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86th session
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**REPORT OF THE MARITIME SAFETY COMMITTEE ON ITS
EIGHTY-SIXTH SESSION**

Attached are annexes 1 to 14 to the report of the Maritime Safety Committee on its eighty-sixth session (MSC 86/26).

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ANNEX 1

**RESOLUTION MSC.282(86)
(adopted on 5 June 2009)**

**ADOPTION OF AMENDMENTS TO THE INTERNATIONAL CONVENTION FOR
THE SAFETY OF LIFE AT SEA, 1974, AS AMENDED**

THE MARITIME SAFETY COMMITTEE,

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

RECALLING FURTHER article VIII(b) of the International Convention for the Safety of Life at Sea (SOLAS), 1974 (hereinafter referred to as “the Convention”), concerning the amendment procedure applicable to the Annex to the Convention, other than to the provisions of chapter I thereof,

HAVING CONSIDERED, at its eighty-sixth session, amendments to the Convention, proposed and circulated in accordance with article VIII(b)(i) thereof,

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 2010, 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 their objections to the amendments;
3. INVITES SOLAS 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 2011 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. FURTHER 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, AS AMENDED**

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

**Part A-1
Structure of ships**

Regulation 3-5 – New installation of materials containing asbestos

1 The existing text of paragraph 2 is replaced by the following:

“From 1 January 2011, for all ships, new installation of materials which contain asbestos shall be prohibited.”

**Part C
Machinery installations**

Regulation 35-1 – Bilge pumping arrangements

2 The following new paragraph 2.6.3 is added after the existing paragraph 2.6.2:

“2.6.3 Provisions for the drainage of closed vehicle and ro-ro spaces and special category spaces shall also comply with regulations II-2/20.6.1.4 and II-2/20.6.1.5.”

**CHAPTER V
SAFETY OF NAVIGATION**

Regulation 19 – Carriage requirements for shipborne navigational systems and equipment

3 In paragraph 2.1, the existing subparagraph .4 is replaced by the following:

“.4 nautical charts and nautical publications to plan and display the ship’s route for the intended voyage and to plot and monitor positions throughout the voyage. An electronic chart display and information system (ECDIS) is also accepted as meeting the chart carriage requirements of this subparagraph. Ships to which paragraph 2.10 applies shall comply with the carriage requirements for ECDIS detailed therein;”.

4 In paragraph 2.2, the new subparagraphs .3 and .4 are added after the existing subparagraph .2 as follows:

- “.3 a bridge navigational watch alarm system (BNWAS), as follows:
- .1 cargo ships of 150 gross tonnage and upwards and passenger ships irrespective of size constructed on or after 1 July 2011;
 - .2 passenger ships irrespective of size constructed before 1 July 2011, not later than the first survey* after 1 July 2012;
 - .3 cargo ships of 3,000 gross tonnage and upwards constructed before 1 July 2011, not later than the first survey* after 1 July 2012;
 - .4 cargo ships of 500 gross tonnage and upwards but less than 3,000 gross tonnage constructed before 1 July 2011, not later than the first survey* after 1 July 2013; and
 - .5 cargo ships of 150 gross tonnage and upwards but less than 500 gross tonnage constructed before 1 July 2011, not later than the first survey* after 1 July 2014.

The bridge navigational watch alarm system shall be in operation whenever the ship is underway at sea;

- .4 a bridge navigational watch alarm system (BNWAS) installed prior to 1 July 2011 may subsequently be exempted from full compliance with the standards adopted by the Organization, at the discretion of the Administration.”

* Refer to the Unified interpretation of the term “first survey” referred to in SOLAS regulations (MSC.1/Circ.1290).

5 After the existing paragraph 2.9, the new paragraphs 2.10 and 2.11 are added as follows:

“2.10 Ships engaged on international voyages shall be fitted with an Electronic Chart Display and Information System (ECDIS) as follows:

- .1 passenger ships of 500 gross tonnage and upwards constructed on or after 1 July 2012;
- .2 tankers of 3,000 gross tonnage and upwards constructed on or after 1 July 2012;
- .3 cargo ships, other than tankers, of 10,000 gross tonnage and upwards constructed on or after 1 July 2013;
- .4 cargo ships, other than tankers, of 3,000 gross tonnage and upwards but less than 10,000 gross tonnage constructed on or after 1 July 2014;
- .5 passenger ships of 500 gross tonnage and upwards constructed before 1 July 2012, not later than the first survey* on or after 1 July 2014;

- .6 tankers of 3,000 gross tonnage and upwards constructed before 1 July 2012, not later than the first survey* on or after 1 July 2015;
- .7 cargo ships, other than tankers, of 50,000 gross tonnage and upwards constructed before 1 July 2013, not later than the first survey* on or after 1 July 2016;
- .8 cargo ships, other than tankers, of 20,000 gross tonnage and upwards but less than 50,000 gross tonnage constructed before 1 July 2013, not later than the first survey* on or after 1 July 2017; and
- .9 cargo ships, other than tankers, of 10,000 gross tonnage and upwards but less than 20,000 gross tonnage constructed before 1 July 2013, not later than the first survey* on or after 1 July 2018.

2.11 Administrations may exempt ships from the application of the requirements of paragraph 2.10 when such ships will be taken permanently out of service within two years after the implementation date specified in subparagraphs .5 to .9 of paragraph 2.10.”

* Refer to the Unified interpretation of the term “first survey” referred to in SOLAS regulations (MSC.1/Circ.1290).

CHAPTER VI CARRIAGE OF CARGOES

- 6 The title of chapter VI is replaced by the following:

“CARRIAGE OF CARGOES AND OIL FUELS”

Regulation 1 – Application

- 7 At the beginning of paragraph 1, the words “Unless expressly provided otherwise,” are added and the existing word “This” is replaced by the word “this”.

Regulation 5-1 – Material safety data sheets

- 8 The existing text of the regulation is replaced by the following:

“Ships carrying oil or oil fuel, as defined in regulation 1 of Annex 1 of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, shall be provided with material safety data sheets, based on the recommendations developed by the Organization*, prior to the loading of such oil as cargo in bulk or bunkering of oil fuel.”

* Refer to the Recommendations for material safety data sheets (MSDS) for MARPOL Annex I oil cargo and oil fuel, adopted by the Organization by resolution MSC.286(86), as may be amended.

APPENDIX CERTIFICATES

Record of Equipment for the Passenger Ship Safety Certificate (Form P)

9 In the Record of Equipment for the Passenger Ship Safety Certificate (Form P), in section 5, a new item 14 is inserted as follows:

“14 Bridge navigational watch alarm system (BNWAS)”.

Record of Equipment for the Cargo Ship Safety Equipment Certificate (Form E)

10 In the Record of Equipment for the Cargo Ship Safety Equipment Certificate (Form E), in section 3, a new item 14 is inserted as follows:

“14 Bridge navigational watch alarm system (BNWAS)”.

Record of Equipment for the Nuclear Passenger Ship Safety Certificate (Form PNUC)

11 In the Record of Equipment for Nuclear Passenger Ship Safety Certificate (Form PNUC), in section 5, a new item 15 is inserted as follows:

“15 Bridge navigational watch alarm system (BNWAS)”.

Record of Equipment for the Nuclear Cargo Ship Safety Certificate (Form CNUC)

12 In the Record of Equipment for Nuclear Cargo Ship Safety Certificate (Form CNUC), in section 5, a new item 14 is inserted as follows:

“14 Bridge navigational watch alarm system (BNWAS)”.

* * *

FOOTNOTE TO BE ADDED TO SOLAS REGULATION V/18

In the existing footnote to paragraph 2, the following reference is added after the last reference:

“Performance standards for a bridge navigational watch alarm system (BNWAS) (resolution MSC.128(75))”.

ANNEX 2

**RESOLUTION MSC.283(86)
(adopted on 5 June 2009)**

**ADOPTION OF AMENDMENTS TO THE PROTOCOL OF 1988 RELATING TO
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 FURTHER article VIII(b) of the International Convention for the Safety of Life at Sea (SOLAS), 1974 (hereinafter referred to as “the Convention”) and article VI of the Protocol of 1988 relating to the Convention (hereinafter referred to as “the 1988 SOLAS Protocol”) concerning the procedure for amending the 1988 SOLAS Protocol,

HAVING CONSIDERED, at its eighty-sixth session, amendments to the 1988 SOLAS Protocol in accordance with article VIII(b)(i) of the Convention and article VI of the 1988 SOLAS Protocol,

1. ADOPTS, in accordance with article VIII(b)(iv) of the Convention and article VI of the 1988 SOLAS Protocol, amendments to the appendix to the Annex to the 1988 SOLAS Protocol, 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 and article VI of the 1988 SOLAS Protocol, that the said amendments shall be deemed to have been accepted on 1 July 2010, unless, prior to that date, more than one third of the Parties to the 1988 SOLAS Protocol or Parties the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world’s merchant fleet, have notified their objections to the amendments;
3. INVITES the Parties concerned to note that, in accordance with article VIII(b)(vii)(2) of the Convention and article VI of the 1988 SOLAS Protocol, the amendments shall enter into force on 1 January 2011, upon their acceptance in accordance with paragraph 2 above;
4. REQUESTS the Secretary-General, in conformity with article VIII(b)(v) of the Convention and article VI of the 1988 SOLAS Protocol, to transmit certified copies of the present resolution and the text of the amendments contained in the Annex to all Parties to the 1988 SOLAS Protocol;
5. FURTHER REQUESTS the Secretary-General to transmit copies of this resolution and its Annex to Members of the Organization, which are not Parties to the 1988 SOLAS Protocol.

ANNEX

**AMENDMENTS TO THE PROTOCOL OF 1988 RELATING TO THE
INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1974,
AS AMENDED**

ANNEX

**MODIFICATIONS AND ADDITIONS TO THE ANNEX TO THE INTERNATIONAL
CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1974**

APPENDIX

**MODIFICATIONS AND ADDITIONS TO THE APPENDIX TO THE ANNEX TO THE
INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1974**

Record of Equipment for the Passenger Ship Safety Certificate (Form P)

1 In the Record of Equipment for the Passenger Ship Safety Certificate (Form P), in section 5, a new item 14 is inserted as follows:

“14 Bridge navigational watch alarm system (BNWAS)”.

Record of Equipment for the Cargo Ship Safety Equipment Certificate (Form E)

2 In the Record of Equipment for the Cargo Ship Safety Equipment Certificate (Form E), in section 3, a new item 14 is inserted as follows:

“14 Bridge navigational watch alarm system (BNWAS)”.

Record of Equipment for the Cargo Ship Safety Certificate (Form C)

3 In the Record of Equipment for the Cargo Ship Safety Certificate (Form C), in section 5, a new item 15 is inserted as follows:

“15 Bridge navigational watch alarm system (BNWAS)”.

ANNEX 3**DRAFT MSC RESOLUTION****ADOPTION OF AMENDMENTS TO THE INTERNATIONAL CONVENTION FOR
THE SAFETY OF LIFE AT SEA, 1974, AS AMENDED**

THE MARITIME SAFETY COMMITTEE,

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

RECALLING FURTHER article VIII(b) of the International Convention for the Safety of Life at Sea (SOLAS), 1974 (hereinafter referred to as “the Convention”), concerning the amendment procedure applicable to the Annex to the Convention, other than to the provisions of chapter I thereof,

RECALLING ALSO that among the strategic directions of the Organization relating to developing and maintaining a comprehensive framework for safe, secure, efficient and environmentally sound shipping is the establishment of goal-based standards for the design and construction of new ships,

CONSIDERING that ships should be designed and constructed for a specified design life to be safe and environmentally friendly, so that, if properly operated and maintained under specified operating and environmental conditions, they can remain safe throughout their service life,

HAVING CONSIDERED, at its [eighty-seventh] session, amendments to the Convention, proposed and circulated in accordance with article VIII(b)(i) thereof,

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 [...], 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 their objections to the amendments;
3. INVITES SOLAS Contracting Governments to note that, in accordance with article VIII(b)(vii)(2) of the Convention the amendments shall enter into force on [...] 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. FURTHER 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;

6. RESOLVES to review the progress towards the implementation of SOLAS regulation II-1/3-10 in 2012 and, if proven necessary, to adjust the time periods set forth in paragraph 1 of the regulation.

ANNEX

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

**PART A
GENERAL**

Regulation 2 – Definitions

1 The following new paragraph 27 is added after existing paragraph 26:

“27 *Goal-based ship construction standards for bulk carriers and oil tankers* means the International Goal-Based Ship Construction Standards for Bulk Carriers and Oil Tankers adopted by the Maritime Safety Committee by resolution MSC....(...), as may be amended by the Organization, provided that such amendments are adopted, brought into force and take effect in accordance with the provisions of article VIII of the present Convention concerning the amendment procedures applicable to the annex other than chapter I thereof.”

**PART A-1
STRUCTURE OF SHIPS**

2 The following new regulation II-1/3-10 is added after existing regulation II-1/3-9:

“Regulation 3-10

Goal-based ship construction standards for bulk carriers and oil tankers

1 This regulation shall apply to oil tankers of 150 m in length and above and to bulk carriers of 150 m in length and above, constructed with single deck, top-side tanks and hopper side tanks in cargo spaces, excluding ore carriers and combination carriers:

- .1 for which the building contract is placed on or after 1 January 2015;
- .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 January 2016; or
- .3 the delivery of which is on or after 1 January 2019.

2 Ships shall be designed and constructed for a specified design life to be safe and environmentally friendly, when properly operated and maintained under the specified operating and environmental conditions, in intact and specified damage conditions, throughout their life.

2.1 Safe and environmentally friendly means the ship shall have adequate strength, integrity and stability to minimize the risk of loss of the ship or pollution to the marine environment due to structural failure, including collapse, resulting in flooding or loss of watertight integrity.

2.2 Environmentally friendly also includes the ship being constructed of materials for environmentally acceptable recycling.

2.3 Safety also includes the ship's structure, fittings and arrangements providing for safe access, escape, inspection and proper maintenance and facilitating safe operation.

2.4 Specified operating and environmental conditions are defined by the intended operating area for the ship throughout its life and cover the conditions, including intermediate conditions, arising from cargo and ballast operations in port, waterways and at sea.

2.5 Specified design life is the nominal period that the ship is assumed to be exposed to operating and/or environmental conditions and/or the corrosive environment and is used for selecting appropriate ship design parameters. However, the ship's actual service life may be longer or shorter depending on the actual operating conditions and maintenance of the ship throughout its life cycle.

3 The requirements of paragraphs 2 to 2.5 shall be achieved through satisfying applicable structural requirements of an organization which is recognized by the Administration in accordance with the provisions of regulation XI/1, or national standards of the Administration, conforming to the functional requirements of the goal-based ship construction standards for bulk carriers and oil tankers.

4 A Ship Construction File with specific information on how the functional requirements of the goal-based ship construction standards for bulk carriers and oil tankers have been applied in the ship design and construction shall be provided upon delivery of a new ship, and kept on board the ship and updated as appropriate throughout its service. The contents of the Ship Construction File shall, at least, conform to the guidelines developed by the Organization.*

* Refer to the Guidelines for the information to be included in a Ship Construction File (MSC.1/Circ.[...]).”

ANNEX 4**DRAFT MSC RESOLUTION****INTERNATIONAL GOAL-BASED SHIP CONSTRUCTION STANDARDS
FOR BULK CARRIERS AND OIL TANKERS**

THE MARITIME SAFETY COMMITTEE,

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

BEING DESIROUS that the Organization should play a larger role in determining the structural standards to which new ships are built,

RECALLING ALSO that among the strategic directions of the Organization relating to developing and maintaining a comprehensive framework for safe, secure, efficient and environmentally sound shipping is the establishment of goal-based standards for the design and construction of ships,

CONSIDERING that ships should be designed and constructed for a specified design life to be safe and environmentally friendly, so that, if properly operated and maintained under specified operating and environmental conditions, they can remain safe throughout their service life,

NOTING regulations II-1/2.27 and II-1/3-10 of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended (hereinafter referred to as "the Convention"), adopted by resolution [MSC...(.)], concerning goal-based ship construction standards for bulk carriers and oil tankers,

NOTING ALSO that the aforementioned regulation II-1/3-10 requires that bulk carriers and oil tankers as defined therein satisfy the applicable structural requirements of a recognized organization, or national standards of an Administration, conforming to the functional requirements of the goal-based ship construction standards for bulk carriers and oil tankers,

HAVING CONSIDERED, at its [eighty-seventh] session, the proposed International Goal-Based Ship Construction Standards for Bulk Carriers and Oil Tankers,

1. ADOPTS the International Goal-Based Ship Construction Standards for Bulk Carriers and Oil Tankers, the text of which is set out in the Annex to the present resolution;
2. INVITES Contracting Governments to the Convention to note that the International Goal-Based Ship Construction Standards for Bulk Carriers and Oil Tankers will take effect on [...] upon entry into force of regulation II-1/3-10 of the Convention;
3. REQUESTS the Secretary-General to transmit certified copies of this resolution and the text of the International Goal-Based Ship Construction Standards for Bulk Carriers and Oil Tankers, contained in the Annex to all Contracting Governments to the Convention;
4. FURTHER REQUESTS the Secretary-General to transmit copies of this resolution and the Annex to all Members of the Organization which are not Contracting Governments to the Convention.

ANNEX

INTERNATIONAL GOAL-BASED SHIP CONSTRUCTION STANDARDS FOR BULK CARRIERS AND OIL TANKERS

1 PREAMBLE

1.1 The notion of “goal-based ship construction standards” was introduced in the Organization at the eighty-ninth session of the Council in November 2002 through a proposal by the Bahamas and Greece¹, suggesting that the Organization should develop ship construction standards that would permit innovation in design but ensure that ships are constructed in such a manner that, if properly maintained, they remain safe for their entire economic life. The standards would also have to ensure that all parts of a ship can be easily accessed to permit proper inspection and ease of maintenance. The Council referred the proposal to the seventy-seventh meeting of the Maritime Safety Committee (MSC) in May/June 2003 for consideration.

1.2 The MSC, at its seventy-seventh session, considered the matter as requested and recommended that the ninetieth session of the Council should consider it further in the context of the development of the Organization’s Strategic Plan. The Committee also agreed to include a new item on “Goal-based new ship construction standards” in its work programme and agenda for its next meeting.

1.3 The ninetieth session of the Council, in considering the strategy and policy of the Organization for the 2006 to 2011 period, approved strategic directions regarding the development of goal-based standards for the design and construction of new ships. Subsequently, at its twenty-second extraordinary session, the Council included in the strategic directions of the Organization a provision that “IMO will establish goal-based standards for the design and construction of new ships”.

1.4 The Assembly, at its twenty-third session in November/December 2003, when adopting resolution A.944(23) on the Organization’s Strategic plan for the six-year period 2004 to 2010, resolved, *inter alia*, that “the IMO would establish goal-based standards for the design and construction of new ships”. This decision was also reflected in resolution A.943(23) on the Long-term work plan of the Organization, up to 2010, where the subject “Goal-based new ship construction standards” was introduced in the list of general subjects.

1.5 The MSC commenced detailed technical work on the development of goal-based ship construction standards at its seventy-eighth session in May 2004, when a comprehensive general debate of the issues involved took place and the Committee agreed to utilize a five-tier system initially proposed by the Bahamas, Greece and IACS², consisting of the following:

- .1 **Tier I – Goals**
High-level objectives to be met.
- .2 **Tier II – Functional requirements**
Criteria to be satisfied in order to conform to the goals.

¹ Document C 89/12/1 (Bahamas, Greece) – IMO Strategic Plan.

² Document MSC 78/6/2 (Bahamas, Greece, IACS) – Goal-based new ship construction standards.

- .3 ***Tier III – Verification of conformity***
Procedures for verifying that the rules and regulations for ship design and construction conform to the goals and functional requirements.
- .4 ***Tier IV – Rules and regulations for ship design and construction***
Detailed requirements developed by IMO, national Administrations and/or recognized organizations and applied by national Administrations and/or recognized organizations acting on their behalf to the design and construction of a ship in order to conform to the goals and functional requirements.
- .5 ***Tier V – Industry practices and standards***
Industry standards, codes of practice and safety and quality systems for shipbuilding, ship operation, maintenance, training, manning, etc., which may be incorporated into, or referenced in, the rules and regulations for the design and construction of a ship.

1.6 Following deliberation on the subject at its eighty-first session, the Committee agreed to limit the scope of its consideration initially to bulk carriers and oil tankers and consider expansion to other ship types and areas of safety at a later time.

2 SCOPE

The International Goal-Based Ship Construction Standards for Bulk Carriers and Oil Tankers (hereinafter referred to as “the Standards”) describe the goals and establish the functional requirements that the rules for the design and construction of bulk carriers and oil tankers of an organization recognized by the Administration, or the national rules of an Administration, shall conform to, as defined in SOLAS regulations II-1/2.27 and II-1/3-10. Additionally, the Standards establish that the above mentioned rules shall be verified as conforming to the goals and functional requirements.

3 STRUCTURE

These Standards consist of the following three tiers:

- Tier I – Goals
- Tier II – Functional requirements
- Tier III – Verification of conformity.

4 TIER I – GOALS

The Tier I goals are as defined in SOLAS regulation II-1/3-10 and are reproduced here for ease of reference, as follows:

Ships shall be designed and constructed for a specified design life to be safe and environmentally friendly, when properly operated and maintained under the specified operating and environmental conditions, in intact and specified damage conditions, throughout their life.

- .1 Safe and environmentally friendly means the ship shall have adequate strength, integrity and stability to minimize the risk of loss of the ship or pollution to the marine environment due to structural failure, including collapse, resulting in flooding or loss of watertight integrity.
- .2 Environmentally friendly also includes the ship being constructed of materials for environmentally acceptable recycling.
- .3 Safety also includes the ship's structure, fittings and arrangements providing for safe access, escape, inspection and proper maintenance and facilitating safe operation.
- .4 Specified operating and environmental conditions are defined by the intended operating area for the ship throughout its life and cover the conditions, including intermediate conditions, arising from cargo and ballast operations in port, waterways and at sea.
- .5 Specified design life is the nominal period that the ship is assumed to be exposed to operating and/or environmental conditions and/or the corrosive environment and is used for selecting appropriate ship design parameters. However, the ship's actual service life may be longer or shorter depending on the actual operating conditions and maintenance of the ship throughout its life cycle.

5 TIER II – FUNCTIONAL REQUIREMENTS

(Applicable to bulk carriers and oil tankers in unrestricted navigation³)

DESIGN

II.1 Design life

The specified design life shall not be less than 25 years.

II.2 Environmental conditions

Ships shall be designed in accordance with North Atlantic environmental conditions and relevant long-term sea state scatter diagrams.

II.3 Structural strength

II.3.1 General design

The ship's structural members shall be of a design that is compatible with the purpose of the space and ensures a degree of structural continuity. The structural members of ships shall be designed to facilitate load/discharge for all contemplated cargoes to avoid damage by loading/discharging equipment, which may compromise the safety of the structure.

³ Unrestricted navigation means that the ship is not subject to any geographical restrictions (i.e. any oceans, any seasons) except as limited by the ship's capability for operation in ice.

II.3.2 Deformation and failure modes

The structural strength shall be assessed against excessive deflection and failure modes, including but not limited to buckling, yielding and fatigue.

II.3.3 Ultimate strength

Ships shall be designed to have adequate ultimate strength. Ultimate strength calculations shall include ultimate hull girder capacity and related ultimate strength of plates and stiffeners, and be verified for a longitudinal bending moment based on the environmental conditions in functional requirement II.2.

II.3.4 Safety margins

Ships shall be designed with suitable safety margins:

- .1 to withstand, at net scantlings⁴, in the intact condition, the environmental conditions anticipated for the ship's design life and the loading conditions appropriate for them, which shall include full homogeneous and alternate loads, partial loads, multi-port and ballast voyage, and ballast management condition loads and occasional overruns/overloads during loading/unloading operations, as applicable to the class designation; and
- .2 appropriate for all design parameters whose calculation involves a degree of uncertainty, including loads, structural modelling, fatigue, corrosion, material imperfections, construction workmanship errors, buckling, residual and ultimate strength.

II.4 Fatigue life

The design fatigue life shall not be less than the ship's design life and shall be based on the environmental conditions in functional requirement II.2.

II.5 Residual strength

Ships shall be designed to have sufficient strength to withstand the wave and internal loads in specified damaged conditions such as collision, grounding or flooding. Residual strength calculations shall take into account the ultimate reserve capacity of the hull girder, including permanent deformation and post-buckling behaviour. Actual foreseeable scenarios shall be investigated in this regard as far as is reasonably practicable.

II.6 Protection against corrosion

Measures shall be applied to ensure that net scantlings required to meet structural strength provisions are maintained throughout the specified design life. Measures include, but are not limited to, coatings, corrosion additions, cathodic protection, impressed current systems, etc.

⁴ The net scantlings should provide the structural strength required to sustain the design loads, assuming the structure is in intact condition and without any corrosion margin. However, when assessing fatigue and global strength of hull girder and primary supporting structures, a portion of the total corrosion margin may be added to the net scantlings to reflect the material thickness that can reasonably be expected to exist over the design life.

II.6.1 Coating life

Coatings shall be applied and maintained in accordance with manufacturers' specifications concerning surface preparation, coating selection, application and maintenance. Where coating is required to be applied, the design coating life shall be specified. The actual coating life may be longer or shorter than the design coating life, depending on the actual conditions and maintenance of the ship. Coatings shall be selected as a function of the intended use of the compartment, materials and application of other corrosion prevention systems, e.g., cathodic protection or other alternatives.

II.6.2 Corrosion addition

The corrosion addition shall be added to the net scantling and shall be adequate for the specified design life. The corrosion addition shall be determined on the basis of exposure to corrosive agents such as water, cargo or corrosive atmosphere, or mechanical wear, and whether the structure is protected by corrosion prevention systems, e.g., coating, cathodic protection or by alternative means. The design corrosion rates (mm/year) shall be evaluated in accordance with statistical information established from service experience and/or accelerated model tests. The actual corrosion rate may be greater or smaller than the design corrosion rate, depending on the actual conditions and maintenance of the ship.

II.7 Structural redundancy

Ships shall be of redundant design and construction so that localized damage (such as local permanent deformation, cracking or weld failure) of any stiffening structural member will not lead to immediate consequential collapse of the complete stiffened panel.

II.8 Watertight and weathertight integrity

Ships shall be designed to have adequate watertight and weathertight integrity for the intended service of the ship and adequate strength and redundancy of the associated securing devices of hull openings.

II.9 Human element considerations

Ship's structures and fittings shall be designed and arranged using ergonomic principles to ensure safety during operations, inspection and maintenance. These considerations shall include, but not be limited to, stairs, vertical ladders, ramps, walkways and standing platforms used for means of access, the work environment, inspection and maintenance and the facilitation of operation.

II.10 Design transparency

Ships shall be designed under a reliable, controlled and transparent process made accessible to the extent necessary to confirm the safety of the new as-built ship, with due consideration to intellectual property rights. Readily available documentation shall include the main goal-based parameters and all relevant design parameters that may limit the operation of the ship.

CONSTRUCTION

II.11 Construction quality procedures

Ships shall be built in accordance with controlled and transparent quality production standards with due regard to intellectual property rights. The ship construction quality procedures shall include, but not be limited to, specifications for material, manufacturing, alignment, assembling, joining and welding procedures, surface preparation and coating.

II.12 Survey during construction

A survey plan shall be developed for the construction phase of the ship, taking into account the ship type and design. The survey plan shall contain a set of requirements, including specifying the extent and scope of the construction survey(s) and identifying areas that need special attention during the survey(s), to ensure compliance of construction with mandatory ship construction standards.

IN-SERVICE CONSIDERATIONS

II.13 Survey and maintenance

Ships shall be designed and constructed to facilitate ease of survey and maintenance, in particular avoiding the creation of spaces too confined to allow for adequate survey and maintenance activities. Areas shall be identified that need special attention during surveys throughout the ship's life. In particular, this shall include all necessary in-service survey and maintenance that was assumed when selecting ship design parameters.

II.14 Structural accessibility

The ship shall be designed, constructed and equipped to provide adequate means of access to all internal structures to facilitate overall and close-up inspections and thickness measurements.

RECYCLING CONSIDERATIONS

II.15 Recycling

Ships shall be designed and constructed of materials for environmentally acceptable recycling without compromising the safety and operational efficiency of the ship.

6 TIER III – VERIFICATION OF CONFORMITY

6.1 The rules for the design and construction of bulk carriers and oil tankers of an organization which is recognized by an Administration in accordance with the provisions of SOLAS regulation XI-1/1, or national rules of an Administration used as an equivalent to the rules of a recognized organization according to SOLAS regulation II-1/3-1, shall be verified as conforming to the Tier I goals and Tier II functional requirements, based on the guidelines

developed by the Organization⁵. The final decision on verification of conformity shall be taken by the Maritime Safety Committee of the Organization which shall inform all Contracting Governments of the decision.

6.2 The term “verification” (and any variation of the word “verify”) means that the rules for the design and construction of bulk carriers and oil tankers as described above have been compared to the Standards and have been found to be in conformity with or are consistent with the goals and functional requirements as set out in the Standards.

6.3 Once the rules for the design and construction of bulk carriers and oil tankers of an Administration or recognized organization have been verified as being in conformity with the Standards, this conformity shall be considered to remain in effect for rule changes, provided that no verification of rule changes has resulted in a non-conformity. Unless the Maritime Safety Committee decides otherwise, any rule changes introduced as a result of verification of conformity shall apply to ships for which the building contract is placed on or after the date on which the rule change enters into force.

⁵ Refer to the Guidelines for verification of conformity with goal-based ship construction standards for bulk carriers and oil tankers, adopted by the Organization by resolution MSC...(...).

ANNEX 5**DRAFT MSC RESOLUTION****GUIDELINES FOR VERIFICATION OF CONFORMITY WITH GOAL-BASED SHIP
CONSTRUCTION STANDARDS FOR BULK CARRIERS AND OIL TANKERS**

THE MARITIME SAFETY COMMITTEE,

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

HAVING ADOPTED, by resolution MSC...(...), the International Goal-Based Ship Construction Standards for Bulk Carriers and Oil Tankers (hereinafter referred to as “the Standards”) and, by resolution MSC...(...), SOLAS regulations II-1/2.27 and II-1/3-10 to make the Standards mandatory,

NOTING that paragraph 6.1 of the Standards requires that the rules for the design and construction of bulk carriers and oil tankers of an organization which is recognized by an Administration in accordance with the provisions of SOLAS regulation XI-1/1, or national rules of an Administration used as an equivalent to the rules of a recognized organization according to SOLAS regulation II-1/3-1, shall be verified as conforming to the goals and functional requirements of the Standards, based on the guidelines developed by the Organization,

RECOGNIZING the need for guidelines on how to carry out such verification, so as to ensure uniformity of the verification process,

HAVING CONSIDERED, at its [eighty-seventh] session, the proposed Guidelines for verification of conformity with goal-based ship construction standards for bulk carriers and oil tankers,

1. ADOPTS the Guidelines for verification of conformity with goal-based ship construction standards for bulk carriers and oil tankers, the text of which is set out in the Annex to the present resolution;
2. REQUESTS Administrations and organizations recognized by Administrations in accordance with the provisions of SOLAS regulation XI-1/1 to utilize the Guidelines when applying for verification that their design and construction rules for bulk carriers and oil tankers conform to the Standards;
3. RESOLVES to review these Guidelines, as necessary, in view of experience gained with their application.

ANNEX

GUIDELINES FOR VERIFICATION OF CONFORMITY WITH THE INTERNATIONAL GOAL-BASED SHIP CONSTRUCTION STANDARDS FOR BULK CARRIERS AND OIL TANKERS

INTRODUCTION

1 The Organization has adopted, by resolution MSC...(...), the International goal-based ship construction standards for bulk carriers and oil tankers (hereinafter referred to as “the Standards”), specifying goals, functional requirements and verification of conformity to ensure that ships are constructed in such a manner that, when properly operated and maintained, they can remain safe for their design life, and that all parts of a ship can be easily accessed to permit proper inspection and ease of maintenance.

2 These Guidelines for verification of conformity with goal-based ship construction standards for bulk carriers and oil tankers (hereinafter referred to as “the Guidelines”) provide the procedures necessary for demonstrating and verifying that the ship design and construction rules for bulk carriers and oil tankers of an Administration or its recognized organization conform to the Standards, including both the method and criteria to be applied during the verification process.

3 The Guidelines are composed of two parts:

- .1 Part A establishes the procedures to be followed in order to verify that ship design and construction rules conform to the Standards. It includes sections on initial verification and maintenance of verification of the rules.
- .2 Part B provides detailed documentation requirements and evaluation criteria that should be used to verify that the rules conform to the Standards.

Definitions

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

- .1 “Conformity” means fulfilment of a requirement.
- .2 “Finding” means an observation or a non-conformity.
- .3 “Non-conformity” means non-fulfilment of a requirement.
- .4 “Objective evidence” means quantitative or qualitative information, records or statement of fact which are based on observation, measurement or test and which can be verified.
- .5 “Observation” means statements of fact or proposals made during an audit which are based on objective evidence but are not a non-conformity.

- .6 “Organization” means the International Maritime Organization.
- .7 “Rules” or “rule set” means regulations for hull design and construction of bulk carriers and/or oil tankers operating in unrestricted worldwide service.
- .8 “Secretary-General” means the Secretary-General of the International Maritime Organization.
- .9 “Self-assessment” means the Submitter assesses its rules for the design and construction of bulk carriers and/or oil tankers for conformity with the goals and functional requirements as set out in the Standards.
- .10 “SOLAS” means the International Convention for the Safety of Life at Sea, 1974, as amended.
- .11 “Standards” means the International goal-based ship construction standards for bulk carriers and oil tankers, adopted by the Organization by resolution MSC...(...).
- .12 “Submitter” means any Administration or recognized organization that requests the Organization to verify that its ship design and construction rules for bulk carriers and/or oil tankers conform to the Standards.
- .13 “Verification” (and any variation of the word “verify”) means the rules for the design and construction of bulk carriers and oil tankers have been compared to the Standards and have been found to be in conformity with or are consistent with the goals and functional requirements as set out in the Standards.
- .14 “Verification audit” or “audit” means the process of evaluating the Submitter’s rules, self-assessment and supporting documentation to ascertain the validity and reliability of information. The purpose of the audit is to assess the conformity of the submitted rules with the Standards based on work done on a sampling basis.

PART A

VERIFICATION PROCESS

Scope of verification

5 This part establishes the procedures to be followed in order to verify that design and construction rules for bulk carriers and/or oil tankers conform to the Standards. It includes sections on initial verification, maintenance of verification and establishment of a Goal-based Standards Audit Team (the Team). The verification process consists of two main elements: self-assessment of the rules by the Submitter and an audit of the rules, the self-assessment and the supporting documentation by the Organization.

Initial verification

Initiation

6 Any Administration or recognized organization wishing to have its rules verified as conforming to the Standards should initiate the process with a letter to the Secretary-General, requesting a verification audit of their rules. The letter should be accompanied by a complete technical documentation package (see paragraph 9) and a supporting letter from an Administration that has recognized the Submitter, if applicable.

7 The Secretary-General notifies the Submitter of his decision to accept or reject the request, and, if accepted, advises the expected date for establishment of the Team to audit the submission. If the request is rejected, the Secretary-General will include the reason for doing so.

8 The Submitter may withdraw the application at any time prior to consideration by the Maritime Safety Committee.

Submission

9 The Submitter should provide a technical documentation package for review in hard copy (one copy for each member of the Team and one for the Secretariat) and in electronic form in English, including:

- .1 The rule set to be verified as conforming to the Standards.
- .2 All items listed under information and documentation requirements in part B of these Guidelines which are not included in .1 above and are included in the internal quality management system or the rule development process as applicable.
- 3 A self-assessment, addressing all items listed under information and documentation requirements and evaluation criteria in part B of these Guidelines.
- .4 A clear indication of any instance where a functional requirement, or portions of it, are satisfied by IMO mandatory instruments that are not part of the submitted rules (e.g., SOLAS or MARPOL requirements).
- .5 Any other documentation, which in the Submitter's opinion supports their assessment that the rules conform to the Standards.
- .6 A completed Submission Template (see appendix 1).
- .7 A clear indication of any confidential and/or proprietary information submitted with the documentation package.

Audit process

10 The verification audit (audit) is an iterative process based on the following steps:

- .1 the Secretary-General verifies that the submitted technical documentation package includes all of the elements specified in paragraph 9;

- .2 the Secretary-General establishes the GBS Audit Team and forwards the request for audit and technical documentation package to the Team with the instructions given in paragraph 11;
- .3 the Team reviews the information, confirms completeness of the documentation submitted, exchanges views and establishes an audit plan;
- .4 the Team conducts the audit;
- .5 the Team prepares an interim audit report for the Submitter that contains the preliminary findings of the audit, requests for additional information as needed, and possible non-conformities, using the report format specified in appendix 2. Where the Team has identified a possible non-conformity, they should explain the reasons for reaching that conclusion;
- .6 upon receipt of the interim report, the Submitter may respond by submitting additional documentation to the Team to address the reported non-conformities and/or requests for additional information;
- .7 the Team prepares a final audit report with a recommendation, using the report format specified in appendix 2, and provides it to the Secretary-General with a copy to the Submitter. Where the Team has identified an unresolved non-conformity, they should explain the reasons for reaching that conclusion; and
- .8 the Team's observations on the audit process should be submitted in a separate report to the Secretary-General.

11 The Team is expected to conduct an audit to determine whether the submitted rules conform to each of the Tier II functional requirements, based on the criteria in Part B of these Guidelines. In undertaking this task, the Team should exercise their professional judgement in determining the depth of the audit.

12 Where the Submitter can clearly indicate that a functional requirement, or portions of it, are covered by IMO mandatory instruments (e.g., SOLAS or MARPOL requirements), but are not part of the submitted rules, the Team should accept this as part of the verification, provided that it does not affect other covered functional requirements. Mandatory IMO instruments used to satisfy functional requirements should be applied in a manner consistent with IMO interpretations.

Appeal

13 The Submitter, through their supporting Administration, can appeal a finding of the GBS Audit Team to the Secretary-General. Notification of intent to appeal must be made within 30 days after receiving the Team's final audit report. The appeal request should follow within six months of the notification with the documentation to support the appeal request. After the supporting documentation is received, the Secretary-General should establish an Appeal Board, independent of the original Team, to adjudicate the request. This Appeal Board should be comprised of three or five members and be selected by the Secretary-General from the same list of experts described in paragraph 22. These members should not have participated in the Team that conducted the audit that is being appealed.

Approval

14 The Secretary-General forwards the final audit report of the Team, supplemented by any appeal report, if applicable, to the Maritime Safety Committee for consideration and final decision.

15 Ships contracted to rules prior to the final decision of the MSC may be deemed to meet the Standards. Where non-conformities have been found, the rules should be revised and a new self-assessment submitted for audit. During this process ships contracted to the revised rules may be deemed to meet the Standards.

16 The Maritime Safety Committee considers the report prepared by the Team, supplemented by any appeal report, if applicable, with a view to confirming that the information provided by the Submitter demonstrates that the rules conform to the Standards.

17 Upon final decision by the Maritime Safety Committee, the Secretary-General notifies the relevant Administration and recognized organization as to whether the submitted rules conform to the Tier I goals and Tier II functional requirements of the Standards. In the case of non-conformity, the notification letter should include specific details to support the determination of non-conformity.

18 The Secretary-General circulates the results of successful verifications to Member Governments by appropriate means and maintains a list of all rule sets that have been verified for conformity as well as the original copy of the documentation package submitted.

Maintenance of verification

19 Changes to rules already verified as conforming to the Standards should be processed as follows:

- .1 At least annually, each recognized organization whose rules have been verified as conforming to the Standards should notify and make available any rule changes, including any errata, corrigenda or clarifications, to the Secretary-General and to all Administrations that have recognized them. The notification should include a rule commentary, clearly indicating the impact of those changes on conformity with the Standards of those rules already verified, including, but not limited to:
 - .1 an explanation of why the changes were considered necessary, including a description of the issues under consideration;
 - .2 the extent to which the changes address the issues under consideration;
 - .3 an explanation of the way the rules were formulated/drafted;
 - .4 an indication of any impact on and/or contribution to safety, security or environmental protection; and
 - .5 an indication of any impact on net and gross scantlings.

- .2 When an Administration considers a rule change described in .1 above to result in non-conformity with the Standards, it may request the Secretary-General to conduct a review of the change. The request should include supporting justification why such a review is necessary. The Secretary-General should establish a Team to assess the impact of the change(s) on conformity with the Standards. The findings of the Team should be forwarded to the Maritime Safety Committee by the Secretary-General, along with the request from the Administration and supporting documentation, for further consideration and final disposition.
- .3 The Organization should aim to audit 10% of the rule changes received per .1 on an annual basis. The Secretary-General should establish a GBS Audit Team accordingly and forward the compilation of annual changes received per .1 to it for consideration. The Team should conduct a preliminary review of the changes, exchange views and establish an audit plan. The Team should exercise their professional judgement in identifying the changes to be audited. The Team conducts the audit and prepares a maintenance of verification audit report with a recommendation and provides it to the Secretary-General. Where the Team has identified a non-conformity, they should explain the reasons for reaching that conclusion. The findings of the Team should be forwarded by the Secretary-General to the Maritime Safety Committee for further consideration and final disposition.
- .4 Any Administration the rules of which have been verified as conforming to the Standards should submit rule changes as per .1 to .3 above, as applicable.
- .5 Rules should be considered to be in conformity unless .2 or .3 above results in non-conformities. Where non-conformities have been found, the rules should be revised and a new self-assessment submitted for audit. During this process ships contracted to the revised rules may be deemed to meet the Standards.

20 The Maritime Safety Committee may request re-verification of rules if significant changes are made to the Standards or other IMO mandatory instruments or if there is a compelling need.

GBS Audit Team

21 A GBS Audit Team, established under the auspices of the Maritime Safety Committee, will conduct an audit of the Submitter's documentation package to verify whether the rules conform to the Standards. The Team will serve as an independent panel of technical experts which are not considered to be representing any Member State of the Organization or any organization in consultative status. The Team should consist of three (3) or five (5) members, depending on the complexity of the submission(s). A simple majority will be required to recommend a finding of non-conformity for a functional requirement. The voting of individual members will be kept confidential, with the resulting outcome considered as a decision of the Team. In any case, the view of the minority should be fully documented in the final audit report of the Team.

22 Administrations and non-governmental organizations in consultative status with the Organization may nominate individuals for inclusion in a list of experts, maintained by the Secretary-General, from which the members of the Team will be selected. Nominations should be provided to the Secretary-General and should be accompanied by a curriculum vitae.

23 Nominees should have adequate knowledge of, and experience in, ship structural design and construction, the Standards and classification society rules and rule development and be able to correctly interpret the rules for correlation with relevant regulatory requirements. Additionally, nominees should satisfy at least some of the following requirements:

- .1 engineering degree in naval architecture and/or structural engineering;
- .2 scientific or engineering knowledge of technical subjects addressed in ship structural standards including strength of materials, structural analysis, fatigue analysis, hydrodynamics and load calculations, and structural reliability;
- .3 design, construction or operating experience with the type of ship addressed by the ship rules being verified;
- .4 knowledge of ship safety construction requirements, including SOLAS requirements and industry standards, guidelines and practices;
- .5 knowledge of environmental protection requirements related to ship structures;
- .6 knowledge and experience in survey, inspection and maintenance of ship structures;
- .7 knowledge and experience in ship building and ship construction practices;
- .8 knowledge and experience in auditing; and
- .9 research experience in any of the areas referred to in .1 to .7 above.

24 The members of the Team will be selected by the Secretary-General as needed from the list of experts, giving due consideration to the qualifications listed in paragraph 23 and ensuring appropriate and balanced representation and expertise for the specific rules being considered. Additionally, the Secretary-General will select one of the members of the Team to be responsible for overall coordination of the audit. Team members should not have any conflict of interest relating to the rules being verified.

25 Each member of the GBS Audit Team or of the Appeal Board should sign a confidentiality agreement with the Secretary-General, stating that they will not disclose any proprietary information that is provided to them for the purpose of verifying rules, with the exception of the documentation required for the interim or final reports.

26 The Team should consider the need for transparency throughout their deliberations. The Team should meet in person with the Submitter during the audit process at a mutually agreed location to address any questions and issues that may arise during the audit process, review any additional documentation needed to complete the audit, and to share their preliminary findings.

27 The Secretary-General will provide the GBS Audit Team with adequate administrative assistance to support the verification process, including a permanent secretary.

PART B

INFORMATION/DOCUMENTATION REQUIREMENTS AND EVALUATION CRITERIA

INTRODUCTION

28 This part provides detailed information and documentation requirements and evaluation criteria to assist the Submitter to conduct a self-assessment that the rules conform to the Tier II functional requirements of the Standards, as outlined in part A. It includes a statement of intent, information and documentation requirements, and evaluation criteria for each Tier II functional requirement. Additionally, the information and documentation requirements and evaluation criteria serve as the audit standard for the GBS Audit Team.

29 The statement of intent links Tier II functional requirements to Tier III verification criteria by providing an overview of what the verification of the particular functional requirement should achieve.

30 The information and documentation requirements establish specific items that should be included and addressed in the submission supporting the verification.

31 The evaluation criteria should be considered as the basis for conducting the self-assessment and audit.

32 The rules, as referred to in this part, include the rule set, guidelines, interpretations, internal procedures, etc.

33 Justification means providing the supporting data, analysis or other study that demonstrates the adequacy of the methodology, process or requirement. It should include:

- .1 basis for the assumptions made;
- .2 description of the uncertainties associated with them; and
- .3 any sensitivity analyses carried out.

It includes documented rationale on which the validity of the hypothesis or criteria used in the requirements or calculations are based. These may be the results of research work, historical data, statistics, etc. For example, justification of safety factors should describe how the many related assumptions and uncertainties, such as environmental conditions, loads, structural analysis methodology and strength criteria, are accounted for.

34 Where commentary or data is requested, it is sufficient for such information to be contained in a rule commentary or other supporting documentation.

35 Where the rules establish a process to evaluate and accept alternatives, the submission should clearly identify the process for determining that an equivalent level of safety is achieved.

INFORMATION AND DOCUMENTATION REQUIREMENTS AND EVALUATION CRITERIA

DESIGN

1 Design life

1.1 Statement of intent

Confirm that the specified design life is at least 25 years and properly incorporated in the rules.

1.2 Information and documentation requirements

1.2.1 Statement of the design life in years used in developing the rules.

1.2.2 Description of the assumptions and methods used to incorporate design life into the rules. This should include, but not be limited to, consideration of extreme loads, design loads, fatigue and corrosion.

1.3 Evaluation criteria

1.3.1 Are structural strength, fatigue and corrosions additions, and any other design parameters used in the rules based upon the specified design life?

1.3.2 Has the design life been properly applied in sections of the rules where specified?

2 Environmental conditions

2.1 Statement of intent

Confirm that the wave data and associated ship motions and loads are developed on the basis of North Atlantic environmental conditions and the relevant long-term sea state scatter diagrams for the specified design life.

2.2 Information and documentation requirements

2.2.1 Source of sea state data (scatter diagrams, etc.) including method and date of data collection and geographical location represented by the data.

2.2.2 Justification that sea state data and predictions used to develop motions and loads are representative of North Atlantic environmental conditions.

2.2.3 Justification of the methodology used to develop ship motions and loads, including assumptions related to speed, distribution of headings, number of cycles of wave encounters, probability of exceedance of design values, sea states, wave spectral shapes, hull form and other relevant parameters. Clearly define limits of applicability, and provide guidance for assessment when outside this range.

2.2.4 Description of how the methodology used to develop ship motions and loads has been benchmarked with experimental or service history data.

2.3 Evaluation criteria

2.3.1 Does the wave data properly represent North Atlantic conditions and include the regions where the most severe conditions are expected?

2.3.2 Do the rules specify the wave spectrum and statistical analysis methods used to obtain the design extreme value, including its probability of exceedance?

2.3.3 Are the design extreme motions and loads based on appropriate number of cycles of wave encounters corresponding to at least a 25-year design life?

2.3.4 Are the ship speeds and headings used for assessment of ship motions and loads based upon speeds and headings that can be expected in the sea states under consideration?

2.3.5 Do the rules properly specify the range of applicability of ship motions and loads, and when further analysis, such as direct sea-keeping analysis or model testing, is required? Do the rules clearly state the assumptions used in the methodologies to develop ship motions and loads?

2.3.6 Are the methodologies used to develop ship motions and loads validated by experimental or service history data?

3 Structural strength

3.1 Statement of intent

Confirm that the rules require a ship to be designed to withstand at net scantlings the operational and environmental loads for its specified design life. Confirm that the rules include the appropriate safety margins which reflect the degree of uncertainty.

3.2 Information and documentation requirements

3.2.1 Description of how the rules provide net scantlings that are sufficient to avoid excessive deformation (either elastic or plastic, as appropriate) and prevent failure modes including, but not limited to, those involving yielding and buckling of hull girder and structural members. Include the following:

- .1 Description of the strength assessment methodology.
- .2 Explanation of how the net scantlings concept is applied in the rules for structural design.
- .3 Justification of the methodologies used to obtain the global and local, static and dynamic design loads.
- .4 Justification of the acceptable limits of yielding and buckling.
- .5 Explanation of how the rules prevent deformation from compromising the integrity of the ship's structure. The term "deformation" means translational and/or rotational displacement.

- .6 Explanation of the requirements for finite element structural modelling, including load application, boundary conditions, element selection and mesh size. Explanation of how primary, secondary and tertiary stresses are considered.
- .7 List of the loading conditions considered in the rules that are to be included in the structural evaluation. Justification of the loading conditions especially in terms of what parts of the structure may be critically loaded and stressed.
- .8 Description of how construction tolerances and procedures, and material imperfections are accounted for in the rules.
- .9 Justification of the rationale of the rules for weld design and procedures.
- .10 Justification of how structural continuity is taken into account in the rules, including termination of primary structures at the fore and aft ends of the cargo block.
- .11 Explanation of how the rules consider deformations or vibration levels that may damage or impair the ship structure, equipment or machinery.
- .12 Description of the safety factors in conjunction with assumed design load(s) and justification as to why they are appropriate.
- .13 Description of how the strength assessment methodology has been benchmarked with experimental and service history data.
- .14 Application of the rules to representative design(s). Documentation should include an illustration of the midships section and of the cargo region showing net and gross scantlings, as well as a summary of the background calculations used to develop the scantlings.

3.2.2 Explanation of how the rules consider structural integrity at net scantlings for typical loading/discharging and ballast exchange scenarios, including criteria to determine acceptability and provide reasonably attainable sequences of loading, discharging and ballasting.

3.2.3 Justification of the methodology used for the calculation of local stresses, including stress concentration factors, if utilized.

3.2.4 Justification of how the rules account for sloshing effects.

3.2.5 Description of how the rules determine that the net scantlings are sufficient to provide adequate ultimate strength. Include the following:

- .1 Description of the ultimate strength assessment methodology.
- .2 Justification of how the net scantlings concept is applied in the rules for ultimate strength.
- .3 Justification of the loads considered for the ultimate strength analysis.
- .4 Explanation of the methodology used for calculating hull girder capacity and ultimate strength of plates and stiffeners, individually and in combination.

- .5 Description of acceptable limits of ultimate strength, including safety factors, with justification why they are appropriate.
- .6 Description of how the ultimate strength assessment methodology has been benchmarked with experimental and service history data.

3.2.6 Description of any protective arrangements and/or reinforcements required to avoid damage caused by loading/unloading equipment that would compromise the ship's structural integrity.

3.3 Evaluation criteria

3.3.1 Do the rules specify the probability of exceedance for which global and local dynamic loads are calculated?

3.3.2 Are the limits of yielding, buckling and ultimate strength set at levels that will maintain the structural integrity?

3.3.3 Do the rules satisfactorily consider deformations that may compromise the integrity of the ship's structure?

3.3.4 Do the rules adequately specify the required extent of finite element models and how ship structures should be modelled, including how boundary conditions and loads are to be applied, and elements and mesh size selected? Are primary, secondary and tertiary stresses properly accounted for?

3.3.5 Are the following loading conditions included: homogeneous, partial, alternate loads, multi-port, ballast conditions including ballast management, and loading and offloading sequences and intermediate conditions? Are these, and any other conditions identified in the loading or stability manuals, considered without exceeding allowable bending moments, shear forces and stresses?

3.3.6 Is the methodology for developing the lightship and deadweight load distributions clearly defined, in a way that it will be consistently applied?

3.3.7 Do the rules satisfactorily consider workmanship standards and construction tolerances?

3.3.8 Do weld designs and procedures provide a level of strength of welds in their net condition to withstand the expected loads on the joints?

3.3.9 Are the requirements for tapering primary structures, including transitions fore and aft of the cargo block, defined in sufficient detail in the rules?

- .1 Where prescriptive measures are specified, do these measures provide for adequate continuity and termination of primary structure and primary supporting members?
- .2 Where analytical methods are allowed for evaluating structural continuity, is the methodology sufficiently defined to enable adequate assessment of the proposed arrangements for the termination of primary structure and primary supporting members? Do these analytical methods include both the local stress evaluation and the effect of the relative stiffness of the members at the termination?

3.3.10 Do the rules satisfactorily consider deformations or vibration levels that may damage or impair the ship structure, equipment or machinery?

3.3.11 Do the rules include adequate safety factors?

3.3.12 Do the rules include methodology for the development of local loads, including specifying the characteristics of intended cargoes relevant to loading (cargo arrangement, minimum density, angle of repose for bulk cargo) and minimum density of ballast to be applied?

3.3.13 Do the rules specify procedures for direct calculation of local stresses in structural details. If direct calculation is not required, do the rules include definition and application of stress concentration factors? If stress concentration factors are utilized, a justification of the definition and application of these factors should be included.

3.3.14 With regard to local strength:

- .1 Do the rules require the structure in way of cargo and ballast spaces to be suitable for any level of filling, from empty to maximum capacity (where maximum capacity is either full or the clearly defined operational limit on filling height or cargo mass)?
- .2 Do the rules define loading conditions for evaluation, including the loaded/empty condition of adjacent cargo and/or ballast spaces, and the draughts to be considered for each loading condition?
- .3 For oil tankers, do the rules consider any reasonable combination of cargo or ballast space loading, including asymmetric loading and loading in any one athwartships row across to be empty at or near the scantling draught?
- .4 Do the assumed draught limits and assumed densities and other cargo characteristics cover the expected operational range?
- .5 Do the local strength evaluations consider the effects of maximum allowable still water and wave bending and shear loads on the structure?
- .6 Are sloshing effects adequately covered by the rules?

3.3.15 Do the rules require adequate protective arrangements and/or reinforcements to avoid damage caused by loading/unloading equipment that would compromise the ship's structural integrity?

3.3.16 Have the results from the strength and ultimate strength assessments been benchmarked? Do they compare favourably with service history and other standards?

3.3.17 Do the illustrations of the representative designs show net and gross scantlings? Do the background calculations show how the structure at net scantlings withstands the operational and environmental loads for the specified design life?

4 Fatigue life

4.1 *Statement of intent*

Confirm that the fatigue life is not less than the specified design life.

4.2 *Information and documentation requirement*

4.2.1 Description of how the rules provide that structural arrangement and net scantlings are sufficient to meet a calculated fatigue life not less than the specified design life. Include the following:

- .1 Description of the fatigue assessment methodology used in the rules including sea state data, long term statistics of wave data applied in fatigue calculations, derivation of cyclic loads, calculation of stress ranges, modelling of their distribution functions, S-N curves used and factors of safety or margins taken.
- .2 Explanation of where and how the net scantlings concept is applied in the rules for fatigue. Justification of the values of the scantlings used in the calculations.
- .3 List of the loading conditions required by the rules to be considered as part of the fatigue evaluation. Justification of the selection of loading conditions.
- .4 Justification of how the rules take into account dynamic loads and their combinations, including the probability level for which dynamic loads are calculated.
- .5 Justification of the process for the selection of the structural members and typical critical design details required to be included in evaluation of ship's fatigue life.
- .6 Justification of procedures for the calculation of cyclic stresses and stress ranges in structural details. Explanation of the method used to take into account stress concentrations, as may be applicable to the detail analysed.
- .7 Explanation of the requirements for finite element structural modelling, including load application, boundary conditions, element selection and mesh size. Explanation of how primary, secondary and tertiary stresses are considered.
- .8 Description of how construction tolerances and procedures are accounted for in the rules. Description of how surface treatment, such as grinding and peening, are addressed in the rules.
- .9 Description of how the rules consider the effect on fatigue life of unprotected structural details in seawater (e.g., when the breakdown of coating leads to exposure to seawater).
- .10 Description of how the rules take into consideration slamming (e.g., whipping) and vibratory-induced fatigue effects (e.g., springing or propeller induced vibrations). Justification should be provided if not explicitly considered in fatigue assessment.
- .11 Explanation of the effect of uncertainties/assumptions on fatigue life, highlighting any margins used in fatigue calculations, taking into consideration the consequence of failure of the particular structural member.
- .12 Description of how the fatigue assessment methodology has been benchmarked with experimental and/or service history data.

4.3 Evaluation criteria

4.3.1 Is the methodology used in fatigue life assessment properly justified? Are the explanations provided to cover the sea state data used, long term statistics of wave data applied, derivation of cyclic loads, method of calculation of the stress ranges and their distribution functions, S-N curves used and the factors of safety or margins taken, satisfactory?

4.3.2 Are the values of the scantlings required to be used in the calculations properly justified according to the net scantlings concept?

4.3.3 Are the assumed operating conditions (e.g., loaded and ballast) specified by the rules in the long term fatigue response analysis adequate for a representative ship's operating profile? Are the stress ranges so obtained appropriate to represent the long term fatigue response?

4.3.4 Are the internal/external dynamic loads and their combinations based on the North Atlantic environment? Is the probability level for which these loads are calculated properly justified?

4.3.5 Do the rules require the systematic identification of areas prone to fatigue throughout the entire ship that are required to be included in the evaluation of the ship's fatigue life?

4.3.6 Are the procedures for the calculation of cyclic stresses and stress ranges in structural details properly justified?

4.3.7 Do the rules properly take into account stress concentrations, as may be applicable to the detail analysed?

4.3.8 Do the rules specify the required extent of finite element models and how ship structures should be modelled, including how boundary conditions and loads are to be applied, and elements and mesh size selected? Are primary, secondary and tertiary stresses properly accounted for?

4.3.9 Do the rules satisfactorily consider construction tolerances and procedures? Are surface treatments, such as grinding and peening, adequately considered?

4.3.10 Do the fatigue life calculations consider degradation of coating performance under seawater environment?

4.3.11 Do the rules take slamming (e.g., whipping) and vibratory-induced fatigue effects (e.g., springing or propeller induced vibrations) into consideration? If not explicitly considered in fatigue assessment, is adequate justification provided?

4.3.12 Do the rules satisfactorily account for uncertainties or assumptions on fatigue life assessment?

4.3.13 Have the results from the fatigue life assessment methodology been benchmarked? Do the results compare favourably with service history and other standards?

