1 If hinged, this door should be of quick acting or single action type.

2 The time of opening such doors in port and closing them before a voyage commences should be entered in the logbook, in case of doors in watertight bulkheads subdividing cargo spaces.

3 Doors should be fitted with a device which prevents unauthorized opening.

4 Passenger ships which have to comply with SOLAS regulation II-1/14.2 require an indicator on the navigation bridge to show automatically when each door is closed and all door fastenings are secured.

5 Refer to the explanatory note to SOLAS regulation II-1/17.1 regarding sliding watertight doors with a reduced pressure head and sliding semi-watertight doors.

B. Doors in external watertight boundaries below equilibrium or intermediate waterplane

Position relative to bulkhead or freeboard deck	1 SOLAS regulation	2 Frequency of use while at sea	3 Type	4 Remote closure	5 Remote indication	6 Audible or visual alarm	7 Notice	8 Comments
I. Passenger ships								
A. Below	II-1/15.9, 22.6 and 22.12	Permanently closed	S, H	No	No	No	Yes	See Notes 2 + 3
B. At or above	II-1/17.1 and 22.3 MSC.Circ.541	Normally closed	S, H	No	Yes	No	Yes	See Note 1
	II-1/17-1.1.1, 17-1.1.2, 17-1.3, 23.6 and 23.8		S, H	No	Yes	Yes (Remote)	Yes	Doors giving access to below ro-ro deck
	II-1/17-1.1.1, 17-1.2, 17-1.3, 23.3 and 23.5	Permanently closed	S, H	No	Yes	Yes (Remote)	Yes	See Notes 2 + 3
II. Cargo ships								
A. Below	II-1/15.9, 15-1.2, 15-1.3, 15-1.4, 22.6, 22.12 and 24.1	Permanently closed	S, H	No	Yes	No	Yes	See Notes 2 + 3
B. At or above	II-1/15-1.2	Normally closed	S, H	No	Yes	No	Yes	See Note 1
	II-1/15-1.2 and 15-1.4	Permanently closed	S, H	No	Yes	No	Yes	See Notes 2 + 3

Notes:

1 If hinged, this door should be of quick acting or single action type.

2 The time of opening such doors in port and closing them before a voyage commences should be entered in the logbook.

3 Doors should be fitted with a device which prevents unauthorized opening.

4 SOLAS REGULATION II-1/26 – GENERAL

4.1 PARAGRAPH 4

Interpretation

1 Dead ship condition for the purpose of SOLAS regulation II-1/26.4 should be understood to mean a condition under which the main propulsion plant, boilers and auxiliaries are not in operation and in restoring the propulsion, no stored energy for starting and operating the propulsion plant, the main source of electrical power and other essential auxiliaries is assumed to be available.

2 Where the emergency source of power is an emergency generator which complies with SOLAS regulation II-1/44, IACS SC185 and IACS SC124, this generator may be used for restoring operation of the main propulsion plant, boilers and auxiliaries where any power supplies necessary for engine operation are also protected to a similar level as the starting arrangements.

3 Where there is no emergency generator installed or an emergency generator does not comply with SOLAS regulation II-1/44, the arrangements for bringing main and auxiliary machinery into operation should be such that the initial charge of starting air or initial electrical power and any power supplies for engine operation can be developed on board ships without external aid. If for this purpose an emergency air compressor or an electric generator is required, these units should be powered by a hand-starting oil engine or a hand-operated compressor. The arrangements for bringing main and auxiliary machinery into operation should have capacity such that the starting energy and any power supplies for engine operation are available within 30 min of a dead ship condition.

4.2 PARAGRAPH 11

Interpretation

1 Arrangements complying with this regulation and acceptable "equivalent arrangements", for the most commonly utilized fuel systems, are shown below.

2 A service tank is a fuel oil tank which contains only fuel of a quality ready for use, i.e. fuel of a grade and quality that meets the specification required by the equipment manufacturer. A service tank should be declared as such and not be used for any other purpose.

3 Use of a setting tank with or without purifiers, or purifiers alone, and one service tank is not acceptable as an "equivalent arrangement" to two service tanks.

Examples of application for the most common systems

1 Example 1

1.1 Requirement according to SOLAS – Main and auxiliary engines and boiler(s) operating with heavy fuel oil (HFO) (one fuel ship)

HFO Serv. TK Capacity for at least 8 h Main Eng. + Aux. Eng. + Aux. Boiler	HFO Serv. TK Capacity for at least 8 h Main Eng. + Aux. Eng. + Aux. Boiler	MDO TK For initial cold starting or repair work Engines/Boiler

1.2 Equivalent arrangement

HFO Serv. TK Capacity for at least 8 h Main Eng. + Aux. Eng. + Aux. Boiler	MDO Serv. TK Capacity for at least 8 h Main Eng. + Aux. Eng. + Aux. Boiler

This interpretation only applies where main and auxiliary engines can operate with heavy fuel oil under all load conditions and, in the case of main engines, during manoeuvring.

For pilot burners of auxiliary boilers if provided, an additional MDO tank for 8 hours may be necessary.

2 Example 2

2.1 Requirement according to SOLAS – Main engine(s) and auxiliary boiler(s) operating with HFO and auxiliary engine operating with marine diesel oil (MDO)

HFO Serv. TK Capacity for at least 8 h Main Eng. + Aux. Boiler	HFO Serv. TK Capacity for at least 8 h Main Eng. + Aux. Boiler	MDO Serv. TK Capacity for at least 8 h Aux. Eng.	MDO Serv. TK Capacity for at least 8 h Aux. Eng.

2.2 Equivalent arrangement

HFO Serv. TK Capacity for at least 8 h Main Eng. + Aux. Boiler	MDO Serv. TK Capacity for at least the highest of: • 4 h Main Eng. + Aux. Eng + Aux. Boiler or • 8 h Aux. Eng. + Aux Boiler	MDO Serv. TK Capacity for at least the highest of: • 4 h Main Eng. + Aux. Eng + Aux. Boiler or • 8 h Aux. Eng. + Aux Boiler

The arrangements in paragraphs 1.2 and 2.2 apply, provided the propulsion and vital systems which use two types of fuel support rapid fuel changeover and are capable of operating in all normal operating conditions at sea with both types of fuel (MDO and HFO).

5 SOLAS REGULATIONS II-1/40 – GENERAL – AND 41 – MAIN SOURCE OF ELECTRICAL POWER AND LIGHTING SYSTEMS

Interpretation

Essential services and arrangements of sources of power, supply, control and monitoring to the different categories of essential services

1 Classification of essential services

1.1 Essential services are those services essential for propulsion and steering, and safety of the ship, which are made up of "Primary Essential Services" and "Secondary Essential Services". Definitions and examples of such services are given in 2 and 3 below.

1.2 Services to ensure minimum comfortable conditions of habitability are those services defined in 4 below.

2 Primary Essential Services

Primary Essential Services are those services which need to be in continuous operation to maintain propulsion and steering. Examples of equipment for "Primary Essential Services" are as follows:

- steering gears;
- pumps for controllable pitch propellers;
- scavenging air blower, fuel oil supply pumps, fuel valve cooling pumps, lubricating oil pumps and cooling water pumps for main and auxiliary engines and turbines necessary for propulsion;
- forced draught fans, feed water pumps, water circulating pumps, vacuum pumps and condensate pumps for steam plants on steam turbine ships, and also for auxiliary boilers on ships where steam is used for equipment supplying primary essential services;
- oil burning installations for steam plants on steam turbine ships and for auxiliary boilers where steam is used for equipment supplying primary essential services;
- azimuth thrusters, which are the sole means for propulsion/steering with lubricating oil pumps, cooling water pumps;
- electrical equipment for electric propulsion plant with lubricating oil pumps and cooling water pumps;
- electric generators and associated power sources supplying the above equipment;
- hydraulic pumps supplying the above equipment;
- viscosity control equipment for heavy fuel oil;
- control, monitoring, and safety devices/systems for equipment to primary essential services;
- fire pumps and other fire extinguishing medium pumps;
- navigation lights, aids and signals;
- internal safety communication equipment; and
- lighting system.

3 Secondary Essential Services

Secondary Essential Services are those services which need not necessarily be in continuous operation to maintain propulsion and steering but which are necessary for maintaining the vessel's safety. Examples of equipment for secondary essential services are as follows:

- windlass;
- fuel oil transfer pumps and fuel oil treatment equipment;
- lubrication oil transfer pumps and lubrication oil treatment equipment;
- pre-heaters for heavy fuel oil;
- starting air and control air compressors;
- bilge, ballast and heeling pumps;
- ventilating fans for engine and boiler rooms;
- services considered necessary to maintain dangerous spaces in a safe condition;
- fire detection and alarm system;
- electrical equipment for watertight closing appliances;
- electric generators and associated power sources supplying the above equipment;
- hydraulic pumps supplying the above equipment;
- control, monitoring, and safety systems for cargo containment systems; and
- control, monitoring, and safety devices/systems for equipment to secondary essential services.

4 Services for habitability

Services for habitability are those services which need to be in operation for maintaining the ship's minimum comfort conditions for the crew and passengers. Examples of equipment for maintaining conditions of habitability are as follows:

- cooking;
- heating;
- domestic refrigeration;
- mechanical ventilation;
- sanitary and fresh water; and
- electrical generators and associated power sources supplying the above equipment.

5 SOLAS regulations II-1/40.1.1 and 41.1.1 – For the purposes of these regulations, the services as included in paragraphs 2 to 4 should be considered.

6 SOLAS regulation II-1/40.1.2 – For the purposes of this regulation, the services as included in paragraphs 2 and 3 and the services in regulations II-1/42 or 43, as applicable, should be considered.

7 SOLAS regulation II-1/41.1.2 – For the purposes of this regulation, the services as included in paragraphs 2 to 4, except for those also listed in the interpretation set out in section 6.1 below, should be considered.

8 SOLAS regulation II-1/41.1.5 – For the purposes of this regulation, the services as included in paragraphs 2, 3 and 4 should be considered.[10]

[10] See also IACS UI SC83.

9 SOLAS regulation II-1/41.5.1.2 – For the purposes of this regulation, the following interpretations are applicable:

.1 services in paragraph 2 should not be included in any automatic load shedding or other equivalent arrangements;

.2 services in paragraph 3 may be included in the automatic load shedding or other equivalent arrangement provided disconnection will not prevent services required for safety being immediately available when the power supply is restored to normal operating conditions; and

.3 services for habitability in paragraph 4 may be included in the load shedding or other equivalent arrangement.

6 SOLAS REGULATION II-1/41 – MAIN SOURCE OF ELECTRICAL POWER AND LIGHTING SYSTEMS

6.1 PARAGRAPH 1.2

Interpretation

Those services necessary to provide normal operational conditions of propulsion and safety do not include services such as:

.1 thrusters not forming part of the main propulsion;

.2 moorings;

.3 cargo handling gear;

.4 cargo pumps; and

.5 refrigerators for air conditioning (those which are not necessary to establish a minimum condition of habitability).

6.2 PARAGRAPH 1.3

Interpretation

Generators and generator systems, having the ship's main propulsion machinery as their prime mover, may be accepted as part of the ship's main source of electrical power, provided that:

.1 they are capable of operating under all weather conditions during sailing and during manoeuvring, also when the ship is stopped, within the specified limits for the voltage variation in IEC 60092-301 and the frequency variation in IACS UR E5;

.2 their rated capacity is safeguarded during all operations given under 1, and is such that in the event of any other one of the generators failing, the services given under SOLAS regulation II-1/41.1.2 (see section 6.1 above) can be maintained;

.3 the short circuit current of the generator/generator system is sufficient to trip the generator/generator system circuit-breaker taking into account the selectivity of the protective devices for the distribution system. Protection should be arranged in order to safeguard the generator/generator system in case of a short circuit in the main busbar. The generator/generator system should be suitable for further use after fault clearance; and

.4 standby sets are started in compliance with paragraph 2 of the interpretation of SOLAS regulation II-1/41.5.1.1 (see section 6.3 below).

6.3 PARAGRAPH 5

Interpretation of paragraph 5.1.1

1 Where the electrical power is normally supplied by more than one generator set simultaneously in parallel operation, provision of protection, including automatic disconnection of sufficient non-essential services and, if necessary, secondary essential services as defined in the unified interpretation of SOLAS regulations II-1/40 and 41 (see chapter 5 above) and those provided for habitability, should be made to ensure that, in case of loss of any of these generating sets, the remaining ones are kept in operation to permit propulsion and steering and to ensure safety.