5 Residual strength

5.1 Statement of intent

Confirm that the rules provide a reasonable level of residual strength after damage (e.g., collision, grounding and flooding).

5.2 Information and documentation requirements

5.2.1 Description of how ships designed to the rules with intact structure at net scantlings have sufficient ultimate strength to sustain flooding as defined in relevant IMO instruments.

5.2.2 Justification that ships designed to the rules have adequate residual strength to survive a casualty event. Include the following:

- .1 Description of the methodology used to assess residual strength.
- .2 Description of the flooding scenarios and the corresponding structural damage. Explanation of the relationship of the flooding scenarios with IMO instruments.
- .3 Description of the environmental conditions and period of exposure representative of the sea states expected for collision and grounding scenarios, and justification why they are appropriate.
- .4 Description of the acceptance criteria for residual strength of the ship in damaged condition, and justification if different from ultimate strength.
- .5 Where it is determined that the rules inherently provide adequate residual strength, justification should be provided that demonstrates through analysis of a range of representative ship designs and loading conditions.

5.2.3 Description of how the residual strength assessment procedure has been validated with experimental and/or casualty history data.

5.3 Evaluation criteria

5.3.1 Can a ship designed to the rules sustain flooding as defined in relevant IMO instruments and survive with intact structure at net scantlings?

5.3.2 Does a ship designed to the rules have sufficient residual strength to survive a more significant casualty event (e.g., flooding with structural damage due to collision or grounding) under environmental conditions consistent with the likelihood of occurrence? Are the assumed damage scenarios representative of the intent of damage in relevant IMO instruments?

5.3.3 Has the residual strength assessment procedure been validated with experimental and/or casualty data?

6 Protection against corrosion

6.1 Coating life

6.1.1 Statement of intent

Confirm that the coatings are properly selected and applied to protect the structure throughout the target useful life of the coating.

6.1.2 Information and documentation requirements

6.1.2.1 Provision of information on coating life and mandatory use of coatings, including:

- .1 Mandatory locations and/or spaces where coatings are required to be used.
- .2 Types of coating to be used for the various spaces.
- .3 Required target useful life of the coating and explanation for selection.
- .4 The coating performance standard to be followed (e.g., IMO PSPC⁶ where mandated).

6.1.2.2 Description of the requirements to be followed in spaces where other corrosion prevention systems are used.

6.1.2.3 Description of the procedures used to verify that the selected coating system with associated surface preparation and application methods is compatible with the shipyard production processes.

6.1.2.4 Description of the procedures used to verify that the specified coating procedures have been followed.

6.1.2.5 If an alternative is proposed to that prescribed by IMO instruments, justification to support the selection of coating standards and target useful life of the coating or areas of application.

6.1.3 Evaluation criteria

6.1.3.1 Do the rules include appropriate requirements to achieve stated target useful life of the coating and fulfil SOLAS requirements as a minimum?

6.1.3.2 Do alternative or additional requirements allowed by the rules provide protection levels at least equivalent to those required by SOLAS?

6.1.3.3 Are the procedures indicated in 6.1.2.3 and 6.1.2.4 adequately documented in the rules?

6.1.3.4 Is adequate justification provided to support the use of alternatives to SOLAS or other IMO instruments?

6.2 Corrosion addition

6.2.1 Statement of intent

Confirm that the rules for corrosion addition values are rationally based and adequate for the specified design life.

6.2.2 Information and documentation

6.2.2.1 Description of the methodology used to determine values for the design corrosion additions so that the scantlings remain above net scantlings over the specified design life.

⁶ Performance standard for protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers, adopted by the Organization by resolution MSC.215(82).

6.2.2.2 Description of how assumed corrosion rates and rule design corrosion additions are determined based on ship type and location within the hull. Description should address how stress corrosion and any other modes of accelerated corrosion have been taken into consideration.

6.2.2.3 Description of any additional rule requirements that provide special consideration for other parameters such as unusual cargoes, loadings, trading patterns, material properties, etc.

6.2.2.4 Description of how corrosion of welds and heat-affected zones are considered.

6.2.2.5 Description of the steel/structure renewal criteria.

6.2.2.6 Description of how the methodology to determine corrosion addition and establish steel/structure renewal criteria has been benchmarked with experimental and service history data.

6.2.3 Evaluation criteria

6.2.3.1 Does the methodology and supporting statistical data justify the corrosion additions?

6.2.3.2 Confirm that reductions in the rule design corrosion additions are prohibited.

6.2.3.3 Is consideration given to the corrosion of welds and heat-affected zones?

6.2.3.4 Do the rules clearly establish the steel/structure renewal criteria? For ships in service, do the renewal criteria provide for scantlings that are not less than the required net scantlings and that produce a hull girder section modulus within SOLAS requirements?

6.2.3.5 Has the methodology used to determine corrosion addition and establish steel/structure renewal criteria been benchmarked? Does it compare favourably with experimental and service history data?

7 Structural redundancy

7.1 Statement of intent

Confirm that the rules require sufficient redundancy to withstand localized damage in any one stiffening structural member.

7.2 Information and documentation requirements

7.2.1 Demonstration that the rules have adequate requirements to provide ship structural redundancy.

7.2.2 Description of the requirements for localized damage assessments, including where applicable, modelling in finite element structural analysis.

7.2.3 Description of how the methodology used to assess structural redundancy has been benchmarked with experimental and/or service history data.

7.3 Evaluation criteria

7.3.1 Does a ship designed to the rules have sufficient structural redundancy to survive localized damage to a stiffening member?

7.3.2 Are the methods for assessing the consequences of localized damage satisfactorily described?

7.3.3 Has the methodology used to assess structural redundancy been benchmarked? Does it compare favourably with experimental or casualty history data?

8 Watertight and weathertight integrity

8.1 *Statement of intent*

Confirm that the rules require adequate watertight and weathertight integrity for North Atlantic environmental conditions, including adequate strength for the closing arrangements and adequate redundancy for the securing devices.

8.2 *Information and documentation requirements*

8.2.1 Description of the rule requirements for watertight and weathertight integrity.

8.2.2 Description of how the rules consider criteria from IMO instruments for determining which openings in the hull envelope are required to be watertight or weathertight.

8.2.3 Explanation of the criteria used in the development of the rules to determine that the strength and redundancy for closing arrangements, if appropriate, of the watertight and weathertight openings is adequate for the environmental conditions and specified design life.

8.3 *Evaluation criteria*

8.3.1 Do the rules satisfy all relevant IMO watertight and weathertight integrity requirements?

8.3.2 Do the rules require sufficient strength for closing arrangements and securing devices to meet environmental conditions, design loads and specified design life? Do the rules require securing devices to have adequate redundancy?

9 Human element considerations

9.1 *Statement of intent*

Confirm that the rules incorporate human element and ergonomic considerations into the structural design and arrangement to facilitate operations, inspection and maintenance activity.

9.2 *Information and documentation requirements*

9.2.1 Description of how the rules consider human element and ergonomics during the structural design and arrangement of the ship, including:

- .1 Stairs, vertical ladders, ramps, walkways and work platforms used for permanent means of access and/or for inspection and maintenance operations.
- .2 Structural arrangements to facilitate the provision of adequate lighting and ventilation, and to minimize noise and vibration in spaces normally occupied or manned by shipboard personnel.

- .3 Structural arrangements to facilitate the provision of adequate lighting and ventilation in tanks or closed spaces (e.g., duct keels, pipe tunnels, etc.) for periodic inspections, survey and maintenance.
- .4 Structural arrangements to facilitate emergency egress of inspection personnel or ships crew from tanks, holds, voids, etc.

9.2.2 Description of how ergonomic design principles are factored into the design rules, including any guidance information provided to designers.

9.3 Evaluation criteria

9.3.1 Are human element and ergonomic considerations accounted for in the design of stairs, vertical ladders, ramps, walkways and work platforms?

9.3.2 Do the rules address structural or other arrangements to facilitate adequate lighting and ventilation in spaces normally manned or occupied by the crew?

9.3.3 Do the rules address structural or other measures to reduce the generation and transmission of vibration to a level at or below the acceptable ergonomic standards for spaces normally manned or occupied by the crew?

9.3.4 Do the rules address structural or other arrangements to facilitate adequate lighting and ventilation for the purposes of inspection, survey and maintenance?

9.3.5 Do the rules require structural arrangements to facilitate emergency egress from tanks or closed spaces?

9.3.6 Are relevant IMO requirements included or referred to in the rules (i.e. bow access, etc.)?

10 Design transparency

10.1 Statement of intent

Confirm that the design and construction process is transparent, and that design information is clearly stated and made available to the classification society, the owner and the flag State, with due consideration to intellectual property rights.

10.2 Information and documentation requirements

[10.2.1 Description of how the rules require design specific information [as required by SOLAS regulation ...] [procedures for updating the SCF] to be included in the Ship Construction File, including:

- [.1 Areas requiring special attention throughout the ship's life.
- .2 All design parameters limiting the operation of a ship.
- .3 Any alternatives to the rules, including structural details and equivalency calculations.

- .4 Approved and stamped “as built” drawings and information.
- .5 Procedures for updating the Ship Construction File over the lifetime of the ship.
- .6 Net (renewal) scantlings for all the structural members.
- .7 Minimum hull girder section modulus along the length of the ship which has to be maintained throughout the life of the ship.]]

10.2.2 Description of the process, requirements and criteria for assessing, documenting and communicating alternative methods as being equivalent to specific rule requirements.

10.2.3 Description of procedures for ensuring that all relevant design and construction information, including correspondence exchanged between shipyard and recognized organization, is available to the owner and flag State during the construction process.

10.3 Evaluation criteria

10.3.1 Do the rules establish requirements for including and updating design specific and critical information, including limitations, in the Ship Construction File?

10.3.2 Do the rules establish clear criteria and techniques for assessing alternative methods used in the design? Are all equivalencies documented in the Ship Construction File and made available to the owner and/or flag State?

10.3.3 Do the rules establish procedures to provide all relevant design and construction information, including correspondence exchanged between shipyard and recognized organization, e.g., on net scantlings, corrosion margins used, etc., to be made available to the owner and flag State during the construction process?

CONSTRUCTION

11 Construction quality procedures

11.1 Statement of intent

Confirm that the rules contain provisions for ensuring that construction tolerances and procedures assumed during rule formulation are implemented during construction.

11.2 Information and documentation requirements

11.2.1 Demonstration that the rules require the shipyard’s construction procedures and standards to meet a minimum level of quality. Include the following:

- .1 Procedures for specifying the materials and their tracking.
- .2 Assembly requirements, including alignment, joining, welding, surface preparation, coating, castings, heat treatment, etc.
- .3 Approval scheme of welding procedures.

- .4 Qualification scheme of welders.
- .5 Requirements for yard fit-up and other quality control inspections.

11.2.2 Description of actions taken when a shipyard is determined as not meeting the minimum level of quality construction.

11.2.3 Description of the procedures followed when the “as built” is different than “design”. Include the following:

- .1 Criteria for determining when review of the “as built” drawings is required.
- .2 Criteria for determining when re-evaluation for strength and/or fatigue life is required. This should include consideration of net scantlings where appropriate.

11.2.4 Description of the procedures for ensuring that construction tolerances are verified and maintained.

11.2.5 Description of the procedures used to continuously update the rules based on construction and in-service experience.

11.2.6 Description of how the quality construction requirements have been benchmarked with recognized international shipbuilding and repair quality standards.

11.3 Evaluation criteria

11.3.1 Are the construction tolerances used in rule formulations and calculations incorporated in the construction plan and verified during construction?

11.3.2 Do the quality requirements include continuous design improvement based on experience?

11.3.3 Have the rules’ quality construction requirements been benchmarked? Do they compare favourably with recognized international shipbuilding and repair quality standards?

12 Survey during construction

12.1 Statement of intent

Confirm that the rules include provisions to ensure that the construction of ships is carried out to an acceptable quality level.

12.2 Information and documentation requirements

12.2.1 Description of the construction survey procedure requirements, including:

- .1 Types of surveys (visual, non-destructive examination, etc.) depending on location, materials, welding, casting, coatings, etc.
- .2 Establishment of a construction survey schedule for all assembly stages from the kick-off meeting, through all major construction phases, up to delivery.

- .3 Inspection/survey plan, including provisions for critical areas identified during design approval.
- .4 Survey criteria for acceptance.
- .5 Interaction with shipyard, including notification and documentation of survey results.
- .6 Correction procedures to remedy construction defects.
- .7 List of items that would require scheduling or formal surveys.
- .8 Qualification of surveyors.
- .9 Determination and documentation of areas that need special attention throughout ship's life, including criteria used in making the determination.
- .10 Procedures for determining the number and qualifications of surveyors for a project.

12.2.2 Description of procedures for providing shipowner and/or flag Administration representatives results of construction surveys.

12.2.3 Description of the requirements for testing during survey, including test criteria.

12.2.4 Description of how the construction survey requirements have been benchmarked with recognized international shipbuilding and repair quality standards.

12.3 Evaluation criteria

12.3.1 Do the rules require the development of a Survey Plan that is reviewed during the initial kick-off meeting? Does the survey plan address activities during ship construction sufficient to verify the ship is built in accordance with the appropriate rules or standards and address all elements in 12.2.1?

12.3.2 Do the rules contain provisions that areas of high stress or fatigue risk identified during design approval are surveyed with adequate detail and extent during construction?

12.3.3 Do the rules have procedures to provide for an adequate number of qualified surveyors to carry out proposed surveys in accordance with the size of the project?

12.3.4 Is survey related correspondence between shipyard and recognized organization relating to ship design and construction made available to the owner and flag Administration?

12.3.5 Do the rules include acceptance criteria for all tests required? Are the test criteria based on rule formulation parameters?

12.3.6 Have the rules' construction survey requirements been benchmarked? Do they compare favourably with recognized international shipbuilding and repair quality standards?

IN-SERVICE CONSIDERATIONS

13 Survey and maintenance

13.1 Statement of intent

Verify that the rules provide for spaces of adequate size to facilitate survey and maintenance. Confirm that the rules provide for the identification of areas requiring special attention over the life of the ship based on design parameter selection.

13.2 Information and documentation requirements

13.2.1 Description of the rule requirements to provide for spaces of adequate size to facilitate ship survey and maintenance.

13.2.2 Description of rule requirements to identify items for inclusion in an in-service Survey Plan, including:

- .1 Areas of high stress and with special fatigue considerations.
- .2 Any other areas that need special attention throughout the ship's life, including criteria used in making the determination (e.g., wave impact loading, mechanical impact areas, special materials, etc.).
- .3 Structural design features that were selected on the basis of special in-service requirements.

13.3 Evaluation criteria

13.3.1 Do the rules include design requirements to provide for spaces of adequate size for ship survey and maintenance?

13.3.2 Do the rules contain provisions for the identification of areas of high stress or fatigue risk that require monitoring while in-service?

13.3.3 Do the rules include provisions for the identification of structural design features selected on the basis of special in-service requirements?

13.3.4 Do the rules include provisions for the identification of any other areas needing special attention during the ship's life?

14 Structural accessibility

14.1 Statement of intent

Confirm that the rules include provisions to facilitate access for internal structural inspection and thickness measurements.

14.2 Information and documentation requirements

Description of rule requirements to facilitate overall and close-up inspections and thickness measurements of the internal structure. Include the following:

- .1 Standards for access.
- .2 Requirements for development of an Access Plan.

14.3 Evaluation criteria

14.3.1 Are relevant IMO requirements included or referred to in the rules (i.e. permanent means of access, etc.)?

14.3.2 Are there provisions to provide for safe access to critical areas referred to in 13.2.2?

RECYCLING CONSIDERATIONS

15 Recycling

15.1 Statement of intent

Confirm that the rules require the listing of materials used for the construction of the hull structure with a view toward identification of environmentally acceptable or recyclable materials and the development of an inventory list.

15.2 Information and documentation requirements

15.2.1 Description of the rule requirements for listing of materials, including:

- .1 List of materials used for the construction of the hull structure.
- .2 Provisions for listing of materials in the Ship Construction File.
- .3 Provisions for documenting changes to any of the above during the ship's service life.

15.3 Evaluation criteria

15.3.1 Do the rules include provisions that listing of materials used for the construction of the hull structure within the scope of the Standard, including:

- .1 List of materials used for the construction of the hull structure.
- .2 Provisions for listing of materials in the Ship Construction File.

15.3.2 Do the rules include provisions for documenting changes to any of the above during the Ship's service life?

APPENDIX 1
SUBMISSION TEMPLATE

<i>1 FLAG STATE INFORMATION</i>	
1 Name of flag State:	
2 Full contact details for the designated single point of contact:	
Name and title:	
Address:	
Telephone No.:	
Fax No.:	
E-mail address:	
3 Organization recognized by flag State:	

<i>2 RECOGNIZED ORGANIZATION INFORMATION</i>	
1 Name of recognized organization:	
2 Full contact details for the designated single point of contact:	
Name and title:	
Address:	
Telephone No.:	
Fax No.:	
E-mail address:	
3 Rules coverage:	Oil tanker Bulk carrier

3 SELF-ASSESSMENT SUMMARY			
Functional requirement	Fully covered in rules	Not covered in rules	Comments
<i>Design</i>			
1 Design life			
2 Environmental conditions			
3 Structural strength			
4 Fatigue life			
5 Residual strength			
6 Protection against corrosion			
6.1 Coating life			
6.2 Corrosion addition			
7 Structural redundancy			
8 Watertight and weathertight integrity			
9 Human element consideration			
10 Design transparency			
<i>Construction</i>			
11 Construction quality procedures			
12 Survey during construction			
<i>In-service considerations</i>			
13 Survey and maintenance			
14 Structural accessibility			
<i>Recycling considerations</i>			
15 Recycling			

4 RULE LINKAGE SUMMARY TABLE

1 (Title and text of the relevant functional requirement)

1.1 (Text of the Statement of intent)

Information and documentation requirement	Regulation submitted (2)	Rule type (3)	Reference (4)
1.2.1	(Text) (1)		

Justification (If applicable) (5):

Evaluation criterion	Summarized comment (7)	Satisfied by rules (8)	Rule linkage (9)
1.3.1	(Text) (6)	(YES/NO)	

Detailed technical explanation (10):

Information and documentation requirement	Regulation submitted (2)	Rule type (3)	Reference (4)
1.2.n	(Text) (1)		

Justification (If applicable) (5):

Evaluation criterion	Summarized comment (7)	Satisfied by rules (8)	Rule linkage (9)
1.3.n	(Text) (6)	(YES/NO)	

Detailed technical explanation (10):

Notes:

Section 4 of the submission template should be filled for each information and documentation element and its associated evaluation criterion, for each functional requirement.

- (1) Copy text of the relevant information and documentation requirement established in the Guidelines.
- (2) Indicate the file name or internet link or title of the hard copy where the information/documentation provided is found in the documentation package.
- (3) Specify type of information/documentation provided (public rule, internal procedure, unified requirement, guidelines, etc.).
- (4) Indicate the reference in the rules where the information is found.
- (5) Develop the justification required. If a justification is not required, detailed technical explanation should be submitted in any case.
- (6) Copy text of the evaluation criterion established in the Guidelines for the relevant information and documentation requirement.
- (7) Include a short comment explaining why the relevant evaluation criterion is satisfied.
- (8) Indicate if the relevant evaluation criterion is satisfied by rules according to self assessment.
- (9) Specify all the rules locations where the relevant criterion is applied.
- (10) Provide a technical explanation showing why the evaluation criterion is said to be satisfied or why it is not satisfied.

APPENDIX 2

FORMAT FOR GBS AUDIT TEAM REPORTS

1 EXECUTIVE SUMMARY

- 1.1 Subject of audit
- 1.2 Scope of verification audit (e.g., audit plan)
- 1.3 Findings of audit
- 1.4 Recommendation of the GBS Audit Team

2 SUBMISSION OF PARTICULARS

- 2.1 Submitting Administration(s)
- 2.2 Recognized organization name (if applicable)
- 2.3 Title and revision date of rules submitted
- 2.4 Submission date
- 2.5 Report type: [Interim] [Final]
- 2.6 GBS Audit Team members

3 AUDIT SUMMARY

Functional requirement	Conforming	Not conforming	Summary comment
<i>Design</i>			
1 Design life			
2 Environmental conditions			
3 Structural strength			
4 Fatigue life			
5 Residual strength			
6 Protection against corrosion			
6.1 Coating life			
6.2 Corrosion addition			
7 Structural redundancy			
8 Watertight and weathertight integrity			
9 Human element considerations			
10 Design transparency			
<i>Construction</i>			
11 Construction quality procedures			
12 Survey during construction			
<i>In-service considerations</i>			
13 Survey and maintenance			
14 Structural accessibility			
<i>Recycling considerations</i>			
15 Recycling			

ANNEX 6**PRINCIPLES AND GUIDELINES RELATING TO THE REVIEW AND AUDIT
OF THE PERFORMANCE OF LRIT DATA CENTRES AND
OF THE INTERNATIONAL LRIT DATA EXCHANGE¹****General**

1 The Maritime Safety Committee, pursuant to the provisions of SOLAS regulation² V/19-1.14 and subject to the relevant provisions of section 14 of the Revised performance standards³, has determined the following in relation to the review and audit of the performance of LRIT Data Centres and of the International LRIT Data Exchange.

Audit client⁴

2 The audit client is all Contracting Governments to the 1974 SOLAS Convention (Contracting Governments) acting through the Committee.

Auditor

3 The auditor is the LRIT Coordinator.

Auditee(s)

4 The auditees are all LRIT Data Centres (DCs) and the International LRIT Data Exchange (IDE).

Audit programme

5 The audit programme is a third party audit conducted by the LRIT Coordinator annually.

Audit programme objectives

6 The objectives of the review and audit of the performance of DCs and of the IDE are:

- .1 to verify that the LRIT system operates in accordance with the provisions of SOLAS regulation V/19-1 and of the Revised performance standards, taking into account the related provisions of the Technical specification for the LRIT system and any relevant decisions of the Committee;

¹ Terms not otherwise defined in this document should have the same meaning as the meaning attributed to them in chapters I and V of the International Convention for the Safety of Life at Sea, 1974, as amended; Revised performance standards and functional requirements for the Long-range identification and tracking of ships adopted by resolution MSC.263(84).

² *Regulation* means a regulation of the annex to the International Convention for the Safety of Life at Sea, 1974, as amended.

³ *Revised performance standards* means the Revised performance standards and functional requirements for the Long-range identification and tracking of ships adopted by resolution MSC.263(84).

⁴ All audit related terms used in this document have the same meaning as in ISO 19011:2002 on Guidelines for quality and/or environmental management systems auditing.

- .2 to verify that Contracting Governments and Search and rescue services receive only the LRIT information they have requested and are entitled to receive;
- .3 to verify that DCs operate in accordance with the provisions of SOLAS regulation V/19-1 and of the Revised performance standards, taking into account the related provisions of the Technical specification for the LRIT system and any relevant decisions of the Committee;
- .4 to verify that the IDE operates in accordance with the provisions of SOLAS regulation V/19-1 and of the Revised performance standards, taking into account the related provisions of the Technical specification for the LRIT system and any relevant decisions of the Committee;
- .5 to identify any need for initiating corrective and/or preventative actions in the LRIT system; and
- .6 to identify opportunities for improving the efficiency, effectiveness and security of the LRIT system.

Audit criteria

7.1 The main criteria are SOLAS regulation V/19-1 and the Revised performance standards.

7.2 The supplementary criteria are the Technical specification for the LRIT system⁵; guidance, guidelines and recommendations approved or adopted by the Committee in relation to the LRIT system; and instructions of the Committee to the LRIT Coordinator in connection with the review and audit of the performance of the auditees.

7.3 The documents setting out the main and supplementary criteria are listed in appendix 1 which provides an index of all documents relating to the long-range identification and tracking of ships as on 5 June 2009.

7.4 After each session of the Committee and when amendments to any of the technical documentation for the LRIT system⁶ are agreed, the Secretariat should update the information provided in appendix 1 accordingly and should forward the revised copy of appendix 1 to the LRIT Coordinator and to all auditees.

Audit scope

8.1 The scope of the audit is limited to matters relating to the operation of the DCs and of the IDE to the extent such matters can be reasonably and with confidence verified through the audit evidence.

8.2 Matters relating to the implementation of the provisions of SOLAS regulation V/19-1 and of the Revised performance standards by Contracting Governments are outside the scope of the audit and fall within the scope of the Framework and Procedures for the Voluntary IMO Member State Audit Scheme adopted by resolution A.974(24).

⁵ Refer to MSC.1/Circ.1259/Rev.2 on Interim revised technical specifications for the LRIT system.

⁶ Refer to MSC.1/Circ.1259/Rev.2 on Interim revised technical specifications for the LRIT system and annexes 2 and 3 of the annex to MSC.1/Circ.1294 on Long-range identification and tracking system Technical documentation (Part II).

8.3 Specifically all matters which would require the provision to the LRIT Coordinator of list(s) of ships which at any particular time are required to transmit LRIT information in accordance with the provisions of SOLAS regulation V/19-1.4.1 are outside the scope of the audit. For example, questions such as whether all such ships have in fact been integrated and are transmitting LRIT information or whether or how the provisions of SOLAS regulation V/19-1.7 are implemented.

Audit evidence

9.1 The LRIT Coordinator should establish the details of the audit evidence it requires to be submitted for the review and audit of the performance of DCs and of the IDE.

9.2 The audit evidence should, at least, consist of:

- .1 replies to questionnaire(s) developed by the LRIT Coordinator taking into account the audit objectives, criteria and scope;
- .2 samples of LRIT information and samples of LRIT messages, including related samples of journals, where such ones are required;
- .3 statistics compiled by DCs and the IDE;
- .4 records of communications between the LRIT Coordinator and DCs and/or the IDE;
- .5 data and information contained in the production environment of the LRIT Data Distribution Plan.

9.3 The LRIT Coordinator should put in place the necessary arrangements to ensuring that all audit evidence is protected from unauthorized access or disclosure as from the time such evidence is received by the LRIT Coordinator.

9.4 The LRIT Coordinator is not normally required to submit for the consideration of the Committee any of the audit evidence.

9.5 The LRIT Coordinator should destroy all audit evidence relating to the review and audit of the performance of a DC or of the IDE immediately after the Committee has reviewed and accepted its related report, or after the resolution of any pending or outstanding issues or after the closing of any outstanding non-conformities, whichever is later. The method for the destruction of the audit evidence remains at the discretion of the LRIT Coordinator.

9.6 All DCs are required to provide to the LRIT Coordinator at least one sample of LRIT information and LRIT messages which covers 30 consecutive calendar days (the 30 day sample) during the period which is to be covered by the audit. The LRIT Coordinator should determine, in consultation with the DC concerned, the first and last date to be covered by the samples. The DC and the LRIT Coordinator should endeavour to reach a mutual understanding on the dates to be covered by the sample in cases of any difference of opinion. If such consultations do not yield an agreed approach, then the stipulations of the LRIT Coordinator should prevail.

9.7 Taking into account the number of DCs, it is recognized that the IDE may be required to provide, in relation to the review and audit of the performance of DCs, the journal(s) of all transactions for each calendar year. As a result the LRIT Coordinator and the IDE should consider and agree the related arrangements and the LRIT Coordinator should provide information to the Committee as appropriate.

9.8 The LRIT Coordinator may, if it finds it fit and appropriate, require the submission of further audit evidence as the circumstances may warrant.

9.9 The LRIT Coordinator should establish and make known to all DCs and to the IDE the method(s) and format(s) to be used for providing the audit evidence and in particular the samples. The LRIT Coordinator should provide information to this end to the Committee.

9.10 Notwithstanding the related provisions of the Revised performance standards, the LRIT Coordinator should seek the provision of audit evidence from Search and rescue services if it finds it fit and appropriate.

Audit plan and procedures

10 The LRIT Coordinator should develop the audit plans and procedures and should provide details of these to all DCs and the IDE. The LRIT Coordinator should provide information to this end to the Committee.

Non-conformities and corrective actions

11.1 The LRIT Coordinator should determine and grade all non-conformities as either major non-conformities or non-conformities.

11.2 The DC concerned or the IDE should, in consultation with the LRIT Coordinator, determine and propose the corrective action(s) and the period within which the non-conformities should be dealt with and closed.

11.3 The LRIT Coordinator should, if it finds it fit and appropriate, require the submission of further audit evidence or samples with a view to ascertaining that the agreed corrective action(s) have been implemented and the non-conformity has been dealt with and/or that any further non-conformities have not occurred.

11.4 In case any identified non-conformity affects the continuity of the LRIT system, the LRIT Coordinator should, pending the adoption by MSC 87 of the continuity of service plan for the LRIT system, inform accordingly, as soon as is practically possible, the United States as operator of the IDE, the Secretariat and the Chairman of the *Ad Hoc* LRIT Group and should provide to them relevant details in order to enable them to determine the actions to be taken in accordance to the instructions of the Committee.

Date of commencement of the audit

12 The LRIT Coordinator should, in consultation with the auditee, determine the date on which the audit should commence.

Audit language

13 All correspondence, records, communications, audit evidence and audit plans and procedures should be in the English language.

Reporting

14.1 For each of DCs and for the IDE, the LRIT Coordinator should submit:

- .1 to the Secretary-General a detailed audit report which should provide a complete, accurate, concise and clear record of the audit and should include or refer to the following: the audit objectives, the audit scope, particularly identification of the unit or processes audited and the time period covered; a list of the auditee representative(s); the dates when the audit activities were conducted; the audit criteria; the audit findings; the audit conclusions; and any statement of a confidential nature; and
- .2 to the Committee, through the Secretary-General, a summary audit report which should include or refer to the following: the audit findings, including information on non-conformities and their status; the audit conclusions; any uncertainties and/or obstacles encountered that could decrease the reliability of the audit conclusions; any areas not covered although within the scope of the audit; any unresolved diverging opinions between the LRIT Coordinator and the auditee; recommendations for improvement, if any; and agreed follow-up action plans, if any.

14.2 The LRIT Coordinator should, prior to submitting the detailed and summary audit reports to the Secretary-General, forward these, no later than one month after the completion of the audit, to the auditee for its perusal and comments, if any.

14.3 Any comments of the auditee should be submitted to the LRIT Coordinator within 15 days after the date of which the report has been sent to the auditee and, unless the LRIT Coordinator and the auditee agree to include these in the summary audit report, these should be included in the detailed audit report.

14.4 The LRIT Coordinator and the auditee should endeavour to resolve any difference of opinion in relation to the contents of the detailed and the summary audit reports within 5 days after the date the auditee has submitted its comments. If the matter can not be resolved, the comments of the auditee should be included in the summary audit report for consideration of the issue by the Committee.

14.5 The LRIT Coordinator should submit the detailed and the summary audit reports to the Secretary-General no later than one month prior to the opening of the session of the Committee which will consider the reports. The LRIT Coordinator should send copies of the detailed and the summary audit reports submitted to the auditee concerned. The detailed and the summary audit reports should be in the English language.

14.6 The Secretary-General should submit a report to the Committee in the three working languages of the Organization listing the auditees and providing a summary of the related summary audit reports it has received. The summary audit reports should not be translated in the three working languages and should be circulated for consideration by the Committee as documents containing information in the English language only.

14.7 The Secretary-General should protect the detailed audit reports from unauthorized access or disclosure and should keep these for a period not exceeding five years as from the date of completion of the audit they referred to and afterwards should destroy these, provided there are no outstanding or pending issues.

14.8 The Secretary-General should make available to the Committee the detailed audit reports if requested. In such cases, the detailed audit reports should not be translated in the three working languages of the Organization and should be made available to the Committee as documents containing information in the English language only.

Reporting to the Committee

15.1 The LRIT Coordinator should report to each session of the Committee on the review and audit of the performance of DCs and/or of the IDE which had been conducted and completed since the previous session of the Committee.

15.2 The review and audit of the performance of the IDE should be considered as becoming due on 15 October of each year.

15.3 The review and audit of the performance of a DC should be considered as becoming due on the anniversary of the date on which DCs:

- .1 which participated in the prototype testing phase, become part of the production environment of the LRIT system; and
- .2 which have undergone or are undergoing or are to undergo developmental and integration testing, have completed or are to complete the integration testing phase.

15.4 The review and audit of the performance of DCs and of the IDE could be carried out within 3 months before and after the anniversary date provided the period between two consecutive audits does not exceed 15 months.

15.5 A DC may request the LRIT Coordinator to review and audit its performance on a date other than the anniversary date referred to in paragraph 13.3, provided the first audit is not held more than 15 months after the date referred to in paragraph 13.3. In such a case the new date should be considered thereafter as being the anniversary date. The LRIT Coordinator should provide to the Committee information to this end as appropriate.

Review of fee structures

16 Unless the Committee decides otherwise, the LRIT Coordinator is not required to audit the fee structures of DCs or of the IDE.

Technical issues

17 Appendix 2 provides related information on a number of matters in connection with the review and audit of the performance of DCs and of the IDE of a technical nature.

Audit programme review and monitoring

18 Contracting Governments acting through the Committee should monitor the implementation of the audit programme and, at appropriate intervals, should review it to assess whether its objectives have been met and identify opportunities for improvement or to initiate corrective or preventative actions.

APPENDIX 1

LIST OF DOCUMENTS RELATING TO THE LONG-RANGE IDENTIFICATION AND TRACKING OF SHIPS (as on 5 June 2009)

Resolution MSC.202(81)	2006 SOLAS (chapter V) amendments
Resolution MSC.211(81)	Arrangements for the timely establishment of the Long-range identification and tracking system
Resolution MSC.242(83)	Use of long-range identification and tracking information for safety and marine environmental protection purposes
Resolution MSC.263(84)	Revised performance standards and functional requirements for the long-range identification and tracking of ships
Resolution MSC.264(84)	Establishment of the International LRIT Data Exchange on an interim basis
Resolution MSC.275(85)	Appointment of the LRIT Coordinator
Resolution MSC 276(85)	Operation of the international LRIT data exchange on an interim basis
MSC.1/Circ.1259/Rev.2	Interim revised technical specifications for the LRIT system
MSC.1/Circ.1294	Long-range identification and tracking system Technical documentation (Part II)
MSC.1/Circ.1295	Guidance in relation to certain types of ships which are required to transmit LRIT information on exemptions and on certain operational matters
MSC.1/Circ.1298	Guidance on the implementation of the LRIT system
MSC.1/Circ.1307	Guidance on the survey and certification of compliance of ships with the requirement to transmit LRIT information
MSC.1/Circ.1308	Guidance to Search and rescue services in relation to requesting and receiving LRIT information
MSC.1/Circ.1309	Information communicated to the Organization in relation to the establishment of LRIT Data Centres and their position in relation to developmental testing or the production LRIT system

APPENDIX 2

TECHNICAL MATTERS

1 The LRIT Coordinator is not expected to engage in any audit, verification or investigation as to the existence, accuracy or veracity of Notices of Arrival in connection with requests for the provision of LRIT information pursuant to the provisions of regulation V/19-1.8.1.2 and in this respect Notices of Arrival should be considered as being outside the scope of the review and audit.

2 In order to verify compliance with the provisions of paragraph 13.1 of the Revised performance standards, *TimeStamp1* and *TimeStamp4* of the LRIT position report message should be used. The time duration established by the difference between *TimeStamp1* and *TimeStamp4* of the LRIT position report message should be less than 15 min. Furthermore, the latency between the transmitting DC sending the LRIT information to the end user should be considered as being negligible (i.e. of the order of seconds).

3 In order to verify compliance with the provisions of paragraph 13.2 of the Revised performance standards on-demand LRIT information should be considered as a poll request and the *TimeStamp* parameter of the LRIT position request and the *TimeStamp4* of the LRIT position report should be used. The time duration established by the difference between *TimeStamp* parameter of the LRIT position request and *TimeStamp4* of the LRIT position report message should be less than 30 min. Furthermore, the latency between the transmitting DC sending the report to the end user should be considered as being negligible (i.e. of the order of seconds). Additionally, if for any reason it is found necessary to use alternative sources to verify such compliance, the LRIT Coordinator should use the Rx and Tx *TimeStamps* contained in the IDE's journal for the LRIT position request and LRIT position report messages.

4 Each port, port facility or place under the jurisdiction of a Contracting Government should be considered as the centre of a circle and the distance indicated in the LRIT position request as corresponding with the radius of the circle. The difference on the calculation of the distances using different chart projections should be considered as being irrelevant, in terms of the precision required by the LRIT system as in most cases the ships are in motion when transmitting LRIT information.

5 DCs should provide to the LRIT Coordinator all LRIT Messages with the exception of the file attachments associated with Message 10 (DDP Update) and Message 12 (Journal). All LRIT messages are required to have a unique *MessageId* parameter.

6 LRIT position reports that have not been transmitted to any other DCs until the time of the information for the review and audit is provided should be classified as Message type 1 with Response type 2 when provided to the LRIT Coordinator. The parameters *TimeStamp5*, *DataUserRequestor* and the attribute *positionSent* of the LRIT position reports that have not been transmitted to any other DCs should be populated with values as follows:

- .1 *Timestamp5* = dummy value (i.e.1000-01-01T00:00:00Z)
- .2 *DataUserRequestor* = 0003 (the LRIT ID of the LRIT Coordinator)
- .3 *positionSent* = false

7 The IDE should provide its journal with the exception of the file attachments associated with Message 10 (DDP Update) and Message 12 (Journal). The parameters *Latitude*, *Longitude*, *TimeStamp1* and *ShipborneEquipmentId* of the LRIT position reports should be populated with values as follows:

- .1 *Latitude* = dummy value
- .2 *Longitude* = dummy value
- .3 *TimeStamp1* = dummy value (i.e.1000-01-01T00:00:00Z)
- .4 *ShipborneEquipmentId* = dummy value

8 All information contained in the audit files should be in XML and in the English language encoded in UTF-8.

8.1 DCs should provide to the LRIT Coordinator, upon request, a file *LRITMessageLog_<LRIT ID of the DC>.xml*⁷.

8.2 The IDE should provide the LRIT Coordinator, upon request, a file *LRITMessageLog_<LRIT ID of the IDE>.xml*⁸.

⁷ The XML schema to be used for the *LRITMessageLog* file is specified in section 2.3.10 (Processing Journal messages) of the Technical specifications for communications within the LRIT system.

⁸ The XML schema file to be used for the *LRITMessageLog* file is specified in section 2.3.10 (Processing Journal messages) of the Technical specifications for communications within the LRIT system.

ANNEX 7**DRAFT AMENDMENTS TO THE FSS CODE****CHAPTER 1****GENERAL****1 Application**

- 1 The following new sentence is added to the end of paragraph 1.2:

“However, amendments to the Code adopted after 1 July 2002 shall apply only to ships the keels of which are laid or which are at a similar stage of construction, on or after the date on which the amendments enter into force, unless expressly provided otherwise.”

CHAPTER 10**SAMPLE EXTRACTION SMOKE DETECTION SYSTEMS**

- 2 The existing text of chapter 10 is replaced by the following:

“1 APPLICATION

1.1 This chapter details the specification of sample extraction smoke detection systems in cargo spaces as required by chapter II-2 of the Convention. Unless expressly provided otherwise, the requirements of this paragraph shall apply to ships constructed on or after [*date of entry into force*].

2 ENGINEERING SPECIFICATIONS**2.1 General requirements**

2.1.1 Wherever in the text of this chapter the word “system” appears, it shall mean “sample extraction smoke detection system”.

2.1.1.1 A sample extraction smoke detection system consists of the following main components:

- .1 smoke accumulators: air collection devices installed at the open ends of the sampling pipes in each cargo hold that perform the physical function of collecting air samples for transmission to the control panel through the sampling pipes, and may also act as discharge nozzles for the fixed-gas fire-extinguishing system, if installed;
- .2 sampling pipes: a piping network that connects the smoke accumulators to the control panel, arranged in sections to allow the location of the fire to be readily identified;

- .3 three-way valves: if the system is interconnected to a fixed-gas fire-extinguishing system, three-way valves are used to normally align the sampling pipes to the control panel and, if a fire is detected, the three-way valves are re-aligned to connect the sampling pipes to the fire-extinguishing system discharge manifold and isolate the control panel; and
- .4 control panel: the main element of the system which provides continuous monitoring of the protected spaces for indication of smoke. It typically may include a viewing chamber or smoke sensing units. Extracted air from the protected spaces is drawn through the smoke accumulators and sampling pipes to the viewing chamber, and then to the smoke sensing chamber where the airstream is monitored by electrical smoke detectors. If smoke is sensed, the repeater panel (normally on the bridge) automatically sounds an alarm (not localized). The crew can then determine at the smoke sensing unit which cargo hold is on fire and operate the pertinent three-way valve for discharge of the extinguishing agent.

2.1.2 Any required system shall be capable of continuous operation at all times except that systems operating on a sequential scanning principle may be accepted, provided that the interval between scanning the same position twice gives a maximum allowable interval determined as follows:

The interval (I) should depend on the number of scanning points (N) and the response time of the fans (T), with a 20% allowance:

$$I = 1.2 \times T \times N$$

However, the maximum allowable interval should not exceed 120 s ($I_{\max} = 120$ s).

2.1.3 The system shall be designed, constructed and installed so as to prevent the leakage of any toxic or flammable substances or fire-extinguishing media into any accommodation and service space, control station or machinery space.

2.1.4 The system and equipment shall be suitably designed to withstand supply voltage variations and transients, ambient temperature changes, vibration, humidity, shock, impact and corrosion normally encountered in ships and to avoid the possibility of ignition of a flammable gas-air mixture.

2.1.5 The system shall be of a type that can be tested for correct operation and restored to normal surveillance without the renewal of any component.

2.1.6 An alternative power supply for the electrical equipment used in the operation of the system shall be provided.

2.2 Component requirements

2.2.1 The sensing unit shall be certified to operate before the smoke density within the sensing chamber exceeds 6.65% obscuration per metre.

2.2.2 Duplicate sample extraction fans shall be provided. The fans shall be of sufficient capacity to operate with the normal conditions or ventilation in the protected area and the connected pipe size shall be determined with consideration of fan suction capacity and piping arrangement to satisfy the conditions of paragraph 2.4.2.2. Sampling pipes shall be a minimum of 12 mm internal diameter. The fan suction capacity should be adequate to ensure the response of the most remote area within the required time criteria in paragraph 2.4.2.2. Means to monitor airflow shall be provided in each sampling line.

2.2.3 The control panel shall permit observation of smoke in the individual sampling pipes.

2.2.4 The sampling pipes shall be so designed as to ensure that, as far as practicable, equal quantities of airflow are extracted from each interconnected accumulator.

2.2.5 Sampling pipes shall be provided with an arrangement for periodically purging with compressed air.

2.2.6 The control panel for the smoke detection system shall be tested according to standards EN 54-2 (1997), EN 54-4 (1997) and IEC 60092-504 (2001). Alternative standards may be used as determined by the Administration.

2.3 Installation requirements

2.3.1 *Smoke accumulators*

2.3.1.1 At least one smoke accumulator shall be located in every enclosed space for which smoke detection is required. However, where a space is designed to carry oil or refrigerated cargo alternatively with cargoes for which a smoke sampling system is required, means may be provided to isolate the smoke accumulators in such compartments for the system. Such means shall be to the satisfaction of the Administration.

2.3.1.2 Smoke accumulators shall be located on the overhead or as high as possible in the protected space, and shall be spaced so that no part of the overhead deck area is more than 12 m measured horizontally from an accumulator. Where systems are used in spaces which may be mechanically ventilated, the position of the smoke accumulators shall be considered having regard to the effects of ventilation. At least one additional smoke accumulator is to be provided in the upper part of each exhaust ventilation duct. An adequate filtering system shall be fitted at the additional accumulator to avoid dust contamination.

2.3.1.3 Smoke accumulators shall be positioned where impact or physical damage is unlikely to occur.

2.3.1.4 Sampling pipe networks shall be balanced to ensure compliance with paragraph 2.2.4 above. The number of accumulators connected to each sampling pipe shall ensure compliance with paragraph 2.4.2.2.

2.3.1.5 Smoke accumulators from more than one enclosed space shall not be connected to the same sampling pipe.

2.3.1.6 In cargo holds where non-gastight “tween deck panels” (movable stowage platforms) are provided, smoke accumulators shall be located in both the upper and lower parts of the holds.

2.3.2 *Sampling pipes*

2.3.2.1 The sampling pipe arrangements shall be such that the location of the fire can be readily identified.

2.3.2.2 Sampling pipes shall be self-draining and suitably protected from impact or damage from cargo working.

2.4 System control requirements

2.4.1 *Visual and audible fire signals*

2.4.1.1 The detection of smoke or other products of combustion shall initiate a visual and audible signal at the control panel and indicating units.

2.4.1.2 The control panel shall be located on the navigation bridge or in the fire control station. An indicating unit shall be located on the navigation bridge if the control panel is located in the fire control station.

2.4.1.3 Clear information shall be displayed on or adjacent to the control panel and indicating units designating the spaces covered.

2.4.1.4 Power supplies necessary for the operation of the system shall be monitored for loss of power. Any loss of power shall initiate a visual and audible signal at the control panel and the navigating bridge which shall be distinct from a signal indicating smoke detection.

2.4.1.5 Means to manually acknowledge all alarm and fault signals shall be provided at the control panel. The audible alarm sounders on the control panel and indicating units may be manually silenced. The control panel shall clearly distinguish between normal, alarm, acknowledged alarm, fault and silenced conditions.

2.4.1.6 The system shall be arranged to automatically reset to the normal operating condition after alarm and fault conditions are cleared.

2.4.2 *Testing*

2.4.2.1 Suitable instructions and component spares shall be provided for the testing and maintenance of the system.

2.4.2.2 After installation, the system shall be functionally tested using smoke generating machines or equivalent as a smoke source. An alarm shall be received at the control unit in not more than 180 s for vehicle decks, and not more than 300 s for container and general cargo holds, after smoke is introduced at the most remote accumulator.”

3 The following new chapter 16 is added after the existing chapter 15:

“CHAPTER 16

FIXED HYDROCARBON GAS DETECTION SYSTEMS

1 APPLICATION

1.1 This chapter details the specifications for fixed hydrocarbon gas detection systems as required by chapter II-2 of the Convention.

1.2 A combined gas detection system required by regulation II-2/4.5.7.3 and under regulation II-2/4.5.10 may be accepted in cases where the system fully complies with the requirement of regulation II-2/2 of the Convention.

2 ENGINEERING SPECIFICATIONS

2.1 General

2.1.1 The fixed hydrocarbon gas detection system referred to in chapter II-2 of the Convention shall be designed, constructed and tested to the satisfaction of the Administration based on performance standards developed by the Organization¹.

2.1.2 The system shall be comprised of a central unit for gas measurement and analysis and gas sampling pipes in all ballast tanks and void spaces of double-hull and double-bottom spaces adjacent to the cargo tanks, including the forepeak tank and any other tanks and spaces under bulkhead deck adjacent to cargo tanks.

2.1.3 The system may be integrated with the cargo pump-room gas detection system provided the spaces in paragraph 2.1.2 are sampled at the rate required in paragraph 2.2.3.1. Continuous sampling from other locations may also be considered provided the sampling rate is complied with.

2.2 Component requirements

2.2.1 *Gas sampling lines*

2.2.1.1 Common sampling lines to the detection equipment shall not be fitted, except the lines serving each pair of sampling points as required in paragraph 2.2.1.3.

2.2.1.2 The materials of construction and the dimensions of gas sampling lines shall be such as to prevent restriction. Where non-metallic materials are used, they shall be electrically conductive. The gas sampling lines shall not be made of aluminium.

¹ Refer to the Guidelines for the design, construction and testing of fixed hydrocarbon gas detection system to be developed by the Organization.

2.2.1.3 The configuration of gas sampling lines shall be adapted to the design and size of each space. Except as provided in paragraphs 2.2.1.4 and 2.2.1.5, the sampling system shall allow for a minimum of two hydrocarbon gas sampling points, one located on the lower and one on the upper part where sampling is required. When required, the upper gas sampling point shall not be located lower than 1 m from the tank top. The position of the lower located gas sampling point shall be above the height of the girder of bottom shell plating but at least 0.5 m from the bottom of the tank and it shall be provided with means to be closed when clogged. In positioning the fixed sampling points, due regard should also be given to the density of vapours of the oil products intended to be transported and the dilution from space purging or ventilation.

2.2.1.4 For ships with deadweight of less than 50,000 tonnes, the Administration may allow the installation of one sampling location for each tank for practical and/or operational reasons.

2.2.1.5 For ballast tanks in the double bottom, ballast tanks not intended to be partially filled and void spaces, the upper gas sampling point is not required.

2.2.1.6 Means shall be provided to prevent gas sampling lines from clogging when tanks are ballasted by using compressed air flushing to clean the line after switching from ballast to cargo loaded mode. The system shall have an alarm to indicate if the gas sampling lines are clogged.

2.2.2 Gas analysis unit

2.2.2.1 The gas analysis unit shall be located in a safe space and may be located in areas outside the ship's cargo area; for example, in the cargo control room and/or navigation bridge in addition to the hydraulic room when mounted on the forward bulkhead, provided the following requirements are observed:

- .1 sampling lines shall not run through gas safe spaces, except where permitted under paragraph 5.7.2.3.5;
- .2 the hydrocarbon gas sampling pipes shall be equipped with flame arresters. Sample hydrocarbon gas is to be led to the atmosphere with outlets arranged in a safe location, not close to a source of ignitions and not close to the accommodation area air intakes;
- .3 a manual isolating valve, which shall be easily accessible for operation and maintenance, shall be fitted in each of the sampling lines at the bulkhead on the gas safe side;
- .4 the hydrocarbon gas detection equipment including sample piping, sample pumps, solenoids, analysing units etc., shall be located in a reasonably gas-tight cabinet (e.g., fully enclosed steel cabinet with a door with gaskets) which is to be monitored by its own sampling point. At a gas concentration above 30% of the lower flammable limit inside the steel enclosure the entire gas analysing unit is to be automatically shut down; and

- .5 where the enclosure cannot be arranged directly on the bulkhead, sample pipes shall be of steel or other equivalent material and without detachable connections, except for the connection points for isolating valves at the bulkhead and analysing unit, and are to be routed on their shortest ways.

2.2.3 Gas detection equipment

2.2.3.1 The gas detection equipment shall be designed to sample and analyse from each sampling point, sequentially at intervals not exceeding 30 min.

2.2.3.2 Means shall be provided to enable measurements with portable instruments, in case the fixed system is out of order or for system calibration. In case the system is out of order, procedures shall be in place to continue to monitor the atmosphere with portable instruments and to record the measurement results.

2.2.3.3 Audible and visual alarms are to be initiated in the cargo control room, navigating bridge and at the analysing unit when the vapour concentration in a given space reaches a pre-set value, which shall not be higher than the equivalent of 30% of the lower flammable limit.

2.2.3.4 The gas detection equipment shall be so designed that it may readily be tested and calibrated.”

ANNEX 8

RESOLUTION MSC.284(86)

**AMENDMENTS TO THE REVISED GUIDELINES FOR APPROVAL OF
SPRINKLER SYSTEMS EQUIVALENT TO THAT REFERRED TO IN
SOLAS REGULATION II-2/12 (RESOLUTION A.800(19))**

THE MARITIME SAFETY COMMITTEE,

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

NOTING the significance of the performance and reliability of the sprinkler systems approved under provisions of regulation II-2/12 of the International Convention for the Safety of Life at Sea (SOLAS), 1974,

DESIROUS of clarifying the application of the amended Revised Guidelines for approval of sprinkler systems equivalent to that referred to in SOLAS regulation II-2/12 (resolution A.800(19)), adopted by resolution MSC.265(84),

HAVING CONSIDERED, at its eighty-sixth session, the text of the proposed amendments to the Revised Guidelines for approval of sprinkler systems equivalent to that referred to in SOLAS regulation II-2/12 (resolution A.800(19)),

1. ADOPTS the amendments to the Revised Guidelines for approval of sprinkler systems equivalent to that referred to in SOLAS regulation II-2/12 (resolution A.800(19)), the text of which is set out in the Annex to the present resolution;
2. INVITES Governments to apply the amendments when approving equivalent sprinkler systems according to paragraph 1-1 (Application) of the Annex.

ANNEX

**AMENDMENTS TO THE REVISED GUIDELINES FOR APPROVAL OF
SPRINKLER SYSTEMS EQUIVALENT TO THAT REFERRED TO IN
SOLAS REGULATION II-2/12* (RESOLUTION A.800(19))**

1 The existing section 1-1 is replaced by the following:

“1-1 APPLICATION

1-1.1 The present Guidelines apply to equivalent sprinkler systems, referred to in SOLAS regulation II-2/10.6 and chapter 8 of the FSS Code, tested on or after 9 May 2008. Equivalent sprinkler systems undergoing testing and approval in accordance with resolution A.800(19), may be approved by the Administration until 1 July 2009.

1-1.2 All type approvals issued to confirm compliance of equivalent sprinkler systems with the Revised Guidelines, adopted by resolution A.800(19), remain valid and may be renewed to remain valid until 1 July 2015.

1-1.3 Existing equivalent sprinkler systems, approved and installed based on resolution A.800(19), should be permitted to remain in service as long as they are serviceable.”

* Refer to SOLAS chapter II-2 in force before 1 January 2002. The equivalent regulation in the amended chapter II-2 is regulation II-2/10.6.4, and chapter 8 of the FSS Code.

ANNEX 9

DRAFT AMENDMENTS TO SOLAS CHAPTER II-2

CHAPTER II-2
CONSTRUCTION – FIRE PROTECTION, FIRE DETECTION
AND FIRE EXTINCTIONPART A
GENERAL**Regulation 1 – Application**

1 The existing paragraph 1.1 is replaced by the following:

“1.1 Unless expressly provided otherwise, this chapter shall apply to ships the keels of which are laid or which are at a similar stage of construction on or after [...]”

2 The existing subparagraph .2 of paragraph 1.2 is replaced by the following:

“.2 the expression *all ships* means ships, irrespective of type, constructed before, on or after [...]; and”

3 The existing subparagraph .2 of paragraph 1.3 is replaced by the following:

“.2 the expression *all ships* means ships constructed before, on or after [...]”

4 The existing paragraph 2.1 is replaced by the following:

“2.1 Unless expressly provided otherwise, for ships constructed before [...], the Administration shall ensure that the requirements which are applicable under chapter II-2 of the International Convention for the Safety of Life at Sea, 1974, as amended by resolutions MSC.1(XLV), MSC.6(48), MSC.13(57), MSC.22(59), MSC.24(60), MSC.27(61), MSC.31(63), MSC.57(67), MSC.194(80), MSC.201(81), MSC.216(82), MSC.256(84), MSC.269(85) and [MSC....(88)] are complied with.”

5 In paragraph 3.1, the date “1 July 2002” is replaced by the date [...].

6 In paragraph 3.2, the date “1 July 2002” is replaced by the date [...].

Regulation 3 – Definitions

7 The existing paragraph 23 is replaced by the following:

“23 *Fire Test Procedures Code* means the International Code for Application of Fire Test Procedures, 2010 as adopted by the Maritime Safety Committee of the Organization by resolution [MSC....(88)], as may be amended by the Organization, provided that such amendments are adopted, brought into force and take effect in accordance with the provisions of article VIII of the present Convention concerning the amendment procedures applicable to the Annex other than chapter I.”

PART B
PREVENTION OF FIRE AND EXPLOSION

Regulation 4 – Probability of ignition

8 The existing paragraph 5.7 is replaced by the following:

“5.7 Gas measurement and detection

5.7.1 *Portable instrument*

Tankers shall be equipped with at least one portable instrument for measuring oxygen and one for measuring flammable vapour concentrations, together with a sufficient set of spares. Suitable means shall be provided for the calibration of such instruments.

5.7.2 *Arrangements for gas measurement in double-hull spaces and double-bottom spaces*

5.7.2.1 Suitable portable instruments for measuring oxygen and flammable vapour concentrations in double-hull spaces and double-bottom spaces shall be provided. In selecting these instruments, due attention shall be given to their use in combination with the fixed gas sampling line systems referred to in paragraph 5.7.2.2.

5.7.2.2 Where the atmosphere in double-hull spaces cannot be reliably measured using flexible gas sampling hoses, such spaces shall be fitted with permanent gas sampling lines. The configuration of gas sampling lines shall be adapted to the design of such spaces.

5.7.2.3 The materials of construction and dimensions of gas sampling lines shall be such as to prevent restriction. Where plastic materials are used, they shall be electrically conductive.

5.7.3 *Arrangements for fixed hydrocarbon gas detection systems in double-hull and double-bottom spaces of oil tankers*

5.7.3.1 In addition to the requirements in paragraphs 5.7.1 and 5.7.2, oil tankers of 20,000 tonnes deadweight and above, constructed on or after [date], shall be provided with a fixed hydrocarbon gas detection system complying with the International Code for Fire Safety Systems for measuring hydrocarbon gas concentrations in all ballast tanks and void spaces of double-hull and double-bottom spaces adjacent to the cargo tanks, including the forepeak tank and any other tanks and spaces under bulkhead deck adjacent to cargo tanks.

5.7.3.2 Oil tankers provided with constant operative inerting systems for such spaces need not be equipped with fixed hydrocarbon gas detection equipment.

5.7.3.3 Notwithstanding the above, cargo pump-rooms subject to the provisions of paragraph 5.10 of this regulation need not comply with the requirements of this paragraph.”

ANNEX 10**DRAFT MSC-MEPC CIRCULAR****PROHIBITION OF BLENDING MARPOL CARGOES ON BOARD
[DURING THE SEA VOYAGE] [AT SEA]**

1 The Maritime Safety Committee, at its eighty-sixth session (27 May to 5 June 2009) [and the Marine Environment Protection Committee, at its fifty-ninth session (13 to 17 July 2009)], noted that there were concerns that the practice of the physical blending of MARPOL regulated cargoes on board [during the sea voyage] [at sea] for the purposes of creating new product blends presents clear hazards for the safety of the ship and protection of the marine environment. Having considered the proposal by the Bulk Liquids and Gases Sub-Committee at its thirteenth session, it was agreed that such practices should be prohibited and that mandatory provisions should be developed in that respect under the auspices of both Committees.

2 Until the matter can be further discussed in detail by the BLG Sub-Committee and approved by the Maritime Safety Committee and the Marine Environment Protection Committee, physical blending refers to the process whereby the ship's cargo pumps and pipelines are used to internally circulate two or more different cargoes within the ship with the intent to achieve a cargo with a different product designation. This circular does not preclude the master from undertaking cargo transfers for the safety of the ship or protection of the marine environment.

3 As an interim measure, pending the adoption of such mandatory provisions, the Committees have agreed to issue this circular with the aim of bringing the attention of all stakeholders, to the above referred decision.

4 Member Governments are invited to bring the content of the circular to the attention of all interested parties.

ANNEX 11

**RESOLUTION MSC.285(86)
(adopted on 1 June 2009)**

**INTERIM GUIDELINES ON SAFETY FOR NATURAL GAS-FUELLED ENGINE
INSTALLATIONS IN SHIPS**

THE MARITIME SAFETY COMMITTEE,

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

NOTING that the International Convention for the Safety of Life at Sea, 1974 currently does not have any provisions for use of gas as fuel on ships other than gas carriers,

RECOGNIZING a need for the development of a code for gas-fuelled ships,

ACKNOWLEDGING that, in the interim, there is an urgent need to provide guidance to the Administrations on the gas-fuelled engine installations in ships,

HAVING CONSIDERED the Interim Guidelines prepared by the Sub-Committee on Bulk Liquids and Gases at its thirteenth session,

1. ADOPTS the Interim Guidelines on safety for natural gas-fuelled engine installations in ships, the text of which is set out in the Annex to the present resolution;
2. INVITES Governments to apply the Interim Guidelines to gas-fuelled ships other than those covered by the IGC Code;
3. URGES Member Governments and the industry to submit information, observations, comments and recommendations based on the practical experience gained through the application of these Interim Guidelines and submit relevant safety analysis on gas-fuelled installations;
4. AGREES to continue the work on the development of the International Code of Safety for Gas-fuelled Ships (IGF Code).

ANNEX

**INTERIM GUIDELINES ON SAFETY FOR
NATURAL GAS-FUELLED ENGINE INSTALLATIONS IN SHIPS**

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PREAMBLE

- 1 These Interim Guidelines have been developed to provide an international standard for ships, other than vessels covered by the IGC Code, with natural gas-fuelled engine installations.
- 2 The goal of these Interim Guidelines is to provide criteria for the arrangement and installation of machinery for propulsion and auxiliary purposes, using natural gas as fuel, which will have an equivalent level of integrity in terms of safety, reliability and dependability as that which can be achieved with a new and comparable conventional oil-fuelled main and auxiliary machinery.
- 3 To achieve this goal, the functional requirements described below are embodied in the relevant parts of these Interim Guidelines:
 - .1 Minimize hazardous areas as far as is practicable to reduce the potential risks that might affect the safety of the ship, personnel and equipment.
 - .2 Minimize equipment installed in hazardous areas to that required for operational purposes. Equipment installed in hazardous areas should be suitable and appropriately certified.
 - .3 Arrange hazardous areas to ensure pockets of gas cannot accumulate under normal and foreseeable failure conditions.
 - .4 Arrange propulsion and electrical power generating installation to be capable of sustained or restored operation in the event that a gas-fuelled essential service becomes inoperative.
 - .5 Provide ventilation to protect personnel from an oxygen deficient atmosphere in the event of a gas leakage.
 - .6 Minimize the number of ignition sources in hazardous spaces by design, arrangements and selection of suitable equipment.
 - .7 Arrange safe and suitable gas fuel storage and bunkering arrangements capable of taking on board and containing the gas fuel in the required state without leakage and overpressure.
 - .8 Provide gas piping systems, containment and overpressure relief arrangements that are of suitable design, construction and installation for their intended application.
 - .9 Design, construct, install, operate and protect gas-fuelled machinery, gas system and components to achieve safe and reliable operation consistent with that of oil-fuelled machinery.
 - .10 Arrange and locate gas storage tank rooms and machinery spaces such that a fire or explosion in either will not render the machinery/equipment in other compartments inoperable.

- .11 Provide safe and reliable gas-fuel control engineering arrangements consistent with those of oil-fuelled machinery.
- .12 Provide appropriate selection of certified equipment and materials that are suitable for use within gas systems.
- .13 Provide gas detection systems suitable for the space concerned together with monitoring, alarm and shutdown arrangements.
- .14 Provide protection against the potential effects of a gas-fuel explosion.
- .15 Prevent explosion and hazardous consequences.
- .16 Provide fire detection, protection and extinction measures appropriate to the hazards concerned.
- .17 Provide a level of confidence in a gas-fuelled unit that is equivalent to that for an oil-fuelled unit.
- .18 Ensure that commissioning, trials and maintenance of gas utilization machinery satisfy the goal in terms of reliability, availability and safety.
- .19 Provide provision for procedures detailing the guidelines for safe routine and unscheduled inspection and maintenance.
- .20 Provide operational safety through appropriate training and certification of crew.
- .21 Provide for submission of technical documentation in order to permit an assessment of the compliance of the system and its components with the applicable rules and guidelines.

4 The Interim Guidelines address the safety of ships utilizing natural gas as fuel.

5 Natural gas (dry) is defined as gas without condensation at common operating pressures and temperatures where the predominant component is methane with some ethane and small amounts of heavier hydrocarbons (mainly propane and butane).

6 The gas composition can vary depending on the source of natural gas and the processing of the gas. Typical composition in volume (%):

Methane (C ₁)	94.0%
Ethane (C ₂)	4.7%
Propane (C ₃)	0.8%
Butane (C ₄ +)	0.2%
Nitrogen	0.3%
Density gas	0.73 kg/sm ³
Density liquid	0.45 kg/dm ³
Calorific value (low)	49.5 MJ/kg
Methane number	83

The gas may be stored and distributed as compressed natural gas (CNG) or liquefied natural gas (LNG).

CHAPTER 1

GENERAL

1.1 Application

1.1.1 These Interim Guidelines apply to internal combustion engine installations in ships using natural gas as fuel. The engines may use either a single fuel (gas) or dual fuel (gas and oil fuel), and the gas may be stored in gaseous or liquid state.

1.1.2 These Interim Guidelines should be applied in addition to the relevant provisions of the International Convention for the Safety of Life at Sea (SOLAS), 1974 and the Protocol of 1988 relating thereto, as amended.

1.1.3 The Interim Guidelines are applicable to new ships. Application to existing ships should be decided by the Administration to the extent it deems necessary.

1.2 Hazards

These Guidelines address the hazards related to the arrangements for the storage, distribution and use of natural gas as a fuel.

1.3 Definitions

For the purpose of these Guidelines, unless otherwise stated below, definitions are as defined in SOLAS chapter II-2.

1.3.1 *Accidents* mean uncontrolled events that may entail the loss of human life, personal injuries, environmental damage or the loss of assets and financial interests.

1.3.2 *Certified safe type* means electrical equipment that is certified safe by a recognized body based on a recognized standard¹. The certification of electrical equipment is to correspond to the category and group for methane gas.

1.3.3 *CNG* means compressed natural gas.

1.3.4 *Control stations* mean those spaces defined in SOLAS chapter II-2 and additionally for these Guidelines, the engine control room.

1.3.5 *Double block and bleed valve* means a set of three automatic valves located at the fuel supply to each of the gas engines.

1.3.6 *Dual fuel engines* mean engines that can burn natural gas and fuel oil oil fuel simultaneously or operate on oil fuel or gas only.

1.3.7 *Enclosed space* means any space within which, in the absence of artificial ventilation, the ventilation will be limited and any explosive atmosphere will not be dispersed naturally².

¹ Refer to IEC 60079 series, Explosive atmospheres and IEC 60092-502:1999 Electrical Installations in Ships – Tankers – Special Features.

² See also definition in IEC 60092-502:1999.

1.3.8 *ESD* means emergency shutdown.

1.3.9 *Explosion* means a deflagration event of uncontrolled combustion.

1.3.10 *Explosion pressure relief* means measures provided to prevent the explosion pressure in a container or an enclosed space exceeding the maximum overpressure the container or space is designed for, by releasing the overpressure through designated openings.

1.3.11 *Gas* means a fluid having a vapour pressure exceeding 2.8 bar absolute at a temperature of 37.8°C.

1.3.12 *Hazardous area* means an area in which an explosive gas atmosphere or a flammable gas (flashpoint below 60°C) is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of electrical apparatus.

Hazardous areas are divided into zones 0, 1 and 2 as defined below³:

- .1 *Zone 0* is an area in which an explosive gas atmosphere or a flammable gas with a flashpoint below 60°C is present continuously or is present for long periods.
- .2 *Zone 1* is an area in which an explosive gas atmosphere or a flammable gas with a flashpoint below 60°C is likely to occur in normal operation.
- .3 *Zone 2* is an area in which an explosive gas atmosphere or a flammable gas with a flashpoint below 60°C is not likely to occur in normal operation and, if it does occur, is likely to do so only infrequently and will exist for a short period only.

1.3.13 *Non-hazardous area* means an area which is not considered to be hazardous, i.e. gas safe, provided certain conditions are being met.

1.3.14 *High-pressure piping* means gas fuel piping with maximum working pressure greater than 10 bar.

1.3.15 *IEC* means the International Electrotechnical Commission.

1.3.16 *IGC Code* means the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk, as amended.

1.3.17 *LEL* means the lower explosive limit.

1.3.18 *LNG* means liquefied natural gas (refer to 1.3.22).

1.3.19 *Main tank valve* means a remote operated valve on the gas outlet from a gas storage tank, located as close to the tank outlet point as possible.

1.3.20 *MARVS* means the maximum allowable relief valve setting of a gas tank.

1.3.21 *Master gas fuel valve* means an automatic valve in the gas supply line to each engine located outside the machinery space for gas-fuelled engines and as close to the gas heater (if fitted) as possible.

³ Refer also to the area classification specified in Sec. 2.5 of IEC 60079-10-1:2008 Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres.

1.3.22 *Natural gas* means a gas without condensation at common operating pressures and temperatures where the predominant component is methane with some ethane and small amounts of heavier hydrocarbons (mainly propane and butane).

1.3.23 *Open deck* means a deck that is open on both ends, or is open on one end and equipped with adequate natural ventilation that is effective over the entire length of the deck through permanent openings distributed in the side panels or in the deck above.

1.3.24 *Organization* means the International Maritime Organization (IMO).

1.3.25 *Risk* means the expression of the danger that an undesired event represents to persons, to the environment or to material property. The risk is expressed by the probability and consequences of an accident.

1.3.26 *Recognized standards* means applicable international or national standards acceptable to the Administration or standards laid down and maintained by an organization which complies with the standards adopted by the Organization and which is recognized by the Administration.

1.3.27 *Safety management system* means the international safety management system as described in the ISM Code.

1.3.28 *Second barrier* means a technical measure which prevents the occurrence of a hazard if the first barrier fails, e.g., second housing of a tank protecting the surroundings from the effect of tank leaks.

1.3.29 *Semi-enclosed space* means a space limited by decks and or bulkheads in such manner that the natural conditions of ventilation are notably different from those obtained on open deck⁴.

1.3.30 *Single gas fuel engine* means a power generating engine capable of operating on gas-only, and not able to switch over to oil fuel operation.

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

1.3.32 *Source of release* means any valve, detachable pipe joint, pipe packing, compressor or pump seal in the gas fuel system.

1.3.33 *Tank room* means the gastight space surrounding the bunker tank, containing all tank connections and all tank valves.

1.4 Survey requirements

1.4.1 Surveys should be performed and certificates issued in accordance with the provisions of SOLAS 1974, as modified by its 1988 Protocol and as amended, chapter 1, part B, regulation 6 or 7, as applicable⁵.

⁴ Refer also to IEC 60092-502:1999 Electrical Installations in Ships – Tankers – Special Features.

⁵ Refer to the Revised survey guidelines under the harmonized system of survey and certification (resolution A.997(25)).

CHAPTER 2

SHIP ARRANGEMENTS AND SYSTEM DESIGN

2.1 General

2.1.1 For any new or altered concept or configuration a risk analysis should be conducted in order to ensure that any risks arising from the use of gas-fuelled engines affecting the structural strength and the integrity of the ship are addressed. Consideration should be given to the hazards associated with installation, operation, and maintenance, following any reasonably foreseeable failure.

2.1.2 The risks should be analysed using acceptable and recognized risk analysis techniques and loss of function, component damage, fire, explosion and electric shock should as a minimum be considered. The analysis should ensure that risks are eliminated wherever possible. Risks which cannot be eliminated should be mitigated as necessary. Details of risks, and the means by which they are mitigated, should be included in the operating manual.

2.1.3 An explosion in any space containing open gas sources should not:

- .1 cause damage to any space other than that in which the incident occurs;
- .2 disrupt the proper functioning of other zones;
- .3 damage the ship in such a way that flooding of water below the main deck or any progressive flooding occur;
- .4 damage work areas or accommodation in such a way that people who stay in such areas under normal operating conditions are injured;
- .5 disrupt the proper functioning of control stations and switchboard rooms for necessary power distribution;
- .6 damage life-saving equipment or associated launching arrangements;
- .7 disrupt the proper functioning of fire-fighting equipment located outside the explosion-damaged space; or
- .8 affect other areas in the vessel in such a way that chain reactions involving, *inter alia*, cargo, gas and bunker oil may arise.

2.2 Material requirements

2.2.1 Materials used in gas tanks, gas piping, process pressure vessels and other components in contact with gas should be in accordance with IGC Code, chapter 6, Materials of construction. For CNG tanks, the use of materials not covered by the IGC Code may be specially considered by the Administration.

2.2.2 Materials for piping system for liquefied gases should comply with the requirements of the IGC Code, section 6.2. Some relaxation may, however, be permitted in the quality of the material of open-ended vent piping, provided the temperature of the gas at atmospheric pressure is -55°C or higher, and provided no liquid discharge to the vent piping can occur. Materials should in general be in accordance with recognized standards.

2.2.3 Materials having a melting point below 925°C should not be used for piping outside the gas tanks except for short lengths of pipes attached to the gas tanks, in which case the low melting point materials should be wrapped in class A-60 insulation.

2.3 Location and separation of spaces

2.3.1 *The arrangement and location of spaces*

The arrangement and location of spaces for gas fuel storage, distribution and use should be such that the number and extent of hazardous areas is kept to a minimum.

2.3.2 *Gas compressor room*

2.3.2.1 Compressor rooms, if arranged, should be located above freeboard deck, unless those rooms are arranged and fitted in accordance with the requirements of these Guidelines for tank rooms.

2.3.2.2 If compressors are driven by shafting passing through a bulkhead or deck, the bulkhead penetration should be of gastight type.

2.3.3 *Machinery spaces containing gas-fuelled engines*

2.3.3.1 When more than one machinery space is required for gas-fuelled engines and these spaces are separated by a single bulkhead, the arrangements should be such that the effects of a gas explosion in either space can be contained or vented without affecting the integrity of the adjacent space and equipment within that space.

2.3.3.2 ESD-protected machinery spaces for gas-fuelled engines should have as simple a geometrical shape as possible.

2.3.4 *Tank rooms*

2.3.4.1 Tank room boundaries including access doors should be gastight.

2.3.4.2 The tank room should not be located adjacent to machinery spaces of category A. If the separation is by means of a cofferdam the separation should be at least 900 mm and insulation to class A-60 should be fitted on the engine-room side.

2.4 Arrangement of entrances and other openings

2.4.1 Direct access through doors, gastight or otherwise, should generally not be permitted from a gas-safe space to a gas-dangerous space. Where such openings are necessary for operational reasons, an air lock which complies with the requirements of chapter 3.6 (2 to 7) of the IGC Code should be provided.

2.4.2 If the compressor room is approved located below deck, the room should, as far as practicable, have an independent access direct from the open deck. Where a separate access from deck is not practicable, an air lock which complies with the requirements of chapter 3.6 (2 to 7) of the IGC Code should be provided.

2.4.3 The tank room entrance should be arranged with a sill height of at least 300 mm.

2.4.4 Access to the tank room should as far as practicable be independent and direct from open deck. If the tank room is only partially covering the tank, this requirement should also apply to the room surrounding the tank and where the opening to the tank room is located. Where a separate access from deck is not practicable, an air lock which complies with the requirements of chapter 3.6 (2 to 7) of the IGC Code should be provided. The access trunk should be fitted with separate ventilation. It should not be possible to have unauthorized access to the tank room during normal operation of the gas system.

2.4.5 If the access to an ESD-protected machinery space is from another enclosed space in the ship, the entrances should be arranged with self-closing doors. An audible and visual alarm should be provided at a permanent manned location. Alarm should be given if the door is open continuously for more than 1 min. As an alternative, an arrangement with two self-closing doors in series may be acceptable.

2.5 General pipe design

2.5.1 The requirements of this section apply to gas piping. The Administration may accept relaxation from these requirements for gas piping inside gas tanks and open-ended piping after special consideration, such as risk assessment.

2.5.2 Gas piping should be protected against mechanical damage and the piping should be capable of assimilating thermal expansion without developing substantial tension.

2.5.3 The piping system should be joined by welding with a minimum of flange connections. Gaskets should be protected against blow-out.

2.5.4 The wall thickness of pipes should not be less than:

$$t = \frac{t_0 + b + c}{1 - \frac{a}{100}} \quad (\text{mm})$$

where:

t_0 = theoretical thickness

$t_0 = pD/(20Ke + p)$

where:

p = design pressure (bar), refer to 2.5.5.

D = outside diameter (mm).

K = allowable stress (N/mm²), refer to 2.5.6.

e = efficiency factor equal to 1 for seamless pipes and for longitudinally or spirally welded pipes, delivered by approved manufacturers of welded pipes, which 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 value depending on the manufacturing process may be determined by the Administration.

b = allowance for bending (mm). The value of b should 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 should be:

$$b = \frac{Dt_0}{2.5r} \text{ (mm)}$$

with:

r = mean radius of the bend (mm).

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

a = negative manufacturing tolerance for thickness (%).

The minimum wall thickness should be in accordance with recognized standards.

2.5.5 The greater of the following design conditions should be used for piping, piping system and components as appropriate:

- .1 for systems or components which may be separated from their relief valves and which contain only vapour at all times, the superheated vapour pressure at 45°C or higher or lower if agreed upon by the Administration (refer to IGC Code, paragraph 4.2.6.2), assuming an initial condition of saturated vapour in the system at the system operating pressure and temperature; or
- .2 the MARVS of the gas tanks and gas processing systems; or
- .3 the pressure setting of the associated pump or compressor discharge relief valve if of sufficient capacity; or
- .4 the maximum total discharge or loading head of the gas piping system; or
- .5 the relief valve setting on a pipeline system if of sufficient capacity; or
- .6 a pressure of 10 bar except for open-ended lines where it is not to be less than 5 bar.

2.5.6 For pipes made of steel including stainless steel, the allowable stress to be considered in the formula of the strength thickness in 2.5.4 should be the lower of the following values:

$$\frac{R_m}{A} \text{ or } \frac{R_e}{B}$$

where:

R_m = specified minimum tensile strength at room temperature (N/mm²).

R_e = specified lower minimum yield stress or 0.2% proof stress at room temperature (N/mm²).

A = 2.7.

B = 1.8.

For pipes made of materials other than steel, the allowable stress should be considered by the Administration.

2.5.7 Where necessary for mechanical strength to prevent damage, collapse, excessive sag or buckling of pipe due to superimposed loads from supports, ship deflection or other causes, the wall thickness should be increased over that required by 2.5.4 or, if this is impractical or would cause excessive local stresses, these loads should be reduced, protected against or eliminated by other design methods.

2.5.8 Gas piping systems should have sufficient constructive strength. For high pressure gas piping systems this should be confirmed by carrying out stress analysis and taking into account:

- .1 stresses due to the weight of the piping system;
- .2 acceleration loads when significant; and
- .3 internal pressure and loads induced by hog and sag of the ship.

2.5.9 Flanges, valves, fittings, etc., should be in accordance with recognized standards taking into account the design pressure defined in 2.5.5. For bellows and expansion joints used in vapour service, a lower minimum design pressure than defined in 2.5.5 may be accepted.

2.5.10 All valves and expansion joints used in high pressure gas systems should be of an approved type.

2.5.11 The following types of connections may be considered for direct connection of pipe lengths (without flanges):

- .1 Butt welded joints with complete penetration at the root may be used in all applications. For design temperature below -10°C, butt welds should be either double welded or equivalent to a double welded butt joint. This may be accomplished by use of a backing ring, consumable insert or inert gas back-up on the first pass. For design pressures in excess of 10 bar and design temperatures -10°C or lower, backing rings should be removed.

- .2 Slip-on welded joints with sleeves and related welding, having dimensions satisfactory to the Administration, should only be used for open-ended lines with external diameter of 50 mm or less and design temperatures not lower than -55°C .
- .3 Screwed couplings should only be used for accessory lines and instrumentation lines with external diameters of 25 mm or less.

2.5.12 Flanges should be of the welding neck, slip-on or socket welding type. For all piping (except open-ended lines), the following apply:

- .1 For design temperatures $< -55^{\circ}\text{C}$ only welding neck flanges should be used.
- .2 For design temperatures $< -10^{\circ}\text{C}$ slip-on flanges should not be used in nominal sizes above 100 mm and socket welding flanges should not be used in nominal sizes above 50 mm.

2.5.13 Piping connections other than those mentioned above may be accepted upon consideration in each case.

2.5.14 Postweld heat treatment should be required for all butt welds of pipes made with carbon, carbon-manganese and low-alloy steels. The Administration may waive the requirement for thermal stress relieving of pipes having wall thickness less than 10 mm in relation to the design temperature and pressure of the piping system concerned.

2.5.15 When the design temperature is -110°C or lower, a complete stress analysis for each branch of the piping system should be submitted. This analysis should take into account all stresses due to weight of pipes with cargo (including acceleration if significant), internal pressure, thermal contraction and loads induced by movements of the ship. For temperatures above -110°C , a stress analysis may be required by the Administration. In any case, consideration should be given to thermal stresses, even if calculations need not be submitted. The analysis should be carried out according to a recognized code of practice.

2.5.16 Gas pipes should not be located less than 760 mm from the ship's side.

2.5.17 Gas piping should not be led through other machinery spaces. Alternatively, double gas piping may be approved, provided the danger of mechanical damage is negligible, the gas piping has no discharge sources and the room is equipped with a gas alarm.

2.5.18 An arrangement for purging gas bunkering lines and supply lines (only up to the double block and bleed valves if these are located close to the engine) with nitrogen should be provided.

2.5.19 The gas piping system should be installed with sufficient flexibility. Arrangement for provision of the necessary flexibility should be demonstrated to maintain the integrity of the piping system in all foreseen service situations.

2.5.20 Gas pipes should be colour marked based on a recognized standard⁶.

⁶ Refer to EN ISO 14726:2008 Ships and marine technology – Identification colours for the content of piping systems.

2.5.21 If the fuel gas contains heavier components that may condense in the system, knock out drums or equivalent means for safely removing the liquid should be fitted.

2.5.22 All pipelines and components which may be isolated containing liquid gas should be provided with relief valves.

2.5.23 Where tanks or piping are separated from the ship's structure by thermal isolation, provision should be made for electrically bonding to the ship's structure both the piping and the tanks. All gasketed pipe joints and hose connections should be electrically bonded.

2.6 System configuration

2.6.1 *Alternative system configurations*

2.6.1.1 Two alternative system configurations may be accepted:

- .1 *Gas safe machinery spaces*: Arrangements in machinery spaces are such that the spaces are considered gas safe under all conditions, normal as well as abnormal conditions, i.e. inherently gas safe.
- .2 *ESD-protected machinery spaces*: Arrangements in machinery spaces are such that the spaces are considered non-hazardous under normal conditions, but under certain abnormal conditions may have the potential to become hazardous. In the event of abnormal conditions involving gas hazards, emergency shutdown (ESD) of non-safe equipment (ignition sources) and machinery is to be automatically executed while equipment or machinery in use or active during these conditions are to be of a certified safe type.

2.6.2 *Gas safe machinery spaces*

2.6.2.1 All gas supply piping within machinery space boundaries should be enclosed in a gastight enclosure, i.e. double wall piping or ducting.

2.6.2.2 In case of leakage in a gas supply pipe making shutdown of the gas supply necessary, a secondary independent fuel supply should be available. Alternatively, in the case of multi-engine installations, independent and separate gas supply systems for each engine or group of engines may be accepted.

2.6.2.3 For single fuel installations (gas only), the fuel storage should be divided between two or more tanks of approximately equal size. The tanks should be located in separate compartments.

2.6.3 *ESD-protected machinery spaces*

2.6.3.1 Gas supply piping within machinery spaces may be accepted without a gastight external enclosure on the following conditions:

- .1 Engines for generating propulsion power and electric power should be located in two or more machinery spaces not having any common boundaries unless it can be documented that the common boundary can withstand an explosion in one of the rooms. Distribution of engines between the different machinery spaces should be such that in the case of shutdown of fuel supply to any one machinery space it

is possible to maintain at least 40% of the propulsion power plus normal electrical power supply for sea-going services. Incinerators, inert gas generators or other oil fired boilers should not be located within an ESD-protected machinery space.

- .2 The gas machinery, tank and valve installation spaces should contain only a minimum of such necessary equipment, components and systems as are required to ensure that any piece of equipment in each individual space maintains its principal function.
- .3 Pressure in gas supply lines within machinery spaces should be less than 10 bar, e.g., this concept can only be used for low pressure systems.
- .4 A gas detection system arranged to automatically shutdown the gas supply (also oil fuel supply if dual fuel) and disconnect all non-explosion protected equipment or installations should be fitted, as outlined in 5.5 and 5.6.

2.6.3.2 For single fuel installations (gas only), the fuel storage should be divided between two or more tanks of approximately equal size. The tanks should be located in separate compartments.

2.7 Gas supply system in gas machinery spaces

2.7.1 Gas supply system for gas safe machinery spaces

2.7.1.1 Gas supply lines passing through enclosed spaces should be completely enclosed by a double pipe or duct. This double pipe or duct should fulfil one of the following:

- .1 the gas piping should be a double wall piping system with the gas fuel contained in the inner pipe. The space between the concentric pipes should be pressurized with inert gas at a pressure greater than the gas fuel pressure. Suitable alarms should be provided to indicate a loss of inert gas pressure between the pipes. When the inner pipe contains high pressure gas, the system should be so arranged that the pipe between the master gas valve and the engine is automatically purged with inert gas when the master gas valve is closed; or
- .2 the gas fuel piping should be installed within a ventilated pipe or duct. The air space between the gas fuel piping and the wall of the outer pipe or duct should be equipped with mechanical under pressure ventilation having a capacity of at least 30 air changes per hour. This ventilation capacity may be reduced to 10 air changes per hour provided automatic filling of the duct with nitrogen upon detection of gas is arranged for. The fan motors should comply with the required explosion protection in the installation area. The ventilation outlet should be covered by a protection screen and placed in a position where no flammable gas-air mixture may be ignited.

2.7.1.2 The connecting of gas piping and ducting to the gas injection valves should be so as to provide complete coverage by the ducting. The arrangement should facilitate replacement and/or overhaul of injection valves and cylinder covers. The double ducting should be required also for gas pipes on the engine itself, and all the way until gas is injected into the chamber.⁷

⁷ If gas is supplied into the air inlet on a low pressure engine, double ducting may be omitted on the air inlet pipe on the condition that a gas detector is fitted above the engine.

2.7.1.3 For high-pressure piping the design pressure of the ducting should be taken as the higher of the following:

- .1 the maximum built-up pressure: static pressure in way of the rupture resulting from the gas flowing in the annular space;
- .2 local instantaneous peak pressure in way of the rupture: this pressure is to be taken as the critical pressure and is given by the following expression:

$$p^* = p_0 \left(\frac{2}{k+1} \right)^{\frac{k}{k-1}}$$

where:

p_0 = maximum working pressure of the inner pipe

k = C_p/C_v constant pressure specific heat divided by the constant volume specific heat

k = 1.31 for CH₄

The tangential membrane stress of a straight pipe should not exceed the tensile strength divided by 1.5 ($R_m/1.5$) when subjected to the above pressures. The pressure ratings of all other piping components should reflect the same level of strength as straight pipes.

As an alternative to using the peak pressure from the above formula, the peak pressure found from representative tests can be used. Test reports should then be submitted.

2.7.1.4 For low pressure piping the duct should be dimensioned for a design pressure not less than the maximum working pressure of the gas pipes. The duct should also be pressure tested to show that it can withstand the expected maximum pressure at gas pipe rupture.

2.7.1.5 The arrangement and installation of the high-pressure gas piping should provide the necessary flexibility for the gas supply piping to accommodate the oscillating movements of the main engine, without running the risk of fatigue problems. The length and configuration of the branch lines are important factors in this regard.

2.7.2 Gas supply system for ESD-protected machinery spaces

2.7.2.1 The pressure in the gas supply system should not exceed 10 bar.

2.7.2.2 The gas supply lines should have a design pressure not less than 10 bar.

2.8 Gas fuel storage

2.8.1 Liquefied gas storage tanks

2.8.1.1 The storage tank used for liquefied gas should be an independent tank designed in accordance with the IGC Code, chapter 4.

2.8.1.2 Pipe connections to the tank should normally be mounted above the highest liquid level in the tanks. However, connections below the highest liquid level may be accepted after special consideration by the Administration.

2.8.1.3 Pressure relief valves as required in the IGC Code chapter 8 should be fitted.

2.8.1.4 The outlet from the pressure relief valves should normally be located at least $B/3$ or 6 m, whichever is greater, above the weather deck and 6 m above the working area and gangways, where B is the greatest moulded breadth of the ship in metres. The outlets should normally be located at least 10 m from the nearest:

- .1 air intake, air outlet or opening to accommodation, service and control spaces, or other gas safe spaces; and
- .2 exhaust outlet from machinery or from furnace installation.

2.8.1.5 Storage tanks for liquid gas should not be filled to more than 98% full at the reference temperature, where the reference temperature is as defined in the IGC Code, paragraph 15.1.4. A filling limit curve for actual filling temperatures should be prepared from the formula given in the IGC Code, paragraph 15.1.2. However, when the tank insulation and tank location makes the probability very small for the tank contents to be heated up due to external fire, special considerations may be made to allow a higher filling limit than calculated using the reference temperature, but never above 95%.

2.8.1.6 Means that are not dependent on the gas machinery system should be provided whereby liquid gas in the storage tanks can be emptied.

2.8.1.7 It should be possible to empty, purge gas and vent bunker tanks with gas piping systems. Procedures should be prepared for this. Inerting should be performed with, for instance, nitrogen, CO₂ or argon prior to venting to avoid an explosion hazardous atmosphere in tanks and gas pipes.

2.8.2 *Compressed gas storage tanks*

2.8.2.1 The storage tanks to be used for compressed gas should be certified and approved by the Administration.

2.8.2.2 Tanks for compressed gas should be fitted with pressure relief valves with a set point below the design pressure of the tank and with outlet located as required in 2.8.1.4.

2.8.3 *Storage on open deck*

2.8.3.1 Both gases of the compressed and the liquefied type may be accepted stored on open deck.

2.8.3.2 The storage tanks or tank batteries should be located at least $B/5$ from the ship's side. For ships other than passenger ships a tank location closer than $B/5$ but not less than 760 mm from the ship's side may be accepted.

2.8.3.3 The gas storage tanks or tank batteries and equipment should be located to assure sufficient natural ventilation, so as to prevent accumulation of escaped gas.

2.8.3.4 Tanks for liquid gas with a connection below the highest liquid level (see 2.8.1.2) should be fitted with drip trays below the tank which should be of sufficient capacity to contain the volume which could escape in the event of a pipe connection failure. The material of the drip tray should be stainless steel, and there should be efficient separation or isolation so that the hull or deck structures are not exposed to unacceptable cooling, in case of leakage of liquid gas.

2.8.4 Storage in enclosed spaces

2.8.4.1 Gas in a liquid state may be stored in enclosed spaces, with a maximum acceptable working pressure of 10 bar. Storage of compressed gas in enclosed spaces and location of gas tanks with a higher pressure than 10 bar in enclosed spaces is normally not acceptable, but may be permitted after special consideration and approval by the Administration provided the following is fulfilled in addition to 2.8.4.3:

- .1 adequate means are provided to depressurize the tank in case of a fire which can affect the tank; and
- .2 all surfaces within the tank room are provided with suitable thermal protection against any lost high-pressure gas and resulting condensation unless the bulkheads are designed for the lowest temperature that can arise from gas expansion leakage; and
- .3 a fixed fire-extinguishing system is installed in the tank room.

2.8.4.2 The gas storage tank(s) should be placed as close as possible to the centreline:

- .1 minimum, the lesser of $B/5$ and 11.5 m from the ship side;
- .2 minimum, the lesser of $B/15$ and 2 m from the bottom plating;
- .3 not less than 760 mm from the shell plating.

For ships other than passenger ships and multi-hulls, a tank location closer than $B/5$ from the ship side may be accepted.

2.8.4.3 The storage tank and associated valves and piping should be located in a space designed to act as a second barrier, in case of liquid or compressed gas leakage. The material of the bulkheads of this space should have the same design temperature as the gas tank, and the space should be designed to withstand the maximum pressure build-up. Alternatively, pressure relief venting to a safe location (mast) can be provided. The space should be capable of containing leakage, and is to be isolated thermally so that the surrounding hull is not exposed to unacceptable cooling, in case of leakage of the liquid or compressed gas. This second barrier space is in other parts of these Guidelines called "tank room". When the tank is double walled and the outer tank shell is made of cold resistant material, a tank room could be arranged as a box fully welded to the outer shell of the tank, covering all tank connections and valves, but not necessarily all of the outer tank shell.

2.8.4.4 The tank room may be accepted as the outer shell of a stainless steel vacuum insulated tank in combination with a stainless steel box welded to the outer shell, containing all tank pipe connections, valves, piping, etc. In this case the requirements for ventilation and gas detection should be made applicable to the box, but not to the double barrier of the tank.

2.8.4.5 Bilge suctions from the tank room, if provided, should not be connected to the bilge system for the rest of the ship.

2.9 Fuel bunkering system and distribution system outside machinery spaces

2.9.1 Fuel bunkering station

2.9.1.1 The bunkering station should be so located that sufficient natural ventilation is provided. Closed or semi-enclosed bunkering stations should be subject to special consideration. The bunkering station should be physically separated or structurally shielded from accommodation, cargo/working deck and control stations. Connections and piping should be so positioned and arranged that any damage to the gas piping does not cause damage to the vessel's gas storage tank arrangement leading to uncontrolled gas discharge.

2.9.1.2 Drip trays should be fitted below liquid gas bunkering connections and where leakage may occur. The drip trays should be made of stainless steel, and should be drained over the ship's side by a pipe that preferably leads down near the sea. This pipe could be temporarily fitted for bunkering operations. The surrounding hull or deck structures should not be exposed to unacceptable cooling, in case of leakage of liquid gas. For compressed gas bunkering stations, low temperature steel shielding should be provided to prevent the possible escape of cold jets impinging on surrounding hull structure.

2.9.1.3 Control of the bunkering should be possible from a safe location in regard to bunkering operations. At this location tank pressure and tank level should be monitored. Overfill alarm and automatic shutdown should also be indicated at this location.

2.9.2 Bunkering system

2.9.2.1 The bunkering system should be so arranged that no gas is discharged to air during filling of storage tanks.

2.9.2.2 A manually-operated stop valve and a remote operated shutdown valve in series, or a combined manually-operated and remote valve should be fitted in every bunkering line close to the shore connecting point. It should be possible to release the remote-operated valve in the control location for bunkering operations and or another safe location.

2.9.2.3 If the ventilation in the ducting around the gas bunkering lines stops, an audible and visual alarm should be provided at bunkering control location.

2.9.2.4 If gas is detected in the ducting around the bunkering lines an audible and visual alarm should be provided at the bunkering control location.

2.9.2.5 Means should be provided for draining the liquid from the bunkering pipes at bunkering completion.

2.9.2.6 Bunkering lines should be arranged for inerting and gas freeing. During operation of the vessel the bunkering pipes should be gas free.

2.9.3 Distribution outside of machinery spaces

2.9.3.1 Gas fuel piping should not be led through accommodation spaces, service spaces or control stations.

2.9.3.2 Where gas pipes pass through enclosed spaces in the ship, they should be enclosed in a duct. This duct should be mechanically under pressure ventilated with 30 air changes per hour, and gas detection as required in 5.5 should be provided.

2.9.3.3 The duct should be dimensioned according to 2.7.1.3 and 2.7.1.4.

2.9.3.4 The ventilation inlet for the duct should always be located in open air, away from ignition sources.

2.9.3.5 Gas pipes located in open air should be so located that they are not likely to be damaged by accidental mechanical impact.

2.9.3.6 High-pressure gas lines outside the machinery spaces containing gas-fuelled engines should be installed and protected so as to minimize the risk of injury to personnel in case of rupture.

2.10 Ventilation system

2.10.1 General

2.10.1.1 Any ducting used for the ventilation of hazardous spaces should be separate from that used for the ventilation of non-hazardous spaces. The ventilation should function at all temperature conditions the ship will be operating in. Electric fan motors should not be located in ventilation ducts for hazardous spaces unless the motor is certified for the same hazard zone as the space served.

2.10.1.2 Design of ventilation fans serving spaces containing gas sources should fulfil the following:

- .1 Electric motors driving fans should comply with the required explosion protection in the installation area. Ventilation fans should not produce a source of vapour ignition in either the ventilated space or the ventilation system associated with the space. Ventilation fans and fan ducts, in way of fans only, should be of non-sparking construction defined as:
 - .1 impellers or housings of non-metallic material, due regard being paid to the elimination of static electricity;
 - .2 impellers and housings of non-ferrous metals;
 - .3 impellers and housing of austenitic stainless steel;
 - .4 impellers of aluminium alloys or magnesium alloys and a ferrous (including austenitic stainless steel) housing on which a ring of suitable thickness of non-ferrous materials is fitted in way of the impeller, due regard being paid to static electricity and corrosion between ring and housing; or
 - .5 any combination of ferrous (including austenitic stainless steel) impellers and housings with not less than 13 mm tip design clearance.
- .2 In no case should the radial air gap between the impeller and the casing be less than 0.1 of the diameter of the impeller shaft in way of the bearing but not less than 2 mm. The gap need not be more than 13 mm.

- .3 Any combination of an aluminium or magnesium alloy fixed or rotating component and a ferrous fixed or rotating component, regardless of tip clearance, is considered a sparking hazard and should not be used in these places.
- .4 The installation on board of the ventilation units should be such as to ensure the safe bonding to the hull of the units themselves.

2.10.1.3 Any loss of the required ventilating capacity should give an audible and visual alarm at a permanently manned location.

2.10.1.4 Required ventilation systems to avoid any gas accumulation should consist of independent fans, each of sufficient capacity, unless otherwise specified in these Guidelines.

2.10.1.5 Air inlets for hazardous enclosed spaces should be taken from areas which, in the absence of the considered inlet, would be non-hazardous. Air inlets for non-hazardous enclosed spaces should 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 should have over-pressure relative to this space, unless mechanical integrity and gastightness of the duct will ensure that gases will not leak into it.

2.10.1.6 Air outlets from non-hazardous spaces should be located outside hazardous areas.

2.10.1.7 Air outlets from hazardous enclosed spaces should be located in an open area which, in the absence of the considered outlet, would be of the same or lesser hazard than the ventilated space.

2.10.1.8 The required capacity of the ventilation plant is normally based on the total volume of the room. An increase in required ventilation capacity may be necessary for rooms having a complicated form.

2.10.1.9 Non-hazardous spaces with opening to a hazardous area should be arranged with an air-lock and be maintained at overpressure relative to the external hazardous area. The overpressure ventilation should be arranged according to the following requirements:

- .1 During initial start-up or after loss of overpressure ventilation, before energizing any electrical installations not certified safe for the space in the absence of pressurization, it should be required to:
 - .1 proceed with purging (at least 5 air changes) or confirm by measurements that the space is non-hazardous; and
 - .2 pressurize the space.
- .2 Operation of the overpressure ventilation should be monitored.
- .3 In the event of failure of the overpressure ventilation:
 - .1 an audible and visual alarm should be given at a manned location; and
 - .2 if overpressure cannot be immediately restored, automatic or programmed disconnection of electrical installations according to a recognized standard⁸.

⁸ Refer to IEC 60092-502:1999 Electrical Installations in Ships – Tankers – Special Features, table 5.

2.10.2 Tank room

2.10.2.1 The tank room for gas storage should be provided with an effective mechanical forced ventilation system of the under pressure type, providing a ventilation capacity of at least 30 air changes per hour. The rate of air changes may be reduced if other adequate means of explosion protection are installed. The equivalence of alternative installations should be demonstrated by a safety analysis.

2.10.2.2 Approved automatic fail-safe fire dampers should be fitted in the ventilation trunk for tank room.

2.10.3 Machinery spaces containing gas-fuelled engines

2.10.3.1 The ventilation system for machinery spaces containing gas-fuelled engines should be independent of all other ventilation systems.

2.10.3.2 ESD-protected machinery spaces should have ventilation with a capacity of at least 30 air changes per hour. The ventilation system should ensure a good air circulation in all spaces, and in particular ensure that any formation of gas pockets in the room are detected. As an alternative, arrangements whereby under normal operation the machinery spaces is ventilated with at least 15 air changes an hour is acceptable provided that, if gas is detected in the machinery space, the number of air changes will automatically be increased to 30 an hour.

2.10.3.3 The number and power of the ventilation fans should be such that the capacity is not reduced by more than 50% of the total ventilation capacity, if a fan with a separate circuit from the main switchboard or emergency switchboard or a group of fans with common circuit from the main switchboard or emergency switchboard, is out of action.

2.10.4 Pump and compressor rooms

2.10.4.1 Pump and compressor rooms should be fitted with effective mechanical ventilation system of the under pressure type, providing a ventilation capacity of at least 30 air changes per hour.

2.10.4.2 The number and power of the ventilation fans should be such that the capacity is not reduced by more than 50%, if a fan with a separate circuit from the main switchboard or emergency switchboard or a group of fans with common circuit from the main switchboard or emergency switchboard, is out of action.

2.10.4.3 Ventilation systems for pump and compressor rooms should be in operation when pumps or compressors are working.

2.10.4.4 When the space is dependent on ventilation for its area classification, the following should apply:

- .1 During initial start-up, and after loss of ventilation, the space should be purged (at least 5 air changes), before connecting electrical installations which are not certified for the area classification in absence of ventilation. Warning notices to this effect should be placed in an easily visible position near the control stand.
- .2 Operation of the ventilation should be monitored.

- .3 In the event of failure of ventilation, the following should apply:
 - .1 an audible and visual alarm should be given at a manned location;
 - .2 immediate action should be taken to restore ventilation; and
 - .3 electrical installations should be disconnected⁹ if ventilation cannot be restored for an extended period. The disconnection should be made outside the hazardous areas, and be protected against unauthorized reconnection, e.g., by lockable switches.

CHAPTER 3

FIRE SAFETY

3.1 General

3.1.1 The requirements in this chapter are additional to those given in SOLAS chapter II-2.

3.1.2 A compressor room should be regarded as a machinery space of category A for fire protection purposes.

3.2 Fire protection

3.2.1 Tanks or tank batteries located above deck should be shielded with class A-60 insulation towards accommodation, service stations, cargo spaces and machinery spaces.

3.2.2 The tank room boundaries and ventilation trunks to such spaces below the bulkhead deck should be constructed to class A-60. However, where the room is adjacent to tanks, voids, auxiliary machinery spaces of little or no fire risk, sanitary and similar spaces, the insulation standard may be reduced to class A-0.

3.2.3 The fire and mechanical protection of gas pipes lead through ro-ro spaces on open deck should be subject to special consideration by the Administration depending on the use and expected pressure in the pipes. Gas pipes lead through ro-ro spaces on open deck should be provided with guards or bollards to prevent vehicle collision damage.

3.2.4 The bunkering station should be separated by class A-60 divisions towards other spaces, except for spaces such as tanks, voids, auxiliary machinery spaces of little or no fire risk, sanitary and similar spaces where the insulation standard may be reduced to class A-0.

3.2.5 When more than one machinery space is required and these spaces are separated by a single bulkhead, the bulkhead should be class A-60.

3.2.6 A compressor room in a ship not subject to the IGC Code should be regarded as a machinery space of category A for fire insulation requirements.

⁹ Intrinsically safe equipment suitable for zone 0 is not required to be switched off. Certified flameproof lighting may have a separate switch-off circuit.

3.3 Fire extinction

3.3.1 *Fire main*

3.3.1.1 The water spray system required below may be part of the fire main system provided that the required fire pump capacity and working pressure is sufficient to operation of both the required numbers of hydrants and hoses and the water spray system simultaneously.

3.3.1.2 When the storage tank is located on open deck, isolating valves should be fitted in the fire main in order to isolate damage sections of the main. Isolation of a section of fire main shall not deprive the fire line ahead of the isolated section of water.

3.3.2 *Water spray systems*

3.3.2.1 A water spray system should be fitted for cooling and fire prevention and to cover exposed parts of gas storage tank located above deck.

3.3.2.2 The system should be designed to cover all areas as specified above with an application rate of 10 l/min/m² for horizontal projected surfaces and 4 l/min/m² for vertical surfaces.

3.3.2.3 For the purpose of isolating damage sections, stop valves should be fitted at least every 40 m or the system may be divided into two or more sections with control valves located in a safe and readily accessible position not likely to be cut-off in case of fire.

3.3.2.4 The capacity of the water spray pump should be sufficient to deliver the required amount of water to the hydraulically most demanding area as specified above in the areas protected.

3.3.2.5 A connection to the ship's fire main through a stop valve should be provided.

3.3.2.6 Remote start of pumps supplying the water spray system and remote operation of any normally closed valves to the system should be located in a readily accessible position which is not likely to be cut off in case of fire in the areas protected.

3.3.2.7 The nozzles should be of an approved full bore type and they should be arranged to ensure an effective distribution of water throughout the space being protected.

3.3.2.8 An equivalent system to the water spray system may be fitted provided it has been tested for its on-deck cooling capability to the satisfaction of the Administration.

3.3.3 *Dry chemical powder fire-extinguishing system*

3.3.3.1 In the bunkering station area a permanently installed dry chemical powder extinguishing system should cover all possible leak points. The capacity should be at least 3.5 kg/s for a minimum of 45 s discharges. The system should be arranged for easy manual release from a safe location outside the protected area.

3.3.3.2 One portable dry powder extinguisher of at least 5 kg capacity should be located near the bunkering station.

3.4 Fire detection and alarm system

3.4.1 Detection

3.4.1.1 An approved fixed fire detection system should be provided for the tank room and the ventilation trunk for tank room below deck.

3.4.1.2 Smoke detectors alone should not be considered sufficient for rapid fire detection.

3.4.1.3 Where the fire detection system does not include means of remotely identifying each detector individually, the detectors should be arranged on separate loops.

3.4.2 Alarms and safety actions

3.4.2.1 Required safety actions at fire detection in the machinery space containing gas-fuelled engines and tank room are given in table 1 of chapter V. In addition, the ventilation should stop automatically and fire dampers are to close.

CHAPTER 4

ELECTRICAL SYSTEMS

4.1 General

4.1.1 The provisions of this chapter should be applied in conjunction with applicable electrical requirements of part D of SOLAS chapter II-1.

4.1.2 Hazardous areas on open deck and other spaces not defined in this chapter should be decided based on a recognized standard¹⁰. The electrical equipment fitted within hazardous areas should be according to the same standard.

4.1.3 Electrical equipment and wiring should in general not be installed in hazardous areas unless essential for operational purposes based on a recognized standard¹¹.

4.1.4 Electrical equipment fitted in an ESD-protected machinery space should fulfil the following:

- .1 In addition to fire and hydrocarbon detectors and fire and gas alarms, lighting and ventilation fans should be certified safe for hazardous area zone 1.
- .2 All electrical equipment in a machinery space containing gas-fuelled engines, and not certified for zone 1 should be automatically disconnected, if gas concentrations above 20% LEL is detected on two detectors in the space containing gas-fuelled engines.

¹⁰ Refer to IEC standard 60092-502, part 4.4: Tankers carrying flammable liquefied gases as applicable.

¹¹ The type of equipment and installation requirements should comply with IEC standard 60092-502: IEC 60092-502:1999 Electrical Installations in Ships – Tankers – Special Features and IEC 60079-10-1:2008 Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres, according to the area classification.

4.1.5 There should be an equalization connection between the bunker supplier and the bunkering station on the ship when a flammable gas/liquid is transferred.

4.1.6 Cable penetrations should satisfy the requirements regulating the dispersion of gas.

4.2 Area classification

4.2.1 General

4.2.1.1 Area classification is a method of analysing and classifying the areas where explosive gas atmospheres may occur. The object of the classification is to allow the selection of electrical apparatus able to be operated safely in these areas.

4.2.1.2 In order to facilitate the selection of appropriate electrical apparatus and the design of suitable electrical installations, hazardous areas are divided into zones 0, 1 and 2¹². See also 4.3 below.

4.2.1.3 Area classification of a space may be dependent on ventilation¹³.

4.2.1.4 A space with opening to an adjacent hazardous area on open deck, may be made into a less hazardous or non-hazardous space, by means of overpressure. Requirements to such pressurization are given in 2.10.

4.2.1.5 Ventilation ducts should have the same area classification as the ventilated space.

4.3 Definition of hazardous area zones

4.3.1 Hazardous area zone 0

This zone includes:

- .1 the interiors of gas tanks, any pipework of pressure-relief or other venting systems for gas tanks, pipes and equipment containing gas.¹⁴

4.3.2 Hazardous area zone 1

This zone includes:

- .1 tank room;
- .2 gas compressor room arranged with ventilation according to 2.10.4;

¹² Refer to standards IEC 60079-10-1:2008 Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres and guidance and informative examples given in IEC 60092-502:1999, Electrical Installations in Ships – Tankers – Special Features for tankers.

¹³ Refer to standard IEC 60092-502:1999 Electrical Installations in Ships – Tankers – Special Features for tankers, table 1.

¹⁴ Instrumentation and electrical apparatus in contact with the gas or liquid gas should be of a type suitable for zone 0. Temperature sensors installed in thermo wells, and pressure sensors without additional separating chamber should be of intrinsically safe type Ex-ia.

- .3 areas on open deck, or semi-enclosed spaces on deck, within 3 m of any gas tank outlet, gas or vapour outlet¹⁵, bunker manifold valve, other gas valve, gas pipe flange, gas pump-room ventilation outlets and gas tank openings for pressure release provided to permit the flow of small volumes of gas or vapour mixtures caused by thermal variation;
- .4 areas on open deck or semi-enclosed spaces on deck, within 1.5 m of gas compressor and pump room entrances, gas pump and compressor room ventilation inlets and other openings into zone 1 spaces;
- .5 areas on the open deck within spillage coamings surrounding gas bunker manifold valves and 3m beyond these, up to a height of 2.4 m above the deck;
- .6 enclosed or semi-enclosed spaces in which pipes containing gas are located, e.g., ducts around gas pipes, semi-enclosed bunkering stations; and
- .7 the ESD-protected machinery space is considered as non-hazardous area during normal operation, but changes to zone 1 in the event of gas leakage.

4.3.3 Hazardous area zone 2

This zone includes:

- .1 areas within 1.5 m surrounding open or semi-enclosed spaces of zone 1¹⁶.

CHAPTER 5

CONTROL, MONITORING AND SAFETY SYSTEMS

5.1 General

5.1.1 A local reading pressure gauge should be fitted between the stop valve and the connection to shore at each bunker pipe.

5.1.2 Pressure gauges should be fitted to gas pump discharge lines and to the bunkering lines.

5.1.3 A bilge well in each tank room surrounding an independent liquid gas storage tank should be provided with both a level indicator and a temperature sensor. Alarm should be given at high level in bilge well. Low temperature indication should lead to automatic closing of main tank valve.

5.2 Gas tank monitoring

5.2.1 Gas tanks should be monitored and protected against overfilling as required in the IGC Code, sections 13.2 and 13.3.

¹⁵ Such areas are, for example, all areas within 3 m of gas tank hatches, ullage openings or sounding pipes for gas tanks located on open deck and gas vapour outlets.

¹⁶ Refer to IEC 60092-502:1999 Electrical Installations in Ships – Tankers – Special Features or IEC 60079-10-1:2008 Explosive atmospheres – Part 10-1: Classification of areas, according to the area classification., as applicable if not otherwise specified in this standard.

5.2.2 Each tank should be monitored with at least one local indicating instrument for pressure and remote pressure indication at the control position. The pressure indicators should be clearly marked with the highest and lowest pressure permitted in the tank. In addition, high-pressure alarm, and if vacuum protection is required, low pressure alarm should be provided on the bridge. The alarms should be activated before the set pressures of the safety valves are reached.

5.3 Gas compressor monitoring

Gas compressors should be fitted with audible and visual alarms both on the bridge and in the engine-room. As a minimum the alarms should be in relation to low gas input pressure, low gas output pressure, high gas output pressure and compressor operation.

5.4 Gas engine monitoring

5.4.1 Additional to the instrumentation provided in accordance with SOLAS chapter II-1, Part C, indicators should be fitted on the navigation bridge, the engine control room and the manoeuvring platform for:

- .1 operation of the engine in case of gas-only engines; or
- .2 operation and mode of operation of the engine in the case of dual fuel engines.

5.4.2 Auxiliary systems where gas may leak directly into the system medium (lubricating oil, cooling water) should be equipped with appropriate gas extraction measures fitted directly after the outlet from the engine in order to prevent gas dispersion. The gas extracted from auxiliary systems media should be vented to a safe location in the open.

5.5 Gas detection

5.5.1 Permanently installed gas detectors should be fitted in the tank room, in all ducts around gas pipes, in machinery spaces of the ESD-protected type, compressor rooms and other enclosed spaces containing gas piping or other gas equipment without ducting. In each ESD-protected machinery space, two independent gas detector systems should be required.

5.5.2 The number of detectors in each space should be considered taking size, layout and ventilation of the space into account.

5.5.3 The detection equipment should be located where gas may accumulate and/or in the ventilation outlets. Gas dispersal analysis or a physical smoke test should be used to find the best arrangement.

5.5.4 An audible and visible alarm should be activated before the vapour concentration reaches 20% of the lower explosion limit (LEL). For ventilated ducts around gas pipes in the machinery spaces containing gas-fuelled engines, the alarm limit can be set to 30% LEL. The protective system should be activated at a LEL of 40%.

5.5.5 Audible and visible alarms from the gas detection equipment should be located on the bridge and in the engine control room.

5.5.6 Gas detection for gas pipe ducts and machinery spaces containing gas-fuelled engines should be continuous without delay.

5.6 Safety functions of gas supply systems

5.6.1 Each gas storage tank should be provided with a tank valve capable of being remote operated and should be located as close to the tank outlet as possible.

5.6.2 The main gas supply line to each engine or set of engines should be equipped with a manually operated stop valve and an automatically operated “master gas fuel valve” coupled in series or a combined manually and automatically operated valve. The valves should be situated in the part of the piping that is outside machinery space containing gas-fuelled engines, and placed as near as possible to the installation for heating the gas, if fitted. The master gas-fuel valve should automatically cut off the gas supply as given in table 1.

5.6.2.1 The automatic master gas fuel valve should be operable from a reasonable number of places in the machinery space containing gas-fuelled engines, from a suitable location outside the space and from the bridge.

5.6.3 Each gas consuming equipment should be provided with a set of “double block and bleed” valves. These valves should be arranged as outlined in .1 or .2 (respectively shown as alternatives 1 and 2 in figure 1) so that when automatic shutdown is initiated as given in table 1, this will cause the two gas fuel valves that are in series to close automatically and the ventilation valve to open automatically and:

- .1 two of these valves should be in series in the gas fuel pipe to the gas consuming equipment. The third valve should be in a pipe that vents to a safe location in the open air that portion of the gas fuel piping that is between the two valves in series; or
- .2 the function of one of the valves in series and the ventilation valve can be incorporated into one valve body, so arranged that the flow to the gas utilization unit will be blocked and the ventilation opened.

5.6.3.1 The two block valves should be of the fail-to-close type, while the ventilation valve should be fail-to-open.

5.6.3.2 The double block and bleed valves should also be used for normal stop of the engine.

5.6.4 In cases where the master gas fuel valve is automatically shutdown, the complete gas supply branch downstream of the double block and bleed valve should be ventilated, if reverse flow from the engine to the pipe must be assumed.

5.6.5 There should be one manually operated shutdown valve in the gas supply line to each engine upstream of the double block and bleed valves to assure safe isolation during maintenance on the engine.

5.6.6 For one-engine installations and multi-engine installations, where a separate master valve is provided for each engine, the master gas fuel valve and the double block and bleed valve functions can be combined. Examples for the high-pressure system are shown in figures 1 and 2.