2 Where Administrations permit electrical power to be normally supplied by one generator, provision should be made, upon loss of power, for automatic starting and connecting to the main switchboard of stand-by generator(s) of sufficient capacity with automatic restarting of the essential auxiliaries, in sequential operation if required. Starting and connection to the main switchboard of one generator should be as rapid as possible, preferably within 30 seconds after loss of power. Where prime movers with longer starting time are used, this starting and connection time may be exceeded upon approval from the Administration.

Interpretation of paragraph 5.1.2

3 The load shedding should be automatic.

4 The non-essential services, service for habitable conditions, may be shed and, where necessary, additionally the Secondary Essential Services, sufficient to ensure the connected generator set(s) is/are not overloaded.

Interpretation of paragraph 5.1.3

1 Other approved means can be achieved by:

.1 circuit breaker without tripping mechanism; or

.2 disconnecting link or switch by which busbars can be split easily and safely.

2 Bolted links, for example bolted busbar sections, should not be accepted.

7 SOLAS REGULATIONS II-1/42 AND 43 – EMERGENCY SOURCE OF ELECTRICAL POWER IN PASSENGER AND CARGO SHIPS

Interpretation

1 "Blackout" as used in SOLAS regulations II-1/42.3.4 and 43.3.4 should be understood to mean a "dead ship" condition-initiating event.

2 "Dead ship" condition, for the purpose of SOLAS regulations II-1/42.3.4 and 43.3.4, should be understood to mean a condition under which the main propulsion plant, boilers and auxiliaries are not in operation and in restoring the propulsion, no stored energy for starting the propulsion plant, the main source of electrical power and other essential auxiliaries should be assumed available. It is assumed that means are available to start the emergency generator at all times.

3 Emergency generator stored starting energy is not to be directly used for starting the propulsion plant, the main source of electrical power and/or other essential auxiliaries (emergency generator excluded).

4 For steam ships, the 30-min time limit given in SOLAS can be interpreted as time from blackout defined above to light-off of the first boiler.

5 Exceptionally is understood to mean conditions such as:

.1 blackout situation;

.2 dead ship situation;

.3 routine use for testing;

.4 short-term parallel operation with the main source of electrical power for the purpose of load transfer; and

.5 use of the emergency generator during lay time in port for the supply of the ship's main switchboard, provided the requirements of 6 (Suitable measures for the exceptional use of the emergency generator for power-supply of non-emergency circuits in port) are achieved and unless instructed otherwise by the Administration.

6 Suitable measures for the exceptional use of the emergency generator for power-supply of non-emergency circuits in port:

.1 To prevent the generator or its prime mover from becoming overloaded when used in port, arrangements should be provided to shed sufficient non-emergency loads to ensure its continued safe operation.

.2 The prime mover should be arranged with fuel oil filters and lubrication oil filters, monitoring equipment and protection devices as required for the prime mover for main power generation and for unattended operation.

.3 The fuel oil supply tank to the prime mover should be provided with a low-level alarm, arranged at a level ensuring sufficient fuel oil capacity for the emergency services for the period of time as required by SOLAS.

.4 The prime mover should be designed and built for continuous operation and should be subjected to a planned maintenance scheme ensuring that it is always available and capable of fulfilling its role in the event of an emergency at sea.

.5 Fire detectors should be installed in the location where the emergency generator set and emergency switchboard are installed.

.6 Means should be provided to readily change over to emergency operation.

.7 Control, monitoring and supply circuits, for the purpose of the use of emergency generator in port should be so arranged and protected that any electrical fault will not influence the operation of the main and emergency services.

.8 When necessary for safe operation, the emergency switchboard should be fitted with switches to isolate the circuits.

.9 Instructions should be provided on board to ensure that when the ship is under way all control devices (e.g. valves, switches) are in a correct position for the independent emergency operation of the emergency generator set and emergency switchboard.

8 SOLAS REGULATION II-1/44 – STARTING ARRANGEMENTS FOR EMERGENCY GENERATING SETS

8.1 PARAGRAPH 1

Interpretation (from MSC/Circ.736)

Emergency generating sets should be capable of being readily started in their cold condition at a temperature of 0ºC. If this is impracticable, or if lower temperatures are likely to be encountered, heating should be provided to ensure ready starting of the generating sets.

8.2 PARAGRAPH 2

Interpretation (from MSC/Circ.736)

Each emergency generating set arranged to be automatically started should be equipped with starting devices with a stored energy capability of at least three consecutive starts. A second source of energy should be provided for an additional three starts within 30 min unless manual starting can be demonstrated to be effective.

9 SOLAS REGULATION XII/12 – HOLD, BALLAST AND DRY SPACE WATER INGRESS ALARMS

When water level detectors are installed on bulk carriers in compliance with regulation XII/12, the *Performance standards for water level detectors on ships subject to SOLAS regulations II-1/25, II-1/25-1 and XII/12*, annexed to resolution MSC.188(79)/Rev.2 adopted on 8 June 2023 by MSC 107, should be applied, taking into account the following interpretations to the paragraphs of the Performance standards.

9.1 PERFORMANCE STANDARDS FOR WATER LEVEL DETECTORS ON SHIPS SUBJECT TO SOLAS REGULATIONS II-1/25 AND 25-1, AND XII/12, PARAGRAPH 3.2.3

Interpretation

Detection equipment includes the sensor and any filter and protection arrangements for the detector installed in cargo holds and other spaces as required by regulation XII/12.1.

9.2 PERFORMANCE STANDARDS FOR WATER LEVEL DETECTORS ON SHIPS SUBJECT TO SOLAS REGULATIONS II-1/25 AND 25-1, AND XII/12, PARAGRAPH 3.2.5

Interpretation

1 In general, the equipment in cargo area should be suitable for installation in hazardous area comparable with Zone 1) as defined in IEC 60092-506, Clause 3.1. The equipment should be suitable for the explosive gas atmosphere and/or combustible dust that can be present, depending on the cargo carried.

2 The equipment should be manufactured, tested, marked and installed in accordance with IEC 60079-series or other equivalent recognized international standard.

3 Where certified safe type equipment is installed, the equipment should be adequately protected against mechanical damage from the cargo so as to maintain its EX-properties.

4 Where a ship is designed only for the carriage of cargoes that cannot create a combustible or explosive atmosphere then the requirement for certified safe type equipment should not be insisted upon, provided the operational instructions included in the Manual required by 4.1 of the appendix to the annex specifically exclude the carriage of cargoes that could produce a potential explosive atmosphere. Any exclusion of cargoes identified in the annex should be consistent with the ship's Cargo Book and any Certification relating to the carriage of specifically identified cargoes.

5 Where the characteristics of the dust and/or gases are unknown, temperature class T6, gas group IIC and/or either dust group IIIC or IP5X, are to be used as appropriate.

6 Where detector systems include certified safe type equipment, plans of the arrangements should be appraised/approved by individual classification societies.

9.3 PERFORMANCE STANDARDS FOR WATER LEVEL DETECTORS ON SHIPS SUBJECT TO SOLAS REGULATIONS II-1/25 AND 25-1, AND XII/12, PARAGRAPH 3.3.2

Interpretation

The pre-alarm, as a primary alarm, should indicate a condition that requires prompt attention to prevent an emergency condition and the main alarm, as an emergency alarm should indicate that immediate actions must be taken to prevent danger to human life or to the ship.

9.4 PERFORMANCE STANDARDS FOR WATER LEVEL DETECTORS ON SHIPS SUBJECT TO SOLAS REGULATIONS II-1/25 AND 25-1, AND XII/12, PARAGRAPH 3.3.6

Interpretation

Fault monitoring should address faults associated with the system that include open circuit, short circuit, as well as arrangement details that would include loss of power supplies and CPU failure for computer-based alarm/monitoring system, etc.

9.5 PERFORMANCE STANDARDS FOR WATER LEVEL DETECTORS ON SHIPS SUBJECT TO SOLAS REGULATIONS II-1/25 AND 25-1, AND XII/12, PARAGRAPH 3.3.7

Interpretation

1 The electrical power supply should be from two separate sources, one should be the main source of electrical power and the other should be the emergency source, unless a continuously charged dedicated accumulator battery is fitted, having arrangement, location and endurance equivalent to that of the emergency source (18 hours). The battery supply may be an internal battery in the water level detector system.

2 The changeover arrangement of supply from one electrical source to another need not be integrated into the water level detector system.

3 Where batteries are used for the secondary power supply, failure alarms for both power supplies should be provided.

9.6 PERFORMANCE STANDARDS FOR WATER LEVEL DETECTORS ON SHIPS SUBJECT TO SOLAS REGULATIONS II-1/25 AND 25-1, AND XII/12, FOOTNOTE TO PARAGRAPH 3.4.1

Interpretation

1 IACS UR E10 may be used as an equivalent test standard to IEC 60092-504.

2 The range of tests should include the following:

For alarm/monitoring panel:

.1 functional tests in accordance with resolution MSC.188(79)/Rev.2 on the *Performance standards for water level detectors on ships subject to SOLAS regulations II-1/25, II-1/25-1 and XII/12*;

.2 electrical power supply failure test;

.3 power supply variation test;

.4 dry heat tests;

.5 damp heat tests;

.6 vibration test;

.7 EMC tests;

.8 insulation resistance test;

.9 high-voltage test; and

.10 static and dynamic inclinations tests, if moving parts are contained.

For IS barrier unit, if located in the wheelhouse: in addition to the certificate issued by a competent independent testing laboratory, EMC tests should also be carried out.

For water ingress detectors:

.1 functional tests in accordance with resolution MSC.188(79)/Rev.2 on the *Performance standards for water level detectors on ships subject to SOLAS regulations II-1/25, II-1/25-1 and XII/12*;

.2 electrical power supply failure test;

.3 power supply variation test;

.4 dry-heat test;

.5 damp-heat test;

.6 vibration test;

.7 enclosure class in accordance with resolution MSC.188(79)/Rev.2 on the *Performance standards for water level detectors on ships subject to SOLAS regulations II-1/25, II-1/25-1 and XII/12*;

.8 insulation resistance test;

.9 high-voltage test; and

.10 static and dynamic inclinations tests (if the detectors contain moving parts).

9.7 PERFORMANCE STANDARDS FOR WATER LEVEL DETECTORS ON SHIPS SUBJECT TO SOLAS REGULATIONS II-1/25 AND 25-1, AND XII/12, APPENDIX, PARAGRAPH 2.1.1

Interpretation

The test procedure should satisfy the following criteria:

.1 the type tests should be witnessed by a classification society surveyor if the tests are not carried out by a competent independent test facility;

.2 type tests should be carried out on a prototype or randomly selected item(s) which are representative of the manufactured item that is being type tested; and

.3 type tests should be documented (type test reports) by the manufacturer and submitted for review by classification societies.

9.8 PERFORMANCE STANDARDS FOR WATER LEVEL DETECTORS ON SHIPS SUBJECT TO SOLAS REGULATIONS II-1/25 AND 25-1, AND XII/12, APPENDIX, PARAGRAPH 2.1.1.1

Interpretation

1 The submerged test period for electrical components intended to be installed in ballast tanks and cargo tanks used as ballast tanks should be not less than 20 days.

2 The submerged test period for electrical components intended to be installed in dry spaces and cargo holds not intended to be used as ballast tanks should be not less than 24 hours.

3 Where a detector and/or cable connecting device (e.g. junction box, etc.) is installed in a space adjacent to a cargo hold (e.g. lower stool, etc.) and the space is considered to be flooded under damage stability calculations, the detectors and equipment should satisfy the requirements of IP68 for a water head equal to the hold depth for a period of 20 days or 24 hours on the basis of whether or not the cargo hold is intended to be used as a ballast tank as described in the previous paragraphs.

9.9 PERFORMANCE STANDARDS FOR WATER LEVEL DETECTORS ON SHIPS SUBJECT TO SOLAS REGULATIONS II-1/25 AND 25-1, AND XII/12, APPENDIX, PARAGRAPH 2.1.1.2

Interpretation

1 The type test required for the sensor should be in accordance with the following:

.1 The test container for the cargo/water mixture should be dimensioned so that its height and volume are such that the sensor and any filtration fitted can be totally submerged for the repeated functionality tests required by paragraph 2.1.1.2 and the static and dynamic inclination tests identified in the previous interpretation.

.2 The sensor and any filtration fitted that should be submerged and should be arranged in the container as they would be installed in accordance with the installation instructions required by paragraph 4.4.

.3 The pressure in the container for testing the complete detector should be not more than 0.2 bar at the sensor and any filter arrangement. The pressure may be realized by pressurization or by using a container of sufficient height.

.4 The cargo/water mixture should be pumped into the test container and suitable agitation of the mixture provided to keep the solids in suspension. The effect of pumping the cargo/water mixture into the container should not affect the operation of the sensor and filter arrangements.

.5 The cargo/water mixture should be pumped into the test container to a predetermined level that submerges the detector and the operation of the alarm observed.

.6 The test container should then be drained and the deactivation of the alarm condition observed.

.7 The test container and sensor with any filter arrangement should be allowed to dry without physical intervention.

.8 The test procedure should be repeated consecutively ten times without cleaning any filter arrangement that may be fitted in accordance with the manufacturer's installation instructions (see also 2.1.1.2).

.9 Satisfactory alarm activation and deactivation at each of the 10 consecutive tests will demonstrate satisfactory type testing.

2 The cargo/water mixture used for type testing should be representative of the range of cargoes within the following groups and should include the cargo with the smallest particles expected to be found from a typical representative sample:

.1 iron ore particles and seawater;

.2 coal particles and seawater;

.3 grain particles and seawater; and

.4 aggregate (sand) particles and seawater.

The smallest and largest particle size together with the density of the dry mixture should be ascertained and recorded. The particles should be evenly distributed throughout the mixture. Type testing with representative particles will in general qualify all types of cargoes within the four groupings shown above.

The following provides guidance on the selection of particles for testing purposes:

.1 Iron ore particles should mainly consist of small loose screenings of iron ore and not lumps of ore (dust with particle size < 0.1 mm).

.2 Coal particles should mainly consist of small loose screenings of coal and not lumps of coal (dust with particle size < 0.1 mm).

.3 Grain particles should mainly consist of small loose grains of free-flowing grain (grain having a size > 3 mm, such as wheat).

.4 Aggregate particles should mainly consist of small loose grains of free-flowing sand and without lumps (dust with particle size < 0.1 mm).

9.10 PERFORMANCE STANDARDS FOR WATER LEVEL DETECTORS ON SHIPS SUBJECT TO SOLAS REGULATIONS II-1/25 AND 25-1, AND XII/12, APPENDIX, PARAGRAPH 3.1.1

Interpretation

The test procedure should satisfy the following criteria:

.1 type tests should be witnessed by a classification society surveyor if the tests are not carried out by a competent independent test facility;

.2 type tests should be carried out on a prototype or randomly selected item(s) which are representative of the manufactured item that is being type tested; and

.3 type tests should be documented (type test reports) by the manufacturer and submitted for review by classification societies.

9.11 PERFORMANCE STANDARDS FOR WATER LEVEL DETECTORS ON SHIPS SUBJECT TO SOLAS REGULATIONS II-1/25 AND 25-1, AND XII/12, APPENDIX, SECTION 4 – MANUALS

Interpretation

For each ship, a copy of the manual should be made available to the surveyor at least 24 hours prior to survey of the water-level detection installation. Each classification society should ensure that any plans required for classification purposes have been appraised/approved as appropriate.

10 SOLAS REGULATION XII/13 – AVAILABILITY OF PUMPING SYSTEMS

SOLAS REGULATION XII/13.1 AND MSC/CIRC.1069

Dewatering of forward spaces of bulk carriers

Interpretation

1 Where the piping arrangements for dewatering closed dry spaces are connected to the piping arrangements for the drainage of water ballast tanks, two non-return valves should be provided to prevent the ingress of water into dry spaces from those intended for the carriage of water ballast. One of these non-return valves should be fitted with a shut-off isolation arrangement. The non-return valves should be located in readily accessible positions. The shut-off isolation arrangement should be capable of being controlled from the navigation bridge, the propulsion machinery control position or enclosed space which is readily accessible from the navigation bridge or the propulsion machinery control position without travelling exposed freeboard or superstructure decks. In this context, a position which is accessible via an under-deck passage, a pipe trunk or other similar means of access should not be taken as being in the "readily accessible enclosed space".

2 Under SOLAS regulation XII/13.1:

.1 the valve specified under SOLAS regulation II-1/12.6.1 should be capable of being controlled from the navigation bridge, the propulsion machinery control position or enclosed space which is readily accessible from the navigation bridge or the propulsion machinery control position without travelling exposed freeboard or superstructure decks. In this context, a position which is accessible via an under-deck passage, a pipe trunk or other similar means of access should not be taken as being in the "readily accessible enclosed space";

.2 the valve should not move from the demanded position in the case of failure of the control system power or actuator power;

.3 positive indication should be provided at the remote control station to show that the valve is fully open or closed; and

.4 local hand-powered valve operation from above the freeboard deck, as permitted under SOLAS regulation II-1/12.6.1, is required. An acceptable alternative to such arrangement may be remotely operated actuators as specified in SOLAS regulation XII/13.1, on the condition that all of the provisions of SOLAS regulation XII/13.1 are met.

3 The dewatering arrangements should be such that any accumulated water can be drained directly by a pump or eductor.

4 The dewatering arrangements should be such that when they are in operation, other systems essential for the safety of the ship, including firefighting and bilge systems, remain available and ready for immediate use. The systems for normal operation of electric power supplies, propulsion and steering should not be affected by the operation of the dewatering systems. It should also be possible to immediately start fire pumps and have a readily available supply of firefighting water, and to be able to configure and use the bilge system for any compartment when the dewatering system is in operation.

5 Bilge wells should be provided with gratings or strainers that will prevent blockage of the dewatering system with debris.

6 The enclosures of electrical equipment for the dewatering system installed in any of the forward dry spaces should provide protection to IPX8 standard as defined in publication IEC 60529 for a water head equal to the height of the space in which the electrical equipment is installed for a time duration of at least 24 hours.

____

INTERNATIONAL MARITIME ORGANIZATION

E

4 ALBERT EMBANKMENT
LONDON SE1 7SR
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

MSC.1/Circ.1599/Rev.3
1 July 2024

REVISED GUIDELINES ON THE APPLICATION OF HIGH MANGANESE AUSTENITIC STEEL FOR CRYOGENIC SERVICE

1 Owing to the growing global demand for liquefied natural gas (LNG), as an environment-friendly energy source, and the increased construction and operation of LNG-fuelled ships, the Maritime Safety Committee, at its ninety-sixth session (11 to 20 May 2016), agreed to the need to ensure that cargo and fuel tanks of LNG carriers and LNG-fuelled ships were safe, and hence tasked the Sub-Committee on Carriage of Cargoes and Containers with addressing the matter by developing amendments to the IGC and IGF Codes in order to include high manganese austenitic steel for cryogenic service.

2 The Maritime Safety Committee, at its 100th session (3 to 7 December 2018), acknowledging the increasing use of high manganese austenitic steel by the industry for cryogenic service and the need for guidance in this respect, approved the *Interim guidelines on the application of high manganese austenitic steel for cryogenic service* (MSC.1/Circ.1599).

3 The Maritime Safety Committee, at its 102nd session (4 to 11 November 2020), approved the Revised Interim Guidelines (MSC.1/Circ.1599/Rev.1), prepared by the Sub-Committee on Carriage of Cargoes and Containers, at its sixth session (9 to 13 September 2019).

4 The Maritime Safety Committee, at its 105th session (20 to 29 April 2022), approved the Revised Guidelines (MSC.1/Circ.1599/Rev.2), prepared by the Sub-Committee on Carriage of Cargoes and Containers, at its seventh session (6 to 10 September 2021).

5 The Maritime Safety Committee, at its 108th session (15 to 24 May 2024), approved the Revised Guidelines, as set out in the annex, containing modifications to the application and appendix 2, as set out in the annex, prepared by the Sub-Committee on Carriage of Cargoes and Containers, at its ninth session (20 to 29 September 2023).

6 The Committee agreed to keep the Revised Guidelines under review, taking into account operational experience gained with their application.

7 Member States are invited to bring the Revised Guidelines to the attention of all parties concerned.

8 This circular supersedes MSC.1/Circ.1599/Rev.2.

***

ANNEX

REVISED GUIDELINES ON THE APPLICATION OF HIGH MANGANESE AUSTENITIC STEEL FOR CRYOGENIC SERVICE

Part I
General

1 Scope

These Guidelines on the application of high manganese austenitic steel for cryogenic service provide the designer and manufacturer with practical information on the design and construction of cargo and fuel tanks using high manganese austenitic steel for cryogenic service, to comply with the Design Conditions defined in section 4.18 of the IGC Code and section 6.4.12 of the IGF Code.

2 Application

2.1 These Guidelines are not intended to replace any requirements of the IGC and IGF Codes. They are intended as complementary requirements for the utilization of high manganese austenitic steel in the design and fabrication of cargo and fuel tanks complying with the IGC and IGF Codes subject to the following:

.1 Application is suitable for the following cargoes and/or fuels if authorized by the IGC and IGF Codes:

   .1 Ammonia, anhydrous

   .2 Butane (all isomers);

   .3 Butane-propane mixture;

   .4 Carbon Dioxide (High Purity and reclaimed quality);

   .5 Ethane;

   .6 Ethylene;

   .7 Methane (LNG);

   .8 Pentane (all isomers); and

   .9 Propane.

.2 Application is limited to plates (hot rolled) between 6 mm and 40 mm thick.

.3 The post-weld stress relief heat treatment referenced in 17.12.2.2 of the IGC Code is waived for ammonia cargo and/or fuel tanks containing ammonia.

2.2 The application of high manganese austenitic steel for cargo and fuel tanks is limited by the requirements specified in the following.

3 Definitions

High manganese austenitic steel: Steel with a high amount of manganese in order to retain austenite as its primary phase at atmospheric and service temperature.

Under-matched welds: For welded connections where the weld metal has lower yield or tensile strength than the parent metal.

Part II
Material specifications and testing requirements

4 Material specification

4.1 The material specification should be submitted to the Administration for approval. The test requirements and acceptance criteria for the material are described in detail in the appendix.

4.2 The steel should be fully killed and fine-grained. The condition of supply for all material should be hot rolled with subsequent controlled cooling as necessary. The reduction ratio of slab to finished product thickness should not be less than 3:1. Other conditions of supply should be in accordance with those prescribed by the Administration.

4.3 The use of high manganese austenitic steel is limited to steel plates with a thickness between 6 mm and 40 mm. For thicknesses greater than 40 mm, special consideration may be given by the Administration. Other dimensions may be subject to acceptance by the Administration.

5 Chemical composition

The chemical composition for high manganese austenitic steel should meet the requirements of recognized standards, such as ASTM standard A1106/A1106M-17 as shown in table 1, or ISO 21635:2018.

Table 1: Chemical composition for high manganese austenitic steel
(Ref. ASTM standard A1106/A1106M-17)

	Chemical Composition (wt.%, product)								
	C	Si	Mn	P	S	Cr	Cu	B	N
Requirements	0.35 - 0.55	0.10 - 0.50	22.50 - 25.50	Max. 0.030	Max. 0.010	3.00 - 4.00	0.30 - 0.70	Max. 0.005	Max. 0.050

Note: Silicon (Si) may be less than 0.10%, provided total aluminium is 0.03% or higher, or provided acid soluble aluminium is 0.025% or higher.

6 Mechanical properties

Mechanical properties for the base metal of high manganese austenitic steel should meet the requirements of the IGC and IGF Codes, as relevant, and also recognized standards applied to chemical composition, such as ISO 21635:2018 (refer to table 2 below) or ASTM A1106/A1106M-17. Compliance should also be documented in accordance with material testing requirements and acceptance criteria outlined in the appendix.

.1 Base metal

Table 2: Mechanical properties for base metal of high manganese austenitic steel

(Reference ISO 21635:2018)

Minimum yield strength (0.2% offset) N/mm^2	**Tensile strength** N/mm^2	**Minimum elongation** % at $5.65\sqrt{S_0}$
400	800 to 970	22.0

(Note the impact test requirements as specified in table 6.3 of the IGC Code or table 7.3 of the IGF Code, as relevant)

.2 As welded condition

Table 3: Typical mechanical properties for "As welded condition"

Tensile properties		
Minimum yield strength (0.2% offset) N/mm^2	**Minimum tensile strength** N/mm^2	**Minimum elongation** % at $5.65\sqrt{S_0}$
400	660	22.0

(Note the impact test requirements as specified in table 6.3 of the IGC Code or table 7.3 of the IGF Code, as relevant)

7 Welding of metallic materials and non-destructive testing

Welding of metallic materials and non-destructive testing should be in accordance with chapter 6 of the IGC Code or chapter 16 of the IGF Code. See "Material testing requirements and test acceptance criteria" as set out in the appendix. Typical minimum values of yield and tensile strength for welded conditions are shown in table 3.