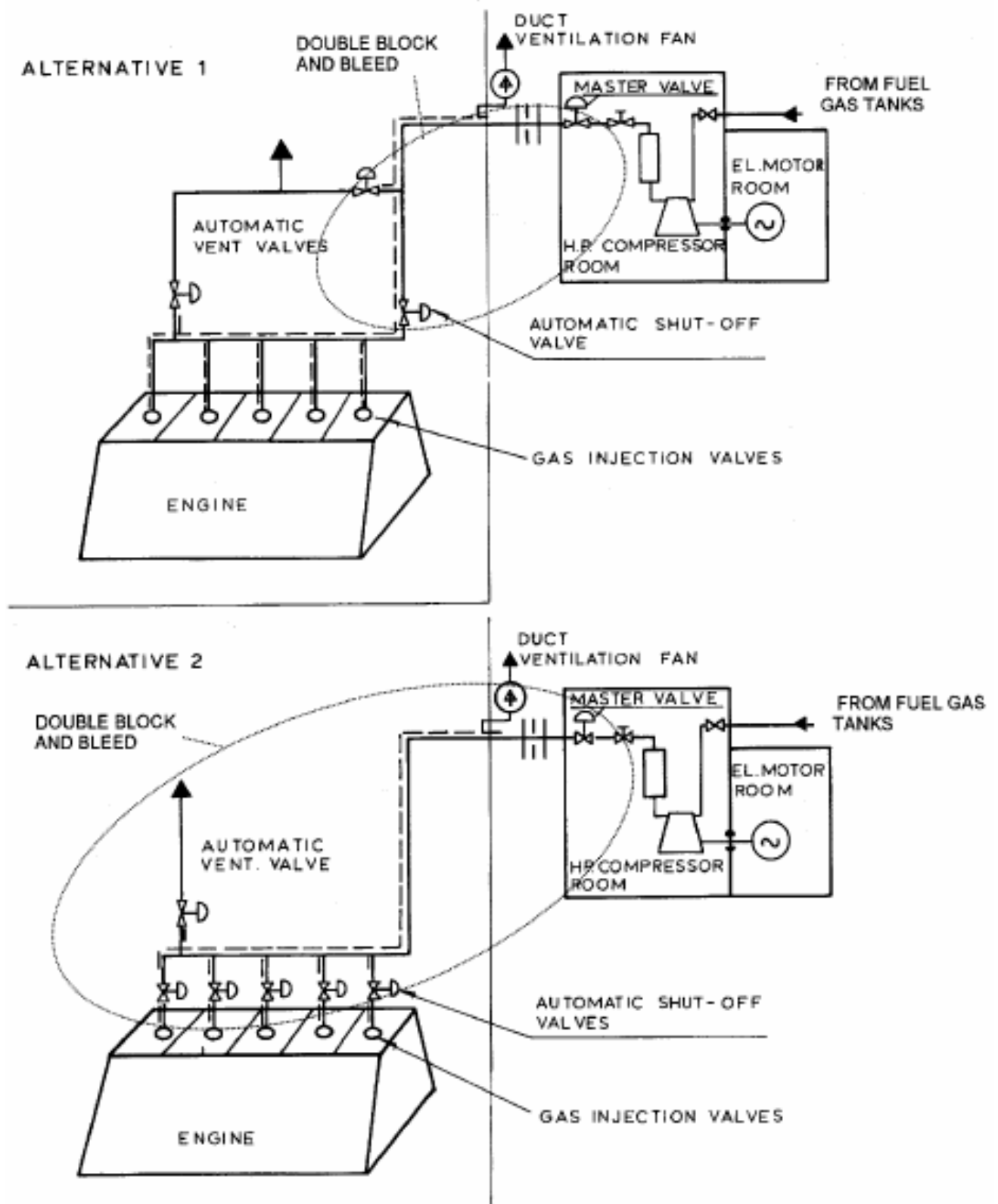


Figure 1

Alternative supply valve arrangements for high-pressure installations (single engine or separate master valve arrangement)

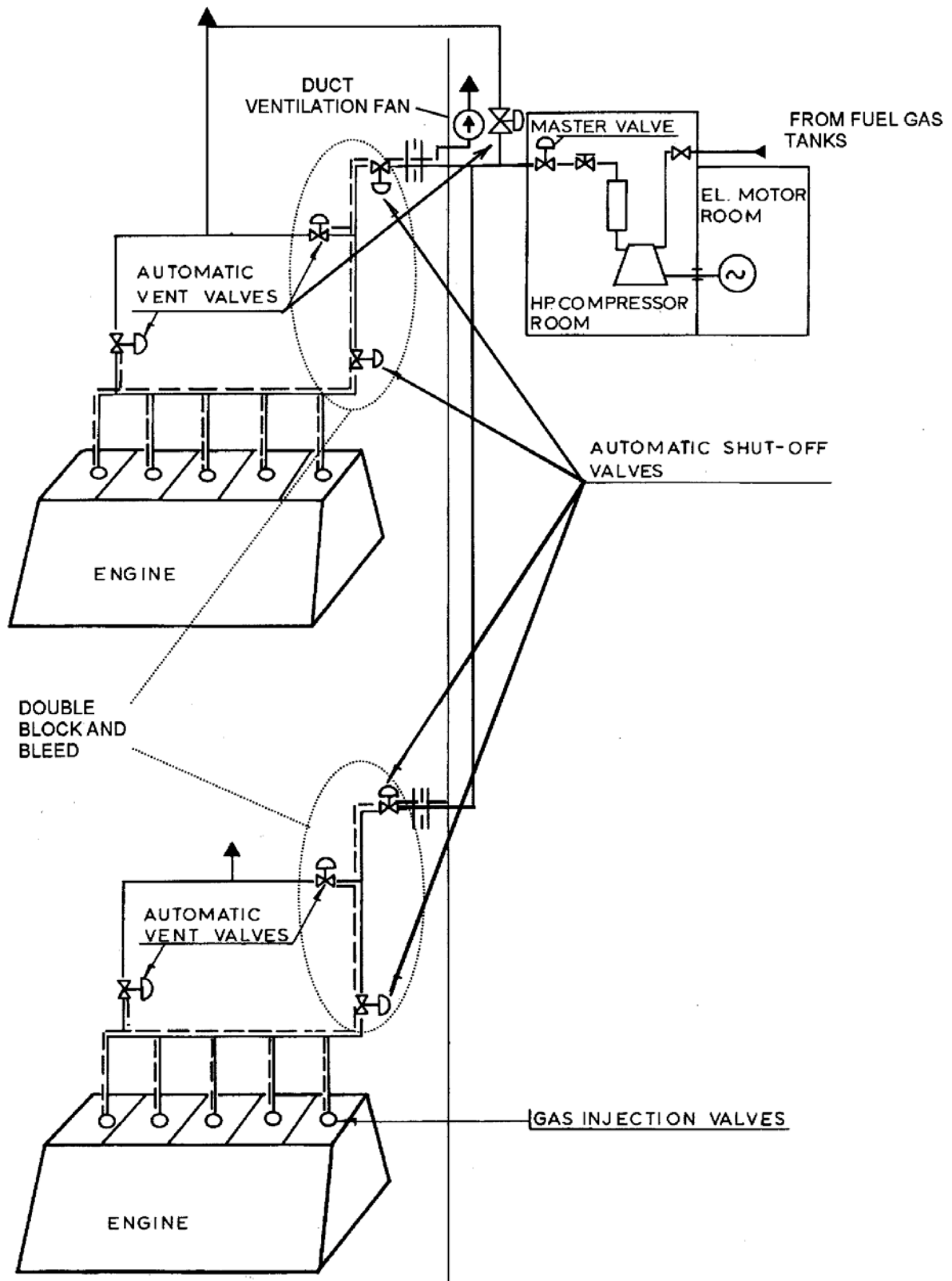


Figure 2

Alternative supply valve arrangements for high-pressure installations (multi-engine installation)

5.6.7 The total loss of ventilation in a machinery space for a single fuelled gas system should, additionally to what is given in table 1, lead to one of the following actions:

- .1 *For a gas electric propulsion system with more than one machinery space:* Another engine should start. When the second engine is connected to bus-bar, the first engine should be shutdown automatically.
- .2 *For a direct propulsion system with more than one machinery space:* The engine in the room with defect ventilation should be manually shutdown, if at least 40% propulsion power is still available after such a shutdown.

If only one machinery space for gas-fuelled engines is fitted and ventilation in one of the enclosed ducts around the gas pipes is lost, the master gas fuel and double block and bleed valves in that supply line should close automatically provided the other gas supply unit is ready to deliver.

5.6.8 If the gas supply is shut off due to activation of an automatic valve, the gas supply should not be opened until the reason for the disconnection is ascertained and the necessary precautions taken. A readily visible notice giving instruction to this effect should be placed at the operating station for the shut-off valves in the gas supply lines.

5.6.9 If a gas leak leading to a gas supply shutdown occurs, the gas fuel supply should not be operated until the leak has been found and dealt with. Instructions to this effect should be placed in a prominent position in the machinery space.

5.6.10 A signboard should be permanently fitted in the machinery space containing gas-fuelled engines stating that heavy lifting, implying danger of damage to the gas pipes, should not be done when the engine(s) is running on gas.

Table 1 – Monitoring of gas supply system to engines

Parameter	Alarm	Automatic shutdown of main tank valve	Automatic shutdown of gas supply to machinery space containing gas-fuelled engines	Comment
Gas detection in tank room above 20% LEL	X			
Gas detection on two detectors ¹⁾ in tank room above 40% LEL	X	X		
Fire detection in tank room	X	X		
Bilge well high level tank room	X			
Bilge well low temperature in tank room	X	X		
Gas detection in duct between tank and machinery space containing gas-fuelled engines above 20% LEL	X			
Gas detection on two detectors ¹⁾ in duct between tank and machinery space containing gas-fuelled engines above 40% LEL	X	X ²⁾		
Gas detection in compressor room above 20% LEL	X			
Gas detection on two detectors ¹⁾ in compressor room above 40% LEL	X	X ²⁾		

Parameter	Alarm	Automatic shutdown of main tank valve	Automatic shutdown of gas supply to machinery space containing gas-fuelled engines	Comment
Gas detection in duct inside machinery space containing gas-fuelled engines above 30% LEL	X			If double pipe fitted in machinery space containing gas-fuelled engines
Gas detection on two detectors ¹⁾ in duct inside machinery space containing gas-fuelled engines above 40% LEL	X		X ³⁾	If double pipe fitted in machinery space containing gas-fuelled engines
Gas detection in machinery space containing gas-fuelled engines above 20% LEL	X			Gas detection only required for ESD protected machinery space
Gas detection on two detectors ¹⁾ in machinery space containing gas-fuelled engines above 40% LEL	X		X	Gas detection only required for ESD protected machinery space containing gas-fuelled engines. It should also disconnect non certified safe electrical equipment in machinery space containing gas-fuelled engines
Loss of ventilation in duct between tank and machinery space containing gas-fuelled engines ⁶⁾	X		X ²⁾⁴⁾	
Loss of ventilation in duct inside machinery space containing gas-fuelled engines ⁶⁾	X		X ³⁾⁴⁾	If double pipe fitted in machinery space containing gas-fuelled engines
Loss of ventilation in machinery space containing gas-fuelled engines	X		X	ESD protected machinery space containing gas-fuelled engines only
Fire detection in machinery space containing gas-fuelled engines	X		X	
Abnormal gas pressure in gas supply pipe	X		X ⁴⁾	
Failure of valve control actuating medium	X		X ⁵⁾	Time delayed as found necessary
Automatic shutdown of engine (engine failure)	X		X ⁵⁾	
Emergency shutdown of engine manually released	X		X	

- 1) Two independent gas detectors located close to each other are required for redundancy reasons. If the gas detector is of self monitoring type the installation of a single gas detector can be permitted.
- 2) If the tank is supplying gas to more than one engine and the different supply pipes are completely separated and fitted in separate ducts and with the master valves fitted outside of the duct, only the master valve on the supply pipe leading into the duct where gas or loss of ventilation is detected is to close.
- 3) If the gas is supplied to more than one engine and the different supply pipes are completely separated and fitted in separate ducts and with the master valves fitted outside of the duct and outside of the machinery space containing gas-fuelled engines, only the master valve on the supply pipe leading into the duct where gas or loss of ventilation is detected is to close.
- 4) This parameter is not to lead to shutdown of gas supply for single fuel gas engines, only for dual fuel engines.
- 5) Only double block and bleed valves to close.
- 6) If the duct is protected by inert gas (see 2.7.1) then loss of inert gas overpressure is to lead to the same actions as given in this table.

CHAPTER 6

COMPRESSORS AND GAS ENGINES

6.1 Gas compressors

6.1.1 The fuel gas compressor should be fitted with accessories and instrumentation necessary for efficient and reliable function.

6.1.2 The gas compressor and fuel gas supply should be arranged for manual remote emergency stop from the following locations:

- .1 cargo control room (relevant for cargo ships only);
- .2 navigation bridge;
- .3 engine control room; and
- .4 fire control station.

6.2 Gas engine design general

6.2.1 The last gas valve prior to the gas engine should be controlled by the engine control system or by the engine gas demand.

All gas engine components, gas engine systems and gas engine subsystems should be designed to:

- .1 exclude any explosion at all possible situations; or
- .2 to allow explosions without detrimental effect and to discharge to a safe location. The explosion event should not interrupt the safe operation of the engine unless other safety measures allow the shutdown of the affected engine.

6.2.1.1 When gas is supplied in a mixture with air through a common manifold, sufficient flame arrestors should be installed before each cylinder head. The mixture inlet system should be designed to withstand explosions of mixture by means of:

- .1 explosion relief venting to prevent excessive explosion pressures. It should be ensured that the explosion relief venting is installed in a way that it discharges to a safe location; or
- .2 documentation demonstrating that the mixture inlet system has sufficient strength to contain the worst case explosion.

6.2.1.2 The exhaust system should be designed to withstand explosions of unburned mixture by means of:

- .1 explosion relief venting to prevent excessive explosion pressures. It should be ensured that the explosion relief venting is installed such that they discharge to a safe location; or
- .2 documentation showing that the exhaust system has sufficient strength to contain the worst case explosion.

6.2.1.3 The crankcase of gas engines should be provided with:

- .1 crankcase explosion relief valves of a suitable type with sufficient relief area. The relief valves should be installed in way of each crank throw and should be arranged or provided with means to ensure that discharge from them is so directed as to minimize the possibility of injury to personnel. Refer to SOLAS regulations II-1/27 and 47.2; or
- .2 documentation showing that the crankcase has sufficient strength to contain the worst case explosion.

6.2.1.4 It should be ensured that the explosion of unburned mixture within the exhaust system or the crankcase or the explosion of mixture within the mixture inlet is allowed without detrimental effect.

6.2.2 The design of piping on gas engines should follow the requirements in chapter 2.6 “System configuration” and chapter 2.7 “Gas supply system in gas machinery spaces”.

6.2.3 The combustion of the gas mixture should be monitored. This can be achieved by monitoring of the exhaust gas or combustion chamber temperature.

6.2.4 The exhaust pipes of gas-fuelled engines should not be connected to the exhaust pipes of other engines or systems.

6.3 Requirements dual fuel engines

6.3.1 Start and normal stop should be on oil fuel only. Gas injection should not be possible without a corresponding pilot oil injection. The amount of pilot fuel fed to each cylinder should be sufficient to ensure a positive ignition of the gas mixture.

6.3.2 In case of shut-off of the gas fuel supply, the engines should be capable of continuous operation by oil fuel only.

6.3.3 Changeover to and from gas fuel operation should only be possible at a power level and under conditions where it can be done with acceptable reliability as demonstrated through testing. On power reduction the changeover to oil fuel is to be automatic. The changeover process itself from and to gas operation should be automatic. Manual interruption should be possible in all cases.

6.3.4 On normal stop as well as emergency shutdown, gas fuel supply should be shut off not later than simultaneously with the oil fuel. It should not be possible to shut off the supply pilot fuel without first or simultaneously closing the gas supply to each cylinder or to the complete engine.

6.4 Requirements gas-only engines

6.4.1 The starting sequence should be such that fuel gas is not admitted to the cylinders until ignition is activated and the engine has reached an engine and application specific minimum rotational speed.

6.4.2 If ignition has not been detected by the engine monitoring system within an engine specific time after opening of the gas supply valve the gas supply valve should be automatically shut off and the starting sequence terminated. It should be ensured by any mean that any unburned gas mixture is flushed away from the exhaust system.

6.4.3 On normal stop as well as emergency shutdown, gas fuel supply should be shut off not later than simultaneously with the ignition. It should not be possible to shut off the ignition without first or simultaneously closing the gas supply to each cylinder or to the complete engine.

6.4.4 For constant speed engines the shut down sequence should be such that the engine gas supply valve closes at idle speed and that the ignition system is kept active until the engine is down to standstill.

CHAPTER 7

MANUFACTURE, WORKMANSHIP AND TESTING

7.1 General

The manufacture, testing, inspection and documentation should be in accordance with recognized standards and the specific requirements given in these Guidelines.

7.2 Gas tanks

Tests related to welding and tank testing should be in accordance with the IGC Code, sections 4.10 and 4.11.

7.3 Gas piping systems

7.3.1 The requirements for testing should apply to gas piping inside and outside the gas tanks. However, relaxation from these requirements may be accepted for piping inside gas tanks and open-ended piping.

7.3.2 Welding procedure tests should be required for gas piping and should be similar to those required for gas tanks in the IGC Code, paragraph 6.3.3. Unless otherwise especially agreed with the Administration, the test requirements should be in accordance with 7.3.3 below.

7.3.3 Test requirements:

- .1 Tensile tests: Generally, tensile strength should not be less than the specified minimum tensile strength for the appropriate parent materials. The Administration may also require that the transverse weld tensile strength should not be less than the specified tensile strength for the weld metal, where the weld metal has a lower tensile strength than that of the parent metal. In every case, the position of fracture should be reported for information.
- .2 Bend tests: No fracture should be acceptable after a 180° bend over a former of a diameter four times the thickness of the test piece, unless otherwise specially required or agreed with the Administration.
- .3 Charpy V-notch impact tests: Charpy tests should be conducted at the temperature prescribed for the base material being joined. The results of the weld impact tests, minimum average energy (E), should be no less than 27 J. The weld metal requirements for sub-size specimens and single energy values should be in accordance with the IGC Code paragraph 6.1.4. The results of fusion line and heat affected zone

impact tests should show a minimum average energy (E) in accordance with the transverse or longitudinal requirements of the base material, whichever applicable, and for sub-size specimens, the minimum average energy (E) should be in accordance with the IGC Code, paragraph 6.1.4. If the material thickness does not permit machining either full-sized or standard sub-size specimens, the testing procedure and acceptance standards should be in accordance with recognized standards.

Impact testing is not required for piping with thickness less than 6 mm.

7.3.4 In addition to normal controls before and during the welding and to the visual inspection of the finished welds, the following tests should be required:

- .1 For butt welded joints for piping systems with design temperatures lower than -10°C and with inside diameters of more than 75 mm or wall thicknesses greater than 10 mm, 100% radiographic testing should be required.
- .2 When such butt welded joints of piping sections are made by automatic welding processes in the pipe fabrication shop, upon special approval, the extent of radiographic inspection may be progressively reduced but in no case to less than 10% of the joints. If defects are revealed the extent of examination should be increased to 100% and shall include inspection of previously accepted welds. This special approval should only be granted if well-documented quality assurance procedures and records are available to enable the Administration to assess the ability of the manufacturer to produce satisfactory welds consistently.
- .3 For other butt welded joints of pipes, spot radiographic tests or other non-destructive tests should be carried out at the discretion of the Administration depending upon service, position and materials. In general, at least 10% of butt welded joints of pipes should be radiographed.

Butt welded joints of high-pressure gas pipes and gas supply pipes in ESD-protected machinery spaces should be subjected to 100% radiographic testing.

The radiographs should be assessed according to a recognized standard¹⁷.

7.3.5 After assembly, all gas piping should be subjected to a hydrostatic test to at least 1.5 times the design pressure. However, when piping systems or parts of systems are completely manufactured and equipped with all fittings, the hydrostatic test may be conducted prior to installation aboard ship. Joints welded on board should be hydrostatically tested to at least 1.5 times the design pressure. Where water cannot be tolerated and the piping cannot be dried prior to putting the system into service, proposals for alternative testing fluids or testing methods should be submitted for approval.

7.3.6 After assembly on board, each gas piping system should be subjected to a leak test using air, halides or other suitable medium.

7.3.7 All gas piping systems including valves, fittings and associated equipment for handling gas should be tested under normal operating condition before set into normal operation.

¹⁷ Refer to ISO 5817:2003, Arc-welded joints in steel – Guidance on quality levels for imperfections, and should at least meet the requirements for quality level B.

7.4 Ducting

If the gas piping duct contains high-pressure pipes the ducting should be pressure tested to at least 10 bar.

7.5 Valves

Each size and each type of valve intended to be used at a working temperature below -55°C should be prototype tested as follows. It should be subjected to a tightness test at the minimum design temperature or lower and to a pressure not lower than the design pressure for the valves. During the test, the good operation of the valve should be ascertained.

7.6 Expansion bellows

7.6.1 The following prototype tests should be performed on each type of expansion bellows intended for use in gas piping, primarily on those used outside the gas tank:

- .1 An overpressure test. A type element of the bellows, not pre-compressed, should be pressure tested to a pressure not less than 5 times the design pressure without bursting. The duration of the test should not be less than 5 min.
- .2 A pressure test on a type expansion joint complete with all the accessories (flanges, stays, articulations, etc.) at twice the design pressure at the extreme displacement conditions recommended by the manufacturer. No permanent deformations should be allowed. Depending on materials the test may be required to be performed at the minimum design temperature.
- .3 A cyclic test (thermal movements). The test should be performed on a complete expansion joint, which is to successfully withstand at least as many cycles, under the conditions of pressure, temperature, axial movement, rotational movement and transverse movement, as it will encounter in actual service. Testing at room temperature, when conservative, is permitted.
- .4 A cyclic fatigue test (ship deformation). The test should be performed on a complete expansion joint, without internal pressure, by simulating the bellow movement corresponding to a compensated pipe length for at least 2×10^6 cycles at a frequency not higher than 5 Hz. This test is only required when, due to the piping arrangement, ship deformation loads are actually experienced.

7.6.2 The Administration may waive performance of the tests specified in 7.6.1, provided that complete documentation is supplied to establish the suitability of the expansion joints to withstand the expected working conditions. When the maximum internal pressure exceeds 1 bar, this documentation should include sufficient tests data to justify the design method used, with particular reference to correlation between calculation and test results.

CHAPTER 8

OPERATIONAL AND TRAINING REQUIREMENTS

8.1 Operational requirement

8.1.1 The whole operational crew of a gas-fuelled cargo and a passenger ship should have necessary training in gas-related safety, operation and maintenance prior to the commencement of work on board.

8.1.2 Additionally, crew members with a direct responsibility for the operation of gas-related equipment on board should receive special training. The company should document that the personnel have acquired the necessary knowledge and that this knowledge is maintained at all times.

8.1.3 Gas-related emergency exercises should be conducted at regular intervals. Safety and response systems for the handling of defined hazards and accidents should be reviewed and tested.

8.1.4 A training manual should be developed and a training programme and exercises should be specially designed for each individual vessel and its gas installations.

8.2 Gas-related training

8.2.1 Training in general

The training on gas-fuelled ships is divided into the following categories:

- .1 category A: Basic training for the basic safety crew;
- .2 category B: Supplementary training for deck officers; and
- .3 category C: Supplementary training for engineer officers.

8.2.1.1 Category A training

- .1 The goal of the category A training should provide the basic safety crew with a basic understanding of the gas in question as a fuel, the technical properties of liquid and compressed gas, explosion limits, ignition sources, risk reducing and consequence reducing measures, and the rules and procedures that must be followed during normal operation and in emergency situations.
- .2 The general basic training required for the basic safety crew is based on the assumption that the crew does not have any prior knowledge of gas, gas engines and gas systems. The instructors should include one or more of the suppliers of the technical gas equipment or gas systems, alternatively other specialists with in-depth knowledge of the gas in question and the technical gas systems that are installed on board.
- .3 The training should consist of both theoretical and practical exercises that involve gas and the relevant systems, as well as personal protection while handling liquid and compressed gas. Practical extinguishing of gas fires should form part of the training, and should take place at an approved safety centre.

8.2.1.2 Categories B and C training

- .1 Deck and engineer officers should have gas training beyond the general basic training. Category B and category C training should be divided technically between deck and engineer officers. The company's training manager and the master should determine what comes under deck operations and what comes under engineering.
- .2 Those ordinary crew members who are to participate in the actual bunkering work, as well as gas purging, or are to perform work on gas engines or gas installations, etc., should participate in all or parts of the training for category B/C. The company and the master are responsible for arranging such training based on an evaluation of the concerned crew member's job instructions/area of responsibility on board.

- .3 The instructors used for such supplementary training should be the same as outlined for category A.
- .4 All gas-related systems on board should be reviewed. The ship's maintenance manual, gas supply system manual and manual for electrical equipment in explosion hazardous spaces and zones should be used as a basis for this part of the training.
- .5 This regulation should be regularly reviewed by the company and onboard senior management team as part of the SMS system. Risk analysis should be emphasized, and any risk analysis and sub-analyses performed should be available to course participants during training.
- .6 If the ship's own crew will be performing technical maintenance of gas equipment, the training for this type of work should be documented.
- .7 The master and the chief engineer officer should give the basic safety crew on board their final clearance prior to the entry into service of the ship. The clearance document should only apply to gas-related training, and it should be signed by both the master/chief engineer officer and the course participant. The clearance document for gas-related training may be integrated in the ship's general training programme, but it should be clearly evident what is regarded as gas-related training and what is regarded as other training.
- .8 The training requirements related to the gas system should be evaluated in the same manner as other training requirements on board at least once a year. The training plan should be evaluated at regular intervals.

8.3 Maintenance

8.3.1 A special maintenance manual should be prepared for the gas supply system on board.

8.3.2 The manual should include maintenance procedures for all technical gas-related installations, and should comply with the recommendations of the suppliers of the equipment. The intervals for, and the extent of, the replacement/approval of gas valves should be established. The maintenance procedure should specify who is qualified to carry out maintenance.

8.3.3 A special maintenance manual should be prepared for electrical equipment that is installed in explosion hazardous spaces and areas. The inspection and maintenance of electrical installations in explosion hazardous spaces should be performed in accordance with a recognized standard.¹⁸

8.3.4 Any personnel that should carry out inspections and maintenance of electrical installations in explosion hazardous spaces should be qualified pursuant to IEC 60079-17, item 4.2.

¹⁸ Refer to IEC 60079-17:2007 Explosive atmospheres – Part 17: Electrical installations inspection and maintenance.

ANNEX 12**RESOLUTION MSC.286(86)
(adopted on 5 June 2009)****RECOMMENDATIONS FOR MATERIAL SAFETY DATA SHEETS (MSDS)
FOR MARPOL ANNEX I OIL CARGO AND OIL FUEL**

THE MARITIME SAFETY COMMITTEE,

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

RECALLING ALSO that, at its seventy-sixth session, it approved the Recommendation for the use of a standard format for the cargo information required by chapter 16 of the IBC Code,

RECALLING FURTHER that, at its seventy-seventh session, it adopted the Recommendation for material safety data sheets for MARPOL Annex I cargoes and marine fuel oils (MSC.150(77)),

NOTING that, at its eighty-third session, it adopted amendments to SOLAS regulation VI/5-1, by means of resolution MSC.239(83), making the provision of material safety data sheets (MSDS) mandatory prior to the loading of MARPOL Annex I type cargo in bulk and oil fuel,

RECOGNIZING the importance of providing seafarers with clear, concise and accurate information on the health and the environmental effects of toxic substances carried on board tankers,

RECOGNIZING ALSO the need to ensure a common understanding for an unambiguous implementation of SOLAS regulation VI/5-1,

HAVING CONSIDERED the recommendation made by the Sub-Committee on Bulk Liquids and Gases at its thirteenth session,

1. ADOPTS:

- .1 the Recommendations for material safety data sheets (MSDS) for marine use suitable to meet the particular needs of the marine industry containing safety, handling, and environmental information to be supplied to a ship prior to the loading of MARPOL Annex I type oil as cargo in bulk and the bunkering of oil fuel, as set out in Annex 1 to the present resolution; and
- .2 the Guidelines for the completion of MSDS for the MARPOL Annex I type oil as cargo in bulk and oil fuel, as set out in Annex 2 to the present resolution;

2. URGES Governments to ensure the supply and carriage of the material safety data sheets (MSDS) for MARPOL Annex I type oil as cargo in bulk and oil fuel, as from 1 July 2009;

3. FURTHER URGES Governments to direct their port State control officers to accept MSDS meeting the Recommendations adopted by this resolution as from 1 July 2009 in lieu of the Recommendations adopted by resolution MSC.150(77); and
4. REVOKES resolution MSC.150(77) as from 1 July 2009.

ANNEX 1

RECOMMENDATIONS FOR MATERIAL SAFETY DATA SHEETS (MSDS) FOR MARINE USE SUITABLE TO MEET THE PARTICULAR NEEDS OF THE MARINE INDUSTRY CONTAINING SAFETY, HANDLING, AND ENVIRONMENTAL INFORMATION TO BE SUPPLIED TO A SHIP PRIOR TO THE LOADING OF MARPOL ANNEX I TYPE OIL AS CARGO IN BULK AND THE BUNKERING OF OIL FUEL

Section	Heading	Content
1	Identification of the substance or mixture and of the supplier	<ul style="list-style-type: none"> Name of the category – see guidance in annex 2 for MARPOL Annex I type oil cargoes and oil fuels. The name of the substances. Trade name of the substances. Description on Bill of Lading (B/L), Bunker Delivery Note or other shipping document. Other means of identification. Supplier's details (including name, address, telephone number, etc.). Emergency telephone number.
2	Hazards identification	<ul style="list-style-type: none"> GHS* classification of the substance/mixture and any regional information. Other hazards which do not result in classification (e.g., hydrogen sulphide) or are not covered by the GHS. See Guidelines in annex 2.
3	Composition/information on ingredients	<ul style="list-style-type: none"> Common name, synonyms, etc. Impurities and stabilizing additives which are themselves classified and which contribute to the classification of the substances. The chemical identity and concentration or concentration ranges of all ingredients which are hazardous within the meaning of GHS and are present above their cut-off levels. Cut-off level for reproductive toxicity, carcinogenicity and category 1 mutagenicity is 0.1%. Cut-off level for all other hazard classes is 1%. See Guidelines in annex 2.
4	First aid measures	<ul style="list-style-type: none"> Description of necessary measures, subdivided according to the different routes of exposure, i.e. inhalation, skin and eye contact and ingestion. Most important symptoms/effects, acute and delayed. Indication of immediate medical attention and special treatment, if necessary.

* Globally Harmonized System of Classification and Labelling of Chemicals (GHS), United Nations (2007 edition, as revised).

Section	Heading	Content
5	Fire-fighting measures	<ul style="list-style-type: none"> • Suitable extinguishing media. • Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products). • Special protective equipment and precautions for fire-fighters.
6	Accidental release measures	<ul style="list-style-type: none"> • Personal precautions, protective equipment and emergency procedures. • Environmental precautions. • Methods and materials for containment and clean-up.
7	Handling and storage	<ul style="list-style-type: none"> • Precautions for safe handling. • Conditions for safe storage, including any incompatibilities.
8	Exposure controls/ personal protection	<ul style="list-style-type: none"> • Control parameters (e.g., occupational exposure limit values). • Appropriate technical precautions. • Individual protection measures, such as personal protective equipment.
9	Physical and chemical properties	<ul style="list-style-type: none"> • See Guidelines in annex 2.
10	Stability and reactivity	<ul style="list-style-type: none"> • Chemical stability. • Possibility of hazardous reactions. • Conditions to avoid (e.g., static discharge).
11	Toxicological information	<ul style="list-style-type: none"> • Concise but complete and comprehensible description of the various toxicological (health) effects and the available data used to identify those effects, including: <ul style="list-style-type: none"> ○ Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact); ○ Symptoms related to the physical, chemical and toxicological characteristics; ○ Delayed and immediate effects and also chronic effects from short- and long-term exposure. • Numerical measures of toxicity (such as acute toxicity estimates). • See Guidelines in annex 2.
12	Ecological information	<ul style="list-style-type: none"> • Ecotoxicity (aquatic and terrestrial, where available). • Persistence and degradability. • Bioaccumulation potential. • Mobility in soil. • Other adverse effects. • See Guidelines in annex 2.
13	Disposal considerations	<ul style="list-style-type: none"> • Description of waste residues and information on their safe handling and methods of disposal, in line with MARPOL requirements.

Section	Heading	Content
14	Transport information	<ul style="list-style-type: none">• UN number, where applicable.• UN Proper shipping name, where applicable.• Transport Hazard class(es), where applicable.• Special precautions which a user needs to be aware of or needs to comply with in connection with transport (e.g., heating and carriage temperatures).• Note that this product is being carried under the scope of MARPOL Annex I.
15	Regulatory information	<ul style="list-style-type: none">• Safety, health and environmental regulations specific for the product in question.
16	Other information including information on preparation and revision of the MSDS	<ul style="list-style-type: none">• Version No.• Date of issue.• Issuing source.

ANNEX 2

GUIDELINES FOR THE COMPLETION OF MSDS FOR THE MARPOL ANNEX I TYPE OIL AS CARGO IN BULK AND OIL FUEL

1 Categories of liquids

The following categories subdivide the full scope of substances covered by Annex I of MARPOL 73/78 and set in groups specific products for general identification purposes.

- .1 crude oils;
- .2 fuel and residual oils, including ship's bunkers*;
- .3 unfinished distillates, hydraulic oils and lubricating oils;
- .4 gas oils, including ship's bunkers**;
- .5 kerosenes;
- .6 naphthas and condensates;
- .7 gasoline blending stocks;
- .8 gasoline and spirits; and
- .9 asphalt solutions.

2 Properties and information

In addition to properties and information specified in annex 1, the following properties and information should be reported:

- .1 for the following provide appropriate hazards identification in section 2, composition/information on ingredients in section 3, and toxicological information in section 11 of the MSDS:
 - .1 Benzene – if present $\geq 0.1\%$ by weight (even if naturally occurring ingredient of the material);
 - .2 Hydrogen sulphide – if present at any concentration, in liquid and vapour phases, or if possible to accumulate in a tank's vapour space; and
 - .3 Total Sulphur – if present $\geq 0.5\%$ by weight, identify in section 3 and warn of potential for hydrogen sulphide evolution in sections 2 and 11;

* Refer to standard ISO 8217:2005, Petroleum products – Fuels (class F) – Specifications of marine fuels, table 2.

** Refer to standard ISO 8217:2005, Petroleum products – Fuels (class F) – Specifications of marine fuels, table 1.

- .2 for physical and chemical properties in section 9 of the MSDS:
 - .1 appearance (physical state, colour, etc.);
 - .2 odour;
 - .3 pour point;
 - .4 boiling range;
 - .5 flashpoint;
 - .6 upper/lower flammability or explosive limits;
 - .7 vapour pressure (Reid vapour pressure (RVP) when appropriate);
 - .8 vapour density;
 - .9 density;
 - .10 auto-ignition temperature; and
 - .11 kinematic viscosity; and
- .3 for ecological information in section 12 of the MSDS: Persistent or non-persistent oil as per the International Oil Pollution Compensation (IOPC) Fund definition* .

* International Oil Pollution Compensation (IOPC) Fund definition: “A non-persistent oil is oil, which, at the time of shipment, consists of hydrocarbon fractions, (a) at least 50% of which, by volume, distils at a temperature of 340°C (645°F) and (b) at least 95% of which, by volume, distils at a temperature of 370°C (700°F) when tested by the ASTM Method D-86/78 or any subsequent revision thereof”.

ANNEX 13**DRAFT ASSEMBLY RESOLUTION****ADOPTION OF THE CODE ON ALERTS AND INDICATORS, 2009**

THE ASSEMBLY,

RECALLING Article 15(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations and guidelines concerning maritime safety and the prevention and control of marine pollution from ships,

RECALLING ALSO that it adopted, by resolution A.830(19), the Code on Alarms and Indicators, 1995, incorporating therein provisions on alarms and indicators contained in respective IMO instruments,

RECOGNIZING the need to further update the provisions of the Code, thereby ensuring compliance with the requirements of the IMO instruments which have been adopted and/or amended since the Code was adopted and, thus, eliminate contradictions, ambiguities and unnecessary redundancies,

HAVING CONSIDERED the recommendations made by the Maritime Safety Committee at its eighty-sixth session and the Marine Environment Protection Committee at its [fifty-ninth] session,

1. ADOPTS the Code on Alerts and Indicators, 2009, set out in the Annex to the present resolution;
2. RECOMMENDS Governments to:
 - (a) take appropriate steps to apply the Code; and
 - (b) use the Code as an international safety standard for designing alarms and indicators for ships, ships' equipment and machinery;
3. REQUESTS the Maritime Safety Committee and the Marine Environment Protection Committee to keep the Code under review and update it as necessary;
4. REVOKES resolution A.830(19).

ANNEX

CODE ON ALERTS AND INDICATORS, 2009

1 PURPOSE AND SCOPE

1.1 The Code is intended to provide general design guidance and to promote uniformity of type, location and priority for those alerts and indicators which are required by the International Convention for the Safety of Life at Sea, 1974 (1974 SOLAS Convention), as amended; associated codes (BCH, Diving, FSS, Gas Carrier, 2000 HSC, IBC, IGC, IMDG, LSA, 2009 MODU, and Nuclear Merchant Ship Codes); the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78), as amended; the Torremolinos Protocol of 1993 relating to the Torremolinos International Convention for the Safety of Fishing Vessels (1993 Torremolinos (SFV) Protocol); the Principles of Safe Manning; the Guidelines for Inert Gas Systems (IGS); the Standards for Vapour Emission Control Systems (VEC); the Performance Standards for a Bridge Navigational Watch Alarm System (BNWAS); and the Revised Performance Standards for Integrated Navigation Systems (INS).

1.2 The Code will benefit designers and operators by consolidating in one document the references to priorities, aggregation, grouping, locations and types, including colours, symbols, etc., of shipboard alerts and indicators. Where the applicable IMO instruments do not specify the type and location of particular alerts, this information, as far as practicable, is presented in this Code to promote uniform application.

1.3 In order to achieve similar uniformity, the Code also serves as guidance for alerts and indicators included in IMO instruments other than those referred to in 1.1.

1.4 The management and presentation of alerts should conform additionally to the appropriate performance standards adopted by the Organization.

2 APPLICATION

The Code applies to shipboard alerts and indicators.

3 DEFINITIONS

3.1 *Alert.* Alerts announce abnormal situations and conditions requiring attention. Alerts are divided in four priorities: emergency alarms, alarms, warnings and cautions.

- .1** *Emergency alarm.* An alarm which indicates that immediate danger to human life or to the ship and its machinery exists and that immediate action should be taken.
- .2** *Alarm.* An alarm is a high priority of an alert. Condition requiring immediate attention and action, to maintain the safe navigation and operation of the ship.
- .3** *Warning.* Condition requiring no immediate attention or action. Warnings are presented for precautionary reasons to bring awareness of changed conditions which are not immediately hazardous, but may become so, if no action is taken.

- .4 *Caution.* Lowest priority of an alert. Awareness of a condition which does not warrant an alarm or warning condition, but still requires attention out of the ordinary consideration of the situation or of given information.

3.2 The following alerts are classified as emergency alarms:

- .1 *General emergency alarm.* An alarm given in the case of an emergency to all persons on board summoning passengers and crew to assembly stations.
- .2 *Fire alarm.* An alarm to summon the crew in the case of fire.
- .3 *Water ingress detection main alarm.* An alarm given when the water level reaches the main alarm level in cargo holds or other spaces on bulk carriers or single hold cargo ships.
- .4 Those alerts giving warning of immediate personnel hazard, including:
 - .1 *Fire-extinguishing pre-discharge alarm.* An alarm warning of the imminent release of fire-extinguishing medium into a space.
 - .2 *Power-operated sliding watertight door closing alarm.* An alarm required by SOLAS regulation II-1/15.7.1.6, warning of the closing of a power-operated sliding watertight door.
- .5 For special ships (e.g., high-speed craft), additional alarms may be classified as emergency alarms in addition to the ones defined above.

3.3 The following alerts are classified as alarms:

- .1 *Machinery alarm.* An alarm which indicates a malfunction or other abnormal condition of the machinery and electrical installations.
- .2 *Steering gear alarm.* An alarm which indicates a malfunction or other abnormal condition of the steering gear system, e.g., overload alarm, phase failure alarm, no-voltage alarm and hydraulic oil tank low-level alarm.
- .3 *Control system fault alarm.* An alarm which indicates a failure of an automatic or remote control system, e.g., the navigation bridge propulsion control failure alarm.
- .4 *Bilge alarm.* An alarm which indicates an abnormally high level of bilge water.
- .5 *Water ingress detection pre-alarm.* An alarm given when the water level reaches a lower level in cargo holds or other spaces on bulk carriers or single hold cargo ships.
- .6 *Engineers' alarm.* An alarm to be operated from the engine control room or at the manoeuvring platform, as appropriate, to alert personnel in the engineers' accommodation that assistance is needed in the engine-room.
- .7 *Personnel alarm.* An alarm to confirm the safety of the engineer on duty when alone in the machinery spaces.

- .8** *Bridge Navigational Watch Alarm System (BNWAS).* Second and third stage remote audible alarm as required by resolution MSC.128(75).
 - .9** *Fire detection alarm.* An alarm to alert the crew in the onboard safety centre, the continuously manned central control station, the navigation bridge or main fire control station or elsewhere that a fire has been detected.
 - .10** *Fixed local application fire-extinguishing system activation alarm.* An alarm to alert the crew that the system has been discharged, with indication of the section activated.
 - .11** Alarms indicating faults in alert management or detection systems or loss of their power supplies.
 - .12** *Cargo alarm.* An alarm which indicates abnormal conditions originating in cargo, or in systems for the preservation or safety of cargo.
 - .13** *Gas detection alarm.* An alarm which indicates that gas has been detected.
 - .14** *Power-operated watertight door fault alarms.* Alarms which indicate low level in hydraulic fluid reservoirs, low gas pressure or loss of stored energy in hydraulic accumulators, and loss of electrical power supply for power-operated sliding watertight doors.
 - .15** Navigation-related alarms as specified in the Revised Performance Standards for Integrated Navigation Systems (INS) (resolution MSC.252(83), appendix 5).
 - .16** For special ships (e.g., high-speed craft), additional alerts may be classified as alarms in addition to the ones defined above.
- 3.4** *Indicator.* Visual indication giving information about the condition of a system or equipment.
- 3.5** *Signal.* Audible indication giving information about the condition of a system or equipment.
- 3.6** *Required alert or indicator.* An alert or indicator required by IMO instruments referred to in paragraph 1.1. Any other alerts and indicators are referred to in this Code as non-required alerts or indicators.
- 3.7** *Call.* The request for contact, assistance and/or action from an individual to another person or group of persons, i.e. the complete procedure of signalling and indicating this request.
- 3.8** *Silence.* Manual stopping of an audible signal.
- 3.9** *Acknowledge.* Manual response to the receipt of an alert or call.
- 3.10** *Aggregation.* Combination of individual alerts to provide one alert (one alert represents many individual alerts), e.g., imminent slowdown or shutdown of the propulsion system alarm at the navigation bridge.

3.11 *Grouping* is a generic term meaning the arrangement of individual alerts on alert panels or individual indicators on indicating panels, e.g., steering gear alerts at the workstation for navigating and manoeuvring on the navigation bridge, or door indicators on a watertight door position indicating panel at the workstation for safety on the navigation bridge.

3.12 *Prioritization/Priority.* The ordering of alerts in terms of their severity, function, sequence, etc.

4 GENERAL

4.1 The presentation of alerts and indicators should be clear, distinctive, unambiguous, and consistent.

4.2 All required alerts should be indicated by both audible and visual means, except the emergency alarms of 3.2 which should be indicated primarily by a signal. In machinery spaces with high ambient noise levels, signals should be supplemented by indicators, presented in accordance with 6.1. Signals and announcements may also be supplemented by indicators in accommodation spaces.

4.3 Where audible alerts are interrupted by public announcements the visual alert should not be affected.

4.4 A new alert condition should be clearly distinguishable from those existing and acknowledged, e.g., existing and acknowledged alarms and warnings are indicated by a constant light and new (unacknowledged) alarms and warnings are indicated by a flashing light and an audible signal. Audible signals should be stopped when silenced or acknowledged. At control positions or other suitable positions as required, alert systems should clearly distinguish between no alert (normal condition), alert, silenced and acknowledged alert conditions.

4.5 Alerts should be maintained until they are acknowledged and the visual indications of individual alerts should remain until the fault has been corrected. If an alert has been acknowledged and a second fault occurs before the first is rectified, the audible signal and visual indication should be repeated.

4.6 Alerts and acknowledged alerts should be capable of being reset only in case the abnormal condition is rectified.

4.7 The presentation and handling of alarms, warnings and cautions indicated on the navigation bridge should comply with the requirements of module C of resolution MSC.252(83) where applicable to ships with Integrated Navigation Systems (INS) and, where fitted, with the requirements of a bridge alert management system.

4.8 Required alert systems should be continuously powered and should have an automatic change-over to a stand-by power supply in case of loss of normal power supply. Emergency alarms and alarms should be powered from the main source of electrical power and from the emergency sources of electrical power defined by SOLAS regulations II-1/42 or II-1/43 unless other arrangements are permitted by those regulations, as applicable, except that:

- .1** the power-operated sliding watertight door closure alarm power sources may be those used to close the doors;

- .2 the fire-extinguishing pre-discharge alarm power source may be the medium itself; and
- .3 continuously charged, dedicated accumulator batteries of an arrangement, location, and endurance equivalent to that of the emergency source of electrical power may be used instead of the emergency source.

4.9 Required rudder angle indicators and power-operated sliding watertight door position indicators should be powered from the main source of electrical power and should have an automatic change-over to the emergency source of electrical power in case of loss of normal power supply.

4.10 Failure of power supply of required alert and alarm systems should be indicated by an audible and visual alarm or warning.

4.11 Required alert and alarm systems should, as far as is practicable, be designed on the fail-to-safety principle, e.g., a detection circuit fault should cause an audible and visual alarm; see also FSS Code, chapter 9, paragraph 2.5.1.5.

4.12 Provision should be made for functionally testing required alerts and indicators. The Administration should ensure, e.g., by training and drills, that the crew is familiar with all alerts.

4.13 Required alert, alarm and indicator systems should be functionally independent of control systems and equipment, or should achieve equivalent redundancy. Any additional requirements for particular alerts in the IMO instruments applicable to the ship should be complied with.

4.14 Software and data for computerized alert and alarm systems should not be permanently lost or altered as a result of power supply loss or fluctuation. Provision should be made to prevent unintentional or unauthorized alteration of software and data.

4.15 Cables for fire and general emergency alarms and public address systems and their power sources should be of a fire-resistant type where they pass through high fire risk areas, and in addition for passenger ships, main vertical fire zones, other than those which they serve. Systems that are self monitoring, fail safe or duplicated with cable runs as widely separated as is practicable may be exempted provided that their functionality can be maintained. Equipment and cables for emergency alarms and indicators (e.g., watertight doors' position indicators) should be arranged to minimize risk of total loss of service due to localized fire, collision, flooding or similar damage.

4.16 To the extent considered practicable by the Administration, general emergency alarm, fire alarm and fire-extinguishing pre-discharge alarm should be arranged so that the audible signals can be heard regardless of failure of any one circuit or component.

4.17 Means should be provided to prevent normal operating conditions from causing false alerts, e.g., provision of time delays because of normal transients.

4.18 The number of alerts and indicators which are not required to be presented on the navigation bridge should be minimized.

4.19 The system should be designed so that alerts can be acknowledged and silenced at the authorized control position. All alerts presented on the navigation bridge should be capable of being acknowledged and silenced as required in module C of resolution MSC.252(83) where applicable to ships with Integrated Navigation Systems (INS) and, where fitted, with the requirements of a bridge alert management system.

4.20 In order to facilitate maintenance and reduce risk of fire or harm to personnel, consideration should be given to providing means of isolation of sensors fitted to tanks and piping systems for flammable fluids or fluids at high temperature or pressure (e.g., valves, cocks, pockets for temperature sensors).

5 AUDIBLE PRESENTATION OF ALERTS AND CALLS

5.1 Required alerts should be clearly audible and distinguishable in all parts of the spaces where they are required. Where a distinct difference between the various audible signals and calls cannot be determined satisfactorily, as in machinery spaces with high ambient noise levels, it is permitted, to install common audible signal and call devices supplemented by visual indicators identifying the meaning of the audible signal or call.

5.2 The fire-extinguishing pre-discharge alarm should have a characteristic which can be easily distinguished from any other audible signal or call installed in the space(s) concerned. Audible signals of fire and fire detection alarm should have a characteristic which can be easily distinguished from any other audible signal or call installed in the space(s).

5.3 Audible signals and calls should have characteristics in accordance with section 7.

5.4 In large spaces, more than one audible signal or call device should be installed, in order to avoid shock to persons close to the source of sound and to ensure a uniform sound level over all the space as far as practicable.

5.5 Facilities for adjusting the frequency of audible signal within the prescribed limits may be provided to optimize their performance in the ambient conditions. The adjustment devices should be sealed, to the satisfaction of the Administration, after setting has been completed.

5.6 Arrangements should not be provided to adjust the sound pressure level of required audible signals. Where loudspeakers with built-in volume controls are used, the volume controls should be automatically disabled by the release of the alert signal.

5.7 Administrations may accept electronically-generated signals provided all applicable requirements herein are complied with.

5.8 Administrations may accept the use of a public address system for the general emergency alarm and the fire alarm provided that:

- .1** all requirements for those alerts of the LSA Code, FSS Code and the 1974 SOLAS Convention, as amended, are met;
- .2** all the relevant requirements for required alerts in this Code are met;

- .3 the system automatically overrides any other input system when an emergency alarm is required and the system automatically overrides any volume controls provided to give the required output for the emergency mode when an emergency alarm is required;
- .4 the system is arranged to prevent feedback or other interference; and
- .5 the system is arranged to minimize the effect of a single failure.

5.9 The general emergency alarm, fire alarm (if not incorporated in the general emergency alarm system), fire-extinguishing medium alarm, and machinery alarm should be so arranged that the failure of the power supply or the signal-generating and amplifying equipment (if any) to one will not affect the performance of the others. Where common audible signals and call devices are installed in accordance with 5.1, arrangements should be provided to minimize the effect of such devices' failure.

5.10 The performance standards and functional requirements of the general emergency alarm are specified in the LSA Code, chapter VII, paragraph 7. In addition, the sound pressure level should be in the 1/3-octave band about the fundamental frequency. In no case should the level of an audible signal in a space exceed 120 dB(A).

5.11 With the exception of bells, audible signals should have a signal frequency between 200 Hz and 2,500 Hz.

5.12 For the audible presentation of alerts on the navigation bridge, the requirements of resolution MSC.191(79), MSC/Circ.982, resolution A.694(17) and module C of resolution MSC.252(83) where applicable to ships with Integrated Navigation Systems (INS) and, where fitted, the requirements of a bridge alert management system should be observed.

5.13 For the audible presentation of navigational alerts on the bridge the sound pressure should be at least 75 dB(A) but not greater than 85 dB(A) at a distance of one metre from the systems. Alternatively, it may be allowed to adjust the sound pressure to at least 10 dB(A) above the ambient noise level instead, if the ambient sound pressure on the bridge can be determined. The upper noise level should not exceed 85 dB(A).

6 VISUAL PRESENTATION OF INDICATORS AND CALLS

6.1 Supplemental visual indicators and calls provided in machinery spaces with high ambient noise levels and in accommodation spaces should:

- .1 be clearly visible and distinguishable either directly or by reflection in all parts of the space in which they are required;
- .2 be of a colour and symbol in accordance with tables 7.1.1 to 7.1.3;
- .3 flash in accordance with 6.2. Instead of individual flashing lights a single flash or rotating white light in addition to a permanent individual indication may be used for light columns;

- .4 be of high luminous intensity; and
- .5 be provided in multiples in large spaces.

6.2 Flashing indicators and calls should be illuminated for at least 50% of the cycle and have a pulse frequency in the range of 0.5 Hz to 1.5 Hz.

6.3 Visual indicators on the navigation bridge should not interfere with night vision. For the visual presentation of alerts on the navigation bridge the requirements of resolution MSC.191(79), module C of resolution MSC.252(83) where applicable to ships with Integrated Navigation Systems (INS) and, where fitted, the requirements of a bridge alert management system should be observed.

6.4 Indicators should be clearly labelled unless standard visual indicator symbols, such as those in tables 7.1.1 to 7.1.3, are used. These standard visual indicator symbols should be arranged in columns for ready identification from all directions. This applies in particular to the emergency alarms in table 7.1.1. Standard visual indicator symbols may also be used on consoles, indicator panels, or as labels for indicator lights.





6.5 Indicator colours should be in accordance with ISO Standard 2412 as deemed appropriate by the Administration. Indicator colours on navigational equipment should be in accordance with resolution MSC.191(79), paragraph 5.7.

6.6 On mobile offshore drilling units (MODUs), where supplemental visual indicators are installed for general emergency alarms, the colour of these supplemental indicators may be amber, provided they flash with a pulse frequency of at least 4 Hz.

7 CHARACTERISTICS

The emergency alarms, alarms, and call signals listed should have the audible and visual characteristics shown in the tables of this section. All other alerts, indicators and call signals should be clearly distinct from those listed in this section to the satisfaction of the Administration. These tables are not all-inclusive and other alerts may be added by the Administration in a manner consistent with this Code.











Table 7.1.1 – Emergency alarms
(Note: See table 7.2 for audible signals)

Function	IMO Instrument	Audible		Visual		Remarks
		Device	Code	Colour	Symbol*	
General emergency alarm	LSA 7.2.1 SOLAS III/6.4 SOLAS II-2/7.9.4	Whistle	1.a, 1.b	Green/ White		Used for summoning passengers to the assembly stations. Used for summoning the crew to the boat stations. Sound levels in accordance with LSA Code 7.2.1.2, 7.2.1.3.
		Siren Bell Claxon Horn			passengers	
Fire alarm	SOLAS II-2/7.9.4	Bell Claxon Siren Horn	2, 1.b	Red		Used for summoning the crew to the fire stations on passenger ships.
	FSS 9.2.5.1	Bell Claxon Siren Horn	2, 3.c, 3.d	Red		Horn/bell in machinery space, buzzer/bell elsewhere. Signal precedes release.
Fire-extinguishing pre-discharge alarm	FSS 5.2.1.3	Siren Horn	2	Red	CO ₂	Audible signal distinct from all others. When other fire-extinguishing mediums are used they should be clearly identifiable.
Power-operated sliding watertight door closing alarm	SOLAS II-1/13.7.1.6 and 13.8.2	Horn Claxon Bell	2	Red Green	No symbol allocated	Signal at door precedes and continues during door closing. At remote position; door open – red indicator, door closed – green indicator. Red indicator on navigation bridge flashes while door closes.
Water ingress detection main alarm	SOLAS XII/12.1, 12.2 and II-1/23-3	Bell Buzzer Horn	2	Red		For cargo holds used for water ballast and the ballast tanks, an alarm overriding device may be installed.

* For use with visual indicator columns (see Appendix).


Table 7.1.2 – Alarms

(Note: See table 7.2 for audible signals. For the presentation of navigation related alerts, resolution MSC.191(79) should be observed.)

Function	IMO Instrument	Audible		Visual*		Remarks
		Device	Code	Colour	Symbol*	
Machinery alarm	SOLAS II-1/51.1	Horn Buzzer	3	Amber		Horn in machinery space, buzzer elsewhere.
Steering gear alarm	SOLAS II-1/29.5.2 II-1/29.8.4 II-1/29.12.2 II-1/30.3	Horn Buzzer	3	Amber		Horn in machinery space, buzzer elsewhere.
Control system fault alarm	SOLAS II-1/29.8.4 II-1/49.5	Horn Buzzer	3	Amber	No symbol allocated	Horn in machinery space, buzzer elsewhere.
Bilge alarm	SOLAS II-1/48	Horn Buzzer	3	Amber		Horn in machinery space, buzzer elsewhere.
Engineers' alarm	SOLAS II-1/38	Horn Buzzer	3	Amber		Horn/buzzer in engineers' corridors, buzzer in engineers' cabins.
Personnel alarm	Resolution A.481(XII), annex 2, paragraph 7.3	Horn Buzzer	3	Amber		Horn in machinery space, buzzer elsewhere.
Fire detection alarm	FSS 8.2.5.2	Bell Buzzer Horn	2	Red		
	SOLAS II-2/7.4.2 FSS 9.2.5.1	Ditto	2	Red		Should automatically actuate fire alarm if not acknowledged in 2 minutes or less. Horn/bell in machinery space, buzzer/bell elsewhere.
	FSS 10.2.4.1.3	Ditto	2	Red		
Activation of fixed local Application Fire-extinguishing system	SOLAS II-2/10.5.6.4	Ditto	2	Red		
Water ingress detection pre-alarm	SOLAS XII/12.1, 12.2 and II-1/23-3	Bell Buzzer Horn	2	Amber		For cargo holds used for water ballast, an alarm overriding device may be installed.
Alarm system fault alarm	SOLAS II-1/51.2.2	Horn Buzzer	3	Amber	No symbol allocated	Horn in machinery space, buzzer elsewhere.
Flashing light/ Rotating light	6.1 of the present Code	-	-	White	No symbol allocated	

* For use with visual indicator columns (see Appendix).



Table 7.1.2 – Alarms (continued)

Function	IMO Instrument	Audible		Visual*		Remarks
		Device	Code	Colour	Symbol*	
Cargo alarm	IBC, BCH, IGC, GC	Horn Buzzer	3	Amber	No symbol allocated	See tables 9.1.1 to 9.1.8 for IMO instrument references. Horn in machinery space, buzzer in engine control room, cargo control station and navigation bridge.
Gas detection alarm	IGC 17.14.4.3 17.14.1.4 GC 17.12.5(d)(iii) 17.12.5(a)(iv)	Siren Horn Bell	2	Red		
	Except for chlorine gas	IGC 13.6, 17.9, 16.2.1.2, 16.2.9 GC 13.6, 17.11, 16.2(b), 16.10	Buzzer Horn	3	Amber	
Power-operated sliding watertight door fault alarm	SOLAS II-1/13.7.3 II-1/13.7.8	Horn Buzzer	3	Amber	No symbol allocated	Horn in machinery space, buzzer elsewhere.

* For use with visual indicator columns (see Appendix).

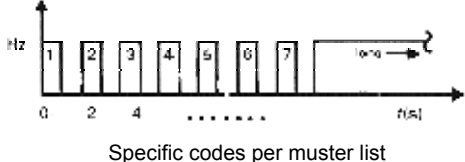
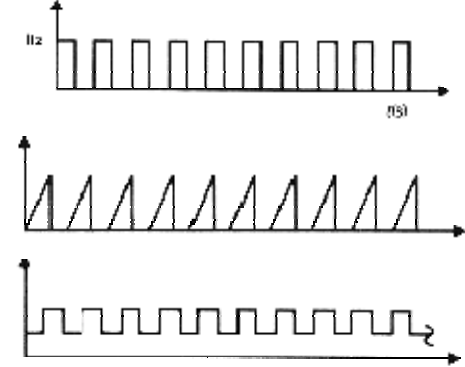

Table 7.1.3 – Call signals

(Note: See table 7.2 for audible signals.)

Function	IMO Instrument	Audible		Visual*		Remarks
		Device	Code	Colour	Symbol*	
Telephone	SOLAS II-1/50	Horn Buzzer Bell	3.a	White		Horn/bell in machinery spaces and engineers' accommodation corridors; buzzer/bell in engine control room, on navigation bridge and in engineers' cabins.
Engine-room telegraph	SOLAS II-1/37	Horn Bell Buzzer	2, 3.a	White		Horn/bell in machinery space, buzzer/bell in engine control room and on navigation bridge.

* For use with visual indicator columns (see Appendix).

Table 7.2 – Audible signals and call waveforms

Audible Code	Waveform	Remarks
1.a 1.b 2		General emergency alarm.
3.a 3.b 3.c		Optional waveforms to provide distinction between alarms. Pulse frequency between 0.5 Hz and 2.0 Hz.
3.d		

8 REQUIREMENTS FOR PARTICULAR ALARMS

8.1 Personnel alarm

8.1.1 The personnel alarm should automatically set off an alarm on the navigation bridge or in the officers' quarters, as appropriate, and, if it is not reset from the machinery spaces in a period satisfactory to the Administration, this should be in a period not exceeding 30 min.

8.1.2 A pre-warning signal should be provided in the machinery spaces which operates 3 min before the alarm required by 8.1.1 is given.

8.1.3 The alarm system should be put into operation:

- .1** automatically when the engineer on duty has to attend machinery spaces in case of a machinery alarm; or
- .2** manually by the engineer on duty when attending machinery spaces on routine checks.

8.1.4 The alarm system should be disconnected by the engineer on duty after leaving the machinery spaces. When the system is brought into operation in accordance with 8.1.3.1, disconnection should not be possible before the engineer has acknowledged the alarm in the machinery spaces.

8.1.5 The personnel alarm may also operate the engineers' alarm.

8.2 Bridge Navigational Watch Alarm Systems (BNWAS)

BNWAS should conform to resolution MSC.128(75) on Performance Standards for a Bridge Navigational Watch Alarm System.

8.3 Engineers' alarm

In addition to manual operation from the machinery space, the engineers' alarm on ships with periodically unattended machinery spaces should operate when the machinery alarm is not acknowledged in the machinery spaces or control room in a specified limited period of time, depending on the size of the ship but not exceeding 5 minutes.

8.4 General emergency alarm

8.4.1 Performance standards and functional requirements are provided in the LSA Code, chapter VII, paragraph 7. The general emergency alarm system should be capable of being operated from the navigation bridge and at least one other strategic point. For passenger ships there should also be an additional activation point in the safety centre. Strategic points are taken to mean those locations, other than the navigation bridge, from where emergency situations are intended to be controlled and the general alarm system can be activated. A fire control station or a cargo control station should normally be regarded as strategic points.