8 Material testing and acceptance criteria

The material testing and applied acceptance criteria should be in accordance with chapter 6 of the IGC Code or chapter 16 of the IGF Code and the appendix. Compliance should also be documented in accordance with the material testing requirements and acceptance criteria outlined in the appendix.

9 Manufacturer approval scheme

Approval of the manufacturer should be carried out in accordance with section 6.2.2 of the IGC Code or section 16.1.1 of the IGF Code and to the satisfaction of the Administration.

Part III
Application

10 Design application

10.1 General

10.1.1 The relevant load conditions and design conditions should be established in accordance with section 4.18 of the IGC Code or section 6.4.12 of the IGF Code. Guidance on special considerations for high manganese austenitic steel is described below.

10.1.2 For the selection of relevant safety factors for high manganese austenitic steels (see paragraphs 4.21 to 4.23 of the IGC Code or section 6.4.15 of the IGF Code), the safety factors specified for "Austenitic Steels" should be applied both for the base material and for as welded condition.

10.2 Ultimate design condition
(Reference: section 4.18.1 IGC Code or section 16.3.3 IGF Code)

It should be noted that high manganese austenitic steels normally have under-matched welds and, therefore, it is of great importance that the design values of the yield strength and tensile strength are based on the "minimum mechanical properties" for the base material and as welded condition (see section 6 on Mechanical Properties). Note the limitation for under-matched welds defined in section 4.18.1.3.1.2 of the IGC Code or section 16.3.3.5.1 of the IGF Code.

10.3 Buckling strength

10.3.1 Buckling strength analysis should be carried out based on recognized standards. Functional loads as defined in section 4.3.4 of the IGC Code or section 6.4.1.6 of the IGF Code should be considered. Note that design tolerances should be considered where relevant and be included in the strength assessment as required in section 6.6.2.1 of the IGC Code or section 16.4.2 of the IGF Code.

10.3.2 It should be noted that the acceptance criteria for the flooding load cases are different from other buckling load cases. Furthermore, the acceptance criteria for flooding load cases, as defined in the IGC Code and the IGF Code, are also different, as the IGF Code requires the tank to "keep its integrity after flooding to ensure safe evacuation of the ship" (section 6.4.1.6.3.3 of the IGF Code), while the IGC Code only refers to endangering the integrity of the ship's hull (section 4.3.4.3.3 of the IGC Code).

10.4 Fatigue design condition (Reference: 4.18.2 IGC Code and 6.4.12.2 IGF Code)

The fatigue design curves for base material and for welded conditions have been documented as a comparison with recognized S-N curves, as provided by the D-curve in reference 11.4 (table 4) and FAT 90 provided by reference 11.5 (figure 1). Fatigue tests have been carried out for butt welded joints only. However, for other details, the application of other S-N curves should be to the satisfaction of the Administration. Section 4.18.2.4.2 of the IGC Code and section 6.4.12.2.4 of the IGF Code specify the design S-N curves to be based on a 97.6% probability of survival corresponding to the mean-minus-two-standard-deviation curves of relevant experimental data up to final failure.

S-N curve	$N \le 10^7$ cycles		$N > 10^7$ cycles	Fatigue limit at 10^7 cycles (MPa) *)	Thickness exponent k	Structural stress concentration embedded in the detail (S-N class), see also equation (2.3.2)
	m_1	$\log \bar{a}_1$	$\log \bar{a}_2$ $m_2 = 5.0$			
B1	4.0	15.117	17.146	106.97	0	
B2	4.0	14.885	16.856	93.59	0	
C	3.0	12.592	16.320	73.10	0.05	
C1	3.0	12.449	16.081	65.50	0.10	
C2	3.0	12.301	15.835	58.48	0.15	
D	3.0	12.164	15.606	52.63	0.20	1.00
E	3.0	12.010	15.350	46.78	0.20	1.13
F	3.0	11.855	15.091	41.52	0.25	1.27
F1	3.0	11.699	14.832	36.84	0.25	1.43
F3	3.0	11.546	14.576	32.75	0.25	1.61
G	3.0	11.398	14.330	29.24	0.25	1.80
W1	3.0	11.261	14.101	26.32	0.25	2.00
W2	3.0	11.107	13.845	23.39	0.25	2.25
W3	3.0	10.970	13.617	21.05	0.25	2.50

*) see also [2.11]

Table 4: (S-N curves in air): High manganese austenitic steel has been documented to be equal or better than the D-curve (reference 11.4) for as welded condition without stress concentration from any structural details

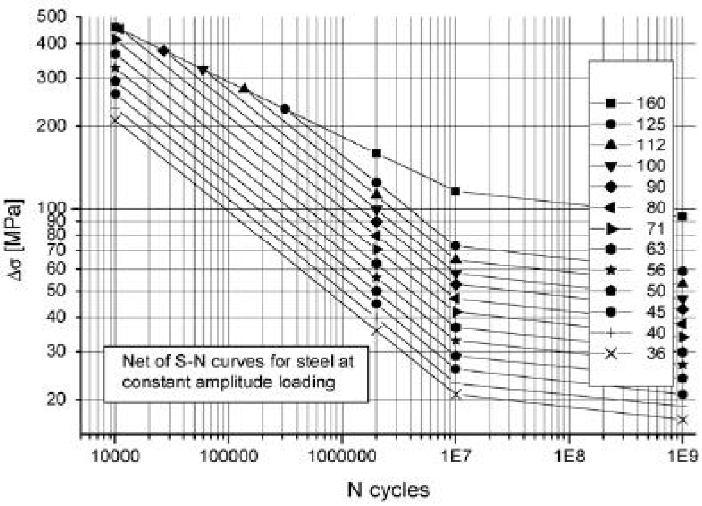


Figure 1: Reference S-N curve to high manganese austenitic steel is the FAT 90 curve (reference 11.5). The FAT 90 curve is as welded condition without stress concentration from any structural details.

10.5 Fracture mechanics analyses

10.5.1 For a cargo tank or fuel tank where a reduced secondary barrier is applied, fracture mechanics analysis should be carried out in accordance with the IGC or IGF Code.

10.5.2 Fracture toughness properties should be expressed using recognized standards. Depending on the material, fracture toughness properties determined for loading rates similar to those expected in the tank system should be required. The fatigue crack propagation rate properties should be documented for the tank material and its welded joints for the relevant service conditions. These properties should be expressed using a recognized fracture mechanics practice relating the fatigue crack propagation rate to the variation in stress intensity, ΔK, at the crack tip. The effect of stresses produced by static loads should be taken into account when establishing the choice of fatigue crack propagation rate parameters.

10.5.3 Note that for the application where very high static load utilization is relevant, alternative methods such as ductile fracture mechanic analyses should be considered.

10.5.4 An example of a typical Crack Tip Opening Displacement (CTOD) value at cryogenic condition can be found in figure 2.

10.5.5 A fracture mechanics analysis is required for type B tanks (section 4.22.4 of the IGC Code and section 6.4.15.2.3.3 of the IGF Code) where a reduced secondary barrier is applied. Fracture mechanics analysis may also be required for other tank types as found relevant to show compliance with fatigue and crack propagation properties. Note that CTOD values used in fracture mechanics analysis may in any case be an important property to analyse to ensure that materials are considered suitable for the application.

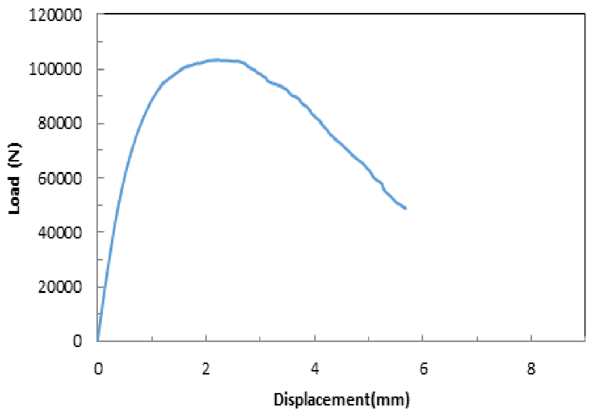
CTOD TEST REPORT										
				REPORT NO.						
Test Method Standard	**ISO 12135/15653 Specimen No.**			FCAW-2		**Test Date**				
Specimen configuration	**Square Cross-Section 3 Point Bend(W=B)**					**Crack plane orientation**		L-T		
Specimen Dimensions			1	2		3		Average		
	Thickness, B (mm)		40	40		40		40		
	Width, W (mm)		80	80		80		80		
	Span, S (mm)		320	**Knife edge thickness, z (mm)**				0		
Test Material	**Young's Modulus of Elasticity, E (MPa)**					182,000				
	YS(0.2% proof), σ_{YSP} (MPa)					474				
	TS, σ_{TSP} (MPa)					780				
	YS(0.2% proof), σ_{YS} (MPa)					655				
	Machined Notch (mm)		**Width, N**	**Length, Lmc**		**Root Radius**				
			4.7	32.4		0.1				
Test Condition	**Temperature (℃)**					-165				
Test Result										
	Crack Length to Tip of Fatigue Pre crack (mm)									
	a_1	**a_2**	**a_3**	**a_4**	**a_5**	**a_6**	**a_7**	**a_8**	**a_9**	**a_0**
	37.62	39.28	39.36	38.95	39.24	38.27	38.55	38.67	37.21	38.72
	a_0/W		0.54		**Plastic Component of V, V_p (mm)**				1.53	
	Critical CTOD (mm)									
	Type of CTOD				**Total CTOD**					
	δm				0.53					

Figure 2: Example of typical values for CTOD test at -165°C

10.6 Welding

10.6.1 Welding should be carried out in accordance with section 6.5 of the IGC Code or section 16.3 of the IGF Code, and to the satisfaction of the Administration.

10.6.2 For welding, the following points should be considered:

.1 for reducing the heat input during production:

.1 special attention should be given to the first root pass when applying flux-cored arc welding (FCAW); reduced amperage should be considered; and

.2 welding heat input of maximum 30 kJ/cm should be used as guidance for 3G position, as that has less heat input for 1G position;

.2 distance between the weld and nozzle should be kept to a minimum to reduce the oxygen content at the vicinity of the weld pool;

.3 weld gas composition of FCAW should normally be an 80/20 mix of argon and carbon dioxide; and

.4 appropriate ventilation should be provided to reduce exposure to hazardous welding fumes.

10.7 Non-destructive testing (NDT)

The scope of non-destructive testing (NDT) should be as required by section 6.5.6 of the IGC Code or section 16.3.6 of the IGF Code. NDT procedures should be in accordance with recognized standards to the satisfaction of the Administration. For high manganese austenitic steel suitable NDT procedures normally applicable for austenitic steels should be used.

10.8 Corrosion resistance

10.8.1 Appropriate measures with respect to corrosion protection and avoidance of a corrosive environment should be taken. Particularly for LNG fuel tanks that may not be in operation, appropriate precautions should be taken at all times to ensure that empty tanks are filled with inert gas or dry air when not in use.

11 References

ASTM A1106 / A1106M-17: Standard Specification for Pressure Vessel Plate, Alloy Steel, Austenitic High Manganese for Cryogenic Application

ISO 21635:2018 Ships and marine technology – Specification of high manganese austenitic steel used for LNG tanks on board ships

Material testing requirements and acceptance criteria (appendix)

DNVGL-RP-C203 Fatigue design of offshore steel structures

IIW 1823-07 Recommendations for fatigue design of welded joints and components

BS 7910:2013 + A1:2015 Guide to methods for assessing the acceptability of flaws in metallic structures

APPENDIX 1

MATERIAL TESTING REQUIREMENTS AND ACCEPTANCE CRITERIA FOR HIGH MANGANESE AUSTENITIC STEEL

1 Test of base material

1.1 Chemical composition Recognized standards, such as ASTM A1106/A1106M-17 or ISO 21635:2018.
Test acceptance criteria In accordance with recognized standards.

1.2 Micrographic examination This test should be carried out in accordance with 6.3.4 of the IGC Code and 16.2.4 of the IGF Code, i.e. recognized standards, such as ASTM E112.
Test acceptance criteria Microstructure to be reported for reference (i.e. grain size/precipitations).

1.3 Tensile test This test should be carried out in accordance with 6.3.1 of the IGC Code and 16.2.1 of the IGF Code. Samples should be taken from three heats of different compositions, both at room and cryogenic temperatures.
Test acceptance criteria The yield, tensile strength and elongation should be in accordance with the recognized standard applied for Chemical composition (2.1) such as ASTM A1106/A1106M-17 or ISO 21635:2018.

1.4 Charpy impact test This test should be carried out in accordance with 6.3.2 of the IGC Code and 16.2.2 of the IGF Code.
Test acceptance criteria In accordance with table 6.3, as for austenitic steels, of the IGC Code and table 7.3 of the IGF Code. *Guidance note 9 of tables 6.3 and 7.3: Impact tests should not be omitted for high manganese austenitic steel owing to lack of experience.*

1.5 Charpy impact test on strain aged specimens Recognized standards, such as ASTM E23.
Test acceptance criteria In accordance with table 6.3, as for austenitic steels, of the IGC Code and 16.2.2 of the IGF Code. *Guidance note 9 of tables 6.3 and 7.3 are not applicable for high manganese steel owing to lack of experience.*

1.6 Drop weight test

Recognized standards should be applied, such as ASTM E208. Tests should be carried out at -196°C.

Test acceptance criteria

No break at test temperature as defined by the applied standard.

1.7 Fatigue test (S-N curve)

The basis for establishing S-N Curves should be in accordance with 4.18.2.4.2 of the IGC Code and 6.4.12.2.4 of the IGF Code.

Test acceptance criteria

S-N curves should be minimum the fatigue strength as established curves for steel as defined in IIW or DNVGL-RP-C203.

1.8 CTOD (crack tip opening displacement) test

Recognized standards, such as ASTM E1820, BS 7448 or ISO 12135, should be used for these purposes.

Test acceptance criteria

CTOD minimum value should be in accordance with design specification for testing at room and cryogenic temperatures as per design conditions. As ~~a~~ guidance a minimum CTOD value of 0.2 mm is often required.

1.9 Corrosion test

These tests should be carried out in accordance with recognized standards.

Test acceptance criteria

In accordance with recognized standard or approved by the Administration.

1.9.1 Intergranular corrosion test

This test should be carried out in accordance with recognized standard, such as ASTM A262.

Test acceptance criteria

In accordance with recognized standard or approved by the Administration.

1.9.2 General corrosion test

This test should be carried out in accordance with recognized standards, such as ASTM G31.

Test acceptance criteria

In accordance with recognized standard or approved by the Administration.

1.9.3 Stress corrosion cracking test

This test should be carried out to the satisfaction of the Administration, in accordance with recognized standards, such as ASTM G36 and ASTM G123.

Test acceptance criteria

In accordance with recognized standard or approved by the Administration.

1.9.4 Corrosion test for ammonia compatibility The additional test should be carried out in accordance with the test requirements set out in appendix 2 to qualify for ammonia service.
Test acceptance criteria In accordance with the acceptance criteria set out in appendix 2.

2 Tests of welded condition (including HAZ)

2.1 Micrographic examination This test should be carried out in accordance with 6.3.4 of the IGC Code and 16.2.4 of the IGF Code, i.e. recognized standards, such as ASTM E112 (or equivalent).
Test acceptance criteria Microstructure should be reported for reference (i.e. grain size/precipitations).

2.2 Hardness test This test should be carried out in accordance with 6.3.4 and 6.5.3.4.5 of the IGC Code and 16.2.4 and 16.3.3.4.5 of the IGF Code, i.e. recognized standards, such as ISO 6507-1.
Test acceptance criteria The hardness value should be reported for reference.

2.3 Cross-weld tensile test This test should be carried out in accordance with 6.5.3.5.1 of the IGC Code and 16.3.3.5.1 of the IGF Code as the relevant requirement for under-matched welds. Recognized standards, such as ASTM E8/E8M, should be applied.
Test acceptance criteria In accordance with 4.18.1.3.1.2 of the IGC Code and 6.4.12.1.1.3 of the IGF Code.

2.4 Charpy impact test This test should be carried out in accordance with 6.3.2 and 6.5.3.4.4 of the IGC Code and 16.2.2 and 16.3.3.4.4 of the IGF Code.
Test acceptance criteria In accordance with 6.5.3.5.3 of the IGC Code and 16.3.3.5.3 of the IGF Code.

2.5 CTOD (crack tip opening displacement) test Recognized standards, such as ASTM E1820, BS 7448 or ISO 15653, should be used for these purposes.
Test acceptance criteria CTOD minimum value should be in accordance with design specification for testing at room and cryogenic temperatures as per design conditions. As a guidance a minimum CTOD value of 0.2 mm is often required.

2.6 Ductile fracture toughness test, JIc

Recognized standards, such as ASTM E1820 or ISO 15653. The ductile fracture toughness test may be omitted at the discretion of the Administration.

Test acceptance criteria

In accordance with recognized standard.

2.7 Bending test

This test should be carried out in accordance with 6.3.3 of the IGC Code and 16.2.3 of the IGF Code.

Test acceptance criteria

No fracture should be acceptable after a 180° bend as required for welded material as per 6.5.3.5.2 of the IGC Code and 16.3.3.5.2 of the IGF Code.

2.8 Fatigue test (S-N curve)

The basis for establishing S-N Curves should be in accordance with 4.18.2.4.2 of the IGC Code and 6.4.12.2.4 of the IGF Code.

Test acceptance criteria

S-N curves should be minimum the fatigue strength as established curves for steel as defined in IIW or DNVGL-RP-C203.

2.9 Corrosion test

These tests should be carried out in accordance with recognized standards.

Test acceptance criteria

In accordance with recognized standard or approved by the Administration.

2.9.1 Intergranular corrosion test

This test should be carried out in accordance with recognized standard, such as ASTM A262.

Test acceptance criteria

In accordance with recognized standard or approved by the Administration.

2.9.2 General corrosion test

This test should be carried out in accordance with recognized standards, such as ASTM G31.

Test acceptance criteria

In accordance with recognized standard or approved by the Administration.

2.9.3 Stress corrosion cracking test

This test should be carried out to the satisfaction of the Administration, in accordance with recognized standard, such as ASTM G36, ASTM G58 and ASTM G123.

Test acceptance criteria

In accordance with recognized standard or approved by Administration.

2.9.4 Corrosion test for ammonia compatibility

The additional test should be carried out in accordance with the test requirements set out in appendix 2 to qualify for ammonia service.

Test acceptance criteria

In accordance with the acceptance criteria set out in appendix 2.

REFERENCES:

ASTM E466-15 *Standard Practice for Conducting Force Controlled Constant Amplitude Axial Fatigue Tests of Metallic Materials*

ASTM E1290-08e1 *Standard Test Method for Crack-Tip Opening Displacement (CTOD) Fracture Toughness Measurement (Withdrawn 2013)*
ASTM G31 *Standard Guide for Laboratory Immersion Corrosion Testing of Metals*.

ASTM B858 *Standard Test Method for Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys*

ISO 12737:1999 *Metallic materials – Determination of plane-strain fracture toughness*[1]

ISO 15653:2018 *Metallic materials – Method of test for the determination of quasistatic fracture toughness of welds*[2]

IIW 1823-07 *Recommendations for fatigue design of welded joints and components*

ISO 12135:2016 *Metallic materials – Unified method of test for the determination of quasistatic fracture toughness*

ISO 15653:2018 Metallic materials – *Method of test for the determination of quasistatic fracture toughness of welds*

1 Replace ASTM E1820-18 Standard Test Method for Measurement of Fracture Toughness, BS 7448 1:1991 – Fracture mechanics toughness tests. Method for determination of KIc, critical CTOD and critical J values of metallic materials.

2 Supersede BS 7448-2 – Fracture Mechanics Toughness Tests: Method for Determination of KIc, Critical CTOD and Critical J Values of Welds in Metallic Materials.

APPENDIX 2

ADDITIONAL COMPATIBILITY TEST REQUIREMENTS FOR AMMONIA SERVICE

The test should be carried out in accordance with a recognized standard such as ASTM B858. This standard is applicable to copper alloys and not specifically to high manganese austenitic steel. Consequently, the following additional non-standard test should be performed:

1 Specimens should be prepared in accordance with standards ISO 7539-2 and ISO 16540. The specimens should be bent, prior to testing, using the four points bending test under constant strain. The total maximum strain of the sample should be equal to the yield strength of the material at atmospheric temperature. Strain gauges should be applied to measure the strain applied. In the case of welded specimens, strain gauges should be applied to each side of the welded joint. The sample should be constrained to maintain its form during testing. The details are described in Specimen preparation.

2 A total of 36 specimens (three welded and three base metal at each ammonia environment) should each be immersed in the following four ammonia environments for a period of 30 days:

.1 liquid phase ammonia environments, obtained by cooling of ammonia at slightly lower temperature than the boiling temperature of ammonia e.g. -33.5°C and at atmospheric pressure with the following liquid ammonia compositions:

.1 0.1% weight of water and 2.5 ppm of oxygen; and

.2 2.5 ppm of oxygen;

.2 gas phase ammonia environments at ambient temperature (+25°C) and atmospheric pressure with the following gas ammonia compositions:

.1 pure ammonia (≥99.99%); and

.2 0.9% volume of oxygen and 99.1%volume of ammonia; and

.3 gas phase ammonia environments at -20°C and atmospheric pressure with the following gas ammonia compositions:

.1 pure ammonia (≥99.99%); and

.2 0.9% volume of oxygen and 99.1% volume of ammonia.

Stress corrosion cracking tests should be performed in agreement with requirements of standards ISO 7539 and ISO 16540.

3 Test report should provide all procedures, set up data, examinations, information about the environment, in agreement with standard ISO 16540 and include:

.1 the orientation, types, and dimensions of specimens;

.2 description of materials:

.1 chemistry and tensile properties of base plate;

.2 chemistry and tensile properties of welding consumables;

.3 type of welding, hardness of the weld metal and heat affected zones;

.3 four points bending test set up data;

.4 target stress and applied deflection;

.5 strain measurement procedures;

.6 loading procedures; and

.7 test environment (temperature, water and oxygen content, and pH).

Test acceptance criteria

After immersion, all specimens should be examined for stress corrosion cracking under an optical microscope with proper magnification. The location and the number of cracks should be specified, and a fluorescent penetration test performed to confirm the results as necessary. For welded joints, the location of cracks should be described as located in the base metal, weldment or HAZ. If no superficial crack is observed, a longitudinal cut should be done at two different locations and a cross-section examination with proper magnification should be performed. The presence of any corrosion pitting and the maximum depth should be reported. The results should be approved by the Administration.

Loading jig

The loading jig made of corrosion resistant alloys with spacing between outer rollers of 85 mm shown in figure 1 is to be used to apply a constant deflection to the specimen. The specimen is electrically isolated from the ceramic rollers in order to avoid undesirable galvanic corrosion.

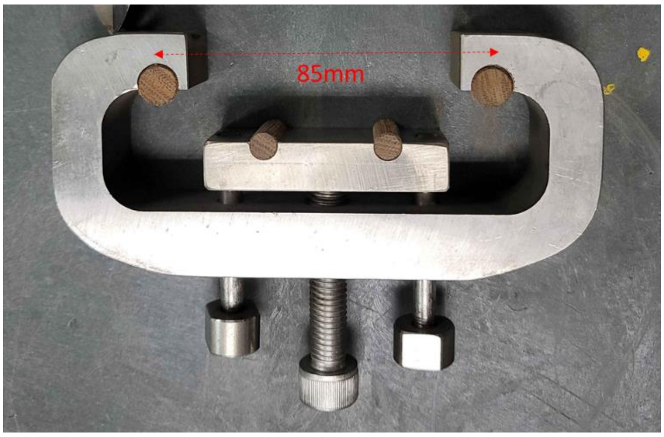


Figure 1: Four-point bend loading jig design

Specimen preparation

The specimens are machined from a 40 mm thick hot rolled plate and are not subjected to post-weld heat treatment. The outer radius of the specimen subject to bending is the original surface of the hot rolled plate. They are bent prior to testing and surface would be exposed to ammonia in a tank is not machined.

Four-point bend specimens are flat strips of uniform rectangular cross section and uniform thickness except in the case of testing welded specimens with one face in the as-welded condition as shown in figure 2. The original surface from a 40 mm hot rolled plate (cap bead in case of welded specimen) is the one to be observed. For weldments, the weld bead to be tested is the weld cap.