8.4.2 The system should be audible throughout all the accommodation and normal crew working spaces. Normal crew working spaces include spaces where routine maintenance tasks or local control of machinery are undertaken.

8.4.3 In addition, on passenger ships, the system should be recognizable at all places accessible to passengers as well as on all open decks.

9 GROUPING AND AGGREGATION OF ALERTS AND INDICATORS

9.1 Grouping and aggregation should not conceal necessary information from the personnel responsible for the safe operation of the ship.

9.2 Where audible and visual alerts and indicators are required at central positions, e.g., on the navigation bridge, in the machinery space, or engine control room; the alerts and indicators, except emergency alarms, should be arranged in groups, as far as practicable.

9.3 The scope of alerts and indicators will vary with the type of ship and machinery. The basic recommendations given in tables 9.1 to 9.3 should be adhered to.

9.4 Where visual alerts are grouped or aggregated in accordance with 3.10 and 3.11, individual visual alerts should be provided at the appropriate position to identify the specific alert condition.

9.5 The purpose of grouping and aggregation is to achieve the following:

- .1** In general, to reduce the variety in type and number of alerts and indicators so as to provide quick and unambiguous information to the personnel responsible for the safe operation of the ship.
- .2** On the navigation bridge:
 - .1** to enable the officer on watch to devote full attention to the safe navigation of the ship;
 - .2** to readily identify any condition or abnormal situation requiring action to maintain the safe navigation of the ship; and
 - .3** to avoid distraction by alerts which require attention but have no direct influence on the safe navigation of the ship and which do not require immediate action to restore or maintain the safe navigation of the ship.
- .3** In the machinery space/engine control room and at any machinery control station, to readily identify and locate any area of abnormal conditions (e.g., main propulsion machinery, steering gear, bilge level) and to enable the degree of urgency of remedial action to be assessed.
- .4** In the engineers' public rooms and in each of the engineers' cabins on ships where the machinery space/engine control room is periodically unattended, to inform the engineer officer on watch of any alert situation which requires immediate presence in the machinery space/engine control room.

Table 9.1 – Grouping/Aggregation of alerts and indicators: machinery space attended, remote control of the main propulsion machinery from the navigation bridge not provided

Navigation bridge ¹		Machinery space
One common audible alert device, except emergency alarms (e.g., buzzer, continuous)		Audible alert devices, in accordance with sections 5, 7 and 9
1	2	3
Workstation for navigating and manoeuvring on navigation bridge Individual visual alerts and indicators for: Each required steering gear: - Power unit power failure - Control system power failure - Hydraulic fluid level alarm - Running indication - Alarm system failure alarm Engine-room telegraph Rudder angle indicator Propeller speed/direction/pitch Telephone call	Other locations on navigation bridge Visual alerts and indicators at any position on the navigation bridge other than the workstation for navigating and manoeuvring for: Required alerts and indicators, as indicated under "Notes" in table 10.1.1 Any non-required alert or indicator which the Administration considers necessary for the officer on watch Fire detection alarm	Machinery space or control room/station Visual alerts and indicators grouped at a position in the machinery space or, in the case of ships provided with a control room, in that control room. In complex machinery alarm arrangements, due account should be taken of 9.4.3 Alerts and indicators as indicated under "Notes" in table 10.1.2 Engine-room telegraph

¹ and/or *ship safety centre* on passenger ships.

Table 9.2 – Grouping/Aggregation of alerts and indicators: machinery space attended, remote control of the main propulsion machinery from the navigation bridge provided

Navigation bridge²		Machinery space
One common audible alert device, except emergency alerts (e.g., buzzer, continuous)		Audible alert devices, in accordance with sections 3, 5 and 7
1	2	3
Workstation for navigating and manoeuvring on navigation bridge	Other locations on navigation bridge	Machinery space or control room/station
Individual visual alerts and indicators as in column 1 of table 9.1, plus: Failure of remote control for main propulsion machinery Starting air low pressure, when the engine can be started from the navigation bridge Propulsion control station in control	Visual alerts and indicators at any position on the navigation bridge other than the workstation for navigating and manoeuvring as in column 2 of table 9.1, plus: Machinery alarm, if provided	Visual Alerts and indicators as in column 3 of table 9.1, plus: Failure of remote control for main propulsion machinery Starting air low pressure Propulsion control station in control Indication of propulsion machinery orders from navigation bridge Alerts and indicators as indicated under "Notes" in table 10.1.2

Table 9.3 – Grouping/Aggregation of alerts and indicators: machinery space unattended, remote control of the main propulsion machinery from the navigation bridge provided

Navigation bridge²		Machinery space	Accommodation
One common audible alert device, except emergency alarms (e.g., buzzer, continuous)		Audible alert devices, in accordance with sections 3, 5 and 7	
1	2	3	4
Workstation for navigating and manoeuvring on navigation bridge	Other locations on navigation bridge	Machinery space or control room	Engineers' public spaces and accommodations
Individual visual alerts and indicators as in column 1 of tables 9.1 and 9.2, plus: Override of automatic propulsion shutdown, if provided	Visual alerts and indicators at any position on the navigation bridge other than the workstation for navigating and manoeuvring as in column 2 of tables 9.1 and 9.2, plus: Machinery space fire detection alarm Alarm conditions requiring action by or the attention of the officer on watch on the navigation bridge Alerts and indicators as indicated under "Notes" in table 10.1.1	As in column 3 of tables 9.1 and 9.2, plus: Alerts as indicated under "Notes" in table 10.1.2 Alert system power failure alarm	Engineers' alarm Machinery space fire detection alarm Machinery alarm* Steering gear alarm (common)* Machinery space bilge alarm* Alarm system power failure alarm Alerts and indicators under "Notes" in table 10.1.5

* Alarm may be common.

² and/or *ship safety centre* on passenger ships.

10 ALERT AND INDICATOR LOCATIONS

10.1 Required alert and indicator type and location should be in accordance with tables 10.1.1 to 10.1.9.

10.2 Applicable regulations in the IMO instruments referred to should be consulted for additional requirements.

Notes to be applied to tables 10.1.1 to 10.1.9:	
(1) Abbreviation for priorities and indicators:	
EM	– emergency alarm
A	– alarm
W	– warning
C	– caution
I	– indication/indicator
Abbreviation for presentation:	
AU	– audible alert display (visual may be necessary in high-noise areas)
V	– visual alert display
AU, V	– both audible and visual alert display
VI	– visual indicator
MI	– measuring indicator
(2) <i>Cargo control station</i>	means a position from which the cargo pumps and valves can be controlled. If a central cargo control station is not provided, then the alert or indicator should be located in a suitable position for the operator (such as at the equipment monitored).
(3)	If a cargo control station is not provided, the alert or indication should be given at the gas detector device readout location.
(4)	Where the types of alerts are not specifically identified in the IMO instruments referred to, the recommendations of the IMO Sub-Committee on Bulk Chemicals are enclosed in parentheses, e.g., (A,V).

Table 10.1.1 – Location: navigation bridge

IMO Instrument	Function	Priority	Display	Notes
SOLAS II-1				
29.11	Rudder angle indicator	I	MI	Column 1, table 9.1
29.5.2	Steering gear power unit power failure	A	AU,V	Ditto
29.8.4	Steering control system power failure	A	AU,V	Ditto
29.12.2	Low steering gear hydraulic fluid level	A	AU,V	Ditto
30.1	Steering gear running	I	VI	Ditto
30.3	Steering system electric phase failure/overload	A	AU,V	Column 1, table 9.3
31.2.7, 49.5	Propulsion machinery remote control failure	A	AU,V	Column 1, table 9.2, 9.3
31.2.9, 49.7	Low propulsion starting air pressure	A	AU,V	Ditto
31.2.10	Imminent slowdown or shutdown of propulsion system	A	AU,V	Column 1, table 9.2
52	Automatic propulsion shutdown override	I	VI	Column 1, table 9.3
52	Automatic shutdown of propulsion machinery	A	AU,V	Ditto

IMO Instrument	Function	Priority	Display	Notes
51.1.3	Fault requiring action by or attention of the officer on watch	A	AU,V	Column 1, table 9.3 (machinery alarm including 53.4.2 and 53.4.3).
31.2.8	Propeller speed/direction/pitch	I	MI	Column 1, table 9.2
49.6	Propeller speed/direction/pitch	I	MI	Column 1, table 9.3
37	Engine-room telegraph	I	VI	Ditto
13.6, 13.8.2, 16.2 13-1.2, 13-1.3, 14.2,15-1.2	Watertight door position	I	VI	Column 2, table 9.1
13.7.3.1	Watertight door low hydraulic fluid level	A	AU,V	Ditto
13.7.3.1 13.7.3.2	Watertight door low gas pressure, loss of stored energy	A	AU,V	Ditto
13.7.8	Watertight door electrical power loss	A	AU,V	Ditto
35-1.2.6.2	High water level alarm	A	AU	!, where required
17-1.1.2, 17-1.1.3	Opening indicator	A	AU,V,VI	Column 2, table 9.1
17-1.2	Shell door position indicator	I	VI	Column 2, table 9.1. Passenger ships with ro-ro cargo spaces or special category spaces. Recommended colours; red – door is not fully closed or not secured, green – door is fully closed and secured.
17-1.3	Water leakage detection indicator	I	VI	Column 2, table 9.1. Passenger ships with ro-ro cargo spaces or special category spaces. For details see regulation 17-1.3.
25.4	Water level pre-alarm	A	AU,V	Column 2, table 9.1. Bulk carriers and single hold cargo ships other than bulk carriers. For details see resolution MSC.188(79).
25.4	Water level main-alarm	EM	AU,V	Ditto
31.2.5, 49.3	Propulsion control station in control	I	VI	Column 1, table 9.2
51.2.2	Alarm system normal power supply failure	A	AU,V	Column 2, table 9.3
SOLAS II-2				
4.5.10.1.3	Hydrocarbon gas detection in tanker cargo pump rooms	A	AU,V	Column 2, table 9.1
7.4.1, 7.4.2	Fire detection in periodically unattended, automated or remotely controlled machinery space	A	AU,V	Column 2, table 9.2
20.3.1.3	Loss of required ventilation	A	AU,V	Column 2, table 9.1
9.6.4	Fire door position	I	VI	Ditto
10.5.6.4	Fixed local application fire-extinguishing system activation	A,	AU,V; VI	Column 2, table 9.1. Indication of the activated zone
SOLAS XII				
12.2	Water level pre-alarm	A	AU,V	Column 2, table 9.1. Bulk carriers and single hold cargo ships other than bulk carriers. For details see resolution MSC.188(79).
12.2	Water level main-alarm	EM	AU,V	Ditto

IMO Instrument	Function	Priority	Display	Notes
Resolution A.481(XII)				
Annex 2, paragraph 7.3	Personnel alarm	A	AU,V	Column 2, table 9.1
Resolution MSC.128(75), Annex				
4.1.2.2, 5.2.2	End of BNWAS dormant period	I	VI	Visible from all operational positions on the bridge where the Officer of the Watch may reasonably be expected to be stationed.
4.1.2.3, 5.2.3	BNWAS first stage audible alarm	A	AU	Tone/modulation characteristics and volume level should be adjustable during the commissioning.
4.4.1	Malfunction of, or power supply failure to, the BNWAS	W	AU,V	
SOLAS III				
16.9	Position of stabilizer wings	I	VI	Column 2, table 9.1
SOLAS V				
19.2.5.4	Rudder angle, propeller revolutions, the force and direction of thrust and, if applicable, the force and direction of lateral thrust and the pitch and operational mode.	I	MI	Column 1, table 9.1
Gas or chemical codes				Column 2, table 9.1 for the following:
IBC 15.2.4 BCH 4.19.4	High and low temperature of cargo and high temperature of heat-exchanging medium	A	AU,V	Ammonium nitrate solution
IBC 15.5.1.6 BCH 4.20.6	High temperature in tanks	A	AU,V,MI	Hydrogen peroxide solution over 60% but not over 70%
IBC 15.5.1.7 BCH 4.20.7	Oxygen concentration in void spaces	A	AU,V,MI	Hydrogen peroxide solution over 60% but not over 70%
IBC 15.8.23.1 BCH 4.7.15(a)	Malfunctioning of temperature controls of cooling systems	A	(AU,V)	!, Propylene oxide
IGC 13.4.1 GC 13.4.1	High and low pressure in cargo tank	A	AU,V	High and low pressure alarms
IGC 13.6.4, 17.9 GC 13.6.4, 17.11	Gas detection equipment	A	AU,V	
IGC 13.5.2 GC 13.5.2	Hull or insulation temperature	A;	AU, (V), MI	!
IGC 17.18.4.4 GC 17.12.2(d)(iv)	Cargo high pressure, or high temperature at discharge of compressors	A	AU,V	Methylacetylene-propadiene mixtures
IGC 17.14.4.3 GC 17.12.5(d)(iii)	Gas detecting system monitoring chlorine concentration	A	AU,V	!
IGC 17.14.4.4 GC 17.12.5(d)(iv)	High pressure in chlorine cargo tank	A	AU, (V)	!
IBC 15.5.2.5 BCH 4.20.19	High temperature in tanks	A	AU,V,MI	Hydrogen peroxide solution over 8% but not over 60%
IBC 15.5.2.6 BCH 4.20.20	Oxygen concentration in void spaces	A	AU,V,MI	Ditto

IMO Instrument	Function	Priority	Display	Notes
IBC 15.10.2 BCH 4.3.1(b)	Failure of mechanical ventilation of cargo tanks	A	(AU,V)	!, Sulphur (molten)
IGC 5.2.1.7, GC 5.2.5(b)	Liquid cargo in the ventilation system	A	(AU,V)	
IGC 8.4.2.1, GC 8.4.2(a)	Vacuum protection of cargo tanks	A	(AU,V)	!
IGC 9.5.2, GC 9.5.2	Inert gas pressure monitoring	A	(AU,V)	!
IGC 13.6.11 GC 13.6.11	Gas detection equipment	A	AU,V	!
IGC 17.14.1.4 GC 17.12.5(a)(iv)	Gas detection after bursting disk for chlorine	A	(AU,V)	!
SFV Protocol 1993 Chapter IV				
4(5), 8(1)(e)(iii)	Machinery failure advance alarm	A	AU,V	Column 1, table 9.3 Column 2, table 9.2
6(2)	Oil-fired steam boiler low water level, air supply failure or flame failure	A	AU,V	!, Column 2, table 9.3 II-1/32.2 (see table 8.1.2)*
8(1)(d)	Propulsion control station in control	I		Column 1, table 9.2 II-1/31.2.5; 49.3*
8(1)(e)(i), 8(1)(e)(ii)	Propeller speed/direction/pitch	I	MI	Column 1, table 9.2 II-1/31.2.8*
8(1)(g)	Propulsion machinery remote control failure	A	AU,V	Column 1, table 9.2 II-1/31.2.7*
8(1)(h)	Low propulsion starting air pressure	A	A,UV	!, Column 1, table 9.2 II-1/31.2.9*
13(3)	Rudder angle indicator	I	MI	Column 1, table 9.1 II-1/29.11*
13(4)	Steering gear power unit power failure	A	AU,V	Column 1, table 9.1 II-1/29.5.2*
13(5)	Steering gear running	I	VI	Column 1, table 9.1 II-1/30.1*
13(5)	Steering gear overload/no volts	A	AU,V	Column 1, table 9.1 II-1/30.3*
15(5)	Refrigerating machinery spaces alarm	A	AU,V	Column 2, table 9.1
19(1)	HP fuel oil pipe leakage	A	AU,V	!, Column 2, table 9.3
19(3)	Fuel heating high temperature alarm	A	AU,V	!, Column 2, table 9.3
19(5)	Fuel detection alarm	A	AU,V	!, Column 2, table 9.3
20(1)	Bilge high water level alarm	A	AU,V	Column 2, table 9.3 II-1/21.1.6.2*
22(2)(a)	Essential and important machinery parameters	A	AU,V	Column 2, table 9.3 II-1/51.1.1 (see table 8.1.2)*
22(2)(d)	Fault requiring action by or attention of the officer on watch	A	AU,V	Column 1, table 9.3 (machinery alarm including 22(2)(c), 23(2), 23(3)(c) and 23(3)(d)) II-1/51.1.3*
22(3)(b)	Alarm system normal power supply failure	A	AU,V	Column 1, table 9.3 II-1/51.2.2*
24	Automatic propulsion shutdown override	I	VI	Column 1, table 9.3 II-1/52*
24	Automatic shutdown of propulsion machinery	A	AU,V	Column 1, table 9.3 II-1/52*

IMO Instrument	Function	Priority	Display	Notes
Chapter V				
14(2)(b)	Fire detection or automatic sprinkler operation	A	AU,V	Column 2, table 9.1 II-2/12.1.2.2*
15(2)(b)	Fire detection alarm	A	AU,V	Column 2, table 9.1 II-2/40.3;13.1.6*
IGS				
3.14.11	Low water level alarm	A	AU,V	
2000 HSC Code				
7.7.1	Automatic smoke detection system in areas of major and moderate fire hazard and other enclosed spaces in accommodation not regularly occupied	I	VI	!, Column 2, table 9.2
7.7.1	Automatic smoke detection and fire detection (with detectors sensing other than smoke) in main propulsion machinery room(s) additionally supervised by TV cameras monitored from the operating compartment	I	VI	Column 2, table 9.2
+7.7.1.2	Fixed fire detection and fire alarm systems' power loss or fault condition	A	AU,V	Column 2, table 9.2
+7.7.1.4	Fire detection signal	A	AU	Column 2, table 9.2 at alarm location easily accessible to crew at all time
7.7.1.6	Fire detection manually operated call point section unit indicator	A	AU,V	Column 2, table 9.3
7.7.2.1	Fire detection for periodically unattended machinery spaces	A	AU,V	Column 2, table 9.3 II-2/7.4.2*
7.8.1.2	Fire door position	I	VI	Column 2, table 9.2 II-2/9.6.4*
7.8.5.3	Loss of required ventilation	A	AU,V	Column 2, table 9.2 II-2/20.3.1.3*
7.9.3.3.3	Fire door closing	I	VI	!, Column 2, table 9.2 II-2/9.6.4*
7.13.1	Manually operated sprinkler system alarms	I	M,I	!, Column 2, table 9.2
7.15	Smoke detection system for cargo spaces	I	VI	!, Column 2, table 9.2
9.1.14	Liquid cooling system failure	A	AU,V	!
9.2.1	Automatic fire detection system	A	AU,V	Column 2, table 9.3 II-2/7.4.1.2; 7.4.2*
9.2.1	Bilge alarm	A	AU,V	Column 2, table 9.3 II-1/48.1; 48.2*
9.2.1	Remote machinery alarm system	A	AU,V	Column 2, table 9.3
9.4.2	Fuel line failure	A	AU,V	Column 2, table 9.2
9.4.5	Lubricating oil pressure or level falling below a safe level	A	AU,V	Column 2, table 9.2
9.5.6	Lubricating fluid supply failure or lubrication fluid pressure loss	A	AU,V	Column 2, table 9.2
10.3.12	Unattended space bilge alarm	A	AU,V	!, Column 2, table 9.2 II-1/48.1*
11.2.1	Failure of any remote or automatic control system	A	AU,V	Column 2, table 9.3
11.4.1	Malfunction or unsafe condition	A	AU,V	!, Column 2, table 9.2
11.4.1.1	Indication of conditions requiring immediate action	EM	AU,V	Column 2, table 9.2; distinctive alarms in full view of crew members

IMO Instrument	Function	Priority	Display	Notes
11.4.1.2	Indication of conditions requiring action to prevent degradation to an unsafe condition	C	V	Column 2, table 9.2; visual display to be distinct from that of alarms referred to in 10.4.1.1
12.3.9	Emergency battery discharge	I	VI	Column 2, table 9.2 II-1/42.5.3; 43.5.3*
12.5.1	Steering system electric overload	A	AU,V	!, Column 2, table 9.2 II-1/30.3*
12.5.2	Steering system electric phase failure	A	AU,V	Column 2, table 9.2 II-1/30.3*
12.6.3	Electrical distribution system low insulation level	A or I	AU or VI	!, Column 2, table 9.2 II-1/45.4.2*
13.7	Rudder angle indicator and rate-of-turn indicator	I	VI	Column 2, table 9.2 5.4.3 II-1/29.11*, V/19.2.5.4*
13.11.2	Propulsion indicator	I	VI	Column 2, table 9.2
13.11.3	Emergency steering position compass reading indicator	I	VI	Column 2, table 9.2
2009 MODU Code				
7.4.1	Propeller pitch indicator	I	VI	Column 2, table 9.1
7.4.2.5, 8.5.5	Propulsion station in control indication	I	VI	Columns 1 & 3, table 9.2 II-1/31.2.5; 49.3*
7.4.2.7, 8.5.7	Propulsion machinery remote control failure	A	AU,V	Column 1, table 9.2 II-1/31.2.7; 49.5*
7.4.2.8	Propeller speed/direction/pitch	I	MI	Column 1, table 9.2 II-1/31.2.8*
7.4.2.9, 8.5.9	Low starting air pressure	A	AU,V	Columns 1 & 3, table 9.2 II-1/31.2.9; 49.7*
7.4.2.10	Imminent slowdown or shutdown of the propulsion	A	AU, V	Column 1, table 9.2
7.5.17	Rudder angle indicator	I	MI	Column 1, table 9.1 II-1/29.11*
7.6.1	Steering gear running	I	VI	Columns 1 and !3, table 9.1 II-1/30.1*
7.6.3	Steering gear phase failure/overload alarm	A	AU,V	Column 1, table 9.3 II-1/30.3*
8.5.8	Propeller speed/direction/pitch	I	MI	Column 1, table 9.3 II-1/49.6*
8.7.1	Fault requiring attention	A	AU,V	Column 1, table 9.3, including 8.3.5.1, 8.4.1, 8.8.6 and 8.9 II-1/51.1.3*
8.7.3	Alarm system normal supply failure	A	AU,V	Column 2, table 9.3 II-1/51.2.2*
9.10.1	Fire detection system alarm	A	AU,V	Column 2, table 9.1
9.11.1, 9.12.1	Gas detection and alarm system	A	AU,V	!, Column 2, table 9.1
FSS Code				
+8.2.5.2.1, +9.2.5.1.2, 9.2.5.1.3	Fire detection or automatic sprinkler operation	A	AU,V	Column 2, table 9.1
+8.2.5.2.1, +9.2.5.1.5, +9.2.5.1.2	Fire detection system fault	A	AU,V	Ditto

IMO Instrument	Function	Priority	Display	Notes
10.2.4.1.4	Smoke detection system power loss	A	AU,V	Ditto
+10.2.4.1.3, +10.2.2.3	Smoke detection	A I	A,V, VI	Ditto
15.2.4.2.3.1	Inert gas supply main pressure	I	MI	Ditto; forward of non-return devices.
15.2.4.2.3.1	Inert gas pressure	I	MI	Column 2, table 9.1. In slop tanks of combination carriers.

* Cross-reference to SOLAS regulation.

+ These alarms may be omitted if they are provided at the central fire control station.

** Watertight door alarms may be grouped in one common failure alarm for each door provided that individual alarms are available at the watertight door emergency control positions above the bulkhead deck.

! No location specified in other IMO instruments. Location is recommended.

Table 10.1.2 – Location: machinery space/machinery control room

IMO Instrument	Function	Priority	Display	Notes
SOLAS II-1				
29.12.2	Low steering gear fluid level	A	AU,V	Column 3, table 9.1
30.1	Steering gear running	I	VI	Ditto
30.3	Steering system electric phase failure or overload	A	AU,V	Ditto
31.2.7, 49.5	Propulsion machinery remote control failure	A	AU,V	Column 3, tables 9.2 and 9.3
31.2.9, 49.7	Low propulsion starting air pressure	A	AU,V	Ditto
32.2	Oil-fired boiler low water level, air supply failure, or flame failure	A	AU,V	Column 3, table 9.1
32.3	Propulsion boiler high water level	A	AU,V	Ditto
31.2.5, 49.3	Propulsion control station in control	I	VI	Column 3, table 9.2
37	Engine-room telegraph	I	VI	Column 3, table 9.1
31.2.4, 49.2	Propulsion machinery orders from bridge	I	VI	Column 3, table 9.2
47.1.1, 47.1.2	Boiler and propulsion machinery internal fire	A	AU,V	Column 3, table 9.3
47.2	Internal-combustion engine monitors	I	MI	Ditto
48.1, 48.2	Bilge monitors	A	AU,V	Ditto
51.2.2	Alarm system normal power supply failure	A	AU,V	Ditto
53.4.3, 51.1.1	Essential and important machinery parameters	A	AU,V	Column 3, table 9.3 (machinery alarm)
42.5.3, 43.5.3	Emergency battery discharge	I	VI	Column 3, table 9.1
52	Automatic shutdown of propulsion machinery	A	AU,V	Column 3, table 9.3
52	Automatic propulsion shutdown override	I	VI	Ditto
53.4.2	Automatic change-over of propulsion auxiliaries	A	AU,V	Ditto
45.4.2	Electrical distribution system low insulation level	A or I	AU or I	!, Column 3, table 9.1
SOLAS II-2				
7.4.1, 7.4.2	Fire detection in periodically unattended, automated or remotely controlled machinery space	A	AU,V	Column 3, table 9.2
4.2.2.5.2	High-pressure fuel oil leakage	A	AU,V	Column 3, table 9.3
4.2.5.2	Service fuel oil tank high temperature	A	AU,V	Ditto

IMO Instrument	Function	Priority	Display	Notes
4.5.10.1.3	Hydrocarbon gas detection in tankers cargo pump rooms	A	AU,V	Column 3, table 9.1
10.5.6.4	Fixed local application fire-extinguishing system activation	A I	AU,V, I	Column 3, table 9.1 Indication of the activated zone
Gas or chemical codes				
IGC 16.3.1.1 GC 16.2(a)	Loss of inert gas pressure between pipes	A	AU,V	!, Column 3, table 9.1
IGC 16.3.10 GC 16.10	Cargo gas/fuel system gas detection	A	AU,V	!, Ditto
IGC 16.3.1.2 GC 16.2(b)	Flammable gas in ventilation duct	A	(AU,V)	!, Ditto
IGC 16.3.4 GC 16.5	Flammable gas in ventilation casing	A	(AU,V)	!, Ditto
Resolution A.481(XII)				
Annex 2, paragraph 7.3	Personnel alarm	A	AU,V	Column 3, table 9.1
SFV Protocol 1993 Chapter IV				
6(2)	Oil-fired steam boiler low water level, air supply failure or flame failure	A	AU,V	! II-1/32.2*
8(1)(e)(iii)	Machinery failure advance alarm	A	AU,V	!
8(1)(d)	Propulsion control station in control	I	VI	Column 3, table 9.2 II-1/31.2.5; 49.3*
8(1)(g)	Propulsion machinery remote control failure	A	AU,V	!, Column 3, table 9.2 II-1/31.2.7*
8(1)(h)	Low propulsion starting air pressure	A	AU,V	!, Column 3, table 9.2 II-1/31.2.9*
15(4)(b)	Refrigerant leak alarm	A	AU,V	
17(6)	Emergency battery discharge	I	VI	!, Column 3, table 9.1 II-1/42.5.3*
18(4)(b)	Electrical distribution system low insulation level	A	AU or VI	!, Column 3, table 9.1 II-1/45.4.2*
19(7)	Internal-combustion engine monitors	I	MI	Column 3, table 9.3 II-1.47.2*
22(2)(a)	Essential and important machinery parameters	A	AU,V	Column 3, table 9.3 II-1/51.1.1*
22(3)(b)	Alarm system normal power supply failure	A	AU,V	Column 3, table 9.3 II-1/51.1.1*
23(2)	Automatic change-over of propulsion auxiliaries	A	AU,V	Column 3, table 9.3 II-1/53.4.2*
24	Automatic shutdown of propulsion machinery	A	AU,V	Column 3, table 9.3 II-1/52*
24	Automatic propulsion shutdown override	I	VI	Column 3, table 9.3 II-1/52*
IGS				
3.14.11	Low water level alarm	A	AU,V	Column 3, table 9.1
MARPOL 73/78 Annex I				
16(5)	Alarm for excessive oil content in oily mixture discharge into the sea	A	(AU,V)	!

IMO Instrument	Function	Priority	Display	Notes
2000 HSC Code				
7.7.2.1.4	Fire detection signal	A	AU,V	Column 3, table 9.2
7.7.3.1	Fire detection for periodically unattended machinery spaces	A	AU,V	Column 3, table 9.3 II-2/7.4.2*
9.2.1	Automatic fire detection system	A	AU,V	Column 3, table 9.3 II-2/7.4.1.2; 7.4.2*
9.2.1	Bilge alarm	A	AU,V	Column 3, table 9.3 II-1/48.1; 48.2*
9.2.1	Remote machinery alarm system	A	AU,V	Column 3, table 9.3
9.4.2	Fuel line failure	A	AU,V	Column 3, table 9.2
9.4.5	Lubricating oil pressure or level falling below a safe level	A	AU,V	Column 3, table 9.2
9.5.6	Lubricating fluid supply failure or lubrication fluid pressure loss	A	AU,V	Column 3, table 9.2
10.2.7.3	High temperature alarm (oil fuel or settling tank)	A	V	!
10.3.12	Unattended space bilge alarm	A	V	!, Column 3, table 9.2, II-1/48.1*
11.2.1	Failure of any remote or automatic control system	A	AU,V	Column 3, table 9.3
11.4.1	Malfunction or unsafe condition	A	AU,V	Column 3, table 9.2
11.4.1.3	Indication of conditions in 11.4.1.1 requiring immediate action	A	AU,V	
11.4.1.3	Indication of conditions in 11.4.1.2 requiring action to prevent degradation to an unsafe condition	A	AU,V	Column 3, table 9.2; visual display to be distinct from that of alarms referred to in 10.4.1.1
11.5	Shutdown system activation	A	AU,V	!, Column 3, table 9.2
12.5.1	Steering system electric overload	A	AU,V	!, Column 3, table 9.2 II-1/30.3*
12.5.2	Steering system electric phase failure	A	AU,V	Column 3, table 9.2, II-1/30.3*
12.6.3	Electrical distribution system low insulation level	A or I	AU or VI	!, Column 3, table 9.2 II-1/45.4.2*
2009 MODU Code				
4.3.7	Machinery failure pre-alarm	A	AU,V	!, Column 3, table 9.1
4.6.2	Manual overriding of the automatic control indicator	I	VI	Column 3, table 9.1
5.4.12	Emergency battery discharge	I	VI	Column 3, table 9.1 II-1/42.5.3*
5.6.7	Electrical distribution system low insulation level	A or I	AU or VI	!, Column 3, table 9.1 II-1/45.4.2*
7.3.1	Water tube boiler high water level alarm	A	AU,V	Column 3, table 9.1
7.4.2.4, 8.5.4	Propulsion machinery orders from bridge	I	VI	Column 3, table 9.2 II-1/31.2.4; 49.2*
7.4.2.5, 8.5.5	Propulsion station in control indication	I	VI	Columns 1 and 3, table 9.2 II-1/31.2.5; 49.3*
7.4.2.9	Low starting air pressure	A	AU,V	Columns 1 and 3, table 9.2 II-1/31.2.9*
7.4.2.10	Imminent slowdown or shutdown of the propulsion system	A	AU, V	Column 1, table 9.2
7.6.1	Steering gear running	I	VI	Columns 1 & !3, table 9.1 II-1/30.1*
8.3.1 4.8.7	HP fuel oil pipe leakage	A	AU,V	!, Column 3, table 9.3 II-2/4.2.2.5.2*
8.3.3	Fuel heating temperature alarm	A	AU,V	!, Column 3, table 9.3 II-2/4.2.5.2*
8.3.6	Fire detection alarm for boiler/propulsion machinery	A	AU,V	!, Column 3, table 9.3 II-1/47.1*

IMO Instrument	Function	Priority	Display	Notes
8.3.7	Internal-combustion engine monitors	I	MI	Column 3, table 9.3 II-1/47.2*
8.5.7	Propulsion machinery remote control failure	A	AU,V	Column 3, table 9.3 II-1/49.5*
8.7.1	Fault requiring attention	A	AU,V	At a normally manned control station in addition to main machinery control station including 8.3.5.1, 8.4.1, 8.8.6 and 8.9 II-1/51.1*
8.8.2	Automatic change-over of propulsion auxiliaries	A	AU,V	Column 3, table 9.3 II-1/53.4.2*
FSS Code				
15.2.4.3.3	Inert gas system:			Column 3, table 9.1
15.2.4.3.1.1	- low water pressure/flow	A	AU,V	
15.2.4.3.1.2	- high water level	A	AU,V	
15.2.4.3.1.3	- high gas temperature	A	AU,V	
15.2.4.3.1.4	- blower failure	A	AU,V	
15.2.4.3.1.5	- oxygen content	A	AU,V	
15.2.4.3.1.6	- power supply failure	A	AU,V	
15.2.4.3.1.7,	- water seal low level	A	AU,V	
15.2.2.4.6				
15.2.4.3.1.8,	- low gas pressure	A	AU,V	
15.2.4.3.4				
15.2.4.3.1.9	- high gas pressure	A	AU,V	
15.2.4.3.2	gas generator failure:			
15.2.4.3.2.1	- low fuel supply	A	AU,V	
15.2.4.3.2.2	- power supply failure	A	AU,V	
15.2.4.3.2.3	- control power failure	A	AU,V	
15.2.4.2.3.2	Inert gas O2 content	I	MI	Ditto

* Cross-reference to SOLAS regulation.

! No location specified in other IMO instruments. Location is recommended.

Table 10.1.3 – Location: central fire control station where provided

IMO Instrument	Function	Priority	Display	Notes
SOLAS II-2				
+7.4.1, 7.4.2	Fire detection in periodically unattended, automated or remotely controlled machinery space	A	AU,V	
SFV Protocol 1993 Chapter V				
14(3)(c)	Automatic sprinkler system pressure	I	MI	
2000 HSC Code				
+7.7.2.1.2	Fixed fire detection and alarm systems ¹ power loss or fault condition	A	AU,V	
+7.7.2.1.4	Fire detection signal	A	AU,V	
2009 MODU Code				
9.10.1	Fire detection system	A I	AU,V VI	
9.11.1, 9.12.1	Gas detection and alarm systems	A	A,V	!

FSS Code				
8.2.4.2.5	Automatic sprinkler system pressure	I	MI	
+8.2.5.2.1, +9.2.5.1.2, 9.2.5.1.3	Fire detection or automatic sprinkler operation	A	AU,V	
+8.2.5.2.1, +9.2.5.1.5, +9.2.5.1.2	Fire detection system fault	A	AU,V	
+10.2.4.1.4	Smoke detection system power loss	A	AU,V	
+10.2.4.1.3, +10.2.2.3	Smoke detection	A I	AU,V VI	

* Cross-reference to SOLAS regulation.

+ These alarms may be omitted if the central fire control station is on the navigation bridge.

Table 10.1.4 – Location: at the equipment or at the location being monitored

IMO Instrument	Function	Priority	Display	Notes
SOLAS II-1				
29.11	Rudder angle indicator	I	MI	At the steering gear compartment
15.8.2.1. 15.8.3	Shell valve closure	I	I	
32.6	Water level of essential boiler	I	MI	
13.7.1.6	Watertight door closing	EM	AU	Distinct from other alarms in area; in passenger areas and high-noise areas, add intermittent visual alarm
13.7.3.2	Watertight door loss of stored energy	A	AU,V	At each local operating position
33.3	Steam pressure	I	MI	
SOLAS II-2				
10.9.1.1.1 IBC 11.2.1	Release of fire-extinguishing medium	EM	AU	Cargo pump-room
4.2.2.3.5	Fuel oil tank level	I	MI	If provided
4.2.2.3.5.1.1 4.2.2.3.5.2	Fuel oil tank level	I	MI	
Gas or chemical codes				
IGC 9.5.1 GC 9.5.1	Content of oxygen in inert gas/trace of oxygen in nitrogen	A	(AU,V) MI	
IGC 3.6.3 GC 3.6.3	Warning on both sides of the airlock	A	AU,V	
IGC 8.2.8.2 GC 8.2.8(b)	Indicates which one of the pressure-relief valves is out of service	I	VI	
IGC 11.5.2 GC 11.5.2	Inerting/extinguishing medium release	EM	AU	Gas-dangerous enclosed spaces
GC 13.4	Cargo pressure	I	MI	Local gauges required by 13.4.1, 13.4.2, 13.4.3 and 13.4.4
IGC 13.6, 17.9 GC 13.6, 17.11	Gas detection equipment	A	AU,V	
SFV Protocol 1993 Chapter II				
13(1)	Shell valve closure	A	AU,V	II-1/17.9.2.1*
13(2)	Shell valve closure	A	AU,V	II-1/17.9.3*

IMO Instrument	Function	Priority	Display	Notes
Chapter IV				
11(7)	Collision bulkhead valve closure	I	VI	II-1/21.2.12*
13(3)	Rudder angle indicator	I	MI	
15(4)(a)	Refrigerant leak indicator	I	VI	
15(5)	Refrigerating machinery spaces alarm	A	AU,V	At escape exits
Chapter V				
14(3)(c)	Automatic sprinkler system pressure	I	MI	At each section stop valve
14(5)(a)	Automatic sprinkler tank level	I	MI	
15(2)(b)	Fire detection alarm	A	AU	To ensure fire alarm sounding on the deck where the fire is detected
IGS				
3.15.3.2.1	Effluent drain valve position indicator	I	VI	!
6.2	Tank pressure sensors	I	MI	!
VEC systems				
2.3.1	Isolation valve position indicator	I	VI	
2.4.1.3	Liquid level indicator	I	MI	At the location where cargo transfer is controlled
2.4.1.4	Liquid level indicator	I	MI	Portable gauging device on the tank
3.2.1.3	Cargo vapour shutoff valve position indicator	I	VI	Near terminal vapour connection
3.3.3	Terminal vapour pressure sensing device	I	MI	!, (3)
3.3.3.2	Terminal vapour pressure alarm	A	AU,V	!, (3)
3.3.3.3	Signal for sequential shutdown of onshore pumps and remotely operated cargo vapour shutoff valve	A	(AU,V)	!, (3)
IMDG Code (Vol I)				
7.7.3.4	Cargo control temperature less than +25°C	A	AU,V	!, Alarms independent of power supply of the refrigeration system
2000 HSC Code				
7.7.3.2.7	Release of fire-extinguishing medium	EM	AU,V	Spaces in which personnel normally work or to which they have access
7.9.3.3.2	Fire door closing	EM	AU	Sounding alarm before the door begins to move and until completely closed
7.13.1	Manually operated sprinkler system alarms	I	M,I	!, Column 2, table 9.2
10.9.5	Bilge cocks and valve position indication	I	VI	To indicate open or closed position
1995 Diving Code				
2.5.3	Diving bell internal pressure	I	MI	!, At the location of the attendant monitoring diving operations
2.5.5	Diving bell, etc., overpressure alarm	A	AU,V	!, At the location of the attendant monitoring diving operations
2.9.3	Diving equipment fire detection alarm	A	AU,V	!, At the location of the attendant monitoring diving operations

IMO Instrument	Function	Priority	Display	Notes
2009 MODU Code				
3.6.5.2	Watertight doors and hatch cover positions alarm	A	AU,V	
4.4.5	Water level of essential boiler	I	MI	II-1/32.6*
4.5.3	Steam pressure	I	MI	II-1/33.3*
4.9.6	Bilge valve indicator	I	VI	II-1/21.2.12*
4.10.8	Ballast valve position indicator	I	VI	
4.12.11	Cable tension, windlass power load and amount of cable paid out	I	VI	
FSS Code				
5.2.1.3.2	Release of fire-extinguishing medium	EM	AU	
8.2.4.2.5	Automatic sprinkler system pressure	I	MI	At each section stop valve
8.2.3.2.1	Automatic sprinkler system tank level	I	MI	
15.2.3.1.1	Flue gas isolating valve open/closed	I	VI	
15.2.4.1	Inert gas discharge temperature/pressure	I	MI	Measured at discharge of gas blower

* Cross-reference to SOLAS regulation.

! No location specified in other IMO instruments. Location is recommended.

Table 10.1.5 – Location: engineers' accommodation

IMO Instrument	Function	Priority	Display	Notes
SOLAS II-1				
38	Engineers' alarm	A	AU	Column 4, table,9.1
51.1.2, 51.1.5	Fault requiring attention of the engineer on duty	A	AU,V	Ditto (machinery alarm)
SOLAS II-2				
7.4.1, 7.4.2	Fire detection in periodically unattended, automated or remotely controlled machinery space	A	AU,V	Ditto
Resolution A.481(XII)				
Annex 2, paragraph 7.3	Personnel alarm	A	AU,V	Column 4, table 9.3 (when the navigation bridge is unmanned)
SFV Protocol 1993 Chapter IV				
14	Engineers' alarm	A	AU	Column 4, table 9.3 II-1/38*
22(2)(b) 22(2)(c)	Fault requiring attention of engineer on duty	A	AU,V	Column 4, table 9.3 II-1/51.1.2; 51.1.5*
2000 HSC Code				
7.7.2.1	Fire detection for periodically unattended machinery spaces	A	AU,V	Column 4, table 9.3 II-2/7.4.1.1; 7.4.2*
2009 MODU Code				
7.8	Engineers' alarm	A	AU	Column 4, table 9.3 II-1/38*
8.7.1	Fault requiring attention	A	AU	Activate engineers' alarm required by 7.8 including 8.3.5.1, 8.4.1, 8.8.6 and 8.9 II-1/51.1.5*

* Cross-reference to SOLAS regulation.

Table 10.1.6 – Location: miscellaneous

IMO Instrument	Function	Priority	Display	Notes
SOLAS II-1				
13.6.13-1.2.13-1.3	Watertight door position	I	VI	At operating stations from which the door is not visible. At all remote operating positions
35-1.3.12	Bilge cocks and valves position	I	VI	At their place of operation
SOLAS II-2				
7.4.1, 7.4.2	Fire detection in periodically unattended, automated or remotely-controlled machinery space	A	AU,V	Alarm at attended location when navigation bridge is unmanned
7.9.1	Fire detection alarm	A	AU,V	Alarm at location to ensure that any initial fire detection alarm is immediately received by a responsible member of crew
7.9.4	Fire (special alarm to summon crew)	EM	AU	May be part of general emergency alarm
4.5.10.1.3	Hydrocarbon gas detection in tankers cargo pump-rooms	A	AU,V	At the pump-room
+4.5.10.1.1	Temperature sensing devices for pumps installed in tankers cargo pump-rooms	A	AU,V	At the pump control station
10.5.6.4	Fixed local application fire-extinguishing system activation	A	AU,V	In each protected space. Protected space is a machinery space where a FWBLAFFS is installed.
7.5.2, 7.5.3.1	Fire alarm	EM	AU	Audible alarm within the space where detectors are located.
SOLAS III				
6.4.2	General emergency alarm	EM	AU	Throughout all the accommodation and normal crew working spaces
SFV Protocol 1993				
Chapter II				
2(6)	Watertight door position	I	VI	At remote operating position II-1/15.6.4*
4(1)	Freezer room weathertight door position	A	AU,V	!, At the attended location
Chapter IV				
15(5)	Refrigerating machinery spaces alarm	A	AU,V	At an attended location (control station)
19(5)	Fire detection alarm	A	AU,V	At appropriate spaces when the ship is in harbour
20(1)	Bilge high-water level alarm	A	AU,V	At places where continuous watch is maintained when navigation bridge is not manned II-1/21.1.6.2*
Chapter V				
14(2)(b)	Fire detection or automatic sprinkler operation	A	AU,V	Alarm at location easily accessible to crew at all times
15(2)(b)	Fire detection alarm	A	AU,V	Alarm at location easily accessible to crew at all times II-2/7.9.1*

IMO Instrument	Function	Priority	Display	Notes
Resolution MSC.128(75), Annex				
4.1.2.4, 5.2.4	BNWAS second stage audible alarm	A	AU	Locations of the master, officers and further crew members capable of taking corrective action
4.1.2.5, 5.2.4	BNWAS third stage audible alarm	A	AU	Locations of the master, officers and further crew members capable of taking corrective action. If provided (ref. 4.1.2.6)
SFV Protocol 1993 Chapter VIII				
2(1)	General emergency alarm	EM	AU	Throughout all the accommodation and normal crew working spaces III/6.4.2*
Nuclear Merchant Ship Code				
3.9.3	Spaces containing NSSS safety equipment fire detection alarm	A	AU,V	!, Alarm at main control position and emergency control position
6.4.3	Controlled areas indication of radiation levels and airborne contamination	I	VI	At main control position
6.10.2	Containment structure purge system radioactivity alarm	A	AU,V	At main control position
6.10.4	Controlled and supervised areas exhaust for radioactivity alarm	A	AU,V	At main control position
2000 HSC Code				
4.2.1	General emergency alarm	EM	AU	Clearly audible throughout all the accommodation and normal spaces and open decks 8.2.2.2 III/6.4.2*
7.7.1.1.4	Fire detection signal	A	AU	Clearly audible throughout the crew accommodation and service spaces
7.7.1.1.6	Fire detection manually operated call point section unit indicator	A	AU,V	Alarm at location easily accessible to crew at all times
2009 MODU Code				
3.6.2	Watertight boundary valve position indicator	I	VI	At the remote control station
4.4.2	Oil-fired boiler low water level, air supply failure or flame failure	A	AU,V	Alarm at an attended location II-1/32.2*
4.9.1	Presence of water indicator	I	VI	
4.12.12	Cable tension and speed and direction of wind	I	VI	At a manned station
4.14.3.1	Jacking system overload alarm, out of level alarm, rack phase differential alarm (when provided)	A	AU, V	At the jacking system control station
4.14.3.2.1	Inclination of the unit on two horizontal perpendicular axes	I	MI	At the jacking system control station
4.14.3.2.2	Power consumption or other indicators or lifting or lowering the legs, as applicable	I	MI	At the jacking system control station

IMO Instrument	Function	Priority	Display	Notes
4.14.3.2.3	Brake release status	I	VI	At the jacking system control station
6.3.1.1.3	Loss of ventilation	A	AU,V	At a manned station
6.3.1.2.3	Loss of ventilation	A	AU,V	At a manned station
6.3.1.3.3	Loss of ventilation overpressure	A	AU,V	At a manned station
8.7.1	Fault requiring attention	A	AU,V	Including 8.3.5.1, 8.4.1, 8.8.6 and 8.9 II-1/51.1*
9.10.1	Fire detection system alarm	A	AU,V	At alarm location easily accessible to crew at all times
9.11.1, 9.12.1	Gas detection and alarm system	A	AU,V	!, Alarm at a location easily accessible to crew at all times
5.7.2	General emergency alarm	EM	AU	Clearly perceptible in all parts of the unit III/6.4.2*
13.5.1	Wind direction indicator	I	MI	It should be free from the effects of airflow disturbances caused by nearby objects or rotor downwash and be visible from a helicopter in flight or in a hover over the helideck
13.5.26	Status light	A	V	To be visible to the helicopter pilot from any direction of approach
13.6	Motion sensing system	I	MI	Display should be located at the aeromobile VHF radiotelephone station
1995 Diving Code				
2.5.2	Compression chamber internal pressure	I	MI	At central control position
2.5.3	Diving bell external pressure	I	MI	Within the bell
2.9.3	Diving equipment fire detection alarm	A	AU,V	!, At an attended location other than the above
2.11.2	Compression chamber/diving bell parameters	I	MI	At central control position
2.11.3	Diving bell oxygen and CO ₂ levels	I	MI	Within the bell
FSS Code				
8.2.5.2.1	Fire detection or automatic sprinkler operation	A	AU,V	Alarm at attended location other than navigation bridge and central fire control station
9.2.5.1.3	Fire detection alarm	A	AU,V	Alarm at location easily accessible to crew at all times
9.2.5.1.1	Fire detection alarm not receiving attention	EM	AU	Alarmed to crew; may be part of general emergency alarm
LSA Code				
7.2.1	General emergency alarm	EM	AU	Throughout all the accommodation and normal crew working spaces

* Cross-reference to SOLAS regulation.

+ These alarms may be omitted if they are provided at the cargo control station.

Table 10.1.7 – Location: cargo control station

IMO Instrument	Function	Priority	Display	Notes
SOLAS II-2				
+11.6.3.1	Cargo tank high level alarm and gauging	A	AU,V MI	!, If required
+4.5.10.1.1	Temperature sensing devices for pumps installed in tankers cargo pump rooms	A	AU,V	
4.5.10.1.3	Hydrocarbon gas detection in tankers cargo pump rooms	A	AU,V	
Gas or chemical codes				
IBC 8.2.3 BCH 2.13.1	High level of the liquid in any tank	A	AU,V	!, (2)
IBC 15.10.2 BCH 4.3.1(b)	Failure of mechanical ventilation system for maintaining low gas concentration in cargo tanks	A	AU,V	!, Sulphur liquid
IBC 15.19.2 BCH 4.14.3	Power failure on any system essential for safe loading	A	AU,V	!, (2)
IBC 15.19.6 BCH 4.14.1	High level alarm, cargo tank	A	AU,V	!, (2)
IGC 13.2.1 GC 13.2.1	Cargo level	I	MI	(2)
IGC 13.4.1 GC 13.4.1	High and low pressure in cargo tank	A	MI AU,(V)	(2)
IGC 13.6.4, 17.9 GC 13.6.4, 17.11	Gas detection equipment	A	AU, (V)	
IGC 17.18.4.4 GC 17.12.2(d)(iv)	Cargo high pressure, or high temperature at discharge of compressors	A	AU,V	(2), Methylacetylene-propadiene mixtures
GC 10.2.2	Shutdown of submerged cargo pumps	A	(AU,V)	
IGC 17.14.4.3 GC 17.12.5(d)(iii)	Gas detecting system monitoring chlorine concentration	A	AU,V	!, (3)
IGC 17.14.4.4 GC 17.12.5(d)(iv)	High pressure in cargo tanks(chlorine)	A	AU,(V)	!, (2)
IGC 13.3.1 GC 13.3.1	High liquid level in cargo tank	A	AU,V	!, (2)
IGC 13.5.1 GC 13.5.1	Cargo temperature	I	MI	!, (2)
IGC 13.5.2 GC 13.5.2	Hull or insulation temperature	I A	MI AU,(V)	!
IGC 13.5.3 GC 13.5.3	Cargo tank temperature	I	MI	!, (2)
IGC 13.6.11 GC 13.6.11	Gas detection equipment	A	AU,V MI	!, (3)
IGC 17.14.1.4 GC 17.12.5(a)(iv)	Gas detection after bursting disk for chlorine	A	(A,V) MI	!, (2)
IBC 15.7.10 BCH 4.5.10	High level of phosphorus	A	(AU,V)	!, (2)
IBC 15.19.7.2 BCH 4.14.2(b)	Overflow alarm	A	AU,V	!
IGC 5.2.1.7 GC 5.2.5(b)	Liquid cargo in the vent system	A	(AU,V)	!, (2)
IGC 8.4.2.1 GC 8.4.2(a)	Vacuum protection of cargo tanks	A	(AU,V)	!, (2)
IGC 9.5.2, GC 9.5.2	Inert gas pressure monitoring	A	(AU,V)	!

IMO Instrument	Function	Priority	Display	Notes
IGS				
3.15.3.2.1	Effluent drain valve position indicator	I	VI	!
6.2	Tank pressure sensors	I	MI	!, If required
VEC systems				
2.5.2.3	Tank overflow alarm	A	AU,V	!, (2)
2.5.2.4	Signal for sequential shutdown of onshore pumps or valves or both and of the ships' valves	A	(AU,V)	!, (2)
2.5.2.5	Overflow alarm and shutdown signal	A	(AU,V)	At an attended location !, (2)
2.5.2.6	Loss of power to the alarm system	A	(AU,V)	!, (2)
2.5.2.6	Tank level sensor electrical circuitry failure	A	(AU,V)	!, (2)
2.6.4	Main vapour collection line pressure	I	MI	!, (2) VEC is equipped, common to two or more tanks
2.6.4.1	High vapour pressure alarm	A	(AU,V)	!, (2) VEC is equipped, common to two or more tanks
2.6.4.2	Low vapour pressure alarm	A	(AU,V)	!, (2) VEC is equipped, common to two or more tanks
FSS Code				
15.2.4.2.1.1, 15.2.4.2.2	Inert gas pressure	I	MI	
15.2.4.2.1.2, 15.2.4.2.2	Inert gas O ₂ content	I	MI	
15.2.4.3.3	Inert gas system:			
15.2.4.3.1.1	- low water pressure/flow	A	AU,V	
15.2.4.3.1.2	- high water level	A	AU,V	
15.2.4.3.1.3	- high gas temperature	A	AU,V	
15.2.4.3.1.4	- blower failure	A	AU,V	
15.2.4.3.1.5	- oxygen content	A	AU,V	
15.2.4.3.1.6	- power supply failure	A	AU,V	
15.2.4.3.1.7, 15.2.2.4.6	- water seal low level	A	AU,V	
15.2.4.3.1.8, 15.2.4.3.4	- low gas pressure	A	AU,V	
15.2.4.3.1.9	- high gas pressure	A	AU,V	
15.2.4.3.2	gas generator failure:			
15.2.4.3.2.1	- low fuel supply	A	AU,V	
15.2.4.3.2.2	- power supply failure	A	AU,V	
15.2.4.3.2.3	- control power failure	A	AU,V	

- * Cross-reference to SOLAS regulation.
- ! No location specified in other IMO instruments. Location is recommended.
(2) and (3) See notes following paragraph 10.2.
- + These alarms may be omitted if they are provided at the pump control.

Table 10.1.8 – Location: not indicated by IMO instruments

IMO Instrument	Function	Priority	Display	Notes
SOLAS II-1 8.7.3	Draught indicator	I	MI	Passenger ships only (if required). For details see regulation 8.7.3. Recommended Location: w/h
SOLAS II-2 4.5.10.1.4	Pump-room bilge high level alarm	A	AU,V	Recommended Location: w/h or ecr
4.5.4.2	Flammable vapour monitoring	I	MI	
Gas or chemical codes				
IBC 7.1.5 BCH 2.15.5(a)	Alarm & Monitoring of cargo temperature	A	A,V, MI	Alert system only required if overheating or overcooling could result in a dangerous condition Recommended Location: w/h or cargo control station
IBC 13.1.1 BCH 3.9	Cargo tank levels	I	MI	Recommended Location: cargo control station
IBC 15.7.7 BCH 4.5.7	High temperature of phosphorus	A	AU,V	Recommended Location: w/h or cargo control station
2009 MODU Code				
4.10.15	Draught indicator	I	MI	At an attended location II-1/8.7.3*

* Cross-reference to SOLAS regulation.

Table 10.1.9 – Location: central ballast control station of column-stabilized MODUs

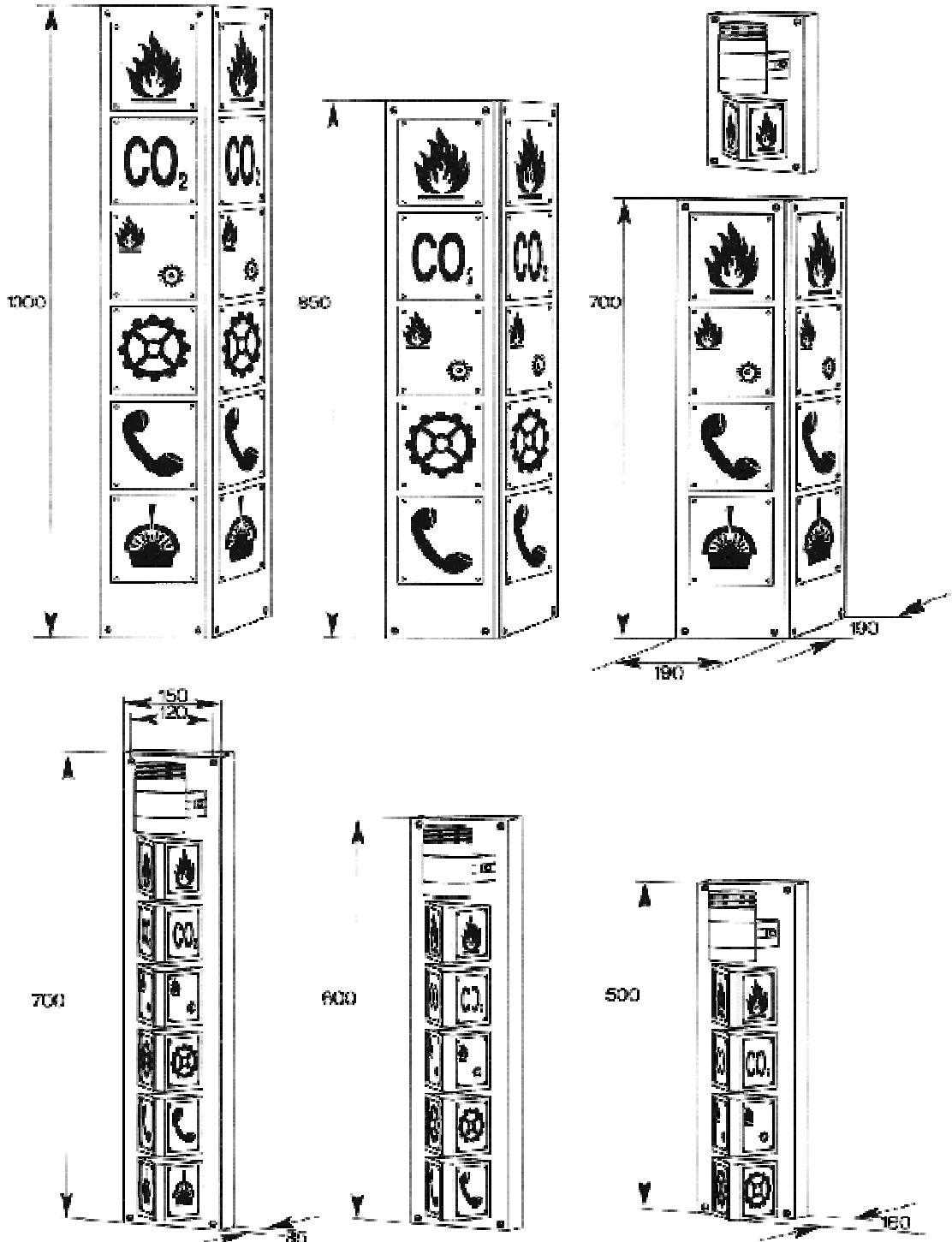
IMO Instrument	Function	Priority	Type	Notes
2009 MODU Code				
3.6.5.1	Watertight doors and hatch cover position indicator	I,A	VI,V	
3.6.5.2	Watertight doors and hatch cover position alarm	A	AU,V	
4.9.8.1	Flooding detector	I	VI	
4.9.8.3	Propulsion room and pump-room bilge high water level alarm	A	AU,V	
4.10.10.2	Ballast pump status-indicating system	I	VI	For details see also 4.9.12
4.10.10.4	Ballast valve position-indicating system	I	VI	For details see also 4.9.17
4.10.10.5	Tank level indicating system	I	VI	For details see also 4.9.14
4.10.10.6	Draught indicating system	I	VI	For details see also 4.9.15
4.10.10.7	Heel and trim indicators	I	VI	
4.10.10.8	Main and emergency power available indication	I	VI	
4.10.10.9	Ballast system hydraulic/pneumatic pressure indicating system	I	VI	
4.10.14.1	Ballast tanks liquid level	I	MI	
4.10.14.2	Other tanks liquid level	I	MI	
4.10.17	Ballast valve position	I	VI	!