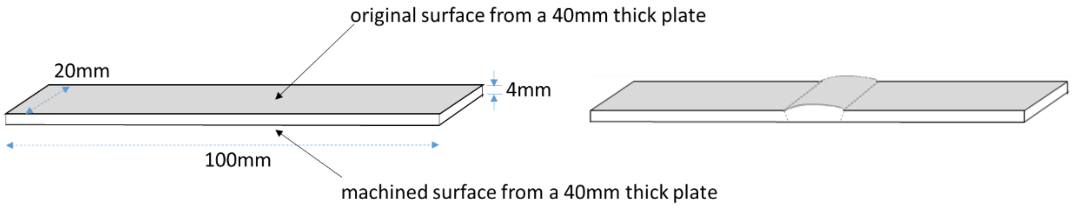


Figure 2: Four-point bend specimens (parent specimen and as-welded specimen)

Strain gauging

Dial gauge will be attached for measurement of deflection at the centre of the face in tension. The loading of the specimen is such that it reaches to the required yield strength level and then the specimen is constrained to maintain its form during testing. The amount of deflection, y, is set as the formula below complying with ISO 16540.

$$Y = \frac{(3H^2 - 4A^2)\sigma}{12Et}$$

where σ is the required stress (yield strength in this case), E is the modulus of elasticity, t is the specimen thickness, A is the distance between the inner and outer supports, and H is the distance between the outer supports. Prior to four-point bending, a uniaxial tensile test of a 40 mm thick plate will be performed to determine the yield strength to be applied for the calculation of the amount of deflection required. For the simplicity of the welded specimen testing, the same amount of the deflection as for the parent plate is to be set out.

INTERNATIONAL MARITIME ORGANIZATION

E

4 ALBERT EMBANKMENT
LONDON SE1 7SR
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

MSC.1/Circ.1622/Rev.1
1 July 2024

REVISED GUIDELINES FOR THE ACCEPTANCE OF ALTERNATIVE METALLIC MATERIALS FOR CRYOGENIC SERVICE IN SHIPS CARRYING LIQUEFIED GASES IN BULK AND SHIPS USING GASES OR OTHER LOW-FLASHPOINT FUELS

1 The Maritime Safety Committee, at its 102nd session (4 to 11 November 2020), acknowledging a potential need for alternative metallic materials to be used for the construction and safe operation of low-temperature fuel and cargo-carrying ships and the need for guidance in this respect, approved the *Guidelines for the acceptance of alternative metallic materials for cryogenic service in ships carrying liquefied gases in bulk and ships using gases or other low-flashpoint fuels* (MSC.1/Circ.1622), prepared by the Sub-Committee on Carriage of Cargoes and Containers (CCC), at its sixth session (9 to 13 September 2019).

2 The Maritime Safety Committee, at its 105th session (20 to 29 April 2022), approved amendments to the Guidelines (MSC.1/Circ.1648), prepared by the Sub-Committee on Carriage of Cargoes and Containers (CCC), at its seventh session (6 to 10 September 2021).

3 The Maritime Safety Committee, at its 108th session (15 to 24 May 2024), having qualified high manganese austenitic steel for ammonia service, and in order to revise additional compatibility test requirements for ammonia service, approved the Revised Guidelines for the acceptance of alternative metallic materials for cryogenic service in ships carrying liquefied gases in bulk and ships using gases or other low-flashpoint fuels, as set out in the annex, prepared by the Sub-Committee on Carriage of Cargoes and Containers (CCC), at its ninth session (20 to 29 September 2023).

4 The Revised Guidelines incorporate the amendments in MSC.1/Circ.1648 and provide detailed guidance on how to document alternative metallic materials for their suitability and compliance with the IGC and IGF Codes, and a framework for evaluation and approval of alternative metallic materials for cryogenic service.

5 Member States are invited to bring the annexed Revised Guidelines to the attention of all parties concerned.

6 This circular supersedes MSC.1/Circ.1622 and revokes MSC.1/Circ.1648.

***

ANNEX

REVISED GUIDELINES FOR THE ACCEPTANCE OF ALTERNATIVE METALLIC MATERIALS FOR CRYOGENIC SERVICE IN SHIPS CARRYING LIQUEFIED GASES IN BULK AND SHIPS USING GASES OR OTHER LOW-FLASHPOINT FUELS

PART 1
GENERAL

1 Introduction

1.1 Ships carrying liquefied gases in bulk should comply with the requirements of the IGC Code adopted by resolution MSC.370(93), as amended. Ships using gases or other low-flashpoint fuels should comply with the requirements of the IGF Code, adopted by resolution MSC.391(95), as amended.

1.2 The requirements for metallic materials used in low temperature applications on board ships constructed in accordance with the IGC and IGF Codes are contained in tables 6.2, 6.3 and 6.4 of the IGC Code and tables 7.2, 7.3 and 7.4 of the IGF Code, respectively. The requirements are identical in both Codes and specify the minimum design temperatures for specific materials based upon chemical composition, mechanical properties and heat treatment. These approved materials have been incorporated in the Codes since their inception and have provided over 40 years of satisfactory service experience.

1.3 There is recent interest in adding new metallic materials to the list of those already covered by the Codes. *Interim guidelines on the application of high manganese austenitic steel for cryogenic service* were adopted and disseminated as MSC.1/Circ.1599. In the process of developing the Interim guidelines, significant experience in the evaluation of this alternative material was acquired. The recommendations contained in MSC.1/Circ.1599 are used as the basis for these Guidelines.

2 Application

2.1 These Guidelines apply to metallic materials not listed in tables 6.2, 6.3 and 6.4 of the IGC Code and tables 7.2, 7.3 and 7.4 of the IGF Code respectively. The testing requirements set out herein provide guidance for the acceptance of alternative metallic materials based upon the equivalency provisions contained in section 1.3 of the IGC Code or alternative design requirements contained in section 2.3 of the IGF Code. The Guidelines apply only to materials used for products listed in chapter 19 of the IGC Code or MSC circulars approved by the Organization, or fuels addressed by the IGF Code.

2.2 The Guidelines also apply to alternative metallic materials having a minimum design temperature between 0ºC and -165ºC or lower if authorized by the Administration in the range of minimum and maximum thicknesses tested during the approval process, up to a maximum thickness of 40 mm. Thicknesses in excess of 40 mm should be approved by the Administration or recognized organization acting on its behalf. In addition to approval for a minimum design temperature of -165ºC, alternative metallic materials may be approved for intermediate minimum design temperatures of -55ºC, -60ºC, -65ºC, -90ºC and -105ºC. Alternative metallic materials qualified at a lower temperature are suitable for use at the intermediate minimum design temperature.

2.3 The Guidelines only apply to alternative metallic materials formed or manufactured by rolling, extrusion, casting or forging.

2.4 Alternative metallic materials approved in accordance with the Guidelines may be used in the construction of cargo containment and piping system under chapter 4 of the IGC Code or similar parts of fuel tanks, under chapter 6 of the IGF Code or piping systems under section 5.12 of the IGC Code and section 7.4.1.2 of the IGF Code. They should be approved for specific cargoes or fuels listed in the IGC or IGF Codes based upon their design temperature and their compatibility with the cargo or fuel. This Guideline does not address material forming part of the hull structure.

3 Definitions

3.1 *Alternative metallic materials*: Homogeneous ferrous and non-ferrous alloys having uniform composition in any direction formed by hot rolling, cold rolling, extrusion, casting or forging, whose compositions or heat treatments are not listed in tables 6.2, 6.3 and 6.4 of the IGC Code and tables 7.2, 7.3 and 7.4 of the IGF Code, respectively.

3.2 *Established metallic materials*: Metallic materials listed in tables 6.2, 6.3 and 6.4 of the IGC Code and tables 7.2, 7.3 and 7.4 of the IGF Code, respectively, or by an IMO MSC circular.

3.3 *Equivalent alternative metallic materials*: Alternative metallic materials having chemical and mechanical properties that are equivalent or superior to those listed in tables 6.2, 6.3 and 6.4 of the IGC Code and tables 7.2, 7.3 and 7.4 of the IGF Code, respectively, that have been approved under these Guidelines.

3.4 *Other alternative metallic materials*: Alternative metallic materials having mechanical properties that do not meet those listed in tables 6.2, 6.3 and 6.4 of the IGC Code and tables 7.2, 7.3 and 7.4 of the IGF Code, respectively.

3.5 *Recognized standards*: Applicable international or national standards acceptable to the Administration, or standards laid down and maintained by the recognized organization.

3.6 *Administration*: Government of the State whose flag the ship is entitled to fly.

PART II
MATERIAL SPECIFICATIONS AND TESTING REQUIREMENTS

4 Material specification

4.1 All alternative metallic materials should have a recognized standard for cryogenic service for consideration under these Guidelines. The standard should cover specific forms of the material being approved, including plates, sections, castings, forgings or pipes, and should specify heat treatment and grain structure. The standard should meet the scope and general requirements of section 6.2 of the IGC Code. Micro-alloying elements not identified in the recognized standards may be considered subject to approval by the Administration.

4.2 Alternative metallic material, including plates, castings and forgings, should be joined using an approved method specified by a recognized standard. When applied, conventional welding procedures qualified in accordance with a recognized standard and complying with procedures contained in chapter 6.5 of the IGC Code and part B-1, section 16.3 of the IGF Code should be specified for the welding of alternative metallic materials. The welding procedures should specify heat input and pre- and post-weld heat treatment.

4.3 Welding procedures and non-destructive testing (NDT) should be specified for all alternative metallic materials. These procedures should conform to a recognized standard and comply with testing requirements specified in chapter 6.5 of the IGC Code and part B-1, section 16.3 of the IGF Code.

5 Testing

5.1 Test requirements are provided in the appendix to the Guidelines and are based upon section 6.3 of the IGC Code and part B-1, section 16.2 of the IGF Code.

5.2 Depending on the design temperature, Charpy V-notch tests should be conducted in accordance with the footnotes in the applicable tables given in chapter 6 of the IGC Code and section 7 of the IGF Code.

5.3 Subject to the approval of the Administration, consideration can be given to alternative test methods that provide an equivalent level of safety. Test requirements should not be waived unless there is a valid technical justification, or the material properties can be confirmed by another test method. Test requirements may be waived if not required for specific tank types within chapter 4 of the IGC Code, section 6 of the IGF Code or if not required for similar established metallic materials.

5.4 The testing of alternative metallic material should be conducted on at least one of the following forms: plates, castings, forgings or pipes. The testing of any form should meet the sampling and specimen position requirements of section 6.4 of the IGC Code and section 7.4 of the IGF Code. Initial testing should be conducted on the form reflecting the application of an alternative metallic material. Approval is limited to forms for which test results are provided; however, all forms do not have to be considered for approval of the alternative metallic material. If a waiver of requirements for post-weld heat treatment is sought, additional welded samples with the required post-weld heat treatment should be provided for comparison purposes.

5.5 Corrosion sensitization can occur in stainless and other austenitic steels. In such cases, the Administration may require additional corrosion testing such as an Intergranular Corrosion Test such as ASTM A262 and a Stress Corrosion Cracking Test such as ASTM G36 or ASTM G123.

6 Acceptance criteria

6.1 Test acceptance criteria are provided in the appendix to this Guideline and are based upon section 6.3 of the IGC Code and part B-1, section 16.2 of the IGF Code.

6.2 The application of an alternative metallic material in a specific design should be based upon the adequacy of the material for the design loads and the suitability of the material properties for their intended use in accordance with the design conditions specified in section 4.18 of the IGC Code and section 6.4.12 of the IGF Code.

6.3 Approval of alternative metallic materials should be for each form of the material for which there are satisfactory test results.

7 Novel design and equivalent arrangements

Alternative metallic materials may be used in the design of novel containment systems under section 4.27 of the IGC Code and section 6.4.16 of the IGF Code. Section 2.1 in appendix 5 of the IGC Code and part A-1 annex, section 2.1 of the IGF Code require the use of established metallic materials. The use of other alternative metallic materials should not be considered in a design.

PART III
APPLICATION

8 Approval procedures

8.1 Upon satisfactory completion of testing of the appropriate forms and acceptance of the results, an alternative metallic material is considered to be an accepted equivalent alternative metallic material for the purpose of the Guidelines.

8.2 The approval should specify any limitations that have been identified in the inherent properties of the approved alternative metallic material that may need to be considered in its use. These properties may include, but are not limited to:

.1 under-matching/over-matching of welds;

.2 pre- and post-weld heat treatment;

.3 corrosion;

.4 specific NDT requirements or limitations; and

.5 toxicity of welding fumes.

8.3 Tables 6.2, 6.3 and 6.4 of the IGC Code and tables 7.2, 7.3 and 7.4 of the IGF Code may be modified to incorporate new alternative metallic materials subject to the following:

.1 material should be qualified using these Guidelines;

.2 material compatibility for all intended cargoes should be demonstrated;

.3 relevant fabrication experience on any tank type on a ship should be documented;

.4 material should have minimum of five years of service experience on board a ship or equivalent to one special survey cycle;

.5 service experience should be on a ship in service, relevant to the material's future use; and

.6 if simulation is used, credit may be given to a reduced service period upon completion of the first intermediate survey. The scope of this survey should be in accordance with the requirements of the first special survey, including NDT, of the tank.