11 REFERENCES

- 11.1** *IBC Code*. The International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (resolution MSC.4(48), as amended).
- 11.2** *BCH Code*. The Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (resolution MSC.9(53), as amended).
- 11.3** *IGC Code*. The International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (resolution MSC.5(48), as amended).
- 11.4** *Gas Carrier (GC) Code*. The Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (resolution A.328(IX), as amended).
- 11.5** *SFV Protocol 1993*. The Protocol of 1993 relating to the Torremolinos International Convention for the Safety of Fishing Vessels, 1977.
- 11.6** *IGS*. The Guidelines for Inert Gas Systems (MSC/Circ.282, as amended by MSC/Circ.353 and MSC/Circ.387).
- 11.7** *2000 HSC Code*. The International Code of Safety for High-Speed Craft, 2000 (resolution MSC.97(73), as amended).
- 11.8** *VEC Systems*. The Standards for Vapour Emission Control Systems (MSC/Circ.585).
- 11.9** *IMDG Code*. The International Maritime Dangerous Goods Code (resolution MSC.122(75), as amended).
- 11.10** *1995 Diving Code*. The Code of Safety for Diving Systems, 1995 (resolution A.831(19), as amended).
- 11.11** *2009 MODU Code*. The Code for the Construction and Equipment of Mobile Offshore Drilling Units, 2009 (resolution [...]).
- 11.12** *Nuclear Merchant Ship Code*. The Code of Safety for Nuclear Merchant Ships (resolution A.491(XII)).
- 11.13** *FSS Code*. The International Code for Fire Safety Systems (resolution MSC.98(73), as amended).
- 11.14** *LSA Code*. The International Life-Saving Appliances (LSA) Code (resolution MSC.48(66), as amended).
- 11.15** *Resolution MSC.128(75)*. The Performance Standards for a Bridge Navigational Watch Alarm System (BNWAS).
- 11.16** *Resolution A.481(XII)*. The Principles of Safe Manning.

APPENDIX

SAMPLE OF INDICATOR COLUMNS WITH DIMENSIONS (mm)



Note: Diagrams above are representative only. Symbols should be as in tables 7.1.1 to 7.1.3.

ANNEX 14**DRAFT ASSEMBLY RESOLUTION****ADOPTION OF THE CODE FOR THE CONSTRUCTION AND EQUIPMENT OF
MOBILE OFFSHORE DRILLING UNITS, 2009 (2009 MODU CODE)**

THE ASSEMBLY,

RECALLING Article 15(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations and guidelines concerning maritime safety,

NOTING that mobile offshore drilling units continue to be moved and operated internationally,

RECOGNIZING that the design criteria for such units are often quite different from those of conventional ships and that, by virtue of this, the application of international conventions, such as the International Convention for the Safety of Life at Sea, 1974, as amended, and the International Convention on Load Lines, 1966, as amended, is inappropriate in respect of mobile offshore drilling units,

RECALLING that, when the Code for the Construction and Equipment of Mobile Offshore Drilling Units (MODU Code) was adopted in 1979 by resolution A.414(XI), it was recognized that the design technology of mobile offshore drilling units was rapidly evolving and that new features of mobile offshore drilling units were being introduced to improve technical and safety standards,

RECALLING ALSO the adoption of the Code for the Construction and Equipment of Mobile Offshore Drilling Units (MODU Code), 1989, which superseded the 1979 MODU Code, by resolution A.649(16), following a number of tragic MODU casualties which emphasized the need for a review of the international safety standards developed by the Organization,

NOTING that, since the adoption of the 1989 MODU Code, ICAO has adopted amendments to the Convention on International Civil Aviation which impact on the provisions for helicopter facilities as contained in the 1989 MODU Code, and the Organization has adopted a number of amendments to regulations of SOLAS which are referenced in the 1989 MODU Code,

HAVING considered the recommendation made by the Maritime Safety Committee at its eighty-sixth session,

1. ADOPTS the Code for the Construction and Equipment of Mobile Offshore Drilling Units, 2009 (2009 MODU Code), set out in the Annex to this resolution, which supersedes the existing 1989 MODU Code adopted by resolution A.649(16), for mobile offshore drilling units the keels of which are laid or which are at a similar stage of construction on or after [1 January 2012];

2. INVITES all Governments concerned:
 - (a) to take appropriate steps to give effect to the 2009 MODU Code;
 - (b) to consider the Code as an equivalent, for purposes of application to mobile offshore drilling units, to the technical requirements of the aforementioned conventions;
 - (c) to inform the Organization of measures taken in this respect;
3. AUTHORIZES the Maritime Safety Committee to amend the 2009 MODU Code as appropriate, taking into consideration developments in design and technology, in consultation with appropriate organizations.

ANNEX

**CODE FOR THE CONSTRUCTION AND EQUIPMENT OF MOBILE OFFSHORE
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Appendix

PREAMBLE

1 This Code has been developed to provide an international standard for mobile offshore drilling units of new construction which will facilitate the international movement and operation of these units and ensure a level of safety for such units, and for personnel on board, equivalent to that required by the International Convention for the Safety of Life at Sea, 1974, as amended, and the Protocol of 1988 relating to the International Convention on Load Lines, 1966, for conventional ships engaged on international voyages. It is not intended that the provisions of the Code of Safety for Special Purpose Ships be applied in addition to the provisions of this Code.

2 Throughout the development of the Code, it was recognized that it must be based upon sound design and engineering principles and experience gained from operating such units; it was further recognized that design technology of mobile offshore drilling units is not only a complex technology but is continually evolving and that the Code should not remain static but be re-evaluated and revised as necessary. To this end the Organization will periodically review the Code, taking into account both experience and future development.

3 Any existing unit which complies with the provisions of this Code should be considered eligible for issuance of a certificate in accordance with this Code.

4 This Code is not intended to prohibit the use of an existing unit simply because its design, construction and equipment do not conform to this Code. Many existing mobile offshore drilling units have operated successfully and safely for extended periods of time and their operating history should be considered in evaluating their suitability to conduct international operations.

5 The coastal State may permit any unit designed to a lower standard than that of the Code to engage in operations having taken account of the local conditions (e.g., meteorological and oceanographic). Any such unit should, however, comply with safety requirements which in the opinion of the coastal State are adequate for the intended operation and ensure the overall safety of the unit and the personnel on board.

6 This Code does not include requirements for the drilling of subsea wells or the procedures for their control. Such drilling operations are subject to control by the coastal State.

CHAPTER 1

GENERAL

1.1 Purpose

The purpose of the Code for the Construction and Equipment of Mobile Offshore Drilling Units, 2009, hereinafter referred to as “the Code”, is to recommend design criteria, construction standards and other safety measures for mobile offshore drilling units so as to minimize the risk to such units, to the personnel on board and to the environment.

1.2 Application

1.2.1 The Code applies to mobile offshore drilling units as defined in section 1.3, the keels of which are laid or which are at a similar stage of construction on or after [1 January 2012].

1.2.2 The coastal State may impose additional requirements regarding the operation of industrial systems not dealt with by the Code.

1.3 Definitions

For the purpose of the Code, unless expressly provided otherwise, the terms used therein have the meanings defined in this section.

1.3.1 *1988 LL Protocol* means the Protocol of 1988 relating to the International Convention on Load Lines, 1966, as amended.

1.3.2 “*A*” class divisions are as defined in SOLAS regulation II-2/3.

1.3.3 *Accommodation spaces* are those used for public spaces, corridors, lavatories, cabins, offices, hospitals, cinemas, games and hobbies rooms, pantries containing no cooking appliances and similar spaces. Public spaces are those portions of the accommodation which are used for halls, dining rooms, lounges and similar permanently enclosed spaces.

1.3.4 *Administration* means the Government of the State whose flag the unit is entitled to fly.

1.3.5 *Anniversary date* means the day and month of each year which will correspond to the date of expiry of the certificate.

1.3.6 *Auxiliary steering gear* is the equipment which is provided for effecting movement of the rudder for the purpose of steering the unit in the event of failure of the main steering gear.

1.3.7 “*B*” class divisions are as defined in SOLAS regulation II-2/3.

1.3.8 “*C*” class divisions are as defined in SOLAS regulation II-2/3.

1.3.9 *Certificate* means Mobile Offshore Drilling Unit Safety Certificate.

1.3.10 *Coastal State* means the Government of the State exercising administrative control over the drilling operations of the unit.

1.3.11 *Column-stabilized unit* is a unit with the main deck connected to the underwater hull or footings by columns or caissons.

1.3.12 *Continuous "B" class ceilings or linings* are those "B" class ceilings or linings which terminate only at an "A" or "B" class division.

1.3.13 *Control stations* are those spaces in which the unit's radio or main navigating equipment or the emergency source of power is located or where the fire recording or fire control equipment or the dynamic positioning control system is centralized or where a fire-extinguishing system serving various locations is situated. In the case of column-stabilized units a centralized ballast control station is a "control station". However, for purposes of the application of chapter 9, the space where the emergency source of power is located is not considered as being a control station.

1.3.14 *D or D-value* means the largest dimension of the helicopter when rotor(s) are turning measured from the most forward position of the main rotor tip path plane to the most rearward position of the tail rotor path plane or helicopter structure.

1.3.15 *Dead ship condition* is the condition under which the main propulsion plant, boilers and auxiliaries are not in operation due to the absence of power.

1.3.16 *Depth for freeboard* has the same meaning as defined in regulation 3 of the 1988 LL Protocol.

1.3.17 *Diving system* is the plant and equipment necessary for the safe conduct of diving operations from a mobile offshore drilling unit.

1.3.18 *Downflooding* means any flooding of the interior of any part of the buoyant structure of a unit through openings which cannot be closed watertight or weathertight, as appropriate, in order to meet the intact or damage stability criteria, or which are required for operational reasons to be left open.

1.3.19 *Emergency source of electrical power* is a source of electrical power intended to supply the necessary services in the event of failure of the main source of electrical power.

1.3.20 *Emergency switchboard* is a switchboard which, in the event of failure of the main system of electrical power supply, is directly supplied by the emergency source of electrical power and/or the transitional source of emergency power and is intended to distribute electrical energy to the emergency services.

1.3.21 *Enclosed spaces* are spaces delineated by floors, bulkheads and/or decks which may have doors or windows.

1.3.22 *Freeboard* is the distance measured vertically downwards amidships from the upper edge of the deck line to the upper edge of the related load line.

1.3.23 *FSS Code* means the International Code for Fire Safety Systems, adopted by the Maritime Safety Committee of the Organization by resolution MSC.98(73), as amended.

1.3.24 *FTP Code* means the International Code for Application of Fire Test Procedures, adopted by the Maritime Safety Committee of the Organization by resolution MSC.61(67), as amended.

1.3.25 *Gastight door* is a solid, close-fitting door designed to resist the passage of gas under normal atmospheric conditions.

1.3.26 *Hazardous areas* are all those areas where, due to the possible presence of a flammable atmosphere arising from the drilling operations, the use without proper consideration of machinery or electrical equipment may lead to fire hazard or explosion.

1.3.27 *Helideck* is a purpose-built helicopter landing platform located on a mobile offshore drilling unit (MODU).

1.3.28 *Industrial machinery and components* are the machinery and components which are used in connection with the drilling operation.

1.3.29 *Length (L)* has the same meaning as defined in regulation 3 of the 1988 LL Protocol.

1.3.30 *Lightweight* is the displacement of a unit in tonnes without variable deck load, fuel, lubricating oil, ballast water, fresh water and feedwater in tanks, consumable stores, and personnel and their effects.

1.3.31 *Low-flame spread* has the same meaning as defined in SOLAS regulation II-2/3.

1.3.32 *LSA Code* means the International Life-Saving Appliance Code, adopted by the Maritime Safety Committee of the Organization by resolution MSC.48(66), as amended.

1.3.33 *Machinery spaces* are all machinery spaces of category A and all other spaces containing propelling machinery, boilers and other fired processes, oil fuel units, steam and internal combustion engines, generators and major electrical machinery, oil filling stations, refrigerating, stabilizing, ventilation and air-conditioning machinery and similar spaces; and trunks to such spaces.

1.3.34 *Machinery spaces of category A* are all spaces which contain internal combustion-type machinery used either:

- .1** for main propulsion; or
- .2** for other purposes where such machinery has in the aggregate a total power of not less than 375 kW;

or which contain any oil-fired boiler or oil fuel unit; and trunks to such spaces.

1.3.35 *Main source of electrical power* is a source intended to supply electrical power for all services necessary for maintaining the unit in normal operational and habitable conditions.

1.3.36 *Main steering gear* is the machinery, the steering gear power units, if any, and ancillary equipment and the means of applying torque to the rudder stock, e.g. tiller or quadrant, necessary for effecting movement of the rudder for the purpose of steering the unit under normal service conditions.

1.3.37 *Main switchboard* is a switchboard directly supplied by the main source of electrical power and intended to distribute electrical energy to the unit's services.

1.3.38 *Maximum ahead service speed* is the greatest speed which the unit is designed to maintain in service at sea at its deepest seagoing draught.

1.3.39 *Maximum astern speed* is the speed which it is estimated the unit can attain at the designed maximum astern power at its deepest seagoing draught.

1.3.40 *Mobile offshore drilling unit (MODU) or unit* is a vessel capable of engaging in drilling operations for the exploration for or exploitation of resources beneath the seabed such as liquid or gaseous hydrocarbons, sulphur or salt.

1.3.41 *Mode of operation* means a condition or manner in which a unit may operate or function while on location or in transit. The modes of operation of a unit include the following:

- .1** *Operating conditions* – conditions wherein a unit is on location for the purpose of conducting drilling operations, and combined environmental and operational loadings are within the appropriate design limits established for such operations. The unit may be either afloat or supported on the seabed, as applicable.
- .2** *Severe storm conditions* – conditions wherein a unit may be subjected to the most severe environmental loading for which the unit is designed. Drilling operations are assumed to have been discontinued due to the severity of the environmental loading. The unit may be either afloat or supported on the seabed, as applicable.
- .3** *Transit conditions* – conditions wherein a unit is moving from one geographical location to another.

1.3.42 *Non-combustible material* has the same meaning as defined in SOLAS regulation II-2/3.

1.3.43 *Normal operational and habitable conditions* means:

- .1** conditions under which the unit as a whole, its machinery, services, means and aids ensuring safe navigation when underway, safety when in the industrial mode, fire and flooding safety, internal and external communications and signals, means of escape and winches for rescue boats, as well as the means of ensuring the minimum comfortable conditions of habitability, are in working order and functioning normally; and
- .2** drilling operations.

1.3.44 *Oil fuel unit* is the equipment used for the preparation of oil fuel for delivery to an oil-fired boiler, or equipment used for the preparation for delivery of heated oil to an internal combustion engine, and includes any oil pressure pumps, filters and heaters dealing with oil at a pressure more than 0.18 N/mm². Oil transfer pumps are not considered oil fuel units.

1.3.45 *Organization* means the International Maritime Organization (IMO).

1.3.46 *Rescue boat* has the same meaning as defined in SOLAS regulation III/3.

1.3.47 *Self-elevating unit* is a unit with movable legs capable of raising its hull above the surface of the sea and lowering it back into the sea.

1.3.48 *Semi-enclosed locations* are locations where natural conditions of ventilation are notably different from those on open decks due to the presence of structures such as roofs, windbreaks and bulkheads and which are so arranged that dispersion of gas may not occur.

1.3.49 *Service spaces* are those used for galleys, pantries containing cooking appliances, lockers and store-rooms, workshops other than those forming part of the machinery spaces, and similar spaces and trunks to such spaces.

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

1.3.51 *Standard fire test* is as defined in SOLAS regulation II-2/3.

1.3.52 *Steel or equivalent material* has the same meaning as defined in SOLAS regulation II-2/3.

1.3.53 *Steering gear power unit* means, in the case of:

- .1 electric steering gear, an electric motor and its associated electrical equipment;
- .2 electrohydraulic steering gear, an electric motor and its associated electrical equipment and connected pump;
- .3 other hydraulic gear, a driving engine and connected pump.

1.3.54 *Surface unit* is a unit with a ship- or barge-type displacement hull of single or multiple hull construction intended for operation in the floating condition.

1.3.55 *Survival craft* has the same meaning as defined in SOLAS regulation III/3.

1.3.56 *Visitors* are personnel not regularly assigned to the unit.

1.3.57 *Watertight* means the capability of preventing the passage of water through the structure in any direction under a head of water for which the surrounding structure is designed.

1.3.58 *Weathertight* means that in any sea conditions water will not penetrate into the unit.

1.3.59 *Working spaces* are those open or enclosed spaces containing equipment and processes, associated with drilling operations, which are not included in *hazardous areas* and *machinery spaces*.

1.4 Exemptions

An Administration may exempt any unit which embodies features of a novel kind from any of the provisions of the Code the application of which might impede research into the development of such features. Any such unit should, however, comply with safety requirements which, in the opinion of that Administration, are adequate for the service intended and are such as to ensure the overall safety of the unit. The Administration which allows any such exemption should list such exemptions on the certificate and communicate to the Organization the particulars, together with the reasons therefor, so that the Organization may circulate the same to other Governments for the information of their officers.

1.5 Equivalentents

1.5.1 Where the Code provides that a particular detail of design or construction, fitting, material, appliance or apparatus, or type thereof, should be fitted or carried in a unit, or that any particular provision should be made, the Administration may allow any other detail of design or construction, fitting, material, appliance or apparatus, or type thereof, to be fitted or carried, or any other provision to be made in that unit, if it is satisfied by trial thereof or otherwise that such detail of design or construction, fitting, material, appliance or apparatus, or type thereof, or provision, is at least as effective as that provided for in the Code.

1.5.2 When an Administration so allows any fitting, material, appliance, apparatus, item of equipment or type thereof, or provision, procedure, arrangement, novel design or application to be substituted, it should communicate to the Organization the particulars thereof, together with a report on the evidence submitted, so that the Organization may circulate the same to other Governments for the information of their officers.

1.6 Surveys and certification

1.6.1 Each unit should be subject to the surveys specified below:

- .1** an *initial survey* before the unit is put in service or before the certificate is issued for the first time;
- .2** a *renewal survey* at intervals specified by the Administration but not exceeding five years except where paragraph 1.6.11.2.1, 1.6.11.5 or 1.6.11.6 is applicable;
- .3** an *intermediate survey* within three months before or after the second anniversary date or within three months before or after the third anniversary date of the certificate, which should take the place of one of the annual surveys specified in paragraph 1.6.1.4;
- .4** an *annual survey* within three months before or after each anniversary date of the certificate;
- .5** a minimum of two *dry-dock surveys* during any five-year period, except where paragraph 1.6.11.5 is applicable. Where paragraph 1.6.11.5 is applicable this five-year period may be extended to coincide with the extended period of the validity of the certificate. In all cases the intervals between any two such surveys should not exceed 36 months;
- .6** *radio station surveys* in accordance with section 11.9; and
- .7** an *additional survey* as the occasion arises.

1.6.2 The surveys referred to in paragraph 1.6.1 should be carried out as follows:

- .1** the initial survey should include a complete inspection of the structure, safety equipment and other equipment, fittings, arrangements and material to ensure that they comply with the provisions of the Code, are in satisfactory condition and are fit for the service for which the unit is intended;

- .2 the renewal survey should include an inspection of the structure, safety equipment and other equipment as referred to in paragraph 1.6.2.1 to ensure that they comply with the provisions of the Code, are in satisfactory condition and are fit for the service for which the unit is intended;
- .3 the intermediate survey should include an inspection of the structure, fittings, arrangements and safety equipment to ensure that they remain satisfactory for the service for which the unit is intended;
- .4 the annual survey should include a general inspection of the structure, safety equipment and other equipment as referred to in paragraph 1.6.2.1, to ensure that they have been maintained in accordance with paragraph 1.6.6.1 and that they remain satisfactory for the service for which the unit is intended;
- .5 the dry-dock survey and the inspection of items surveyed at the same time should be such as to ensure that they remain satisfactory for the service for which the unit is intended. An Administration may allow underwater inspections in lieu of a dry-dock survey provided that they are satisfied that such an inspection is equivalent to a dry-dock survey;
- .6 the radio survey should be sufficient to assure compliance with the relevant provisions for cargo ships of SOLAS chapter IV; and
- .7 an additional survey, either general or partial according to the circumstances, should be made after a repair resulting from investigations prescribed in paragraph 1.6.6.3, or wherever any important repairs or renewals are made. The survey should be such as to ensure that the necessary repairs or renewals have been effectively made, that the material and workmanship of such repairs or renewals are in all respects satisfactory, and that the unit complies in all respects with the provisions of the Code.

1.6.3 The intermediate, annual and dry-dock surveys referred to in paragraphs 1.6.2.3, 1.6.2.4 and 1.6.2.5 should be endorsed on the certificate.

1.6.4 As an alternative to the renewal and intermediate surveys provided for in paragraphs 1.6.2.2 and 1.6.2.3 respectively, the Administration may, at the owner's request, approve a continuous survey programme provided that the extent and frequency of the surveys are equivalent to renewal and intermediate surveys. A copy of the continuous survey programme, together with the record of the surveys, should be kept on board the unit and the certificate annotated accordingly.

1.6.5.1 The inspection and survey of the units, so far as regards the enforcement of the provisions of the Code and the granting of exemptions therefrom, should be carried out by officers of the Administration. The Administration may, however, entrust the inspections and surveys either to surveyors nominated for the purpose or to organizations recognized by it.

1.6.5.2 An Administration nominating surveyors or recognizing organizations to conduct inspections and surveys as set forth in paragraph 1.6.5.1 should as a minimum empower any nominated surveyor or recognized organization to:

- .1 require repairs to a unit; and

- .2** carry out inspections and surveys if requested by the appropriate authorities of a port or coastal State.

The Administration should notify the Organization of the specific responsibilities and conditions of the authority delegated to nominated surveyors or recognized organizations.

1.6.5.3 When a nominated surveyor or recognized organization determines that the condition of the unit or its equipment does not correspond substantially with the particulars of the certificate or is such that the unit is not fit to operate without danger to the unit, or persons on board, such surveyor or organization should immediately ensure that corrective action is taken and should in due course notify the Administration. If such corrective action is not taken the certificate should be withdrawn and the Administration should be notified immediately; and, if the unit is in an area under the jurisdiction of another Government, the appropriate authorities of the port or coastal State should be notified immediately. When an officer of the Administration, a nominated surveyor or recognized organization has notified the appropriate authorities of the port or coastal State, the Government of the port or coastal State concerned should give such officer, surveyor or organization any necessary assistance to carry out their obligations under this regulation. When applicable, the Government of the port or coastal State concerned should ensure that the unit should not continue to operate until it can do so without danger to persons, the environment or the unit.

1.6.5.4 In every case, the Administration should fully guarantee the completeness and efficiency of the inspection and survey, and should undertake to ensure the necessary arrangements to satisfy this obligation.

1.6.6.1 The condition of the unit and its equipment should be maintained to conform with the provisions of the Code to ensure that the unit in all respects will remain fit to operate without danger to persons, the environment or the unit.

1.6.6.2 After any survey of the unit under this regulation has been completed, no change should be made to structure, equipment, fittings, arrangements and materials covered by the survey, without the sanction of the Administration.

1.6.6.3 Should an incident occur, or a defect be discovered, which affects the safety of the unit or the efficiency or completeness of the structure, equipment, fittings, arrangements or materials, the person in charge or the owner of the unit should report the incident or defect at the earliest opportunity to the Administration. In addition, the nominated surveyor or recognized organization responsible, who should cause investigations to be initiated, should determine whether a survey is necessary. If the unit is in an area under the jurisdiction of another Government, the person in charge or the owner of the unit should also report the incident or defect immediately to the appropriate authorities of the port or coastal State and the nominated surveyor or recognized organization should ascertain that such a report has been made.

1.6.7 A certificate called a Mobile Offshore Drilling Unit Safety Certificate (2009) may be issued after an initial or renewal survey to a unit which complies with the provisions of the Code. The Certificate should be issued or endorsed either by the Administration or by any person or organization recognized by it. In every case, that Administration assumes full responsibility for the certificate.

1.6.8 Any exemptions granted under section 1.4 should be clearly noted on the certificate.

1.6.9 A Contracting Government to both SOLAS and the 1988 LL Protocol may, at the request of the Administration, cause a unit to be surveyed and, if satisfied that the provisions of the Code are complied with, should issue or authorize the issue of a certificate to the unit and, where appropriate, endorse or authorize the endorsement of a certificate on the unit in accordance with the Code. Any certificate so issued should contain a statement to the effect that it has been issued at the request of the Government of the State the flag of which the unit is entitled to fly, and it should have the same force and receive the same recognition as a certificate issued under paragraph 1.6.7.

1.6.10 The certificate should be drawn up in the form corresponding to the model given in the appendix to the Code. If the language used is neither English nor French, the text should include a translation into one of these languages.

1.6.11.1 The Mobile Offshore Drilling Unit Safety Certificate (2009) should be issued for a period specified by the Administration which should not exceed five years.

1.6.11.2.1 Notwithstanding the provisions of paragraph 1.6.11.1, when the renewal survey is completed within three months before the expiry date of the existing certificate, the new certificate should be valid from the date of completion of the renewal survey to a date not exceeding five years from the date of expiry of the existing certificate.

1.6.11.2.2 When the renewal survey is completed after the expiry date of the existing certificate, the new certificate should be valid from the date of completion of the renewal survey to a date not exceeding five years from the date of expiry of the existing certificate.

1.6.11.2.3 When the renewal survey is completed more than three months before the expiry date of the existing certificate, the new certificate should be valid from the date of completion of the renewal survey to a date not exceeding five years from the date of completion of the renewal survey.

1.6.11.3 If a certificate is issued for a period of less than five years, the Administration may extend the validity of the certificate beyond the expiry date to the maximum period specified in paragraph 1.6.11.1, provided that the surveys when a certificate is issued for a period of five years are carried out.

1.6.11.4 If a renewal survey has been completed and a new certificate cannot be issued or placed on board the unit before the expiry date of the existing certificate, the person or organization authorized by the Administration may endorse the existing certificate and such a certificate should be accepted as valid for a further period which should not exceed five months from the expiry date.

1.6.11.5 If a unit at the time when a certificate expires is not in the place in which it is to be surveyed, the Administration may extend the period of validity of the certificate but this extension should be granted only for the purpose of allowing the unit to proceed to the place in which it is to be surveyed, and then only in cases where it appears proper and reasonable to do so. No certificate should be extended for a period longer than three months, and a unit to which an extension is granted should not, on its arrival in the place in which it is to be surveyed, be entitled by virtue of such extension to leave that place without having a new certificate. When the renewal survey is completed, the new certificate should be valid to a date not exceeding five years from the date of expiry of the existing certificate before the extension was granted.

1.6.11.6 In special circumstances, as determined by the Administration, a new certificate need not be dated from the date of expiry of the existing certificate as provided for in paragraph 1.6.11.2.2 or 1.6.11.5. In these circumstances, the new certificate should be valid to a date not exceeding five years from the date of completion of the renewal survey.

1.6.11.7 If an annual or intermediate survey is completed before the period specified, then:

- .1 the anniversary date shown on the relevant certificate should be amended by endorsement to a date which should not be more than three months later than the date on which the survey was completed;
- .2 the subsequent annual or intermediate survey required by the relevant regulations should be completed at the intervals prescribed by this regulation using the new anniversary date; and
- .3 the expiry date may remain unchanged provided one or more annual or intermediate surveys, as appropriate, are carried out so that the maximum intervals between the surveys under paragraphs 1.6.1.3 and 1.6.1.4 are not exceeded.

1.6.11.8 A certificate issued under paragraph 1.6.7 or 1.6.9 should cease to be valid in any of the following cases:

- .1 if the relevant surveys are not completed within the periods specified in paragraph 1.6.1;
- .2 if the certificate is not endorsed in accordance with paragraph 1.6.3;
- .3 upon transfer of the unit to the flag of another State. A new certificate should only be issued when the Government issuing the new certificate is fully satisfied that the unit is in compliance with the provisions of paragraphs 1.6.6.1 and 1.6.6.2. In the case of a transfer between Governments that are Contracting Governments to both SOLAS and the 1988 LL Protocol, if requested within three months after the transfer has taken place, the Government of the State whose flag the unit was formerly entitled to fly should, as soon as possible, transmit to the Administration a copy of the certificate carried by the unit before the transfer and, if available, copies of the relevant survey reports.

1.6.12 The privileges of the Code may not be claimed in favour of any unit unless it holds a valid certificate.

1.7 Control

1.7.1 Every unit when in an area under the jurisdiction of another Government is subject to control by officers duly authorized by such Government in so far as this control is directed towards verifying that the certificate issued under section 1.6 is valid.

1.7.2 Such certificate, if valid, should be accepted unless there are clear grounds for believing that the condition of the unit or its equipment does not correspond substantially with the particulars of the certificate or that the unit and its equipment are not in compliance with the provisions of paragraphs 1.6.6.1 and 1.6.6.2.

1.7.3 In the circumstances given in paragraph 1.7.2 or where the certificate has expired or ceased to be valid, the officer carrying out the control should take steps to ensure that the unit should not continue to operate (except, when appropriate, on a temporary basis) or leave the area for the purpose of proceeding to an area for repair if this could cause danger to the unit or persons on board.

1.7.4 In the event of this control giving rise to an intervention of any kind, the officer carrying out the control should forthwith inform, in writing, the consul or, in his absence, the nearest diplomatic representative of the State whose flag the unit is entitled to fly of all the circumstances in which intervention was deemed necessary. In addition, nominated surveyors or recognized organizations responsible for the issue of the certificates should also be notified. The facts concerning the intervention should be reported to the Organization.

1.7.5 When exercising control under this regulation all possible efforts should be made to avoid the operation of the unit being unduly interrupted or delayed. If a unit is unduly interrupted or delayed it should be entitled to compensation for any loss or damage suffered.

1.7.6 Notwithstanding the provisions of paragraphs 1.7.1 and 1.7.2, the provisions of section 1.6 are without prejudice to any rights of the coastal State under international law to impose its own requirements relating to the regulation, surveying and inspection of units engaged, or intending to engage, in the exploration or exploitation of the natural resources of those parts of the seabed and subsoil over which that State is entitled to exercise sovereign rights.

1.8 Casualties

1.8.1 Each Administration and each coastal State should undertake to conduct an investigation of any casualty occurring to any unit subject to its jurisdiction and subject to the provisions of the Code when it judges that such an investigation may assist in determining what changes in the Code might be desirable.¹

1.8.2 Each Administration and each coastal State should undertake to supply the Organization with pertinent information concerning the findings of such investigations. No reports or recommendations of the Organization based upon such information should disclose the identity or nationality of the units concerned or in any manner fix or imply responsibility upon any unit or person.

1.9 Review of the Code

1.9.1 The Code should be reviewed by the Organization as necessary to consider the revision of existing provisions and the formulation of provisions for new developments in design, equipment or technology.

1.9.2 Where a new development in design, equipment or technology has been found acceptable to an Administration, that Administration may submit particulars of such development to the Organization for consideration of its incorporation into the Code.

¹ Refer to the Code of the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident (Casualty Investigation Code), adopted by the Maritime Safety Committee of the Organization by resolution MSC.255(84).

CHAPTER 2

CONSTRUCTION, STRENGTH AND MATERIALS

2.1 General

2.1.1 Administrations should take appropriate action to ensure uniformity in the implementation and application of the provisions of this chapter.

2.1.2 The review and approval of the design of each unit should be carried out by officers of the Administration. However, the Administration may entrust this function to certifying authorities nominated for this purpose or to organizations recognized by it. In every case the Administration concerned should fully guarantee the completeness and efficiency of the design evaluation.

2.1.3 In addition to the provisions contained elsewhere in this Code, units should be designed, constructed and maintained in compliance with the structural, mechanical and electrical requirements of a classification society which:

- .1** has recognized and relevant competence and experience with offshore petroleum activities;
- .2** has established rules and procedures for classification of mobile offshore drilling units; and
- .3** is recognized by the Administration in accordance with the provisions of SOLAS regulation XI-1/1, or with applicable national standards of the Administration which provide an equivalent level of safety.

2.2 Access

2.2.1 *Means of access*

2.2.1.1 Each space within the unit should be provided with at least one permanent means of access to enable, throughout the life of a unit, overall and close-up inspections and thickness measurements of the unit's structures to be carried out by the Administration, the company, and the unit's personnel and others as necessary. Such means of access should comply with the provisions of paragraph 2.2.4 and with the Technical provisions for means of access for inspections, adopted by the Maritime Safety Committee by resolution MSC.133(76), as may be amended by the Organization.

2.2.1.2 Where a permanent means of access may be susceptible to damage during normal operations or where it is impracticable to fit permanent means of access, the Administration may allow, in lieu thereof, the provision of movable or portable means of access, as specified in the Technical provisions, provided that the means of attaching, rigging, suspending or supporting the portable means of access forms a permanent part of the unit's structure. All portable equipment should be capable of being readily erected or deployed by the unit's personnel.

2.2.1.3 The construction and materials of all means of access and their attachment to the unit's structure should be to the satisfaction of the Administration. The means of access should be subject to inspection prior to, or in conjunction with, its use in carrying out surveys in accordance with section 1.6.

2.2.2 *Safe access to holds, tanks, ballast tanks and other spaces*

2.2.2.1 Safe access² to holds, cofferdams, tanks and other spaces should be direct from the open deck and such as to ensure their complete inspection. Safe access may be from a machinery space, pump-room, deep cofferdam, pipe tunnel, hold, double hull space or similar compartment not intended for the carriage of oil or hazardous materials where it is impracticable to provide such access from an open deck.

2.2.2.2 Tanks, and subdivisions of tanks, having a length of 35 m or more, should be fitted with at least two access hatchways and ladders, as far apart as practicable. Tanks less than 35 m in length should be served by at least one access hatchway and ladder. When a tank is subdivided by one or more swash bulkheads or similar obstructions which do not allow ready means of access to the other parts of the tank, at least two hatchways and ladders should be fitted.

2.2.2.3 Each hold should be provided with at least two means of access as far apart as practicable. In general, these accesses should be arranged diagonally, e.g., one access near the forward bulkhead on the port side, the other one near the aft bulkhead on the starboard side.

2.2.3 *Access manual*

2.2.3.1 A unit's means of access to carry out overall and close-up inspections and thickness measurements should be described in an access manual which may be incorporated in the unit's operating manual. The manual should be updated as necessary, and an updated copy maintained on board. The structure access manual should include the following for each space:

- .1.1** plans showing the means of access to the space, with appropriate technical specifications and dimensions;
- .1.2** plans showing the means of access within each space to enable an overall inspection to be carried out, with appropriate technical specifications and dimensions. The plans should indicate from where each area in the space can be inspected;
- .1.3** plans showing the means of access within the space to enable close-up inspections to be carried out, with appropriate technical specifications and dimensions. The plans should indicate the positions of critical structural areas, whether the means of access is permanent or portable and from where each area can be inspected;
- .1.4** instructions for inspecting and maintaining the structural strength of all means of access and means of attachment, taking into account any corrosive atmosphere that may be within the space;

² Refer to Recommendations for entering enclosed spaces aboard ships, adopted by the Organization by resolution A.864(20).

- .1.5 instructions for safety guidance when rafting is used for close-up inspections and thickness measurements;
- .1.6 instructions for the rigging and use of any portable means of access in a safe manner;
- .1.7 an inventory of all portable means of access; and
- .1.8 records of periodical inspections and maintenance of the unit's means of access.

2.2.3.2 For the purpose of this paragraph “critical structural areas” are locations which have been identified from calculations to require monitoring or from the service history of similar or sister units to be sensitive to cracking, buckling, deformation or corrosion which would impair the structural integrity of the unit.

2.2.4 *General technical specifications*

2.2.4.1 For access through horizontal openings, hatches or manholes, the dimensions should be sufficient to allow a person wearing a self-contained air-breathing apparatus and protective equipment to ascend or descend any ladder without obstruction and also provide a clear opening to facilitate the hoisting of an injured person from the bottom of a confined space. The minimum clear opening should not be less than 600 mm x 600 mm. When access to a hold is arranged through a flush manhole in the deck or a hatch, the top of the ladder should be placed as close as possible to the deck or hatch coaming. Access hatch coamings having a height greater than 900 mm should also have steps on the outside in conjunction with the ladder.

2.2.4.2 For access through vertical openings, or manholes, in swash bulkheads, floors, girders and web frames providing passage through the length and breadth of the space, the minimum opening should be not less than 600 mm x 800 mm at a height of not more than 600 mm from the bottom shell plating unless gratings or other footholds are provided.

2.3 Design loads

2.3.1 The modes of operation for each unit are to be investigated using realistic loading conditions including gravity loading with relevant environmental loading for its intended areas of operation. The following environmental considerations should be included where applicable: wind, wave, current, ice, seabed conditions, temperature, fouling and earthquake.

2.3.2 Where possible, the above design environmental conditions should be based upon significant data with a period of recurrence of at least 50 years for the most severe anticipated environment.

2.3.3 Results from relevant model tests may be used to substantiate or amplify calculations.

2.3.4 Limiting design data for each mode of operation should be stated in the operating manual.

Wind loading

2.3.5 Sustained and gust wind velocities, as relevant, should be considered when determining wind loading. Pressures and resultant forces should be calculated by the method referred to in section 3.2 or by some other method to the satisfaction of the Administration.

Wave loading

2.3.6 Design wave criteria should be described by design wave energy spectra or deterministic design waves having appropriate shape and size. Consideration should be given to waves of lesser height, where, due to their period, the effects on structural elements may be greater.

2.3.7 The wave forces utilized in the design analysis should include the effects of immersion, heeling and accelerations due to motion. Theories used for the calculation of wave forces and the selection of coefficients should be to the satisfaction of the Administration.

Current loading

2.3.8 Consideration should be given to the interaction of current and waves. Where necessary, the two should be superimposed by adding the current velocity vectorially to the wave particle velocity. The resultant velocity should be used in calculating the structural loading due to current and waves.

Loading due to vortex shedding

2.3.9 Consideration should be given to loading induced in structural members due to vortex shedding.

Deck loading

2.3.10 A loading plan should be prepared to the satisfaction of the Administration showing the maximum design uniform and concentrated deck loading for each area for each mode of operation.

Other loadings

2.3.11 Other relevant loadings should be determined in a manner to the satisfaction of the Administration.

2.4 Structural analysis

2.4.1 Sufficient loading conditions for all modes of operation should be analysed to enable the critical design cases for all principal structural components to be evaluated. This design analysis should be to the satisfaction of the Administration.

2.4.2 The scantlings should be determined on the basis of criteria which combine, in a rational manner, the individual stress components in each structural element. The allowable stresses should be to the satisfaction of the Administration.

2.4.3 Local stresses, including stresses caused by circumferential loading on tubular members, should be added to primary stresses in evaluating combined stress levels.

2.4.4 The buckling strength of structural members should be evaluated where appropriate.

2.4.5 Where deemed necessary by the Administration, a fatigue analysis based on intended operating areas or environments should be provided.

2.4.6 The effect of notches, local stress concentrations and other stress raisers should be allowed for in the design of primary structural elements.

2.4.7 Where possible, structural joints should not be designed to transmit primary tensile stresses through the thickness of plates integral with the joint. Where such joints are unavoidable, the plate material properties and inspection procedures selected to prevent lamellar tearing should be to the satisfaction of the Administration.

2.5 Special considerations for surface units

2.5.1 The required strength of the unit should be maintained in way of the drilling well, and particular attention should be given to the transition between fore-and-aft members. The plating of the well should also be suitably stiffened to prevent damage when the unit is in transit.

2.5.2 Consideration should be given to the scantlings necessary to maintain strength in way of large hatches.

2.5.3 The structure in way of components of the position mooring system such as fairleads and winches should be designed to withstand the stresses imposed when a mooring line is loaded to its breaking strength.

2.6 Special considerations for self-elevating units

2.6.1 The hull strength should be evaluated in the elevated position for the specified environmental conditions with maximum gravity loads aboard and with the unit supported by all legs. The distribution of these loads in the hull structure should be determined by a method of rational analysis. Scantlings should be calculated on the basis of this analysis, but should not be less than those required for other modes of operation.

2.6.2 The unit should be so designed as to enable the hull to clear the highest design wave including the combined effects of astronomical and storm tides. The minimum clearance may be the lesser of either 1.2 m or 10% of the combined storm tide, astronomical tide and height of the design wave above the mean low water level.

2.6.3 Legs should be designed to withstand the dynamic loads which may be encountered by their unsupported length while being lowered to the bottom, and also to withstand the shock of bottom contact due to wave action on the hull. The maximum design motions, sea state and bottom conditions for operations to raise or lower the hull should be clearly stated in the operating manual.

2.6.4 When evaluating leg stresses with the unit in the elevated position, the maximum overturning moment on the unit due to the most adverse combination of applicable environmental and gravity loadings should be considered.

2.6.5 Legs should be designed for the most severe environmental transit conditions anticipated including wind moments, gravity moments and accelerations resulting from unit motions. The Administration should be provided with calculations, an analysis based on model tests, or a combination of both. Acceptable transit conditions should be included in the operating manual. For some transit conditions, it may be necessary to reinforce or support the legs, or to remove sections to ensure their structural integrity.

2.6.6 Structural members which transmit loads between the legs and the hull should be designed for the maximum loads transmitted and so arranged as to diffuse the loads into the hull structure.

2.6.7 When a mat is utilized to transmit the bottom bearing loads, attention should be given to the attachment of the legs so that the loads are diffused into the mat.

2.6.8 Where tanks in the mat are not open to the sea, the scantlings should be based on a design head using the maximum water depth and tidal effects.

2.6.9 Mats should be designed to withstand the loads encountered during lowering including the shock of bottom contact due to wave action on the hull.

2.6.10 The effect of possible scouring action (loss of bottom support) should be considered. The effect of skirt plates, where provided, should be given special consideration.

2.6.11 Except for those units utilizing a bottom mat, the capability should be provided to pre-load each leg to the maximum applicable combined load after initial positioning at a site. The pre-loading procedures should be included in the operating manual.

2.6.12 Deckhouses located near the side shell of a unit may be required to have scantlings similar to those of an unprotected house front. Other deckhouses should have scantlings suitable for their size, function and location.

2.7 Special considerations for column-stabilized units

2.7.1 Unless deck structures are designed for wave impact, a clearance acceptable to the Administration should be maintained between passing wave crests and the deck structure. The Administration should be provided with model test data, reports on past operating experience with similar configurations or by calculations showing that adequate provision is made to maintain this clearance.

2.7.2 For units designed to be supported by the seabed the clearance in paragraph 2.6.2 should be maintained.

2.7.3 The structural arrangement of the upper hull is to be considered with regard to the structural integrity of the unit after the assumed failure of any primary girder. The Administration may require a structural analysis showing satisfactory protection against overall collapse of the unit after such an assumed failure when exposed to environmental loading corresponding to a one-year return period for the intended area of operation.

2.7.4 The scantlings of the upper structure should not be less than those required for the loading shown in the deck loading plan.

2.7.5 When an approved mode of operation or damage condition in accordance with the provisions governing stability allows the upper structure to become waterborne, special consideration should be given to the resulting structural loading.

2.7.6 The scantlings of columns, lower hulls and footings should be based on the evaluation of hydrostatic pressure loading and combined loading including wave and current considerations.

2.7.7 Where a column, lower hull or footing is a part of the overall structural frame of a unit, consideration should also be given to stresses resulting from deflections due to the applicable combined loading.

2.7.8 Particular consideration should be given to structural arrangements and details in areas subject to high local loading resulting from, for example, external damage, wave impact, partially filled tanks or bottom bearing operations.

2.7.9 When a unit is designed for operations while supported by the seabed, the footings should be designed to withstand the shock of bottom contact due to wave action on the hull. Such units should also be evaluated for the effects of possible scouring action (loss of bottom support). The effect of skirt plates, where provided, should be given special consideration.

2.7.10 The structure in way of components of the position mooring system such as fairleads and winches should be designed to withstand the stresses imposed when a mooring line is loaded to its breaking strength.

2.7.11 Bracing members should be designed to make the structure effective against applicable combined loading and, when the unit is supported by the seabed, against the possibility of uneven bottom bearing loading. Bracing members should also be investigated, where applicable, for combined stresses including local bending stresses due to buoyancy, wave forces and current forces.

2.7.12 The unit's structure should be able to withstand the loss of any slender bracing member without causing overall collapse when exposed to environmental loading corresponding to a one-year return period for the intended area of operation.

2.7.13 Where applicable, consideration should be given to local stresses caused by wave impact.

2.7.14 Where bracings are watertight they should be designed to prevent collapse from hydrostatic pressure. Underwater bracing should be made watertight and have a leak detection system.

2.7.15 Consideration should be given to the need for ring frames to maintain stiffness and shape in tubular bracing members.

2.8 Towing arrangements

2.8.1 The design and arrangement of towing fittings should have regard to both normal and emergency conditions.

2.8.2 Arrangements, equipment and fittings provided in accordance with paragraph 2.8.1 should meet the appropriate requirements of the Administration or an organization recognized by the Administration under paragraph 1.6.5.1.³

2.8.3 Each fitting or item of equipment provided under this regulation should be clearly marked with any restrictions associated with its safe operation, taking into account the strength of its attachment to the unit's structure.

³ Refer to the Guidelines for safe ocean towing (MSC/Circ.884).

2.9 Fatigue analysis

2.9.1 The possibility of fatigue damage due to cyclic loading should be considered in the design of self-elevating and column-stabilized units.

2.9.2 The fatigue analysis should be based on the intended mode and area of operations to be considered in the unit's design.

2.9.3 The fatigue analysis should take into account the intended design life of the unit and the accessibility of load-carrying members for inspection.

2.10 Materials

2.10.1 Units should be constructed from steel or other suitable material having properties acceptable to the Administration taking into consideration the temperature extremes in the areas in which the unit is intended to operate.

2.10.2 Consideration should be given to the minimization of hazardous substances used in the design and construction of the unit, and should facilitate recycling and removal of hazardous materials.⁴

2.10.3 Materials which contain asbestos should be prohibited.

2.11 Anti-fouling systems

If anti-fouling systems are installed, they should conform to the requirements of the International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001.

2.12 Protective coatings of dedicated seawater ballast tanks

2.12.1 All dedicated seawater ballast tanks should be coated during construction in accordance with the recommendations of the Organization.⁵ For the purpose of this section pre-load tanks on self-elevating units are to be considered dedicated seawater ballast tanks. Mat tanks and spud cans on such units are not to be considered dedicated seawater ballast tanks.

2.12.2 Maintenance of the protective coating system should be included in the overall unit's maintenance scheme. The effectiveness of the protective coating system should be verified during the life of a unit by the Administration or an organization recognized by the Administration, based on the guidelines developed by the Organization.⁶

2.13 Construction portfolio

A construction portfolio should be prepared and a copy placed on board the unit. It should include plans showing the location and extent of application of different grades and strengths of materials, together with a description of the materials and welding procedures employed, and any

⁴ Refer to the Guidelines on ship recycling, adopted by the Organization by resolution A.962(23).

⁵ Refer to Performance standard for protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers, adopted by the Maritime Safety Committee by resolution MSC.215(82).

⁶ Refer to the Guidelines for maintenance and repair of protective coatings (MSC.1/Circ.1330).

other relevant construction information. Restrictions or prohibitions regarding repairs or modifications should be included.

2.14 Welding

The welding procedures employed during construction should be to a recognized international standard. Welders should be qualified in the welding processes and procedures utilized. The selection of welds for testing and the methods utilized should meet the requirements of a recognized classification society.

2.15 Testing

Upon completion, boundaries of tanks should be tested to the satisfaction of the Administration.

2.16 Drainage and sediment control⁷

All ballast and preload tanks and related piping systems should be designed to facilitate effective drainage and removal of sediments. Coatings which could entrain sediments and harmful aquatic organisms should be avoided.

⁷ Refer to the Guidelines for the control and management of ships' ballast water to minimize the transfer of harmful aquatic organisms and pathogens, adopted by the Organization by resolution A.868(20).

CHAPTER 3

SUBDIVISION, STABILITY AND FREEBOARD

3.1 Inclining test

3.1.1 An inclining test should be required for the first unit of a design, when the unit is as near to completion as possible, to determine accurately the light ship data (weight and position of centre of gravity).

3.1.2 For successive units which are identical by design, the light ship data of the first unit of the series may be accepted by the Administration in lieu of an inclining test, provided the difference in light ship displacement or position of centre of gravity due to weight changes for minor differences in machinery, outfitting or equipment, confirmed by the results of a lightweight survey, is less than 1% of the values of the light ship displacement and principal horizontal dimensions as determined for the first of the series. Extra care should be given to the detailed weight calculation and comparison with the original unit of a series of column-stabilized, semisubmersible types as these, even though identical by design, are recognized as being unlikely to attain an acceptable similarity of weight or centre of gravity to warrant a waiver of the inclining test.

3.1.3 The results of the inclining test, or those of the lightweight survey together with the inclining test results for the first unit should be indicated in the operating manual.

3.1.4 A record of all changes to machinery, structure, outfitting and equipment that affect the light ship data should be maintained in a light ship data alterations log and be taken into account in daily operations.

3.1.5 For column-stabilized units:

- .1** A lightweight survey or inclining test should be conducted at the first renewal survey. If a lightweight survey is conducted and it indicates a change from the calculated light ship displacement in excess of 1% of the operating displacement, an inclining test should be conducted, or the difference in weight should be placed in an indisputably conservative vertical centre of gravity and approved by the Administration.
- .2** If the survey or test at the first renewal survey demonstrated that the unit was maintaining an effective weight control programme, and at succeeding renewal surveys this is confirmed by the records under paragraph 3.1.4, light ship displacement may be verified in operation by comparison of the calculated and observed draught. Where the difference between the expected displacement and the actual displacement based upon draught readings exceed 1% of the operating displacement, a lightweight survey should be completed in accordance with paragraph 3.1.5.1.

3.1.6 The inclining test or lightweight survey should be carried out in the presence of an officer of the Administration, or a duly authorized person or representative of an approved organization.

3.2 Righting moment and heeling moment curves

3.2.1 Curves of righting moments and of wind heeling moments similar to figure 3-1 with supporting calculations should be prepared covering the full range of operating draughts, including those in transit conditions, taking into account the maximum loading of materials in the most unfavourable position applicable. The righting moment curves and wind heeling moment curves should be related to the most critical axes. Account should be taken of the free surface of liquids in tanks.

3.2.2 Where equipment is of such a nature that it can be lowered and stowed, additional wind heeling moment curves may be necessary and such data should clearly indicate the position of such equipment. Provisions regarding the lowering and effective stowage of such equipment should be included in the operating manual under section 14.1.

3.2.3 The curves of wind heeling moments should be drawn for wind forces calculated by the following formula:

$$F = 0.5C_s C_H \rho V^2 A$$

where:

F = the wind force (newtons)

C_s = the shape coefficient depending on the shape of the structural member exposed to the wind (see table 3-1)

C_H = the height coefficient depending on the height above sea level of the structural member exposed to wind (see table 3-2)

ρ = the air mass density (1.222 kg/m³)

V = the wind velocity (metres per second)

A = the projected area of all exposed surfaces in either the upright or the heeled condition (square metres).

3.2.4 Wind forces should be considered from any direction relative to the unit and the value of the wind velocity should be as follows:

- .1** In general a minimum wind velocity of 36 m/s (70 knots) for offshore service should be used for normal operating conditions and a minimum wind velocity of 51.5 m/s (100 knots) should be used for the severe storm conditions.
- .2** Where a unit is to be limited in operation to sheltered locations (protected inland waters such as lakes, bays, swamps, rivers, etc.) consideration should be given to a reduced wind velocity of not less than 25.8 m/s (50 knots) for normal operating conditions.

3.2.5 In calculating the projected areas to the vertical plane, the area of surfaces exposed to wind due to heel or trim, such as under-deck surfaces, etc., should be included using the appropriate shape factor. Open truss work may be approximated by taking 30% of the projected block area of both the front and back section, i.e. 60% of the projected area of one side.

3.2.6 In calculating the wind heeling moments, the lever of the wind overturning force should be taken vertically from the centre of pressure of all surfaces exposed to the wind to the centre of lateral resistance of the underwater body of the unit. The unit is to be assumed floating free of mooring restraint.

3.2.7 The wind heeling moment curve should be calculated for a sufficient number of heel angles to define the curve. For ship-shaped hulls the curve may be assumed to vary as the cosine function of vessel heel.

3.2.8 Wind heeling moments derived from wind tunnel tests on a representative model of the unit may be considered as alternatives to the method given in paragraphs 3.2.3 to 3.2.7. Such heeling moment determination should include lift and drag effects at various applicable heel angles.

Table 3-1 – Values of the coefficient C_s

Shape	C_s
Spherical	0.4
Cylindrical	0.5
Large flat surface (hull, deckhouse, smooth under-deck areas)	1.0
Drilling derrick	1.25
Wires	1.2
Exposed beams and girders under deck	1.3
Small parts	1.4
Isolated shapes (crane, beam, etc.)	1.5
Clustered deckhouses or similar structures	1.1

Table 3-2 – Values of the coefficient C_H

Height above sea level (metres)	C_H
0 – 15.3	1.00
15.3 – 30.5	1.10
30.5 – 46.0	1.20
46.0 – 61.0	1.30
61.0 – 76.0	1.37
76.0 – 91.5	1.43
91.5 – 106.5	1.48
106.5 – 122.0	1.52
122.0 – 137.0	1.56
137.0 – 152.5	1.60
152.5 – 167.5	1.63
167.5 – 183.0	1.67
183.0 – 198.0	1.70

Height above sea level (metres)	C_H
198.0 – 213.5	1.72
213.5 – 228.5	1.75
228.5 – 244.0	1.77
244.0 – 259.0	1.79
above 259	1.80

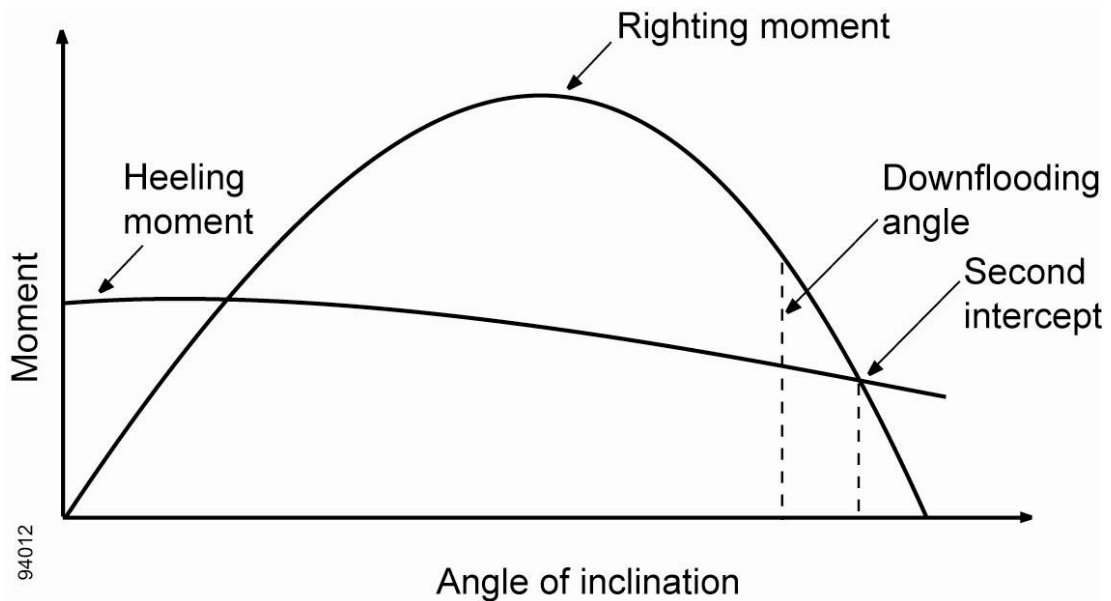


Figure 3-1 – Righting moment and heeling moment curves

3.3 Intact stability criteria

3.3.1 The stability of a unit in each mode of operation should meet the following criteria (see also figure 3-1):

- .1 For surface and self-elevating units the area under the righting moment curve to the second intercept or downflooding angle, whichever is less, should be not less than 40% in excess of the area under the wind heeling moment curve to the same limiting angle.
- .2 For column-stabilized units⁸ the area under the righting moment curve to the angle of downflooding should be not less than 30% in excess of the area under the wind heeling moment curve to the same limiting angle.
- .3 The righting moment curve should be positive over the entire range of angles from upright to the second intercept.

⁸ Refer to An example of alternative intact stability criteria for twin-pontoon column-stabilized semisubmersible units, adopted by the Organization by resolution A.650(16).

3.3.2 Each unit should be capable of attaining a severe storm condition in a period of time consistent with the meteorological conditions. The procedures recommended and the approximate length of time required, considering both operating conditions and transit conditions, should be contained in the operating manual. It should be possible to achieve the severe storm condition without the removal or relocation of solid consumables or other variable load. However, the Administration may permit loading a unit past the point at which solid consumables would have to be removed or relocated to go to severe storm condition under the following conditions, provided the allowable KG is not exceeded:

- .1** in a geographic location where weather conditions annually or seasonally do not become sufficiently severe to require a unit to go to severe storm condition; or
- .2** where a unit is required to support extra deck load for a short period of time that falls well within a period for which the weather forecast is favourable.

The geographic locations, weather conditions and loading conditions in which this is permitted should be identified in the operating manual.

3.3.3 Alternative stability criteria may be considered by the Administration, provided an equivalent level of safety is maintained and if they are demonstrated to afford adequate positive initial stability. In determining the acceptability of such criteria, the Administration should consider at least the following and take into account as appropriate:

- .1** environmental conditions representing realistic winds (including gusts) and waves appropriate for world-wide service in various modes of operation;
- .2** dynamic response of a unit. Analysis should include the results of wind tunnel tests, wave tank model tests, and non-linear simulation, where appropriate. Any wind and wave spectra used should cover sufficient frequency ranges to ensure that critical motion responses are obtained;
- .3** potential for flooding taking into account dynamic responses in a seaway;
- .4** susceptibility to capsizing considering the unit's restoration energy and the static inclination due to the mean wind speed and the maximum dynamic response;
- .5** an adequate safety margin to account for uncertainties.

3.4 Subdivision and damage stability

Surface and self-elevating units

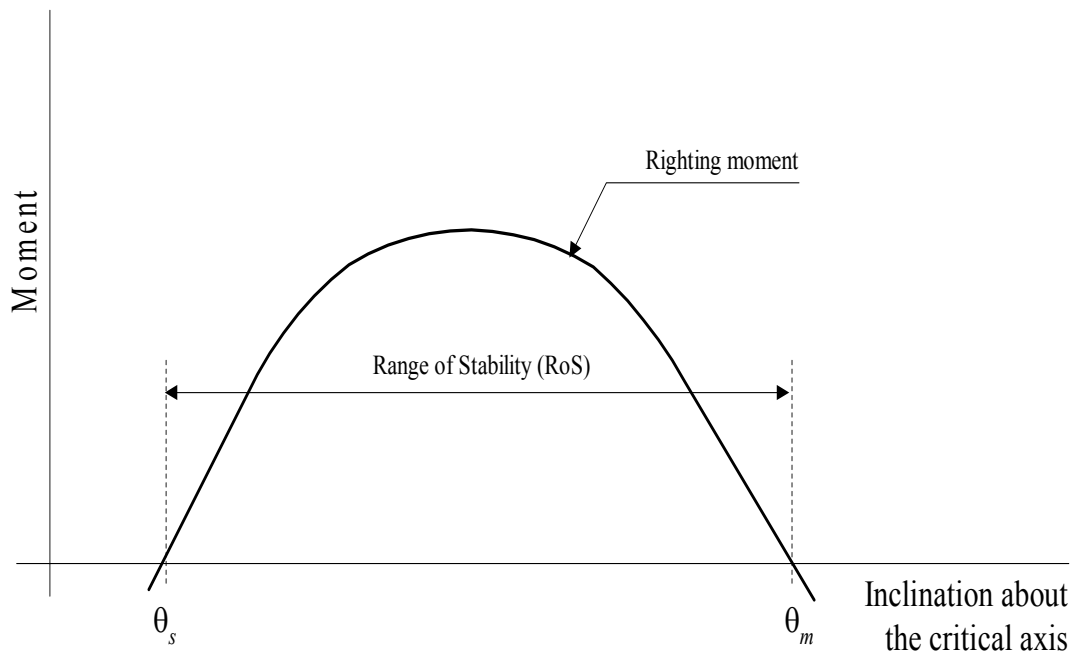


Figure 3-2 – Residual stability for self-elevating units

3.4.1 The unit should have sufficient freeboard and be subdivided by means of watertight decks and bulkheads to provide sufficient buoyancy and stability to withstand:

- .1 in general, the flooding of any one compartment in any operating or transit condition consistent with the damage assumptions set out in section 3.5; and
- .2 for a self-elevating unit, the flooding of any single compartment while meeting the following criterion (see figure 3-2):

$$RoS \geq 7^\circ + (1.5\theta_s)$$

where:

$$RoS \geq 10^\circ$$

$$RoS = \text{range of stability, in degrees} = \theta_m - \theta_s$$

where:

$$\theta_m = \text{maximum angle of positive stability, in degrees}$$

$$\theta_s = \text{static angle of inclination after damage, in degrees}$$

The range of stability is determined without reference to the angle of downflooding.

3.4.2 The unit should have sufficient reserve stability in a damaged condition to withstand the wind heeling moment based on a wind velocity of 25.8 m/s (50 knots) superimposed from any direction. In this condition the final waterline, after flooding, should be below the lower edge of any downflooding opening.

Column-stabilized units

3.4.3 The unit should have sufficient freeboard and be subdivided by means of watertight decks and bulkheads to provide sufficient buoyancy and stability to withstand a wind heeling moment induced by a wind velocity of 25.8 m/s (50 knots) superimposed from any direction in any operating or transit condition, taking the following considerations into account:

- .1 the angle of inclination after the damage set out in paragraph 3.5.10.2 should not be greater than 17°;
- .2 any opening below the final waterline should be made watertight, and openings within 4 m above the final waterline should be made weathertight;
- .3 the righting moment curve, after the damage set out above, should have, from the first intercept to the lesser of the extent of weathertight integrity under paragraph 3.4.3.2 and the second intercept, a range of at least 7°. Within this range, the righting moment curve should reach a value of at least twice the wind heeling moment curve, both being measured at the same angle.⁹ See figure 3-3 below.

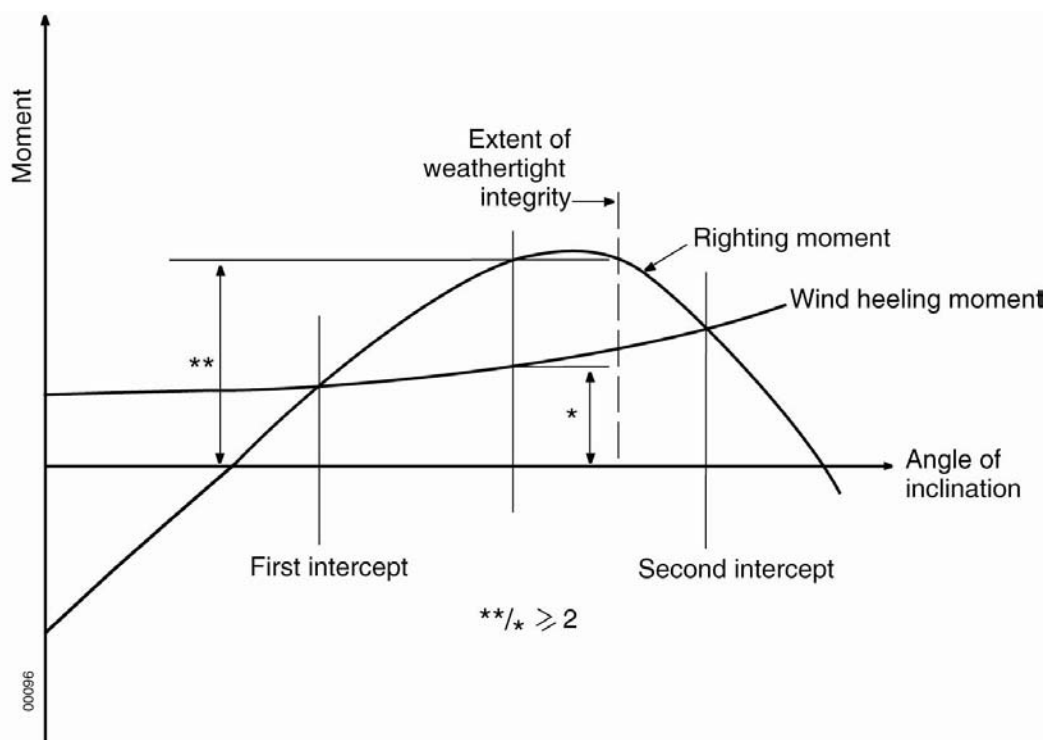


Figure 3-3 – Righting moment and wind heeling moment curves

⁹ Refer to An example of alternative stability criteria for a range of positive stability after damage or flooding for column-stabilized semisubmersible units, adopted by the Organization by resolution A.651(16).

3.4.4 The unit should provide sufficient buoyancy and stability in any operating or transit condition to withstand the flooding of any watertight compartment wholly or partially below the waterline in question, which is a pump-room, a room containing machinery with a salt water cooling system or a compartment adjacent to the sea, taking the following considerations into account:

- .1 the angle of inclination after flooding should not be greater than 25°;
- .2 any opening below the final waterline should be made watertight;
- .3 a range of positive stability¹⁰ should be provided, beyond the calculated angle of inclination in these conditions, of at least 7°.

All types of units

3.4.5 Compliance with the provisions of paragraphs 3.4.1 to 3.4.4 should be determined by calculations which take into consideration the proportions and design characteristics of the unit and the arrangements and configuration of the damaged compartments. In making these calculations, it should be assumed that the unit is in the worst anticipated service condition as regards stability and is floating free of mooring restraints.

3.4.6 The ability to reduce angles of inclination by pumping out or ballasting compartments or application of mooring forces, etc., should not be considered as justifying any relaxation of these provisions.

3.4.7 Alternative subdivision and damage stability criteria may be considered for approval by the Administration provided an equivalent level of safety is maintained. In determining the acceptability of such criteria, the Administration should consider at least the following and take into account:

- .1 extent of damage as set out in section 3.5;
- .2 on column-stabilized units, the flooding of any one compartment as set out in paragraph 3.4.4;
- .3 the provision of an adequate margin against capsizing.

3.5 Extent of damage

Surface units

3.5.1 In assessing the damage stability of surface units, the following extent of damage should be assumed to occur between effective watertight bulkheads:

- .1 horizontal penetration: 1.5 m; and
- .2 vertical extent: from the base line upwards without limit.

¹⁰ Refer to An example of alternative stability criteria for a range of positive stability after damage or flooding for column-stabilized semisubmersible units, adopted by the Organization by resolution A.651(16).

3.5.2 The distance between effective watertight bulkheads or their nearest stepped portions which are positioned within the assumed extent of horizontal penetration should be not less than 3 m; where there is a lesser distance, one or more of the adjacent bulkheads should be disregarded.

3.5.3 Where damage of a lesser extent than in paragraph 3.5.1 results in a more severe condition, such lesser extent should be assumed.

3.5.4 All piping, ventilation systems, trunks, etc., within the extent of damage referred to in paragraph 3.5.1 should be assumed to be damaged. Positive means of closure should be provided at watertight boundaries to preclude the progressive flooding of other spaces which are intended to be intact.

Self-elevating units

3.5.5 In assessing the damage stability of self-elevating units, the following extent of damage should be assumed to occur between effective watertight bulkheads:

- .1** horizontal penetration: 1.5 m; and
- .2** vertical extent: from the base line upwards without limit.

3.5.6 The distance between effective watertight bulkheads or their nearest stepped portions which are positioned within the assumed extent of horizontal penetration should be not less than 3 m; where there is a lesser distance, one or more of the adjacent bulkheads should be disregarded.

3.5.7 Where damage of a lesser extent than in paragraph 3.5.5 results in a more severe condition, such lesser extent should be assumed.

3.5.8 Where a mat is fitted, the above extent of damage should be applied to both the platform and the mat but not simultaneously, unless deemed necessary by the Administration due to their close proximity to each other.

3.5.9 All piping, ventilation systems, trunks, etc., within the extent of damage referred to in paragraph 3.5.5 should be assumed to be damaged. Positive means of closure should be provided at watertight boundaries to preclude the progressive flooding of other spaces which are intended to be intact.

Column-stabilized units

3.5.10 In assessing the damage stability of column-stabilized units, the following extent of damage should be assumed:

- .1** Only those columns, underwater hulls and braces on the periphery of the unit should be assumed to be damaged and the damage should be assumed in the exposed portions of the columns, underwater hulls and braces.
- .2** Columns and braces should be assumed to be flooded by damage having a vertical extent of 3 m occurring at any level between 5 m above and 3 m below the draughts specified in the operating manual. Where a watertight flat is located within this region, the damage should be assumed to have occurred in both

compartments above and below the watertight flat in question. Lesser distances above or below the draughts may be applied to the satisfaction of the Administration, taking into account the actual operating conditions. However, the required damage region should extend at least 1.5 m above and below the draught specified in the operating manual.

- .3 No vertical bulkhead should be assumed to be damaged, except where bulkheads are spaced closer than a distance of one eighth of the column perimeter at the draught under consideration, measured at the periphery, in which case one or more of the bulkheads should be disregarded.
- .4 Horizontal penetration of damage should be assumed to be 1.5 m.
- .5 Underwater hull or footings should be assumed to be damaged when operating in a transit condition in the same manner as indicated in paragraphs 3.5.10.1, 3.5.10.2, 3.5.10.4 and either paragraph 3.5.10.3 or 3.5.6, having regard to their shape.
- .6 All piping, ventilation systems, trunks, etc., within the extent of damage should be assumed to be damaged. Positive means of closure should be provided at watertight boundaries to preclude the progressive flooding of other spaces which are intended to be intact.

3.6 Watertight integrity

3.6.1 The number of openings in watertight subdivisions should be kept to a minimum compatible with the design and safe operation of the unit. Where penetrations of watertight decks and bulkheads are necessary for access, piping, ventilation, electrical cables, etc., arrangements should be made to maintain the watertight integrity of the enclosed compartments.

3.6.2 Where valves are provided at watertight boundaries to maintain watertight integrity, these valves should be capable of being locally operated. Remote operation may be from a pump-room or other normally manned space, a weather deck, or a deck which is above the final waterline after flooding. In the case of a column-stabilized unit this would be the central ballast control station. Valve position indicators should be provided at the remote control station.

3.6.3 Watertight doors should be designed to withstand water pressure to a head up to the bulkhead deck or freeboard deck respectively. A prototype pressure test should be conducted for each type and size of door to be installed on the unit at a test pressure corresponding to at least the head required for the intended location. The prototype test should be carried out before the door is fitted. The installation method and procedure for fitting the door on board should correspond to that of the prototype test. When fitted on board, each door should be checked for proper seating between the bulkhead, the frame and the door. Large doors or hatches of a design and size that would make pressure testing impracticable may be exempted from the prototype pressure test, provided that it is demonstrated by calculations that the doors or hatches maintain watertightness at the design pressure, with a proper margin of resistance. After installation, every such door, hatch or ramp should be tested by means of a hose test or equivalent.

3.6.4 For self-elevating units the ventilation system valves required to maintain watertight integrity should be kept closed when the unit is afloat. Necessary ventilation in this case should be arranged by alternative approved methods.

Internal openings

3.6.5 The means to ensure the watertight integrity of internal openings should comply with the following:

- .1** Doors and hatch covers which are used during the operation of the unit while afloat should be remotely controlled from the central ballast control station and should also be operable locally from each side. Open/shut indicators should be provided at the control station.
- .2** Doors or hatch covers in self-elevating units, or doors placed above the deepest load line draft in column-stabilized and surface units, which are normally closed while the unit is afloat may be of the quick acting type and should be provided with an alarm system (e.g., light signals) showing personnel both locally and at the central ballast control station whether the doors or hatch covers in question are open or closed. A notice should be affixed to each such door or hatch cover stating that it is not to be left open while the unit is afloat.
- .3** Remotely operated doors should meet SOLAS regulation II-1/25-9.2.

3.6.6 The means to ensure the watertight integrity of internal openings which are intended only to provide access for inspection and are kept permanently closed during the operation of the unit, while afloat, should have a notice affixed to each such closing appliance stating that it is to be kept closed while the unit is afloat; however, manholes fitted with close bolted covers need not be so marked.

External openings

3.6.7 All downflooding openings the lower edge of which is submerged when the unit is inclined to the first intercept between the righting moment and wind heeling moment curves in any intact or damaged condition should be fitted with a suitable watertight closing appliance, such as closely spaced bolted covers.

3.6.8 Where flooding of chain lockers or other buoyant volumes may occur, the openings to these spaces should be considered as downflooding points.

3.7 Freeboard

General

3.7.1 The requirements of the 1988 LL Protocol, including those relating to certification, should apply to all units and certificates should be issued as appropriate. The minimum freeboard of units which cannot be computed by the normal methods laid down by that Protocol should be determined on the basis of meeting the applicable intact stability, damage stability and structural requirements for transit conditions and drilling operations while afloat. The freeboard should not be less than that computed from the Protocol where applicable.

3.7.2 The requirements of the 1988 LL Protocol with respect to weathertightness and watertightness of decks, superstructures, deckhouses, doors, hatchway covers, other openings, ventilators, air pipes, scuppers, inlets and discharges, etc., should be taken as a basis for all units in the afloat condition.

3.7.3 In general, heights of hatch and ventilator coamings, air pipes, door sills, etc., in exposed positions and their means of closing should be determined by consideration of the provisions regarding both intact and damage stability.

3.7.4 All downflooding openings which may become submerged before the angle of inclination at which the required area under the intact righting arm curve is achieved should be fitted with weathertight closing appliances.

3.7.5 With regard to damage stability, the provisions of paragraphs 3.4.3.2, 3.4.4 and 3.6.7 should apply.

3.7.6 Administrations should give special consideration to the position of openings which cannot be closed in emergencies, such as air intakes for emergency generators, having regard to the intact righting arm curves and the final waterline after assumed damage.

Surface units

3.7.7 Load lines should be assigned to surface units as calculated under the terms of the 1988 LL Protocol and should be subject to all the conditions of assignment of that Protocol.

3.7.8 Where it is necessary to assign a greater than minimum freeboard to meet the provisions regarding intact or damage stability or on account of any other restriction imposed by the Administration, regulation 6(6) of the 1988 LL Protocol should apply. When such a freeboard is assigned, seasonal marks above the centre of the ring should not be marked and any seasonal marks below the centre of the ring should be marked. If a unit is assigned a greater than minimum freeboard at the request of the owner, regulation 6(6) need not apply.

3.7.9 Where moonpools are arranged within the hull in open communication with the sea, the volume of the moonpool should not be included in the calculation of any hydrostatic properties. If the moonpool has a larger cross-sectional area above the waterline at 85% of the depth for freeboard than below, an addition should be made to the geometric freeboard corresponding to the lost buoyancy. This addition for the excess portion above the waterline at 85% of the depth for freeboard should be made as prescribed below for wells or recesses. If an enclosed superstructure contains part of the moonpool, deduction should be made for the effective length of the superstructure. Where open wells or recesses are arranged in the freeboard deck, a correction equal to the volume of the well or recess to the freeboard deck divided by the waterplane area at 85% of the depth for freeboard should be made to the freeboard obtained after all other corrections, except bow height correction, have been made. Free surface effects of the flooded well or recess should be taken into account in stability calculations.

3.7.10 The procedure described in paragraph 3.7.9 should also apply in cases of small notches or relatively narrow cut-outs at the stern of the unit.

3.7.11 Narrow wing extensions at the stern of the unit should be considered as appendages and excluded for the determination of length (L) and for the calculation of freeboards. The Administration should determine the effect of such wing extensions with regard to the provisions relating to the strength of unit based upon length (L).

Self-elevating units

3.7.12 Load lines should be assigned to self-elevating units as calculated under the terms of the 1988 LL Protocol. When floating, or when in transit from one operational area to another, units should be subject to all the conditions of assignment of that Protocol unless specifically excepted. However, these units should not be subject to the terms of that Protocol while they are supported by the seabed or are in the process of lowering or raising their legs.

3.7.13 The minimum freeboard of units which due to their configuration cannot be computed by the normal methods laid down by the 1988 LL Protocol should be determined on the basis of meeting applicable provisions regarding intact stability, damage stability and structure in the afloat condition.

3.7.14 Where it is necessary to assign a greater than minimum freeboard to meet intact or damage stability provisions or on account of any other restriction imposed by the Administration, regulation 6(6) of the 1988 LL Protocol should apply. When such a freeboard is assigned, seasonal marks above the centre of the ring should not be marked and any seasonal marks below the centre of the ring should be marked. If a unit is assigned a greater than minimum freeboard at the request of the owner, regulation 6(6) need not apply.

3.7.15 Where moonpools are arranged within the hull in open communication with the sea, the volume of the moonpool should not be included in the calculation of any hydrostatic properties. If the moonpool has a larger cross-sectional area above the waterline at 85% of the depth for freeboard than below, an addition should be made to the geometric freeboard corresponding to the lost buoyancy. This addition for the excess portion above the waterline at 85% of the depth for freeboard should be made as prescribed below for wells or recesses. If an enclosed superstructure contains part of the moonpool, deduction should be made for the effective length of the superstructure. Where open wells or recesses are arranged in the freeboard deck, a correction equal to the volume of the well or recess to the freeboard deck divided by the waterplane area at 85% of the depth for freeboard should be made to the freeboard obtained after all other corrections, except bow height correction, have been made. Free surface effects of the flooded well or recess should be taken into account in stability calculations.

3.7.16 The procedure described in paragraph 3.7.15 should apply in cases of small notches or relatively narrow cut-outs at the stern of the unit.

3.7.17 Narrow wing extensions at the stern of the unit should be considered as appendages and excluded for the determination of length (L) and for the calculation of freeboards. The Administration should determine the effect of such wing extensions with regard to the requirements of the 1988 LL Protocol for the strength of unit based upon length (L).

3.7.18 Self-elevating units may be manned when under tow. In such cases a unit would be subject to the bow height and reserve buoyancy requirements which may not always be possible to achieve. In such circumstances, the Administration should consider the extent of application of regulations 39(1), 39(2) and 39(5) of the 1988 LL Protocol, as amended, and give special consideration to such units, having regard to the occasional nature of such voyages on predetermined routes and to prevailing weather conditions.

3.7.19 Some self-elevating units utilize a large mat or similar supporting structure which contributes to the buoyancy when the unit is floating. In such cases the mat or similar supporting structure should be ignored in the calculation of freeboard. The mat or similar supporting structure should, however, always be taken into account in the evaluation of the stability of the unit when floating since its vertical position relative to the upper hull may be critical.

Column-stabilized units

3.7.20 The hull form of this type of unit makes the calculation of geometric freeboard in accordance with the provisions of chapter III of the 1988 LL Protocol impracticable. Therefore the minimum freeboard of each column-stabilized unit should be determined by meeting the applicable provisions for:

- .1** the strength of the unit's structure;
- .2** the minimum clearance between passing wave crests and deck structure (see paragraphs 2.7.1 to 2.7.3); and
- .3** intact and damage stability.

3.7.21 The minimum freeboard should be marked in appropriate locations on the structure.

3.7.22 The enclosed deck structure of each column-stabilized unit should be made weathertight.

3.7.23 Windows, sidescuttles and portlights, including those of the non-opening type, or other similar openings should not be located below the deck structure of column-stabilized units.

3.7.24 Administrations should give special consideration to the position of openings which cannot be closed in emergencies, such as air intakes for emergency generators, having regard to the intact righting arm curves and the final waterline after assumed damage.

CHAPTER 4

MACHINERY INSTALLATIONS FOR ALL TYPES OF UNITS

4.1 General¹¹

4.1.1 The provisions regarding machinery and electrical installations contained in chapters 4 to 8 provide protection for personnel from fire, electric shock or other physical injuries. The provisions apply to both marine and industrial machinery.

4.1.2 Codes and standards of practice which have been proven to be effective by actual application by the offshore drilling industry which are not in conflict with this Code, and which are acceptable to the Administration, may be applied in addition to these provisions.

4.1.3 All machinery, electrical equipment, boilers and other pressure vessels, associated piping systems, fittings and wiring should be of a design and construction adequate for the intended service and should be so installed and protected as to reduce to a minimum any danger to persons on board, due regard being paid to moving parts, hot surfaces and other hazards. The design should have regard to materials used in construction, and to the marine and industrial purposes for which the equipment is intended, the working conditions and the environmental conditions to which it will be subjected. Consideration should be given to the consequences of the failure of systems and equipment essential to the safety of the unit.

4.1.4 All machinery, components and systems essential to the safe operation of a unit should be designed to operate under the following static conditions of inclination:

- .1** column-stabilized units – from upright to an angle of inclination of 15° in any direction;
- .2** self-elevating units – from upright to an angle of inclination of 10° in any direction;
- .3** surface units – from upright and in level trim to an angle of inclination of 15° either way and simultaneously trimmed up to 5° by the bow or stern.

The Administration may permit or require deviations from these angles, taking into consideration the type, size and service conditions of the unit.

4.2 Alternative design and arrangements

When alternative design or arrangements deviate from the prescriptive provisions of the Code, an engineering analysis, evaluation and approval of the design and arrangements should be carried out in accordance with SOLAS regulation II-1/55 based on the guidelines developed by the Organization.¹²

¹¹ Refer to the Guidelines for engine-room layout, design and arrangement (MSC/Circ.834).

¹² Refer to the Guidelines on alternative design and arrangements for SOLAS chapters II-1 and III (MSC.1/Circ.1212).

4.3 Machinery

4.3.1 All boilers, all parts of machinery, all steam, hydraulic, pneumatic and other systems and their associated fittings which are under internal pressure should be subjected to appropriate tests including a pressure test before being put into service for the first time.

4.3.2 Adequate provisions and arrangements should be made to facilitate safe access, cleaning, inspection and maintenance of machinery including boilers and pressure vessels.

4.3.3 Where risk from overspeeding of machinery exists, means should be provided to ensure that the safe speed is not exceeded.

4.3.4 Where machinery including pressure vessels or any parts of such machinery are subject to internal pressure and may be subject to dangerous overpressure, means should, where applicable, be provided which will protect against such excessive pressure.

4.3.5 All gearing, shafts and couplings used for transmission of power to machinery should be designed and constructed so that they will withstand the maximum working stresses to which they may be subjected in all service conditions, taking into account the type of engines by which they are driven or of which they form part.

4.3.6 Internal combustion engines of a cylinder diameter of 200 mm or a crankcase volume of 0.6 m³ and above should be provided with crankcase explosion relief valves of an approved type with sufficient relief area. The relief valves should be arranged or provided with means to ensure that discharge from them is directed so as to minimize the possibility of injury to personnel.

4.3.7 Machinery, where applicable, should be provided with automatic shutoff arrangements or alarms in the case of failures, such as lubricating oil supply failure, which could lead rapidly to complete breakdown, damage or explosion. The Administration may permit provisions for overriding automatic shutoff devices.

4.3.8 Means should be provided whereby normal operation of vital systems, such as ballast systems in semisubmersible units, jacking systems in self-elevating units and blow-out preventers, can be sustained or restored even though one of the essential auxiliaries becomes inoperable.

4.3.9 Means should be provided to ensure that machinery can be brought into operation from the "dead ship" condition without external aid.

4.4 Steam boilers and boiler feed systems

4.4.1 Every steam boiler and every unfired steam generator should be provided with not less than two safety valves of adequate capacity. However, the Administration may, having regard to the output or any other features of any boiler or unfired steam generator, permit only one safety valve to be fitted if it is satisfied that adequate protection against overpressure is provided.

4.4.2 Every oil-fired boiler which is intended to operate without manual supervision should have safety arrangements which shut off the fuel supply and give an alarm at an attended location in the case of low water level, air supply failure or flame failure.

4.4.3 Every steam generating system which could be rendered dangerous by the failure of its feedwater supply should be provided with not less than two separate feedwater systems from and including the feed pumps, noting that a single penetration of the steam drum is acceptable. For those services not essential for the safety of the unit, only one feedwater system is required if automatic shutdown of the steam generating system upon loss of the feedwater supply is provided. Means should be provided which will prevent overpressure in any part of the feedwater system.

4.4.4 Boilers should be provided with means to supervise and control the quality of the feedwater. As far as practicable, means should be provided to preclude the entry of oil or other contaminants which may adversely affect the boiler.

4.4.5 Every boiler essential for the safety of the unit and which is designed to have a water level should be provided with at least two means for indicating its water level, at least one of which should be a direct-reading gauge glass.

4.5 Steam pipe systems

4.5.1 Every steam pipe and every fitting connected thereto through which steam may pass should be so designed, constructed and installed as to withstand the maximum working stresses to which it may be subjected.

4.5.2 Efficient means should be provided for draining every steam pipe where dangerous water hammer action might otherwise occur.

4.5.3 If a steam pipe or fitting may receive steam from any source at a higher pressure than that for which it is designed, a suitable reducing valve, relief valve and pressure gauge should be fitted.

4.6 Machinery controls

4.6.1 Machinery essential for the safety of the unit should be provided with effective means for its operation and control.

4.6.2 Automatic starting, operational and control systems for machinery essential for the safety of the unit should, in general, include provisions for manually overriding the automatic controls. Failure of any part of the automatic and remote control system should not prevent the use of the manual override. Visual indication should be provided to show whether or not the override has been actuated.

4.7 Air pressure systems

4.7.1 In every unit means should be provided to prevent excess pressure in any part of compressed air systems and where water jackets or casings of air compressors and coolers might be subjected to dangerous excess pressure due to leakage into them from air pressure parts. Suitable pressure-relief arrangements should be provided for all systems.

4.7.2 The starting air arrangements for internal combustion engines should be adequately protected against the effects of backfiring and internal explosions in the starting air pipes.

4.7.3 Starting air pipes from the air receivers to internal combustion engines should be entirely separate from the compressor discharge pipe system.

4.7.4 Provision should be made to reduce to a minimum the entry of oil into the starting air pressure systems and to drain these systems.

4.8 Arrangements for oil fuel, lubricating oil and other flammable oils

4.8.1 Arrangements for the storage, distribution and utilization of oil fuel should be such as to ensure the safety of the unit and persons on board.

4.8.2 Arrangements for the storage, distribution and utilization of oil used in pressure lubrication systems should be such as to ensure the safety of the unit and persons on board.

4.8.3 Arrangements for the storage, distribution and utilization of other flammable oils employed under pressure in power transmission systems, control and activating systems and heat transfer systems should be such as to ensure the safety of the unit and persons on board.

4.8.4 In machinery spaces pipes, fittings and valves carrying flammable oils should be of a material approved by the Administration, having regard to the risk of fire.

4.8.5 Location and arrangement of vent pipes for fuel oil service, settling and lubrication oil tanks should be such that, in the event of a broken vent pipe, the risk of ingress of rainwater or seawater is minimized.

4.8.6 Two fuel oil service tanks for each type of fuel used on board necessary for propulsion and vital systems or equivalent arrangements should be provided, each with a capacity of at least eight hours at the maximum continuous rating of the propulsion plant, if any, and normal operating load of the generator plant.

4.8.7 High pressure fuel delivery lines

- .1** All external high pressure fuel delivery lines between the high pressure fuel pumps and fuel injectors should be protected with a jacketed piping system capable of containing fuel from a high pressure line failure. A jacketed pipe incorporates an outer pipe into which the high pressure fuel pipe is placed forming a permanent assembly. The jacketed piping system should include a means for collection of leakages and arrangements should be provided for an alarm to be given of a fuel line failure.
- .2** All surfaces with temperatures above 220°C, which may be impinged as a result of a fuel system failure, should be properly insulated.
- .3** Oil fuel lines should be screened or otherwise suitably protected to avoid, as far as practicable, oil spray or oil leakages onto hot surfaces, into machinery air intakes, or other sources of ignition. The number of joints in such piping systems should be kept to a minimum.

4.9 Bilge pumping arrangements

4.9.1 An efficient bilge pumping system should be provided, capable of pumping from and draining watertight compartments other than spaces permanently appropriated for the carriage of fresh water, water ballast, oil fuel or liquid cargo and for which other efficient means of pumping are provided, under all practical conditions whether the unit is upright or inclined, as specified in paragraph 4.1.4. Additional suctions should be provided in large compartments or compartments of unusual form, as deemed necessary by the Administration. Arrangements should be made whereby water in the compartment may find its way to the suction pipes. Compartments not provided with a bilge suction may be drained to other spaces provided with bilge pumping capability. Means should be provided to detect the presence of water in such compartments which are adjacent to the sea or adjacent to tanks containing liquids and in void compartments through which pipes conveying liquids pass. If the Administration is satisfied that the safety of the unit is not impaired the bilge pumping arrangements and the means to detect the presence of water may be dispensed with in particular compartments.

4.9.2 At least two self-priming power pumps connected to each bilge main should be provided. Sanitary, ballast and general service pumps may be accepted as independent power bilge pumps if fitted with the necessary connections to the bilge pumping system.

4.9.3 All bilge pipes should be of steel or other suitable material having properties acceptable to the Administration. Special consideration should be given to the design of bilge lines passing through ballast tanks taking into account effects of corrosion or other deterioration.

4.9.4 The arrangement of the bilge pumping system should be such as to prevent the possibility of water passing from the sea into dry spaces, or inadvertently from one compartment to another.

4.9.5 All distribution boxes and manually operated valves in connection with the bilge pumping arrangements should be in positions which are accessible under ordinary circumstances. Where such valves are located in normally unmanned spaces below the assigned load line and not provided with high bilge water level alarms, they should be operable from outside the space.

4.9.6 A means to indicate whether a valve is open or closed should be provided at each location from which the valve can be controlled. The indicator should rely on movement of the valve spindle.

4.9.7 Drainage of hazardous areas should be given special consideration having regard to the risk of explosion (see paragraph 6.3.2).

4.9.8 The following additional provisions are applicable to column-stabilized units:

- .1** Chain lockers which, if flooded, could substantially affect the unit's stability should be provided with a remote means to detect flooding and a permanently installed means of dewatering. Remote indication of flooding should be provided at the central ballast control station.
- .2** At least one of the pumps referred to in paragraph 4.9.2 and pump-room bilge suction valves should be capable of both remote and local operation.

- .3 Propulsion rooms and pump-rooms in lower hulls should be provided with two independent systems for high bilge water level detection providing an audible and visual alarm at the central ballast control station.

4.10 Ballast pumping arrangements on column-stabilized units

Ballast pumps and piping

4.10.1 Units should be provided with an efficient pumping system capable of ballasting and deballasting any ballast tank under normal operating and transit conditions. Alternatively, Administrations may permit controlled gravity ballasting.

4.10.2 The ballast system should provide the capability to bring the unit, while in an intact condition, from the maximum normal operating draught to a severe storm draught, or to a greater distance, as may be specified by the Administration, within three hours.

4.10.3 The ballast system should be arranged to provide at least two independent pumps so that the system remains operational in the event of failure of any one such pump. The pumps provided need not be dedicated ballast pumps, but should be readily available for such use at all times.

4.10.4 The ballast system should be capable of operating after the damage specified in paragraph 3.5.10 and have the capability of restoring the unit to a level trim and safe draught condition without taking on additional ballast, with any one pump inoperable. The Administration may permit counter-flooding as an operational procedure. Counter-flooding is not to be considered as a means to improve the suction head available to the ballast pumps when considering the operability of the ballast system after the damage specified in paragraph 3.5.10.

4.10.5 The ballast system should be arranged and operated so as to prevent inadvertent transfer of ballast water from one tank or hull to another, which could result in moment shifts leading to excessive angles of heel or trim.

4.10.6 It should be possible to supply each ballast pump provided to meet paragraph 4.10.3 from the emergency source of power. The arrangements should be such that the system is capable of restoring the unit from an inclination specified in paragraph 4.1.4.1 to a level trim and safe draught condition after loss of any single component in the power supply system.

4.10.7 All ballast pipes should be of steel or other suitable material having properties acceptable to the Administration. Special consideration should be given to the design of ballast lines passing through ballast tanks, taking into account effects of corrosion or other deterioration.

4.10.8 All valves and operating controls should be clearly marked to identify the function they serve. Means should be provided locally to indicate whether a valve is open or closed.

4.10.9 Air pipes should be provided on each ballast tank sufficient in number and cross-sectional area to permit the efficient operation of the ballast pumping system under the conditions referred to in paragraphs 4.10.1 to 4.10.8. In order to allow deballasting of the ballast tanks intended to be used to bring the unit back to normal draught and to ensure no inclination after damage, air pipe openings for these tanks should be above the worst damage waterline specified in chapter 3. Such air pipes should be positioned outside the extent of damage, as defined in chapter 3.

Control and indicating systems

4.10.10 A central ballast control station should be provided. It should be located above the worst damage waterline and in a space not within the assumed extent of damage referred to in chapter 3 and adequately protected from weather. It should be provided with the following control and indicating systems, having appropriate audible and visual alarms, where applicable:

- .1** ballast pump control system;
- .2** ballast pump status-indicating system;
- .3** ballast valve control system;
- .4** ballast valve position-indicating system;
- .5** tank level indicating system;
- .6** draught indicating system;
- .7** heel and trim indicators;
- .8** power availability indicating system (main and emergency);
- .9** ballast system hydraulic/pneumatic pressure-indicating system.

4.10.11 In addition to remote control of the ballast pumps and valves from the central ballast control station, all ballast pumps and valves should be fitted with independent local control operable in the event of remote control failure. The independent local control of each ballast pump and of its associated ballast tank valves should be in the same location.

4.10.12 The control and indicating systems listed in paragraph 4.10.10 should function independently of one another, or have sufficient redundancy, such that a failure in one system does not jeopardize the operation of any of the other systems.

4.10.13 Each power-actuated ballast valve should fail to the closed position upon loss of control power. Upon reactivation of control power, each such valve should remain closed until the ballast control operator assumes control of the reactivated system. The Administration may accept ballast valve arrangements that do not fail to the closed position upon loss of power provided the Administration is satisfied that the safety of the unit is not impaired.

4.10.14 The tank level indicating system under paragraph 4.10.10.5 should provide means to:

- .1** indicate liquid levels in all ballast tanks. A secondary means of determining levels in ballast tanks, which may be a sounding pipe, should be provided. Tank level sensors should not be situated in the tank suction lines;
- .2** indicate liquid levels in other tanks, such as fuel oil, fresh water, drilling water or liquid storage tanks, the filling or emptying of which, in the view of the Administration, could affect the stability of the unit. Tank level sensors should not be situated in the tank suction lines.

4.10.15 The draught indicating system should display the draught as measured at each corner of the unit or at representative positions as required by the Administration.

4.10.16 Enclosures housing ballast system electrical components, the failure of which would cause unsafe operation of the ballast system upon liquid entry into the enclosure, should comply with paragraph 5.6.21.

4.10.17 A means to indicate whether a valve is open or closed should be provided at each location from which the valve can be controlled. The indicators should rely on movement of the valve spindle, or be otherwise arranged with equivalent reliability.

4.10.18 Means should be provided at the central ballast control station to isolate or disconnect the ballast pump control and ballast valve control systems from their sources of electrical, pneumatic or hydraulic power.

Internal communication

4.10.19 A permanently installed means of communication, independent of the unit's main source of electrical power, should be provided between the central ballast control station and spaces that contain ballast pumps or valves, or other spaces that may contain equipment necessary for the operation of the ballast system.

4.11 Protection against flooding

4.11.1 Each seawater inlet and discharge in spaces below the assigned load line should be provided with a valve operable from an accessible position outside the space on:

- .1 all column-stabilized units;
- .2 all other units where the space containing the valve is normally unattended and is not provided with high bilge water level detection.

4.11.2 The control systems and indicators provided in paragraph 3.6.5.1 should be operable in both normal conditions and in the event of main power failure. Where stored energy is provided for this purpose, its capacity should be to the satisfaction of the Administration.

4.11.3 Non-metallic expansion joints in piping systems, if located in a system which penetrates the unit's side and both the penetration and the non-metallic expansion joint are located below the deepest load waterline, should be inspected as part of the dry-dock survey in section 1.6 and replaced as necessary, or at an interval recommended by the manufacturer.

4.12 Anchoring arrangements for surface and column-stabilized units¹³

4.12.1 Anchoring arrangements, where fitted as the sole means for position keeping, should be provided with adequate factors of safety and be designed to maintain the unit on station in all design conditions. The arrangements should be such that a failure of any single component should not cause progressive failure of the remaining anchoring arrangements.

¹³ Refer to the Guidelines on anchoring systems for MODUs (MSC/Circ.737).

4.12.2 The anchors, cables, shackles and other associated connecting equipment should be designed, manufactured and tested in accordance with an internationally recognized standard for offshore mooring equipment. Documentation of testing, where applicable, should be maintained on board the unit. Provisions should be made on board for the recording of changes to and inspection of the equipment.

4.12.3 Anchor cables may be of wire, rope, chain or any combination thereof.

4.12.4 Means should be provided to enable the anchor cable to be released from the unit after loss of main power.

4.12.5 Fairleads and sheaves should be designed to prevent excessive bending and wear of the anchor cable. The attachments to the hull or structure should be such as to adequately withstand the stresses imposed when an anchor cable is loaded to its breaking strength.

4.12.6 Suitable anchor stowage arrangements should be provided to prevent movement of the anchors in a seaway.

4.12.7 Each windlass should be provided with two independent power-operated brakes. Each brake should be capable of holding against a static load in the anchor cable of at least 50% of its breaking strength. Where the Administration so allows, one of the brakes may be replaced by a manually operated brake.

4.12.8 The design of the windlass should provide for adequate dynamic braking capacity to control normal combinations of loads from the anchor, anchor cable and anchor handling vessel during the deployment of the anchors at the maximum design payout speed of the windlass.

4.12.9 On loss of power to the windlasses, the power-operated braking system should be automatically applied and be capable of holding against 50% of the total static braking capacity of the windlass.

4.12.10 Each windlass should be capable of being controlled from a position which provides a good view of the operation.

4.12.11 Means should be provided at the windlass control position to monitor cable tension and windlass power load and to indicate the amount of cable paid out.

4.12.12 A manned control station should be provided with means to indicate and automatically record cable tensions and the wind speed and direction.

4.12.13 Reliable means should be provided to communicate between locations critical to the anchoring operation.

4.12.14 Special consideration should be given to arrangements where the anchoring systems provided are used in conjunction with thrusters to maintain the unit on station.

4.13 Dynamic positioning systems¹⁴

Dynamic positioning systems used as a sole means of position keeping should provide a level of safety equivalent to that provided for anchoring arrangements.¹⁵

4.14 Elevating systems for self-elevating units

Machinery

4.14.1 Jacking mechanisms should be:

- .1** arranged so that a single failure of any component does not cause an uncontrolled descent of the unit;
- .2** designed and constructed for the maximum lowering and lifting loads of the unit as specified in the unit's operation manual in accordance with paragraph 14.1.2.8;
- .3** able to withstand the forces imposed on the unit from the maximum environmental criteria for the unit; and
- .4** constructed such that the elevation of the leg relative to the unit can be safely maintained in case of loss of power (e.g., electric, hydraulic, or pneumatic power).

Control, communication and alarms

4.14.2 The elevating system should be operable from a central jacking control station.

4.14.3 The jacking control station should have the following:

- .1** audible and visual alarms for jacking system overload and out-of-level. Units whose jacking systems are subject to rack phase differential should also have audible and visual alarms for rack phase differential; and
- .2** instrumentation to indicate:
 - .2.1** the inclination of the unit on two horizontal perpendicular axes;
 - .2.2** power consumption or other indicators for lifting or lowering the legs, as applicable; and
 - .2.3** brake release status.

4.14.4 A communication system should be provided between the central jacking control and a location at each leg.

¹⁴ Refer to Guidance for dynamic position system (DP) operator training (MSC.1/Circ.738/Rev.1).

¹⁵ Refer to the Guidelines for vessels with dynamic positioning systems (MSC/Circ.645).

CHAPTER 5

ELECTRICAL INSTALLATIONS FOR ALL TYPES OF UNITS

5.1 General

5.1.1 Electrical installations should be such that:

- .1 all electrical services necessary for maintaining the unit in normal operational and habitable conditions will be assured without recourse to the emergency source of power;
- .2 electrical services essential for safety will be assured in case of failure of the main source of electrical power;
- .3 electromagnetic compatibility of electrical and electronic equipment is assured¹⁶; and
- .4 the safety of personnel and unit from electrical hazards will be assured.

5.1.2 Administrations should take appropriate steps to ensure uniformity in the implementation and application of these provisions in respect of electrical installations.¹⁷

5.2 Alternative design and arrangements

When alternative design or arrangements deviate from the prescriptive provisions of the Code, an engineering analysis, evaluation and approval of the design and arrangements should be carried out in accordance with SOLAS regulation II-1/55 based on the guidelines developed by the Organization.¹⁸

5.3 Main source of electrical power

5.3.1 Every unit should be provided with a main source of electrical power which should include at least two generating sets.

5.3.2 The power of these sets should be such that it is still possible to ensure the functioning of the services referred to in paragraph 5.1.1.1, except for power servicing drilling operations, in the event of any one of these generating sets being stopped.

5.3.3 Where transformers or converters constitute an essential part of the supply system, the system should be so arranged as to ensure the same continuity of the supply as stated in paragraph 5.3.2.

5.3.4 A main electrical lighting system which should provide illumination throughout those parts of the unit normally accessible to and used by personnel should be supplied from the main source of power.

¹⁶ Refer to General requirements for electromagnetic compatibility for all electrical and electronic equipment, adopted by the Organization by resolution A.813(19).

¹⁷ Refer to the recommendations published by the International Electrotechnical Commission.

¹⁸ Refer to the Guidelines on alternative design and arrangements for SOLAS chapters II-1 and III (MSC.1/Circ.1212).

5.3.5 The arrangement of the main lighting system should be such that a fire or other casualty in the space or spaces containing the main source of power, including transformers or converters, if any, will not render the emergency lighting system under section 5.4 inoperative.

5.3.6 The arrangement of the emergency lighting system should be such that a fire or other casualty in the space or spaces containing the emergency source of power, including transformers or converters, if any, will not render the main lighting system required by this section inoperative.

5.3.7 The main source of electrical power should comply with the following:

- .1** Where the electrical power can normally be supplied by one generator, suitable load-shedding arrangements should be provided to ensure the integrity of supplies to services required for propulsion and steering as well as the safety of the unit. In the case of loss of the generator in operation, adequate provision should be made for automatic starting and connecting to the main switchboard of a stand-by generator of sufficient capacity to ensure safe navigation when underway and to ensure the safety of the unit with automatic restarting of the essential auxiliaries including, where necessary, sequential operations. The Administration may dispense with these provisions where the power necessary to ensure the functioning of the service referred to in paragraph 5.1.1.1, except for power servicing drilling operations, is 250 kW or less.
- .2** If the electrical power is normally supplied by more than one generator simultaneously in parallel operation, provision should be made, for instance, by load shedding to ensure that, in case of loss of one of these generating sets, the remaining ones are kept in operation without overload to ensure safe navigation when underway and to ensure the safety of the unit.
- .3** Where the main source of electrical power is necessary for propulsion of the unit, the main busbar should be subdivided into at least two parts which should normally be connected by circuit breakers or other approved means; so far as is practicable, the connection of generating sets and other duplicated equipment should be equally divided between the parts.

5.4 Emergency source of electrical power

5.4.1 Every unit should be provided with a self-contained emergency source of electrical power.

5.4.2 The emergency source of power, the transitional source of emergency power and the emergency switchboard should be located above the worst damage waterline and in a space not within the assumed extent of damage referred to in chapter 3, and be readily accessible. They should not be forward of the collision bulkhead, if any.

5.4.3 The location of the emergency source of power, the transitional source of emergency power and emergency switchboard in relation to the main source of electrical power should be such as to ensure to the satisfaction of the Administration that a fire or other casualty in the space containing the main source of electrical power or in any machinery space of category A will not interfere with the supply or distribution of emergency power. As far as practical, the space containing the emergency source of power, the transitional source of emergency power and the emergency switchboard should not be contiguous to boundaries of machinery spaces of category A or of those spaces containing the main source of electrical power. Where the

emergency source of power, the transitional source of emergency power, and the emergency switchboard are contiguous to the boundaries of machinery spaces of category A or to those spaces containing the main source of electrical power, or to spaces of zone 1 or zone 2, the contiguous boundaries should be in compliance with section 9.2.

5.4.4 Provided that suitable measures are taken for safeguarding independent emergency operation under all circumstances, the emergency switchboard may be used to supply non-emergency circuits, and the emergency generator may be used exceptionally and for short periods to supply non-emergency circuits.

5.4.5 For units where the main source of electrical power is located in two or more spaces which have their own systems, including power distribution and control systems, completely independent of the systems in the other spaces and such that a fire or other casualty in any one of the spaces will not affect the power distribution from the others, or to the services under paragraph 5.4.6, the provisions of paragraph 5.4.1 may be considered satisfied without an additional emergency source of electrical power, provided that the Administration is satisfied that:

- .1** there are at least two generating sets, meeting the provisions of paragraph 5.4.15 and each of sufficient capacity to meet the provisions of paragraph 5.4.6, in each of at least two spaces;
- .2** the arrangements under paragraph 5.4.5.1 in each such space are equivalent to those under paragraphs 5.4.8 and 5.4.11 to 5.4.14 and section 5.5 so that a source of electrical power is available at all times to the services under paragraph 5.4.6;
- .3** the location of each of the spaces referred to in paragraph 5.4.5.1 is in compliance with paragraph 5.4.2 and the boundaries meet the provisions of paragraph 5.4.3 except that contiguous boundaries should consist of an "A-60" bulkhead and a cofferdam, or a steel bulkhead insulated to class "A-60" on both sides.

5.4.6 The power available should be sufficient to supply all those services that are essential for safety in an emergency, due regard being paid to such services as may have to be operated simultaneously. The emergency source of power should be capable, having regard to starting currents and the transitory nature of certain loads, of supplying simultaneously at least the following services for the periods specified hereinafter, if they depend upon an electrical source for their operation:

- .1** For a period of 18 h, emergency lighting:
 - .1.1** at every embarkation station on deck and over sides;
 - .1.2** in all service and accommodation alleyways, stairways and exits, personnel lift cars, and personnel lift trunks;
 - .1.3** in the machinery spaces and main generating stations including their control positions;
 - .1.4** in all control stations and in all machinery control rooms;
 - .1.5** in all spaces from which control of the drilling process is performed and where controls of machinery essential for the performance of this process, or devices for emergency switching-off of the power plant are located;

- .1.6** at the stowage position or positions for fire-fighters' outfits;
 - .1.7** at the sprinkler pump, if any, at the fire pump referred to in paragraph 5.4.6.5, at the emergency bilge pump, if any, and at their starting positions;
 - .1.8** on helidecks, to include perimeter and helideck status lights, wind direction indicator illumination, and related obstruction lights, if any;
- .2** For a period of 18 h, the navigation lights, other lights and sound signals, required by the International Regulations for the Prevention of Collisions at Sea, in force;
- .3** For a period of four days signalling lights and sound signals required for marking of offshore structures;
- .4** For a period of 18 h:
 - .4.1** all internal communication equipment that is required in an emergency;
 - .4.2** fire and gas detection and their alarm systems;
 - .4.3** intermittent operation of the manual fire alarms and all internal signals that are required in an emergency; and
 - .4.4** the capability of closing the blow-out preventer and of disconnecting the unit from the well-head arrangement, if electrically controlled;unless they have an independent supply from an accumulator battery suitably located for use in an emergency and sufficient for the period of 18 h;
- .5** For a period of 18 h, one of the fire pumps, if dependent upon the emergency generator for its source of power;
- .6** For a period of at least 18 h, permanently installed diving equipment, if dependent upon the unit's electrical power;
- .7** On column-stabilized units, for a period of 18 h:
 - .7.1** ballast control and indicating systems under paragraph 4.10.10; and
 - .7.2** any of the ballast pumps under paragraph 4.10.3; only one of the connected pumps need be considered to be in operation at any time;
- .8** For a period of half an hour:
 - .8.1** power to operate the watertight doors as provided under paragraph 3.6.5.1, but not necessarily all of them simultaneously, unless an independent temporary source of stored energy is provided; and
 - .8.2** power to operate the controls and indicators provided under paragraph 3.6.5.1.

5.4.7 The emergency source of power may be either a generator or an accumulator battery.

5.4.8 Where the emergency source of power is a generator it should be:

- .1** driven by a suitable prime mover with an independent supply of fuel, having a flashpoint of not less than 43°C;
- .2** started automatically upon failure of the normal electrical supply unless a transitional source of emergency power in accordance with paragraph 5.4.8.3 is provided; where the emergency generator is automatically started, it should be automatically connected to the emergency switchboard; those services referred to in paragraph 5.4.10 should then be connected automatically to the emergency generator; and unless a second independent means of starting the emergency generator is provided, the single source of stored energy should be protected to preclude its complete depletion by the automatic starting system; and
- .3** provided with a transitional source of emergency power, as specified in paragraph 5.4.10, unless the emergency generator is capable of supplying the services mentioned in paragraph 5.4.10 and of being automatically started and supplying the required load as quickly as is safe and practicable but in not more than 45 s.

5.4.9 Where the emergency source of power is an accumulator battery it should be capable of:

- .1** carrying the emergency load without recharging while maintaining the voltage of the battery throughout the discharge period within plus or minus 12% of its nominal voltage;
- .2** automatically connecting to the emergency switchboard in the event of failure of the main power supply; and
- .3** immediately supplying at least those services specified in paragraph 5.4.10.

5.4.10 The transitional source or sources of emergency power, under paragraph 5.4.8.3, should consist of an accumulator battery suitably located for use in an emergency, which should operate without recharging whilst maintaining the voltage of the battery throughout the discharge period within plus or minus 12% of its nominal voltage, and be of sufficient capacity and so arranged as to supply automatically, in the event of failure of either the main or the emergency source of power, the following services for half an hour at least if they depend upon an electrical source for their operation:

- .1** the lighting under paragraphs 5.4.6.1 and 5.4.6.2. For this transitional phase, the required emergency lighting, in respect of the machinery space and accommodation and service areas, may be provided by permanently fixed, individual accumulator lamps which are automatically charged and operated;
- .2** all essential internal communication equipment under paragraphs 5.4.6.4.1 and 5.4.6.4.2; and
- .3** intermittent operation of the services referred to in paragraphs 5.4.6.4.3 and 5.4.6.4.4,

unless, in the case of paragraphs 5.4.10.2 and 5.4.10.3, they have an independent supply from an accumulator battery suitably located for use in an emergency and sufficient for the period specified.

5.4.11 The emergency switchboard should be installed as near as is practicable to the emergency source of power and, where the emergency source of power is a generator, the emergency switchboard should preferably be located in the same space.

5.4.12 No accumulator battery fitted to meet the provisions for emergency or transitional power supply should be installed in the same space as the emergency switchboard, unless appropriate measures to the satisfaction of the Administration are taken to extract the gases discharged from the said batteries. An indicator should be mounted in a suitable place on the main switchboard or in the machinery control room to indicate when the batteries constituting either the emergency source of power or the transitional source of power, referred to in paragraphs 5.4.9 or 5.4.10, are being discharged.

5.4.13 The emergency switchboard should be supplied in normal operation from the main switchboard by an interconnector feeder which should be adequately protected at the main switchboard against overload and short circuit. The arrangement at the emergency switchboard should be such that the interconnector feeder is disconnected automatically at the emergency switchboard upon failure of the main power supply. Where the system is arranged for feedback operation, the interconnector feeder should also be protected at the emergency switchboard at least against short circuit.

5.4.14 In order to ensure ready availability of emergency supplies, arrangements should be made where necessary to disconnect non-emergency circuits automatically from the emergency switchboard to ensure that power is available automatically to the emergency circuits.

5.4.15 The emergency generator and its prime mover and any emergency accumulator battery should be designed to function at full rated power when upright and when inclined up to the maximum angle of heel in the intact and damaged condition, as determined in accordance with chapter 3. In no case need the equipment be designed to operate when inclined more than:

- .1 25° in any direction on a column-stabilized unit;
- .2 15° in any direction on a self-elevating unit; and
- .3 22.5° about the longitudinal axis and/or when inclined 10° about the transverse axis on a surface unit.

5.4.16 Provision should be made for the periodic testing of the complete emergency system. This should include the testing of transitional sources and automatic starting arrangements.

5.5 Starting arrangements for emergency generators

5.5.1 Emergency generators should be capable of being readily started in their cold condition down to a temperature of 0°C. If this is impracticable, or if lower temperatures are likely to be encountered, consideration should be given to the provision and maintenance of heating arrangements, acceptable to the Administration, so that ready starting will be assured.

5.5.2 Each emergency generator which is arranged to be automatically started should be equipped with starting arrangements acceptable to the Administration with a storage 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 hand (manual) starting can be demonstrated to be effective.

5.5.3 Provision should be made to maintain the stored energy at all times.

5.5.4 Electrical and hydraulic starting systems should be maintained from the emergency switchboard.

5.5.5 Compressed air starting systems may be maintained by the main or auxiliary compressed air receivers, through a suitable non-return valve or by an emergency air compressor energized by the emergency switchboard.

5.5.6 All of these starting, charging and energy storing devices should be located in the emergency generator room; these devices should not be used for any purpose other than the operation of the emergency generator set. This does not preclude the supply to the air receiver of the emergency generator set from the main or auxiliary compressed air system through a non-return valve fitted in the emergency generator room.

5.5.7 When automatic starting is not required by these provisions and where it can be demonstrated as being effective, hand (manual) starting is permissible, such as manual cranking, inertia starters, manual hydraulic accumulators, or powder cartridges.

5.5.8 When hand (manual) starting is not practicable, the provisions in paragraphs 5.5.2 and 5.5.3 to 5.5.6 should be complied with, except that starting may be manually initiated.

5.6 Precautions against shock, fire and other hazards of electrical origin

5.6.1 Exposed metal parts of electrical machines or equipment which are not intended to be live but which are liable under fault conditions to become live should be earthed (grounded) unless the machines or equipment are:

- .1** supplied at a voltage not exceeding 55 V direct current or 55 V, root mean square between conductors; auto-transformers should not be used for the purpose of achieving this voltage; or
- .2** supplied at a voltage not exceeding 250 V by safety isolating transformers supplying only one consuming device; or
- .3** constructed in accordance with the principle of double insulation.

5.6.2 The Administration may require additional precautions for portable electrical equipment for use in confined or exceptionally damp spaces where particular risks due to conductivity may exist.

5.6.3 All electrical apparatus should be so constructed and so installed that it does not cause injury when handled or touched in the normal manner.

5.6.4 Where not obtained through normal construction, arrangements should be provided to effectively earth (ground) all permanently installed machinery, metal structures of derricks, masts and helicopter decks.

5.6.5 Switchboards should be so arranged as to give easy access, where needed, to apparatus and equipment, in order to minimize danger to personnel. The sides and backs and, where necessary, the fronts of switchboards should be suitably guarded. Exposed live parts having voltages to earth (ground) exceeding a voltage to be specified by the Administration should not be installed on the front of such switchboards. There should be non-conducting mats or gratings at the front and rear, where necessary.

5.6.6 Distribution systems with hull return should not be installed, but this does not preclude, under conditions approved by the Administration, the installation of:

- .1** impressed current cathodic protective systems;
- .2** limited and locally earthed systems (e.g., engine starting systems);
- .3** limited and locally earthed welding systems; where the Administration is satisfied that the equipotential of the structure is assured in a satisfactory manner, welding systems with hull return may be installed without this restriction; and
- .4** insulation level monitoring devices provided the circulation current does not exceed 30 mA under the most unfavourable conditions.

5.6.7 When a distribution system, whether primary or secondary, for power, heating or lighting, with no connection to earth is used, a device capable of continuously monitoring the insulation level to earth and of giving an audible or visual indication of abnormally low insulation values should be provided.

5.6.8 Except as permitted by the Administration in exceptional circumstances, all metal sheaths and armour of cables should be electrically continuous and should be earthed (grounded).

5.6.9 All electric cables and wiring external to equipment should be at least of a flame-retardant type and should be so installed as not to impair their original flame-retarding properties.¹⁹ Where necessary for particular applications, the Administration may permit the use of special types of cables such as radio frequency cables, which do not comply with the foregoing.

5.6.10 Cables and wiring serving essential or emergency power, lighting, internal communications or signals should, so far as practicable, be routed clear of galleys, machinery spaces of category A and their casings and other high fire risk areas. Cables connecting fire pumps to the emergency switchboard should be of a fire-resistant type where they pass through high fire risk areas. Where practicable all such cables should be run in such a manner as to preclude their being rendered unserviceable by heating of the bulkheads that may be caused by a fire in an adjacent space.¹⁹

5.6.11 Cables and wiring should be installed and supported in such a manner as to avoid chafing or other damage.

¹⁹ Refer to the recommendations published by the International Electrotechnical Commission concerning flame-retarding properties of bunched cables and characteristics of cables of a fire-resistant type.