9 Application

The Administration should assign approved safety factors based upon those for nickel steels, carbon manganese steels, austenitic steels or aluminium alloys in the IGC and IGF Codes.

10 References

MSC.1/Circ.1599/Rev.3 *Interim guidelines on the application of high manganese austenitic steel for cryogenic service.*

APPENDIX 1

MATERIAL TESTING REQUIREMENTS AND ACCEPTANCE CRITERIA

1 Test of base material

1.1 **Material specifications**: Chemical composition and mechanical properties meeting a recognized standard for the alternative metallic material intended for cryogenic service.

Acceptance criteria: in accordance with the recognized standard.

1.2 **Micrographic examination**: The test should be carried out in accordance with section 6.3.4 of the IGC Code using recognized standards such as ASTM E112.

Acceptance criteria: Microstructure including grain size. The absence of precipitations, segregation and cracking should be reported. Acceptance should be to the satisfaction of the Administration.

1.3 **Tensile test**: The test should be carried out in accordance with section 6.3.1 of the IGC Code. Samples should be taken from three heats of different compositions, both at room and cryogenic temperatures equal to the minimum design temperature of the alternative metallic material. The number of samples should be sufficient to provide statistically valid results.

Acceptance criteria: The yield strength, tensile strength and elongation should be in accordance with the recognized standard for the chemical composition given in 1.1 of this appendix.

1.4 **Charpy impact test**: The test should be carried out in accordance with section 6.3.2 of the IGC Code. Samples should be taken from three heats of different compositions, both at room and cryogenic temperatures equal to the required test temperature. Impact tests should not be omitted for austenitic steels due to lack of experience. Test temperatures should be as follows:

Material thickness (mm)	**Test temperature (ºC)**
t < 25	5ºC below design temperature (ferritic steel only)
25 < t ≤ 30	10ºC below design temperature
30 < t ≤ 35	15ºC below design temperature
35 < t ≤ 40	20ºC below design temperature

Acceptance criteria: unless higher values are required by the material specification
.

Material	**Test piece**	**Minimum average energy (KV)**
Ferrous alloy plates	Transverse	27 J
Ferrous alloy sections and forgings	Longitudinal	41 J
Non-Ferrous alloy		Not required, subject to the approval of the Administration

1.5 **Charpy impact test on strain aged specimens**: The test should be carried out in accordance with a recognized standard such as ASTM E23. Strain ageing consists of 5% deformation for one hour at 250ºC in accordance with IACS UR W11. Samples should be taken from three heats of different compositions, both at room and cryogenic temperatures equal to the minimum test temperature. Impact tests should not be omitted for austenitic steels because of lack of experience. Test temperatures should be as follows:

Material thickness (mm)	**Test temperature (ºC)**
t < 25	5ºC below design temperature (ferritic steel only)
25 < t ≤ 30	10ºC below design temperature
30 < t ≤ 35	15ºC below design temperature
35 < t ≤ 40	20ºC below design temperature

Acceptance criteria: unless higher values are required by the material specification.

Material	**Test piece**	**Minimum average energy (KV)**
Ferrous alloy plates	Transverse	27 J
Ferrous alloy sections and forgings	Longitudinal	41 J
Non-Ferrous alloy	-	Not required, subject to the approval of the Administration

1.6 **Drop weight test**: Applicable only for ferritic steels including ferritic-austenitic (duplex) grade. The aim of the test is to establish the nil ductility transition temperature (NDTT). Samples should be taken from three heats of different compositions, both at room and cryogenic temperatures equal to the minimum test temperature. The test should be carried out in accordance with a recognized standard such as ASTM E208 for ferritic steels.

Acceptance criteria: No break at 10ºC below the design temperature.

1.7 **Fatigue test**: The basis for documenting adequate fatigue performance (S-N curves) should be in accordance with paragraph 4.18.2.4.2 of the IGC Code. The extent of fatigue testing is based on comparison with recognized S-N curves for metallic materials (such as IIW or DNVGL-RP-C203 or BS 7608).

The fatigue tests should be based on a minimum of five test samples at each stress level. For a "one slope S-N curve" a minimum of three stress levels should be tested. Additional stress levels are to be tested for "two slope S-N curves". As guidance, stress levels should be selected to achieve in the range of 10^5 to 10^8 cycles.

Acceptance criteria: The fatigue test results should be at least equal to or better than the reference S-N curve.

1.8 **CTOD (Crack Tip Opening Displacement) test**: The test should be carried out in accordance with a recognized standard such as ASTM E1820, BS 7448 or ISO 12135.

Acceptance criteria: CTOD minimum value should be in accordance with the design specification for testing at room and cryogenic temperatures equal to the minimum design temperature of the material. A minimum of three successful tests should be performed at room and cryogenic temperatures. As guidance a minimum CTOD value of 0.2 mm is often required.

1.9 **Corrosion test:** The type of corrosion tests to be applied will depend on the material, type of weld and the specific cargoes or fuels listed in the IGC or IGF Codes. The tests should include tests for general corrosion, intergranular corrosion and stress corrosion. The tests should be carried out in accordance with ASTM A262, ASTM G31, ASTM G36, ASTM G58, ASTM G123 or other relevant recognized standards. In the absence of a relevant recognized standard for the specific cargo or fuel, the test procedures should align with the general principles of corrosion tests that follow the recognized standards listed herein.

Acceptance criteria: In accordance with the relevant recognized standard approved by the Administration for the material's intended service. In the absence of a relevant recognized standard for the specific cargoes or fuels, the results should align with other recognized standards, and projected corrosion rates and test outcomes should be subject to the satisfaction of the Administration.

1.10 **Corrosion test for ammonia compatibility**: The additional test should be carried out in accordance with the test requirements set out in appendix 2 to qualify for ammonia service.

Acceptance criteria: should be in accordance with the acceptance criteria set out in appendix 2.

2 Test of welded condition (including HAZ)

2.1 **Micrographic examination**: The test should be carried out in accordance with section 6.3.4 of the IGC Code using recognized standards such as ASTM E112.

Acceptance criteria: Microstructure including grain size, absence of precipitations, segregation, and cracking should be reported. Acceptance should be to the satisfaction of the Administration.

2.2 **Hardness test**: The test should be carried out in accordance with section 6.3.4 and paragraph 6.5.3.4.5 of the IGC Code in accordance with recognized standards such as ISO 6507-1.

Acceptance criteria: The hardness value should be to the satisfaction of the Administration.

2.3 **Cross-weld tensile test**: This test should be carried out in accordance with paragraph 6.5.3.4.1 of the IGC Code. Recognized standards such as ASTM E8/E8M may be applied.

Acceptance criteria: In accordance with paragraph 6.5.3.5.1 of the IGC Code. The presence of under-matched welds should be considered for the intended application in accordance with paragraph 4.18.1.3.1.2 of the IGC Code.

2.4 **Charpy impact test**: This test should be carried out in accordance with section 6.3.2 and paragraph 6.5.3.4.4 of the IGC Code.

Acceptance criteria: In accordance with paragraph 6.5.3.5.3 of the IGC Code.

2.5 **CTOD (Crack Tip Opening Displacement) test**: The test should be carried out in accordance with a recognized standard such as ASTM E1820 or ISO 15653. The notch introduced in the test should be positioned in the microstructure with the lowest fracture toughness.

Acceptance criteria: CTOD minimum value should be in accordance with the design specification for testing at room and cryogenic temperatures equal to the minimum design temperature of the material. A minimum of three successful tests should be performed at room and cryogenic temperatures. As guidance a minimum CTOD value of 0.2 mm is often required.

2.6 **Ductile fracture toughness test (J_{Ic})**: The test should be carried out in accordance with a recognized standard such as ASTM E1820, ASTM E2818, ISO 15653 or ISO 12135. The notch introduced in the test should be positioned in the microstructure with the lowest fracture toughness. The ductile fracture toughness test may be carried out as an alternative to the CTOD test in 2.5 at the discretion of the Administration.

Acceptance criteria: In accordance with the recognized standard. A minimum of three successful tests should be performed at room and cryogenic temperatures.

2.7 **Bending test**: The test should be carried out in accordance with section 6.3.3 of the IGC Code.

Acceptance criteria: No fracture should be acceptable after a 180^{o} bend as required for welded material in accordance with paragraph 6.5.3.4.3 and 6.5.3.5.2 of the IGC Code.

2.8 **Fatigue test**: The basis for documenting adequate fatigue performance (S-N curves) should be in accordance with paragraph 4.18.2.4.2 of the IGC Code. The extent of fatigue testing is based on comparison with recognized S-N curves for metallic materials (such as IIW or DNVGL-RP-C203). The fatigue tests should be based on a minimum of five test samples at each stress level. For a "one slope S-N curve" a minimum of three stress levels should be tested. Additional stress levels to be tested for "two slope S-N curves". As guidance, stress levels should be selected to achieve in the range of 10^5 to 10^8 cycles.

Acceptance criteria: The fatigue test results should be at least equal to, or better than, the reference SN curve.

2.9 **Corrosion test**: The type of corrosion tests to be applied will depend on the material, type of weld and the specific cargoes or fuels listed in the IGC or IGF Codes. The tests should include tests for general corrosion, intergranular corrosion and stress corrosion. The tests should be carried out in accordance with ASTM A262, ASTM G31, ASTM G36, ASTM G58, ASTM G123 or other relevant recognized standards. In the absence of a relevant recognized standard for the specific cargo or fuel, the test procedures should align with the general principles of corrosion tests that follow the recognized standards listed herein.

Acceptance criteria: In accordance with the relevant recognized standard approved by the Administration for the material's intended service. In the absence of a relevant recognized standard for the specific cargoes or fuels, the results should align with other recognized standards, and projected corrosion rates and test outcomes should be subject to the satisfaction of the Administration.

2.10 **Corrosion test for ammonia compatibility**: The additional test should be carried out in accordance with the test requirements set out in appendix 2 to qualify for ammonia service.

Acceptance criteria: should be in accordance with the acceptance criteria set out in appendix 2.

APPENDIX 2

ADDITIONAL COMPATIBILITY TEST PROCEDURES FOR AMMONIA SERVICE

The test should be carried out in accordance with a recognized standard such as ASTM B858. This standard is applicable to copper alloys and not specifically to high manganese austenitic steel. Consequently, the following additional non-standard test should be performed:

1 Specimens should be prepared in accordance with standards ISO 7539-2 and ISO 16540. The specimens should be bent, prior to testing, using the four points bending test under constant strain. The total maximum strain of the sample should be equal to the yield strength of the material at atmospheric temperature. Strain gauges should be applied to measure the strain applied. In the case of welded specimens, strain gauges should be applied to each side of the welded joint. The sample should be constrained to maintain its form during testing. The details are described in specimen preparation.

2 A total of 36 specimens (three welded and three base metal at each ammonia environment) should each be immersed in the following four ammonia environments for a period of 30 days:

.1 liquid phase ammonia environments, obtained by cooling of ammonia at slightly lower temperature than the boiling temperature of ammonia e.g. -33.5^{o}C and at atmospheric pressure with the following liquid ammonia compositions:

.1 0.1% weight of water and 2.5 ppm of oxygen; and

.2 2.5 ppm of oxygen;

.2 gas phase ammonia environments at ambient temperature ($+25^{o}$C) and atmospheric pressure with the following gas ammonia compositions:

.1 pure ammonia (³99.99%); and

.2 0.9% volume of oxygen and 99.1%volume of ammonia;

.3 gas phase ammonia environments at -20^{0}C and atmospheric pressure with the following gas ammonia compositions:

.1 pure ammonia (³99.99%); and

.2 0.9% volume of oxygen and 99.1%volume of ammonia.

Stress corrosion cracking tests should be performed in agreement with requirements of standards ISO 7539 and ISO 16540.

3 Test report should provide all procedures, set up data, examinations, information about the environment, in agreement with standard ISO 16540 and include:

.1 the orientation, types, and dimensions of specimens;

.2 description of materials:

.1 chemistry and tensile properties of base plate;

.2 chemistry and tensile properties of welding consumables;

.3 type of welding, hardness of the weld metal and heat affected zones;

.4 four-point bending test set up data;

.5 target stress and applied deflection;

.6 strain measurement procedures;

.7 loading procedures; and

.8 test environment (temperature, water and oxygen content, and pH).

Test acceptance criteria

After immersion, all specimens should be examined for stress corrosion cracking under an optical microscope with proper magnification. The location and the number of cracks should be specified, and a fluorescent penetration test performed to confirm the results as necessary. For welded joints, the location of cracks should be described as located in the base metal, weldment or HAZ. If no superficial crack is observed, a longitudinal cut should be done at two different locations and a cross section examination with proper magnification should be performed. The presence of any corrosion pitting and the maximum depth should be reported. The results should be approved by the Administration.

Loading jig

The loading jig made of corrosion resistant alloys with spacing between outer rollers of 85 mm shown in figure 1 is to be used to apply a constant deflection to the specimen. The specimen is electrically isolated from the ceramic rollers in order to avoid undesirable galvanic corrosion.

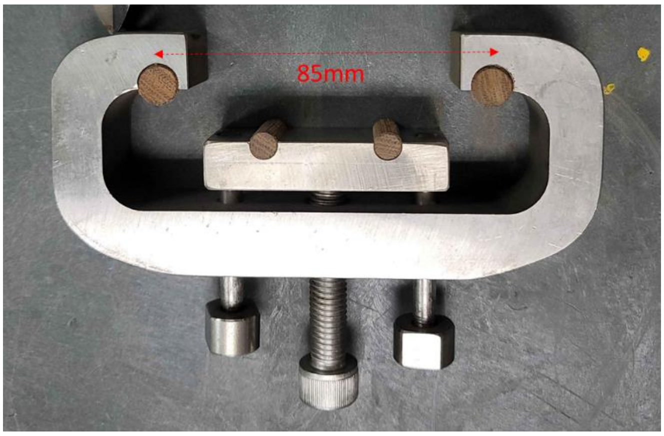


Figure 1: Four-point bend loading jig design

Specimen preparation

The specimens are machined from a 40 mm thick hot rolled plate and are not subjected to post-weld heat treatment. The outer radius of the specimen subject to bending is the original surface of the hot rolled plate. They are bent prior to testing and, surface would be exposed to ammonia in a tank, is not machined.

Four-point bend specimens are flat strips of uniform rectangular cross section and uniform thickness except in the case of testing welded specimens with one face in the as-welded condition as shown in figure 2. The original surface from a 40 mm hot rolled plate (cap bead in case of welded specimen) is the one to be observed. For weldments, the weld bead to be tested is the weld cap.

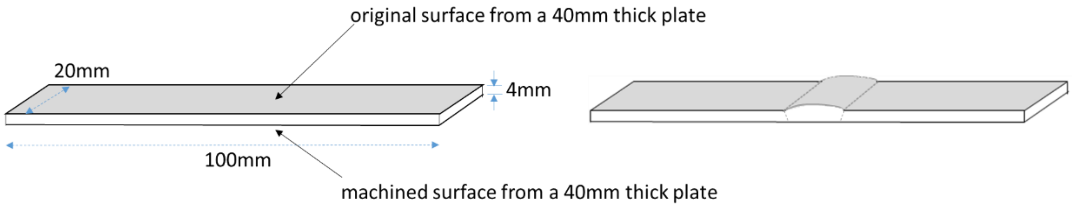


Figure 2: Four-point bend specimens (parent specimen and as-welded specimen)

Strain gauging

Dial gauge will be attached for measurement of deflection at the centre of the face in tension. The loading of the specimen is such that it reaches to the required yield strength level and then the specimen is constrained to maintain its form during testing. The amount of deflection, y, is set as the formula below complying with ISO 16540.

$$\mathrm{Y} = \frac{(3H^2 - 4A^2)\sigma}{12Et}$$

where σ is the required stress (yield strength in this case), E is the modulus of elasticity, t is the specimen thickness, A is the distance between the inner and outer supports, and H is the distance between the outer supports. Prior to four-point bending, uniaxial tensile test of a 40 mm thick plate will be performed to determine the yield strength to be applied for the calculation of the amount of deflection required. For the simplicity of the welded specimen testing, the same amount of the deflection as for the parent plate is to be set out.

____

INTERNATIONAL MARITIME ORGANIZATION

E

4 ALBERT EMBANKMENT
LONDON SE1 7SR
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

MSC-MEPC.2/Circ.18
11 July 2024

GUIDELINES FOR THE SAMPLING OF FUEL OIL FOR DETERMINATION OF COMPLIANCE WITH MARPOL ANNEX VI AND SOLAS CHAPTER II-2

1 The Marine Environment Protection Committee, at its eighty-first session (18 to 22 March 2024), and the Maritime Safety Committee, at its 108th session (15 to 24 May 2024), recognizing the need to establish an agreed method to obtain a representative sample of the fuel oil for combustion purposes delivered to and intended for use on board a ship, approved the *Guidelines for the sampling of fuel oil for determination of compliance with MARPOL Annex VI and SOLAS chapter II-2*, as set out in the annex*.

2 Member Governments and international organizations are invited to bring the annexed Guidelines to the attention of Administrations, recognized organizations, port authorities, shipowners, ship operators and other parties concerned.

***

* MEPC 81 agreed to revoke resolution MEPC.182(59) on *2009 Guidelines for the sampling of fuel oil for determination of compliance with the revised MARPOL Annex VI* when this joint MSC-MEPC circular is issued.

ANNEX

GUIDELINES FOR THE SAMPLING OF FUEL OIL FOR DETERMINATION OF COMPLIANCE WITH MARPOL ANNEX VI AND SOLAS CHAPTER II-2

1 Preface

The primary objective of these Guidelines is to establish an agreed method to obtain a representative sample of the fuel oil delivered to, and intended for use on board, a ship. That representative sample is the MARPOL delivered sample, as defined in regulation 2.1.22 of MARPOL Annex VI. Samples should be drawn in a safe manner under all circumstances.

2 Introduction

2.1 The basis for these Guidelines is regulation 18.5.1 of MARPOL Annex VI, which provides that for each ship subject to regulations 5 and 6 of that Annex, details of fuel oil delivered to, and used on board, that ship, shall be recorded by means of a bunker delivery note that shall contain at least the information specified in appendix V of that Annex. In accordance with regulation 18.8.1 of MARPOL Annex VI, that bunker delivery note shall be accompanied by a representative sample of the fuel oil delivered ("MARPOL-delivered sample" as defined by regulation 2.1.22 of that Annex).

2.2 In addition, these Guidelines are intended to assist in the implementation of the flashpoint-related provisions in SOLAS regulation II-2/4, especially for confirming cases where oil fuel not complying with SOLAS regulation II-2/4.2.1 was delivered.

2.3 This sample is to be used solely for determination of compliance with MARPOL Annex VI and/or SOLAS chapter II-2.

3 Definitions

For the purpose of these Guidelines:

3.1 *Supplier's representative* is the individual from the bunker tanker who is responsible for the delivery and documentation or, in the case of deliveries direct from the shore to the ship, the person who is responsible for the delivery and documentation.

3.2 *Ship's representative* is the ship's master or officer in charge who is responsible for receiving bunkers and documentation.

3.3 *Representative sample* is a product specimen having its physical and chemical characteristics identical to the average characteristics of the total volume being sampled.

3.4 *Primary sample* is the representative sample of the fuel delivered to the ship collected throughout the bunkering period obtained by the sampling equipment positioned at the bunker manifold of the receiving ship.

3.5 *Retained sample* is the representative sample in accordance with regulation 18.8.1 of MARPOL Annex VI, of the fuel oil delivered to the ship derived from the primary sample. The retained sample is intended to be used solely as the MARPOL-delivered sample as defined in regulation 2.1.22 of MARPOL Annex VI and the representative sample as defined in SOLAS regulation II-2/3.60, for determination of compliance with SOLAS chapter II-2.

3.6 For the purpose of these Guidelines, *fuel oil* is as defined in regulation 2.1.14 of MARPOL Annex VI, including oil fuel as defined in regulation 1 of MARPOL Annex I for the application of SOLAS regulation II-2/4.2.1.

4 Sampling methods

4.1 The primary sample should be obtained by one of the following methods:

.1 manual valve-setting continuous-drip sampler; or

.2 time-proportional automatic sampler; or

.3 flow-proportional automatic sampler.

4.2 Sampling equipment should be used in accordance with manufacturer's instructions, or guidelines, as appropriate.

4.3 The personnel taking the primary sample and preparing the retained sample should be familiar with the contents of these Guidelines and the use of the sampling equipment.

4.4 The primary sample should be drawn at the bunker manifold of the receiving ship witnessed by a ship's representative and supplier's representative.

5 Sampling and sample integrity

5.1 A means should be provided to seal the sampling equipment throughout the period of supply.

5.2 Attention should be given to:

.1 the form of set up of the sampler;

.2 the form of the primary sample container;

.3 the cleanliness and dryness of the sampler and the primary sample container prior to use; there should be no traces of low-flashpoint solvents used to clean the equipment as this can contaminate the sample;

.4 the setting of the means used to control the flow to the primary sample container; and

.5 the method to be used to secure the sample from tampering or contamination during the bunker operation.

5.3 The primary sample receiving container should be attached to the sampling equipment and sealed so as to prevent tampering or contamination of the sample throughout the bunker delivery period.

6 Sampling location

6.1 For the purpose of these Guidelines, a sample of the fuel oil delivered to the ship should be obtained at the receiving ship's inlet bunker manifold and should be drawn continuously throughout the bunker delivery period.*

7 Retained sample handling

7.1 The retained sample container should be clean and dry.

7.2 Immediately prior to filling the retained sample container, the primary sample quantity should be thoroughly agitated to ensure that it is homogeneous.

7.3 The retained sample should be of sufficient quantity to perform the tests required but should not be less than 600 ml. The container should be filled to 90% ± 5% capacity and sealed.

8 Sealing of the retained sample

8.1 Immediately following collection of the retained sample, a tamper-proof security seal, with a unique means of identification, should be installed by the supplier's representative in the presence of the ship's representative. A label containing the following information should be secured to the retained sample container:

.1 location at which, and the method by which, the sample was drawn;

.2 date of commencement of delivery;

.3 name of bunker tanker/bunker installation;

.4 name and IMO number of the receiving ship;

.5 signatures and names of the supplier's representative and the ship's representative;

.6 details of seal identification; and

.7 product name as per appendix V of MARPOL Annex VI.

8.2 To facilitate cross reference details of the seal, identification should also be recorded on the bunker delivery note.

* The phrase "be drawn continuously throughout the bunker delivery period" in paragraph 6 of the Guidelines should be taken to mean continuous collection of drip sample throughout the delivery of fuel oil covered by each bunker delivery note. In case of receiving an amount of fuel oil necessitating two or more delivery notes, the sampling work may be temporarily stopped to change primary sample container and then resumed, as necessary.

9 Retained sample storage

9.1 The retained sample should be kept in a safe storage location, outside the ship's accommodation, where personnel would not be exposed to vapours which may be released from the sample. Care should be exercised when entering a sample storage location.

9.2 The retained sample should be stored in a sheltered location where it will not be subject to elevated temperatures, preferably at a cool/ambient temperature, and where it will not be exposed to direct sunlight.

9.3 Pursuant to regulation 18.8.1 of MARPOL Annex VI, the sample should be retained under the ship's control until the fuel oil is substantially consumed, but in any case for a period of not less than 12 months from the time of delivery.

9.4 The company should develop and maintain a process to keep track of the retained samples.

10 Procedures and documentation following testing of retained sample

10.1 This section applies only to the context of compliance with of SOLAS regulation II-2/4.2.1.

10.2 If the retained sample has been sent for testing, the laboratory should take a subsample enabling the tests to be carried out and immediately reseal the remaining retained sample container with a new tamper-proof security seal with a unique means of identification in the presence of a representative for the authority that has ordered the test. A label containing the following information should be secured to the retained sample container:

- .1 name and address of laboratory:
- .2 date when the sample was resealed;
- .3 volume remaining in the retained sample container when resealed;
- .4 names and signatures of the person resealing the sample and the authority's representative witnessing the process;
- .5 details of the new unique seal identification;
- .6 a declaration that no other material has been added to the sample; and
- .7 relevant information from previous label, including details of original seal identification; name and IMO number of the receiving ship and bunker grade.

10.3 The laboratory should issue a test record with copies to all relevant parties, i.e. the authority that requested the testing, and the ship. Copies may also be sent to the supplier and the authority under the jurisdiction of which the supplier operates. The test record should include the test result(s) and the test method(s), and the seal number of the ship's retained sample which the testing was carried out on.

___