5.6.12 Terminations and joints in all conductors should be so made that they retain the original electrical, mechanical, flame-retarding and, where necessary, fire-resisting properties of the cable.

5.6.13 Each separate circuit should be protected against short circuit and against overload, except as permitted in section 7.6, or where the Administration may exceptionally otherwise permit.

5.6.14 The rating or appropriate setting of the overload protection device for each circuit should be permanently indicated at the location of the protection device.

5.6.15 Lighting fittings should be so arranged as to prevent temperature rises which could damage the cables and wiring, and to prevent surrounding material from becoming excessively hot.

5.6.16 Accumulator batteries should be suitably housed, and compartments used primarily for their accommodation should be properly constructed and efficiently ventilated.

5.6.17 Electrical or other equipment which may constitute a source of ignition of flammable vapours should not be permitted in these compartments except as permitted in paragraph 5.6.19.

5.6.18 Accumulator batteries, except for batteries of self-contained battery-operated lights, should not be located in sleeping quarters. Administrations may grant exemptions from or equivalencies to this provision where hermetically sealed batteries are installed.

5.6.19 In paint lockers, acetylene stores, and similar spaces where flammable mixtures are liable to collect as well as any compartment assigned principally to accumulator batteries, no electrical equipment should be installed unless the Administration is satisfied that such equipment is:

- .1 essential for operational purposes;
- .2 of a type which will not ignite the mixture concerned;
- .3 appropriate to the space concerned; and
- .4 appropriately certified for safe usage in the vapours or gases likely to be encountered.

5.6.20 Electrical apparatus and cables should, where practicable, be excluded from any compartment in which explosives are stored. Where lighting is required, the light should come from outside, through the boundaries of the compartment. If electrical equipment cannot be excluded from such a compartment it should be so designed and used as to minimize the risk of fire or explosion.

5.6.21 Where spilling or impingement of liquids could occur upon any electrical control or alarm console, or similar electrical enclosure essential to the safety of the unit, such equipment should have suitable protection against the ingress of liquids.²⁰

²⁰ Refer to IEC 60529 – Degrees of protection provided by enclosures (IP Code). Other arrangements for the enclosures of electrical components may be fitted provided the Administration is satisfied that an equivalent protection is achieved.

5.7 Alarms and internal communication

5.7.1 Alarms and indicators should be installed in accordance with the recommendations of the Organization.²¹

5.7.2 Each unit should be provided with a general alarm system so installed as to be clearly perceptible in all normally accessible parts of the unit, including open decks. Control stations for activating the alarm should be installed to the satisfaction of the Administration. The signals used should be limited to: general emergency, toxic gas (hydrogen sulphide), combustible gas, fire alarm, and abandon unit signals. These signals should be described in the muster list and operations manual.

5.7.3 A public address system should be provided. The system should be clearly audible in all spaces that are normally accessible to personnel during routine operations. It should be possible to make announcements at the following locations (if provided): Emergency response centre, navigation bridge, engine control room, ballast control station, jacking control station, and a location near the drilling console.

5.7.4 The signals given over the general alarm system should be supplemented by instructions over the public address system.

5.7.5 Internal means of communication should be available for transfer of information between all spaces where action may be necessary in case of an emergency.

5.7.6 Audible signals in high noise areas should be supplemented with visual signals. Internal means of communication should be available for transfer of information between all spaces where action may be necessary in case of an emergency.

²¹ Refer to the Code on Alerts and Indicators, 2009, adopted by the Organization by resolution [A...(26)].

CHAPTER 6

MACHINERY AND ELECTRICAL INSTALLATIONS IN HAZARDOUS AREAS FOR ALL TYPES OF UNITS

6.1 Zones²²

Hazardous areas are divided into zones as follows:

- Zone 0: in which ignitable concentrations of flammable gases or vapours are continuously present or present for long periods.
- Zone 1: in which ignitable concentrations of flammable gases or vapours are likely to occur in normal operation.
- Zone 2: in which ignitable concentrations of flammable gases or vapours are not likely to occur, or in which such a mixture, if it does occur, will only exist for a short time.

6.2 Classification of hazardous areas²³

6.2.1 For the purpose of machinery and electrical installations, hazardous areas are classified as in paragraphs 6.2.2 to 6.2.4. Hazardous areas not covered (such as, but not limited to, well test equipment areas, helicopter fuel storage areas, acetylene cylinder storage areas, battery rooms, paint lockers, flammable gas or vapour vents and diverter line outlets) in this section should be classified in accordance with section 6.1.

6.2.2 *Hazardous areas zone 0*

The internal spaces of closed tanks and piping for containing active non-degassed drilling mud, oil that has a closed-cup flashpoint below 60°C or flammable gas and vapour, as well as produced oil and gas in which an oil/gas/air mixture is continuously present or present for long periods.

6.2.3 *Hazardous areas zone 1*

- .1 Enclosed spaces containing any part of the mud circulating system that has an opening into the spaces and is between the well and the final degassing discharge.
- .2 Enclosed spaces or semi-enclosed locations that are below the drill floor and contain a possible source of release such as the top of a drilling nipple.
- .3 Outdoor locations below the drill floor and within a radius of 1.5 m from a possible source of release such as the top of a drilling nipple.

²² Refer to standard IEC 60079-10: 2002 Electrical apparatus for explosive gas atmospheres – Part 10: Classification of hazardous areas.

²³ The identification and extent of hazardous areas in this chapter have been determined taking into account current practice.

- .4 Enclosed spaces that are on the drill floor and which are not separated by a solid floor from the spaces in paragraph 6.2.3.2.
- .5 In outdoor or semi-enclosed locations, except as provided for in paragraph 6.2.3.2, the area within 1.5 m from the boundaries of any openings to equipment which is part of the mud system as specified in paragraph 6.2.3.1, any ventilation outlets of zone 1 spaces, or any access to zone 1 spaces.
- .6 Pits, ducts or similar structures in locations which would otherwise be zone 2 but which are so arranged that dispersion of gas may not occur.

6.2.4 Hazardous areas zone 2

- .1 Enclosed spaces which contain open sections of the mud circulating system from the final degassing discharge to the mud pump suction connection at the mud pit.
- .2 Outdoor locations within the boundaries of the drilling derrick up to a height of 3 m above the drill floor.
- .3 Semi-enclosed locations below and contiguous to the drill floor and to the boundaries of the derrick or to the extent of any enclosure which is liable to trap gases.
- .4 In outdoor locations below the drill floor, within a radius of 1.5 m area beyond the zone 1 area as specified in paragraph 6.2.3.3.
- .5 The areas 1.5 m beyond the zone 1 areas specified in paragraph 6.2.3.5 and beyond the semi-enclosed locations specified in paragraph 6.2.3.2.
- .6 Outdoor areas within 1.5 m of the boundaries of any ventilation outlet from or access to a zone 2 space.
- .7 Semi-enclosed derricks to the extent of their enclosure above the drill floor or to a height of 3 m above the drill floor, whichever is greater.
- .8 Air locks between a zone 1 and a non-hazardous area.

6.3 Openings, access and ventilation conditions affecting the extent of hazardous areas

6.3.1 Except for operational reasons, access doors or other openings should not be provided between a non-hazardous space and a hazardous area or between a zone 2 space and a zone 1 space. Where such access doors or other openings are provided, any enclosed space not referred to under paragraph 6.2.3 or 6.2.4 and having a direct access to any zone 1 location or zone 2 location becomes the same zone as the location except that:

- .1 an enclosed space with direct access to any zone 1 location can be considered as zone 2 if:
 - .1.1 the access is fitted with a self-closing gastight door opening into the zone 2 space,

6.4.4 Where the ventilation duct passes through a hazardous area of a higher level, the ventilation duct should have overpressure in relation to this area; where the ventilation duct passes through a hazardous area of a lower level, the ventilation duct should have underpressure in relation to this area.

6.4.5 Ventilation systems for hazardous spaces should be independent from those for non-hazardous spaces.

6.5 Emergency conditions due to drilling operations

6.5.1 In view of exceptional conditions in which the explosion hazard may extend outside the above-mentioned zones, special arrangements should be provided to facilitate the selective disconnection or shutdown of:

- .1** ventilation systems, except fans necessary for supplying combustion air to prime movers for the production of electrical power;
- .2** main generator prime movers, including the ventilation systems for these;
- .3** emergency generator prime movers.

6.5.2 In the case of units using dynamic positioning systems as a sole means of position keeping, special consideration may be given to the selective disconnection or shutdown of machinery and equipment associated with maintaining the operability of the dynamic positioning system in order to preserve the integrity of the well.

6.5.3 Disconnection or shutdown should be possible from at least two strategic locations, one of which should be outside hazardous areas.

6.5.4 Shutdown systems that are provided to comply with paragraph 6.5.1 should be so designed that the risk of unintentional stoppages caused by malfunction in a shutdown system and the risk of inadvertent operation of a shutdown are minimized.

6.5.5 Equipment which is located in spaces other than enclosed spaces and which is capable of operation after shutdown as given in paragraph 6.5.1 should be suitable for installation in zone 2 locations. Such equipment which is located in enclosed spaces should be suitable for its intended application to the satisfaction of the Administration. At least the following facilities should be operable after an emergency shutdown:

- .1** emergency lighting under paragraphs 5.4.6.1.1 to 5.4.6.1.4 for half an hour;
- .2** blow-out preventer control system;
- .3** general alarm system;
- .4** public address system; and
- .5** battery-supplied radiocommunication installations.

6.6 Electrical installations in hazardous areas

6.6.1 Electrical equipment and wiring installed in hazardous areas should be limited to that necessary for operational purposes. Only the cables and types of equipment described in this chapter may be installed. Selection and installation of equipment and cables in hazardous areas should be in accordance with international standards.²⁴

6.6.2 In selection of electrical apparatus for use in hazardous areas, consideration should be given to:

- .1 the zone in which the apparatus will be used;
- .2 the sensitivity to ignition of the gases or vapours likely to be present, expressed as a gas group; and
- .3 the sensitivity of the gases or vapours likely to be present to ignition by hot surfaces, expressed as a temperature classification.

6.6.3 Electrical apparatus used in hazardous areas should be manufactured, tested, marked and installed in accordance with international standards²⁵ and certified by an independent testing laboratory recognized by the Administration. Equipment classified in accordance with the following protection classes may be used:

²⁴ Refer to the following recommendations published by the International Electrotechnical Commission:

- IEC 61892-1:2001 Mobile and fixed offshore units – Electrical installations – Part 1: General requirements and conditions.
- IEC 61892-2:2005 Mobile and fixed offshore units – Electrical installations – Part 2: System design.
- IEC 61892-3:2007 Mobile and fixed offshore units – Electrical installations – Part 3: Equipment.
- IEC 61892-4:2007 Mobile and fixed offshore units – Electrical installations – Part 4: Cables.
- IEC 61892-5:2000 Mobile and fixed offshore units – Electrical Installations – Part 5: Mobile units.
- IEC 61892-6:2007 Mobile and fixed offshore units – Electrical installations – Part 6: Installation.
- IEC 61892-7:2007 Mobile and fixed offshore units – Electrical installations – Part 7: Hazardous areas.

²⁵ Refer to the following recommendations published by the International Electrotechnical Commission:

- IEC 60079-4: 1975 Electrical apparatus for explosive gas atmospheres – Part 4: Method of test for ignition temperature.
- IEC 60079-4A: 1970 Electrical apparatus for explosive gas atmospheres – Part 4: Method of test for ignition temperature – First supplement.
- IEC 60079-10: 2002 Electrical apparatus for explosive gas atmospheres – Part 10: Classification of hazardous areas.
- IEC/TR 60079-12: 1978 Electrical apparatus for explosive gas atmospheres – Part 12: Classification of mixtures of gases or vapours with air according to their maximum experimental safe gaps and minimum igniting currents.
- IEC/TR 60079-13: 1982-01 Electrical apparatus for explosive gas atmosphere – Part 13: Construction and use of rooms or buildings protected by pressurization.
- IEC 60079-14: 2007-12 Explosive atmospheres – Part 14: Electrical installations design, selection and erection.
- IEC/TR 60079-16: 1990 Electrical apparatus for explosive gas atmospheres – Part 16: Artificial ventilation for the protection of analyser(s) houses.
- IEC 60079-17: 2007 Explosive atmospheres – Part 17: Electrical installations inspection and maintenance.
- IEC 60079-19: 2006-10 Explosive atmospheres – Part 19: Equipment repair, overhaul and reclamation.

(continued on next page)

Table 6-1 – Electrical protection type

Type	Protection method
ia and ib	Intrinsic safety
d	Flameproof enclosures
e	Increased safety
m	Encapsulation
n	Non incendive
o	Oil immersion
p	Pressurized enclosures
q	Powder filling
s	Special ²⁶

6.6.4 Types of electrical equipment permitted should be determined according to the electrical hazardous area classification of the location in which the equipment is to be installed. Permissible equipment is shown by an “x” in table 6-2. The use of type “o” (oil immersion) should be limited. For transportable apparatus, protection type “o” should not be used.

Table 6-2 – Type of electrical apparatus used in hazardous zones

Protection Type	ia	ib	d	e	m	n	o	p	q	s
Zone 0	x									
Zone 1	x	x	x	x	x		x	x	x	
Zone 2	x	x	x	x	x	x	x	x	x	x

(continued from previous page)

IEC/TR 60079-20: 1996 Electrical apparatus for explosive gas atmospheres – Part 20: Data for flammable gases and vapours, relating to the use of electrical apparatus.

IEC 60079-25: 2003 Electrical apparatus for explosive gas atmospheres – Part 25: Intrinsically safe systems.

IEC 60079-27: 2008 Explosive atmospheres – Part 27: Fieldbus intrinsically safe concept (FISCO).

IEC 60079-28: 2006 Explosive atmospheres – Part 28: Protection of equipment and transmission systems using optical radiation.

IEC 60079-29-1: 2007 Explosive atmospheres – Part 29-1: Gas detectors – Performance requirements of detectors for flammable gases.

IEC 60079-29-2: 2007 Explosive atmospheres – Part 29-2: Gas detectors – Selection, installation, use and maintenance of detectors for flammable gases and oxygen.

IEC 60079-30-1: 2007 Explosive atmospheres – Part 30-1: Electrical resistance trace heating – General and testing requirements.

IEC 60079-30-2: 2007 Explosive atmospheres – Part 30-2: Electrical resistance trace heating – Application guide for design, installation and maintenance.

²⁶ Equipment specially approved for use in this zone by an organization recognized by the Administration.

6.6.5 Group selection for electrical equipment should be as follows:

- .1 Group II should be selected for types “e”, “m”, “n”, “o”, “p”, “q” and “s” apparatus.
- .2 Group IIA, IIB or IIC should be selected for types “i”, “d”, and certain types of “n” apparatus according to table 6-3.

Table 6-3 – Relationship between gas/vapour group and permitted equipment group

Gas/vapour group	Electrical equipment group
IIC	IIC
IIB	IIB or IIC
IIA	IIA, IIB or IIC

6.6.6 Electrical apparatus should be so selected that its maximum surface temperature will not reach ignition temperature of any gas/vapour possibly presenting in the hazardous areas in which the electrical apparatus is located. The relationship among equipment temperature class, equipment maximum surface temperature, gas/vapour ignition temperature is shown in table 6-4.

Table 6-4 – Relationship among temperature class, maximum surface temperature and ignition temperature

Electrical apparatus Temperature class	Electrical apparatus maximum surface temperature (°C)	Gas/vapour ignition temperature (°C)
T1	450	>450
T2	300	>300
T3	200	>200
T4	135	>135
T5	100	>100
T6	85	>85

6.6.7 Electrical apparatus located in hazardous drilling well and mud processing areas should meet at least Group IIA and temperature class T3.

6.6.8 Electrical cables should meet the following:

- .1 Only cables associated with type “ia” equipment should be permitted in zone 0 areas.
- .2 Thermoplastic sheathed cables, thermosetting sheathed cables or elastomeric sheathed cables should be used for fixed wiring in zone 2 areas.

- .3 Flexible and portable cables, where necessary, used in zone 1 and zone 2 areas should be to the satisfaction of the Administration.
- .4 Permanently installed, fixed cable passing through zone 1 hazardous areas should be fitted with conductive covering, braiding or sheathed for earth detection.

6.7 Machinery installations in hazardous areas

6.7.1 Mechanical equipment should be limited to that necessary for operational purposes.

6.7.2 Mechanical equipment and machinery in hazardous areas should be so constructed and installed as to reduce the risk of ignition from sparking due to the formation of static electricity or friction between moving parts and from high temperatures of exposed parts due to exhausts or other emissions.

6.7.3 The installation of internal combustion machinery may be permitted in zone 1 and zone 2 hazardous areas, provided that the Administration is satisfied that sufficient precautions have been taken against the risk of dangerous ignition.

6.7.4 The installation of fired equipment may be permitted in zone 2 hazardous areas, provided that the Administration is satisfied that sufficient precaution has been taken against the risk of dangerous ignition.

CHAPTER 7

MACHINERY AND ELECTRICAL INSTALLATIONS FOR SELF-PROPELLED UNITS

7.1 General

7.1.1 The provisions of this chapter apply to units which are designed to undertake self-propelled passages without external assistance and are not applicable to units which are fitted only with means for the purpose of positioning or of assistance in towing operations. These provisions are additional to those in chapters 4, 5 and 6.

7.1.2 Means should be provided whereby normal operation of propulsion machinery can be sustained or restored even though one of the essential auxiliaries becomes inoperative. Special consideration should be given to the malfunction of:

- .1 a generator set which serves as a main source of electrical power;
- .2 the sources of steam supply;
- .3 the arrangements for boiler feedwater;
- .4 the arrangements which supply fuel oil for boilers or engines;
- .5 the sources of lubricating oil pressure;
- .6 the sources of water pressure;
- .7 a condensate pump and the arrangements to maintain vacuum in condensers;
- .8 the mechanical air supply for boilers;
- .9 an air compressor and receiver for starting or control purposes; and
- .10 the hydraulic, pneumatic or electrical means for control in main propulsion machinery including controllable-pitch propellers.

However, the Administration, having regard to overall safety considerations, may accept a partial reduction in capability from full normal operation.

7.1.3 Main propulsion machinery and all auxiliary machinery essential to the propulsion and the safety of the unit should, as fitted in the unit, be capable of operating under the static conditions under paragraph 4.1.4 and the following dynamic conditions:

- .1 column-stabilized units 22.5° in any direction;
- .2 self-elevating units 15° in any direction;
- .3 surface units 22.5° rolling and simultaneously pitching 7.5° by bow or stern.

The Administration may permit deviation from these angles, taking into consideration the type, size and service conditions of the unit.

7.1.4 Special consideration should be given to the design, construction and installation of propulsion machinery systems so that any mode of their vibrations should not cause undue stresses in this machinery in the normal operating ranges.

7.2 Means of going astern

7.2.1 Units should have sufficient power for going astern to secure proper control of the unit in all normal circumstances.

7.2.2 The ability of the machinery to reverse the direction of thrust of the propeller in sufficient time and so to bring the unit to rest within a reasonable distance from maximum ahead service speed should be demonstrated.

7.2.3 The stopping times, unit headings and distances recorded on trials, together with the results of trials to determine the ability of units having multiple propellers to navigate and manoeuvre with one or more propellers inoperative, should be available on board for the use of the master or other designated personnel.²⁷

7.2.4 Where the unit is provided with supplementary means for manoeuvring or stopping, these should be demonstrated and recorded as referred to in paragraphs 7.2.2 and 7.2.3.

7.3 Steam boilers and boiler feed systems

7.3.1 Water tube boilers serving turbine propulsion machinery should be fitted with a high-water-level alarm.

7.3.2 Every steam generating system which provides services essential for the propulsion of the unit should be provided with not less than two separate feedwater systems from and including the feed pumps, noting that a single penetration of the steam drum is acceptable. Means should be provided which will prevent overpressure in any part of the systems.

7.4 Machinery controls

7.4.1 Main and auxiliary machinery essential for the propulsion of the unit should be provided with effective means for its operation and control. All control systems essential for the propulsion, control and safety of the unit should be independent or designed such that failure of one system does not degrade the performance of another system. A pitch indicator should be provided on the navigating bridge for controllable-pitch propellers.

7.4.2 Where remote control of propulsion machinery from the navigating bridge is provided and the machinery spaces are intended to be manned, the following should apply:

- .1** the speed, direction of thrust and, if applicable, the pitch of the propeller should be fully controllable from the navigating bridge under all sailing conditions, including manoeuvring;

²⁷ Refer to the Recommendation on the provision and display of manoeuvring information on board ships, adopted by the Organization by resolution A.601(15).

- .2 the remote control should be performed, for each independent propeller, by a control device so designed and constructed that its operation does not require particular attention to the operational details of the machinery. Where more than one propeller is designed to operate simultaneously, these propellers may be controlled by one control device;
- .3 the main propulsion machinery should be provided with an emergency stopping device on the navigating bridge and independent from the bridge control system;
- .4 propulsion machinery orders from the navigating bridge should be indicated in the main machinery control station or at the manoeuvring platform as appropriate;
- .5 remote control of the propulsion machinery should be possible from only one station at a time; at one control station interconnected control units are permitted. There should be at each station an indicator showing which station is in control of the propulsion machinery. The transfer of control between navigating bridge and machinery spaces should be possible only in the machinery space or machinery control room;
- .6 it should be possible to control the propulsion machinery locally, even in the case of failure in any part of the remote control system;
- .7 the design of the remote control system should be such that in case of its failure an alarm will be given and the preset speed and direction of thrust be maintained until local control is in operation, unless the Administration considers it impracticable;
- .8 indicators should be fitted on the navigating bridge for:
 - .8.1 propeller speed and direction in case of fixed-pitch propellers;
 - .8.2 propeller speed and pitch position in case of controllable-pitch propellers;
- .9 an alarm should be provided at the navigating bridge and in the machinery space to indicate low starting air pressure set at a level which still permits main engine starting operations. If the remote control system of the propulsion machinery is designed for automatic starting, the number of automatic consecutive attempts which fail to produce a start should be limited to safeguard sufficient starting air pressure for starting locally; and
- .10 automation systems should be designed in a manner which ensures a threshold warning of impending or imminent slowdown or shutdown of the propulsion system is given to the officer in charge of the navigational watch in time to assess navigational circumstances in an emergency. In particular, the systems should control, monitor, report, alert and take safety action to slow down or stop propulsion while providing the officer in charge of the navigational watch an opportunity to manually intervene, except for those cases where manual intervention will result in total failure of the engine and/or propulsion equipment within a short time, for example in the case of overspeed.

7.4.3 Where the main propulsion and associated machinery including sources of main electrical supply are provided with various degrees of automatic or remote control and are under continuous manned supervision from a control room, this control room should be designed, equipped and installed so that the machinery operation will be as safe and effective as if it were under direct supervision; for this purpose sections 8.3 to 8.6 should apply as appropriate. Particular consideration should be given to protection against fire and flooding.

7.5 Steering

7.5.1 Except as provided in paragraph 7.5.18, units should be provided with a main steering gear and an auxiliary steering gear to the satisfaction of the Administration. The main steering gear and the auxiliary steering gear should be so arranged that a single failure in one of them so far as is reasonable and practicable will not render the other one inoperative.

7.5.2 The main steering gear should be of adequate strength and sufficient to steer the unit at maximum service speed and this should be demonstrated. The main steering gear and rudder stock should be so designed that they will not be damaged at maximum astern speed but this design requirement need not be proved by trials at maximum astern speed and maximum rudder angle.

7.5.3 The main steering gear should, with the unit at its deepest seagoing draught, be capable of putting the rudder over from 35° on one side to 35° on the other side with the unit running ahead at maximum service speed. The rudder should be capable of being put over from 35° on either side to 30° on the other side in not more than 28 s, under the same conditions.

7.5.4 The main steering gear should be operated by power where necessary to fulfil the provisions of paragraph 7.5.3 and in any case in which the Administration would require a rudder stock of over 120 mm diameter in way of the tiller.

7.5.5 The main steering gear power unit or units should be arranged to start automatically when power is restored after a power failure.

7.5.6 The auxiliary steering gear should be of adequate strength and sufficient to steer the unit at navigable speed and capable of being brought speedily into action in an emergency.

7.5.7 The auxiliary steering gear should be capable of putting the rudder over from 15° on one side to 15° on the other side in not more than 60 s with the unit at its deepest seagoing draught while running at one half of its maximum speed ahead or seven knots, whichever is the greater.

7.5.8 The auxiliary steering gear should be operated by power where necessary to fulfil the provisions of paragraph 7.5.7, and in any case in which the Administration would require a rudder stock of over 230 mm diameter in way of the tiller.

7.5.9 Where the main steering gear comprises two or more identical power units an auxiliary steering gear need not be fitted if the main steering gear is capable of operating the rudder in accordance with the provisions of paragraph 7.5.3 while operating with all power units. As far as is reasonable and practicable the main steering gear should be so arranged that a single failure in its piping or in one of the power units will not impair the integrity of the remaining part of the steering gear.

7.5.10 Control of the main steering gear should be provided both on the navigating bridge and in the steering gear compartment. If the steering gear control system which provides for control from the navigating bridge is electric, it should be supplied from the steering gear power circuit from a point within the steering gear compartment.

7.5.11 When the main steering gear is arranged according to paragraph 7.5.9 two independent control systems should be provided, each of which can be operated from the navigating bridge. Where the control system comprises a hydraulic telemeter, the Administration may waive the provisions for a second independent control system.

7.5.12 Where the auxiliary steering gear is power operated, it should be provided with a control system operated from the navigating bridge and this should be independent of the control system for the main steering gear.

7.5.13 Means should be provided in the steering gear compartment to disconnect the steering gear control system from the power circuit.

7.5.14 A means of communication should be provided between the navigating bridge and:

- .1 the steering gear compartment; and
- .2 the emergency steering position, if provided.

7.5.15 The exact angular position of the rudder, if power operated, should be indicated on the navigating bridge. The rudder angle indication should be independent of the steering gear control system.

7.5.16 The angular position of the rudder should be recognizable in the steering gear compartment.

7.5.17 An alternative power supply, sufficient at least to supply a steering gear power unit which complies with the provisions of paragraph 7.5.7 and also its associated control system and the rudder angle indicator, should be provided, automatically, within 45 s, either from the emergency source of electrical power or from another independent source of power located in the steering gear compartment. This independent source of power should be used only for this purpose and should have a capacity sufficient for 10 min of continuous operation.

7.5.18 Where a non-conventional rudder is installed, or where a unit is steered by means other than a rudder, the Administration should give special consideration to the steering system so as to ensure that an acceptable degree of reliability and effectiveness, which is based on paragraph 7.5.1, is provided.

7.6 Electric and electrohydraulic steering gear

7.6.1 Indicators for running indication of the motors of electric and electrohydraulic steering gear should be installed on the navigating bridge and at a suitable machinery control position.

7.6.2 Each electric or electrohydraulic steering gear comprising one or more power units should be served by at least two circuits fed from the main switchboard. One of the circuits may pass through the emergency switchboard. An auxiliary electric or electrohydraulic steering gear associated with a main electric or electrohydraulic steering gear may be connected to one of the

circuits supplying this main steering gear. The circuits supplying an electric or electrohydraulic steering gear should have adequate rating for supplying all motors which can be simultaneously connected to it and have to operate simultaneously.

7.6.3 Short-circuit protection and an overload alarm should be provided for these circuits and motors. Protection against excess current, if provided, should be for not less than twice the full load current of the motor or circuit so protected, and should be arranged to permit the passage of the appropriate starting currents. Where a three-phase supply is used, an alarm should be provided that will indicate failure of any one of the supply phases. The alarms required in the subparagraph should be both audible and visual and be situated in a position on the navigating bridge where they can be readily observed.

7.7 Communication between the navigating bridge and the engine-room

Units should be provided with at least two independent means for communicating orders from the navigating bridge to the position in the machinery space or control room from which the engines are normally controlled, one of which should provide visual indication of the orders and responses both in the engine-room and on the navigating bridge. Consideration should be given to providing a means of communication to any other positions from which the engines may be controlled.

7.8 Engineers' alarm

An engineers' alarm should be provided to be operated from the engine control room or at the manoeuvring platform, as appropriate, and clearly audible in the engineers' accommodation.

7.9 Main source of electrical power

7.9.1 In addition to complying with section 5.3, the main source of electrical power should comply with the following:

- .1** The arrangement of the unit's main source of power should be such that the services referred to in paragraph 5.1.1.1 can be maintained regardless of the speed and direction of the main propelling engines or shafting.
- .2** The generating plant should be such as to ensure that with any one generator or its primary source of power out of operation, the remaining generator or generators will be capable of providing the electrical services necessary to start the main propulsion plant from a dead ship condition. The emergency generator may be used for the purpose of starting from a dead ship condition if its capability either alone or combined with that of any generator is sufficient to provide at the same time those services required by paragraphs 5.4.6.1 to 5.4.6.4.
- .3** For electrically self-propelled units the application of paragraph 5.3.2 need only include for propulsion sufficient power to ensure safe navigation when underway.
- .4** Where electrical power is necessary to restore propulsion, the capacity should be sufficient to restore propulsion to the unit in conjunction with other machinery, as appropriate, from a dead ship condition within 30 min after blackout.

7.9.2 The main switchboard should be so placed relative to one main generating station that, as far as is practicable, the integrity of the normal supply may be affected only by a fire or other casualty in one space. An environmental enclosure for the main switchboard, such as may be provided by a machinery control room situated within the main boundaries of the space, is not to be considered as separating the switchboards from the generators.

7.9.3 In every unit where the total installed electrical power of the main generators is in excess of 3 MW, the main busbars should be subdivided into at least two parts which should normally be connected by removable links or other approved means; so far as is practicable, the connection of generators and any other duplicated equipment should be equally divided between the parts. Equivalent alternative arrangements should be permitted.

7.10 Emergency source of electrical power

In addition to complying with section 5.4, the emergency source of power should provide:

- .1** For a period of 18 hours, emergency lighting at the steering gear;
- .2** For a period of 18 hours:
 - .2.1** navigational aids as required by SOLAS chapter V;
 - .2.2** intermittent operation of the daylight signalling lamp and the unit's whistle;unless they have an independent supply from an accumulator battery suitably located for use in an emergency and sufficient for the period of 18 hours;
- .3** For the period of 30 min or a lesser period as permitted by SOLAS regulation II-1/29.14, the steering gear.

CHAPTER 8

PERIODICALLY UNATTENDED MACHINERY SPACES FOR ALL TYPES OF UNITS

8.1 General

The provisions of this chapter are additional to those of chapters 4 to 7 and 9 and apply to periodically unattended machinery spaces specified herein. The arrangements should ensure that the safety of the unit in the marine mode, including manoeuvring, and in machinery spaces of category A during drilling operations, where applicable, is equivalent to that of a unit having manned machinery spaces.

8.2 Application

8.2.1 The provisions of sections 8.3 to 8.9 apply to units which are designed to undertake self-propelled passages without external assistance.

8.2.2 Units other than those designed for unassisted passages, having periodically unattended spaces in which machinery associated with the marine mode is located, should comply with the applicable parts of sections 8.3, 8.4, 8.7, 8.8 and 8.9.

8.2.3 Where in any unit machinery spaces of category A for drilling purposes are intended to be periodically unattended the application of sections 8.3 and 8.9 to machinery spaces of category A should be considered by the Administration, due consideration being given to the characteristics of the machinery concerned and to the supervision envisaged to ensure safety.

8.2.4 Measures should be taken to the satisfaction of the Administration to ensure that the equipment of every unit is functioning in a reliable manner and that satisfactory arrangements are made for regular inspections and routine tests to ensure continuous reliable operation.

8.2.5 Every unit should be provided with documentary evidence, to the satisfaction of the Administration, of its fitness to operate with periodically unattended machinery spaces.

8.3 Fire protection

Fire prevention

8.3.1 Where necessary, oil fuel and lubricating oil pipes should be screened or otherwise suitably protected to avoid, as far as practicable, oil spray or oil leakages on to hot surfaces or into machinery air intakes. The number of joints in such piping systems should be kept to a minimum and, where practicable, leakages from high-pressure oil fuel pipes should be collected and arrangements provided for an alarm to be given.

8.3.2 Where daily service oil fuel tanks are filled automatically, or by remote control, means should be provided to prevent overflow spillages. Other equipment which treats flammable liquids automatically, e.g., oil fuel purifiers, which, whenever practicable, should be installed in a special space reserved for purifiers and their heaters, should have arrangements to prevent overflow spillages.

8.3.3 Where daily service oil fuel tanks or settling tanks are fitted with heating arrangements, a high-temperature alarm should be provided if the flashpoint of the oil fuel can be exceeded.

Fire detection

8.3.4 An approved fire detection system based on the self-monitoring principle and including facilities for periodical testing should be installed in periodically unattended machinery spaces.

8.3.5 The fire detection system should comply with the following.

- .1** This fire detection system should be so designed and the detectors so positioned as to detect rapidly the onset of fire in any part of those spaces and under any normal conditions of operation of the machinery and variations of ventilation as required by the possible range of ambient temperatures. Except in spaces of restricted height and where their use is specially appropriate, detection systems using only thermal detectors should not be permitted. The detection system should initiate audible and visual alarms distinct in both respects from the alarms of any other system not indicating fire, in sufficient places to ensure that the alarms are heard and observed at the locations determined in accordance with paragraph 8.7.1.
- .2** After installation the system should be tested under varying conditions of engine operation and ventilation.
- .3** The fire detection system, where electrically supplied, should be fed automatically from an emergency source of power by a separate feeder if the main source of power fails.

8.3.6 Means should be provided in case of fire:

- .1** in boiler air supply casings and exhausts (uptakes); and
- .2** in scavenging air belts of propulsion machinery,

to detect fires and give alarms at an early stage, unless the Administration considers this to be unnecessary in a particular case.

8.3.7 Internal combustion engines of 2,250 kW and above or having cylinders of more than 300 mm bore should be provided with crankcase oil mist detectors or engine bearing temperature monitors or equivalent devices.

Fire fighting

8.3.8 An approved fixed fire-extinguishing system should be provided in units that are not required to have this provision by section 9.8.

8.3.9 Provision should be made for immediate water delivery from the fire main system at a suitable pressure, due regard being paid to the possibility of freezing, either:

- .1** by remote starting arrangements for one of the main fire pumps. The starting positions should be provided at strategic locations including the navigating bridge, if any, and a normally manned control station; or

- .2 by permanent pressurization of the fire main system, either
 - .2.1 by one of the main fire pumps; or
 - .2.2 by a dedicated pump for the purpose with automatic starting of one of the main fire pumps on reduction of the pressure.

8.3.10 The Administration should give special consideration to maintaining the fire integrity of the machinery spaces, to the location and centralization of the fire-extinguishing system controls and to the required shutdown arrangements (e.g., ventilation, fuel pumps, etc.); it may require additional fire-extinguishing appliances and other fire-fighting equipment and breathing apparatus.

8.4 Protection against flooding

Bilge-water level detection

8.4.1 High bilge-water level in periodically unattended machinery spaces below the assigned load line should activate an audible and visual alarm at the locations determined in accordance with paragraph 8.7.1.

8.4.2 Bilge wells should be provided, where practicable, in periodically unattended machinery spaces and should be large enough to accommodate easily the normal drainage during unattended periods. They should be located and monitored in such a way that the accumulation of liquids is detected at pre-set levels, at normal angles of inclination.

8.4.3 Where the bilge pumps are capable of being started automatically, means should be provided to indicate at the locations determined in accordance with paragraph 8.7.1 when the influx of liquid is greater than the pump capacity or when the pump is operating more frequently than would normally be expected. In these cases, smaller bilge wells to cover a reasonable period of time may be permitted. Where automatically controlled bilge pumps are provided, special attention should be given to oil pollution prevention requirements.

8.5 Bridge control of propulsion machinery

8.5.1 In the marine mode, including manoeuvring, the speed, direction of thrust and, if applicable, the pitch of the propeller should be fully controllable from the navigating bridge.

8.5.2 Such remote control should be performed by a single control device for each independent propeller, with automatic performance of all associated services, including, where necessary, means of preventing overload of the propulsion machinery. However, where more than one propeller is designed to operate simultaneously, these propellers may be controlled by a single control device.

8.5.3 The main propulsion machinery should be provided with an emergency stopping device on the navigating bridge which should be independent of the navigating bridge control system referred to in paragraph 8.5.2.

8.5.4 Propulsion machinery orders from the navigating bridge should be indicated in the main machinery control station or at the propulsion machinery control position, as appropriate.

8.5.5 Remote control of the propulsion machinery should be possible only from one location at a time; at such locations interconnected control positions are permitted. At each location there should be an indicator showing which location is in control of the propulsion machinery. The transfer of control between the navigating bridge and machinery spaces should be possible only in the main machinery space or in the main machinery control station. The system should include means to prevent the propelling thrust from altering significantly when transferring control from one location to another.

8.5.6 It should be possible for all machinery essential for propulsion and manoeuvring to be controlled from a local position, even in the case of failure in any part of the automatic or remote control systems.

8.5.7 The design of the remote automatic control system should be such that in case of its failure an alarm will be given on the navigating bridge and at the main machinery control station. Unless the Administration considers it impracticable, the pre-set speed and direction of thrust of the propeller should be maintained until local control is in operation.

8.5.8 Indicators should be fitted on the navigating bridge for:

- .1 propeller speed and direction of rotation in the case of fixed-pitch propellers; or
- .2 propeller speed and pitch position in the case of controllable-pitch propellers.

8.5.9 The number of consecutive automatic attempts which fail to produce a start should be limited to safeguard sufficient starting air pressure. An alarm should be provided to indicate low starting air pressure, set at a level which still permits starting operations of the propulsion machinery.

8.6 Communication

A reliable means of vocal communication should be provided between the main machinery control station or the propulsion machinery control position as appropriate, the navigating bridge, the engineer officers' accommodation and, on column-stabilized units, the central ballast control station.

8.7 Alarm system

8.7.1 An alarm system should be provided in the main machinery control station giving audible and visual indication of any fault requiring attention. It should also:

- .1 activate an audible and visual alarm at another normally manned control station;
- .2 activate the engineers' alarm provided in accordance with section 7.8, or an equivalent alarm acceptable to the Administration, if an alarm function has not received attention locally within a limited time;
- .3 as far as is practicable be designed on the fail-to-safety principle; and
- .4 when in the marine mode, activate an audible and visual alarm on the navigating bridge for any situation which requires action by the officer on watch or which should be brought to the attention of the officer on watch.

8.7.2 The alarm system should be continuously powered and should have an automatic change-over to a stand-by power supply in case of loss of normal power supply.

8.7.3 Failure of the normal power supply of the alarm system should be alarmed.

8.7.4 The alarm system should be able to indicate at the same time more than one fault and the acceptance of any alarm should not inhibit another alarm.

8.7.5 Acceptance at the position mentioned in paragraph 8.7.1 of any alarm condition should be indicated at the positions where it has been shown. Alarms should be maintained until they are accepted and the visual indications should remain until the fault has been corrected, when the alarm system should automatically reset to the normal operating condition.

8.8 Special provisions for machinery, boiler and electrical installations

8.8.1 The special provisions for the machinery, boiler and electrical installations should be to the satisfaction of the Administration and should include at least the requirements of this section.

Change-over function

8.8.2 Where stand-by machines are required for other auxiliary machinery essential to propulsion, automatic change-over devices should be provided. An alarm should be given on automatic change-over.

Automatic control and alarm systems

8.8.3 The control systems should be such that the services needed for the operation of the main propulsion machinery and its auxiliaries are ensured through the necessary automatic arrangements.

8.8.4 Means should be provided to keep the starting air pressure at the required level where internal combustion engines are used for main propulsion.

8.8.5 An alarm system complying with section 8.7 should be provided for all important pressures, temperatures and fluid levels and other essential parameters.

8.9 Safety systems

A safety system should be provided to ensure that serious malfunction in machinery or boiler operations, which presents an immediate danger, should initiate the automatic shutdown of that part of the plant and that an alarm should be given at the locations determined in accordance with paragraph 8.7.1. Shutdown of the propulsion system should not be automatically activated except in cases which could lead to serious damage, complete breakdown, or explosion. Where arrangements for overriding the shutdown of the main propelling machinery are fitted, these should be such as to preclude inadvertent operation. Visual means should be provided to indicate when the override has been activated.

CHAPTER 9

FIRE SAFETY

9.1 Alternative design and arrangements

When fire safety design or arrangements deviate from the prescriptive provisions of the Code, engineering analysis, evaluation and approval of the alternative design and arrangements should be carried out in accordance with SOLAS regulation II-2/17.

9.2 Structural fire protection

9.2.1 These provisions have been formulated principally for units having their hull superstructure, structural bulkheads, decks and deckhouses constructed of steel.

9.2.2 Units constructed of other materials may be accepted, provided that, in the opinion of the Administration, they provide an equivalent standard of safety.

9.2.3 Structural fire protection details, materials and methods of construction should be in accordance with the FTP Code, as applicable, and SOLAS regulations II-2/5.3 and II-2/6, as applied to cargo ships.

Fire integrity of bulkheads and decks

9.2.4 In addition to complying with the specific provisions for fire integrity of bulkheads and decks in this section and in section 9.3, the minimum fire integrity of bulkheads and decks should be as prescribed in tables 9-1 and 9-2. Exterior boundaries of superstructures and deckhouses enclosing accommodation, including any overhanging decks which support such accommodation, should be constructed to “A-60” standard for the whole of the portion which faces and is within 30 m of the centre of the rotary table. For units that have a movable substructure the 30 m should be measured with the substructure at its closest drilling position to the accommodation. The Administration may accept equivalent arrangements.

9.2.5 The following provisions should govern application of the tables:

- .1** Tables 9-1 and 9-2 should apply respectively to the bulkheads and decks separating adjacent spaces.
- .2** For determining the appropriate fire integrity standards to be applied to divisions between adjacent spaces, such spaces are classified according to their fire risk, as shown in categories (1) to (11) below. The title of each category is intended to be typical rather than restrictive. The number in parenthesis preceding each category refers to the applicable column or row in the tables:
 - (1) *Control stations* are spaces as defined in section 1.3.
 - (2) *Corridors* means corridors and lobbies.
 - (3) *Accommodation spaces* are spaces as defined in section 1.3, excluding corridors, lavatories and pantries containing no cooking appliances.

Table 9-1 – Fire integrity of bulkheads separating adjacent spaces

Spaces	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Control stations (1)	A-0 ^(d)	A-0	A-60	A-0	A-15	A-60	A-15	A-60 ^(e)	A-60	*	A-0
Corridors (2)		C	B-0	B-0 A-0 ^(b)	B-0	A-60	A-0	A-0 ^(e)	A-0	*	B-0
Accommodation spaces (3)			C	B-0 A-0 ^(b)	B-0	A-60	A-0	A-0 ^(e)	A-0	*	C
Stairways (4)				B-0 A-0 ^(b)	B-0 A-0 ^(b)	A-60	A-0	A-0 ^(e)	A-0	*	B-0 A-0 ^(b)
Service spaces (low risk) (5)					C	A-60	A-0	A-0	A-0	*	B-0
Machinery spaces of category A (6)						* ^(a)	A-0 ^(a)	A-60	A-60	*	A-0
Other machinery spaces (7)							A-0 ^{(a)(c)}	A-0	A-0	*	A-0
Hazardous areas (8)									A-0	–	A-0
Service spaces (high risk) (9)									A-0 ^(c)	*	A-0
Open decks (10)										–	*
Sanitary and similar spaces (11)											C

See notes under table 9-2.

Table 9-2 – Fire integrity of decks separating adjacent spaces

Space below ↓	Space above →	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Control stations	(1)	A-0	A-0	A-0	A-0	A-0	A-60	A-0	A-0 ^(e)	A-0	*	A-0
Corridors	(2)	A-0	*	*	A-0	*	A-60	A-0	A-0 ^(e)	A-0	*	*
Accommodation spaces	(3)	A-60	A-0	*	A-0	*	A-60	A-0	A-0 ^(e)	A-0	*	*
Stairways	(4)	A-0	A-0	A-0	*	A-0	A-60	A-0	A-0 ^(e)	A-0	*	A-0
Service spaces (low risk)	(5)	A-15	A-0	A-0	A-0	*	A-60	A-0	A-0	A-0	*	A-0
Machinery spaces of category A	(6)	A-60	A-60	A-60	A-60	A-60	* ^(a)	A-60	A-60	A-60	*	A-0
Other machinery spaces	(7)	A-15	A-0	A-0	A-0	A-0	A-0 ^(a)	* ^(a)	A-0	A-0	*	A-0
Hazardous areas	(8)	A-60 ^(e)	A-0 ^(e)	A-0 ^(e)	A-0 ^(e)	A-0	A-60	A-0	–	A-0	*	A-0
Service spaces (high risk)	(9)	A-60	A-0	A-0	A-0	A-0	A-60	A-0	A-0	A-0 ^(c)	*	A-0
Open decks	(10)	*	*	*	*	*	*	*	–	*	–	*
Sanitary and similar spaces	(11)	A-0	A-0	*	A-0	*	A-0	A-0	A-0	A-0	*	*

Notes: to be applied to tables 9-1 and 9-2, as appropriate.

- (a) Where the space contains an emergency power source or components of an emergency power source adjoining a space containing a ship's service generator or the components of a ship's service generator, the boundary bulkhead or deck between those spaces should be an "A-60" class division.
- (b) For clarification as to which note applies see paragraphs 9.3.3 and 9.3.5.
- (c) Where spaces are of the same numerical category and superscript "c" appears, a bulkhead or deck of the rating shown in the tables is only required when the adjacent spaces are for a different purpose, e.g., in category (9). A galley next to a galley does not require a bulkhead but a galley next to a paint room requires an "A-0" bulkhead.
- (d) Bulkheads separating the navigating bridge, chartroom and radio room from each other may be "B-0" rating.
- (e) An engineering evaluation should be conducted in accordance with paragraph 9.3.1. In no case should the bulkhead or deck rating be less than the value indicated in the tables.

Where an asterisk appears in the tables, the division should be of steel or equivalent material, but need not be of "A" class standard. However, where a deck is penetrated for the passage of electric cables, pipes and vent ducts, such penetrations should be made tight to prevent the passage of flame and smoke.

- (4) *Stairways* are interior stairways, lifts and escalators (other than those wholly contained within the machinery spaces) and enclosures thereto. In this connection a stairway which is enclosed only at one level should be regarded as part of the space from which it is not separated by a fire door.
- (5) *Service spaces (low risk)* are lockers, store-rooms and working spaces in which flammable materials are not stored, drying rooms and laundries.
- (6) *Machinery spaces of category A* are spaces as defined in section 1.3.
- (7) *Other machinery spaces* are spaces as defined in section 1.3 other than machinery spaces of category A.
- (8) *Hazardous areas* are areas as defined in section 1.3.
- (9) *Service spaces (high risk)* are lockers, store-rooms and working spaces in which flammable materials are stored, galleys, pantries containing cooking appliances, paint rooms and workshops other than those forming part of the machinery space.
- (10) *Open decks* are open deck spaces, excluding hazardous areas.
- (11) *Sanitary and similar spaces* are communal sanitary facilities such as showers, baths, lavatories, etc., and isolated pantries containing no cooking appliances. Sanitary facilities which serve a space and with access only from that space should be considered a portion of the space in which they are located.

9.2.6 Continuous “B” class ceilings or linings in association with the relevant decks or bulkheads may be accepted as contributing wholly or in part to the required insulation and integrity of a division.

9.2.7 In approving structural fire protection details, the Administration should consider the risk of heat transmission at intersections and terminal points of required thermal barriers. The insulation of a deck or bulkhead should be carried past the penetration, intersection or terminal point for a distance of at least 450 mm in the case of steel and aluminium structures. If a space is divided with a deck or a bulkhead of “A” class standard having insulation of different values, the insulation with the higher value should continue on the deck or bulkhead with the insulation of the lesser value for a distance of at least 450 mm.

9.2.8 Windows and sidescuttles, with the exception of navigating bridge windows, should be of the non-opening type. Navigating bridge windows may be of the opening type provided the design of such windows permits rapid closure. The Administration may permit windows and sidescuttles outside hazardous areas to be of the opening type.

9.2.9 The fire resistance of doors should, as far as practicable, be equivalent to that of the division in which they are fitted. External doors in superstructures and deckhouses should be constructed to at least “A-0” class standard and be self-closing, where practicable.

9.2.10 Self-closing doors in fire rated bulkheads should not be fitted with hold-back hooks. However, hold-back arrangements incorporating remote release fittings of the fail-safe type may be utilized.

9.3 Protection of accommodation spaces, service spaces and control stations

9.3.1 In general, accommodation spaces, service spaces and control stations should not be located adjacent to hazardous areas. However, where this is not practicable, an engineering evaluation should be performed to ensure that the level of fire protection and blast resistance of the bulkheads and decks separating these spaces from the hazardous areas are adequate for the likely hazard.

9.3.2 All bulkheads that are to be "A" class divisions should extend from deck to deck and to the deckhouse side or other boundaries.

9.3.3 All bulkheads forming "B" class divisions should extend from deck to deck and to the deckhouse side or other boundaries, unless continuous "B" class ceilings or linings are fitted on both sides of the bulkhead, in which case the bulkhead may terminate at the continuous ceiling or lining. In corridor bulkheads, ventilation openings may be permitted only in and under the doors of cabins, public spaces, offices and sanitary spaces. The openings should be provided only in the lower half of the door. Where such an opening is in or under a door, the total net area of any such opening or openings should not exceed 0.05 m². When such an opening is cut in a door it should be fitted with a grille made of non-combustible material. Such openings should not be provided in a door in a division forming a stairway enclosure.

9.3.4 Stairs should be constructed of steel or equivalent material.

9.3.5 Stairways which penetrate only a single deck should be protected at least at one level by "A" or "B" class divisions and self-closing doors so as to limit the rapid spread of fire from one deck to another. Personnel lift trunks should be protected by "A" class divisions. Stairways and lift trunks which penetrate more than a single deck should be surrounded by "A" class divisions and protected by self-closing doors at all levels.

9.3.6 Air spaces enclosed behind ceilings, panellings or linings should be divided by close fitting draught stops spaced not more than 14 m apart. In the vertical direction, such enclosed air spaces, including those behind linings of stairways, trunks, etc., should be closed at each deck.

9.3.7 Except for insulation in refrigerated compartments, insulation material, pipe and vent duct lagging, ceilings, linings and bulkheads should be of non-combustible material. Insulation of pipe fittings for cold service systems and vapour barriers and adhesives used in conjunction with insulation need not be non-combustible but they should be kept to a minimum and their exposed surfaces should have low-flame spread characteristics²⁸. In spaces where penetration of oil products is possible, the surfaces of the insulation should be impervious to oil or oil vapours.

9.3.8 The framing, including grounds and the joint pieces of bulkheads, linings, ceilings and draught stops, should be of non-combustible material.

²⁸ Refer to Recommendation on improved fire test procedures for surface flammability of bulkhead, ceiling and deck finish materials, adopted by the Organization by resolution A.653(16), in conjunction with Guidelines on the evaluation of fire hazard properties of materials, adopted by the Organization by resolution A.166(ES.IV) and Annex 1, Part 1 of the International Code for Application of Fire Test Procedures (FTP Code).

9.3.9 All exposed surfaces in corridors and stairway enclosures and surfaces in concealed or inaccessible spaces in accommodation and service spaces and control stations should have low-flame spread characteristics. Exposed surfaces of ceilings in accommodation and service spaces and control stations should have low-flame spread characteristics.

9.3.10 Bulkheads, linings and ceilings may have combustible veneers provided that the thickness of such veneers should not exceed 2.5 mm within any space other than corridors, stairway enclosures and control stations where the thickness should not exceed 1.5 mm. Combustible materials used on these surfaces should have a calorific value²⁹ not exceeding 45 MJ/m² of the area for the thickness used.

9.3.11 Primary deck coverings, if applied within accommodation and service spaces and control stations, should be of approved material which will not readily ignite, this being determined in accordance with the FTP Code.

9.3.12 Paints, varnishes and other finishes used on exposed interior surfaces should not be capable of producing excessive quantities of smoke and toxic products, this being determined in accordance with the FTP Code.

9.3.13 Ventilation ducts should be of non-combustible material. Short ducts, however, not generally exceeding 2 m in length and with a cross-sectional area not exceeding 0.02 m² need not be non-combustible, subject to the following conditions:

- .1 these ducts should be of a material which, in the opinion of the Administration, has a low fire risk;
- .2 they may only be used at the end of the ventilation device;
- .3 they should not be situated less than 600 mm, measured along the duct, from where it penetrates any "A" or "B" class division including continuous "B" class ceilings.

9.3.14 Where a thin plated duct with a free cross-sectional area equal to, or less than, 0.02 m² passes through "A" class bulkhead or decks, the opening should be lined with a steel sheet sleeve having a thickness of at least 3 mm and a length of at least 200 mm, divided preferably into 100 mm on each side of the bulkhead or, in the case of the deck, wholly laid on the lower side of the deck pierced. Where ventilation ducts with a cross-sectional area exceeding 0.02 m² pass through class "A" bulkheads or decks, the opening should be lined with a steel sheet sleeve unless the ducts passing through the bulkheads or decks are of steel in the vicinity of penetrations through the deck or bulkhead; the ducts and sleeves at such places should comply with the following:

- .1 The ducts or sleeves should have a thickness of at least 3 mm and a length of at least 900 mm. When passing through bulkheads, this length should be divided preferably into 450 mm on each side of the bulkhead. These ducts, or sleeves lining such ducts, should be provided with fire insulation. The insulation should

²⁹ Refer to the recommendations published by the International Organization for Standardization, in particular publication ISO 1716:2002, Reaction to fire tests for building products – Determination of the heat of combustion.

have at least the same fire integrity as the bulkhead or deck through which the duct passes. Equivalent penetration protection may be provided to the satisfaction of the Administration.

- .2 Ducts with a cross-sectional area exceeding 0.075 m^2 , except those serving hazardous areas, should be fitted with fire dampers in addition to meeting the provisions of paragraph 9.3.14.1. The fire damper should operate automatically but should also be capable of being closed manually from both sides of the bulkhead or deck. The damper should be provided with an indicator which shows whether the damper is open or closed. Fire dampers are not required, however, where ducts pass through spaces surrounded by "A" class divisions, without serving those spaces, provided those ducts have the same fire integrity as the divisions which they pierce. The Administration may, given special considerations, permit operation from one side of a division only.

9.3.15 In general, ventilation systems for machinery spaces of category A, galleys and hazardous areas should be separated from each other and from the ventilation systems serving other spaces. Ducts serving hazardous areas should not pass through accommodation spaces, service spaces, or control spaces. Ducts provided for the ventilation of machinery spaces of category A and galleys should not pass through accommodation spaces, control stations or service spaces unless:

- .1 the ducts are constructed of steel having a thickness of at least 3 mm and 5 mm for ducts the widths or diameters of which are up to and including 300 mm and 760 mm and over respectively and, in the case of such ducts, the widths or diameters of which are between 300 mm and 760 mm, having a thickness obtained by interpolation;
 - .2 the ducts are suitably supported and stiffened;
 - .3 the ducts are fitted with automatic fire dampers close to the boundaries penetrated; and
 - .4 the ducts are insulated to "A-60" class standard from the machinery spaces or galleys to a point at least 5 m beyond each fire damper;
- or
- .5 the ducts are constructed of steel in accordance with paragraphs 9.3.15.1.1 and 9.3.15.1.2; and
 - .6 the ducts are insulated to "A-60" class standard throughout the accommodation spaces, service spaces or control stations.

9.3.16 Ducts provided for the ventilation of accommodation spaces, service spaces or control stations should not pass through machinery spaces of category A, galleys or hazardous areas. However, the Administration may permit a relaxation from these provisions, except for the ducts passing through hazardous areas, provided that:

- .1 the ducts where they pass through a machinery space of category A or a galley are constructed of steel in accordance with paragraphs 9.3.15.1.1 and 9.3.15.1.2;

- .2 automatic fire dampers are fitted close to the boundaries penetrated; and
 - .3 the integrity of the machinery space or galley boundaries is maintained at the penetrations;
- or
- .4 the ducts where they pass through a machinery space of category A or a galley are constructed of steel in accordance with paragraphs 9.3.15.1.1 and 9.3.15.1.2; and
 - .5 are insulated to “A-60” standard within the machinery space or galley.

9.3.17 Ventilation ducts with a cross-sectional area exceeding 0.02 m² passing through “B” class bulkheads should be lined with steel sheet sleeves of 900 mm in length divided preferably into 450 mm on each side of the bulkhead unless the duct is of steel for this length.

9.3.18 Where they pass through accommodation spaces or spaces containing combustible materials, the exhaust ducts from galley ranges should be of equivalent fire integrity to “A” class divisions.

9.3.19 Each galley exhaust duct should be fitted with:

- .1 a grease trap readily removable for cleaning;
- .2 a fire damper located in the galley end of the duct which is automatically and remotely operated and, in addition a remotely operated fire damper located in the exhaust end of the duct;
- .3 arrangements, operable from within the galley, for shutting off the exhaust fans; and
- .4 fixed means for extinguishing a fire within the duct.

9.3.20 The main inlets and outlets of all ventilation systems should be capable of being closed from outside the spaces being ventilated.

9.3.21 Power ventilation of accommodation spaces, service spaces, control stations, machinery spaces and hazardous areas should be capable of being stopped from an easily accessible position outside the space being served. The accessibility of this position in the event of a fire in the spaces served should be specially considered. The means provided for stopping the power ventilation serving machinery spaces or hazardous areas should be entirely separate from the means provided for stopping ventilation of other spaces.

9.3.22 Windows and sidescuttles in boundaries which are required to meet an “A-60” standard which face the drill floor area should be:

- .1 constructed to an “A-60” standard; or
- .2 protected by a water curtain; or
- .3 fitted with shutters of steel or equivalent material.

9.3.23 The ventilation of the accommodation spaces and control stations should be arranged in such a way as to prevent the ingress of flammable, toxic or noxious gases or smoke from surrounding areas.

9.4 Means of escape

9.4.1 Within the accommodation spaces, service spaces and control stations the following provisions should be applied:

- .1** In every general area which is likely to be regularly manned or in which personnel are accommodated at least two separate escape routes should be provided, situated as far apart as practicable, to allow ready means of escape to the open decks and embarkation stations. Exceptionally, the Administration may permit only one means of escape, due regard being paid to the nature and location of spaces and to the number of persons who might normally be accommodated or employed there.
- .2** Stairways should normally be used for means of vertical escape; however, a vertical ladder may be used for one of the means of escape when the installation of a stairway is shown to be impracticable.
- .3** Every escape route should be readily accessible and unobstructed and all exit doors along the route should be readily operable. Dead-end corridors exceeding 7 m in length should not be permitted.
- .4** In addition to the emergency lighting, the means of escape in accommodation areas, including stairways and exits, should be marked by lighting or photoluminescent strip indicators placed not more than 300 mm above the deck at all points of the escape route, including angles and intersections. The marking should enable personnel to identify the routes of escape and readily identify the escape exits. If electric illumination is used, it should be supplied by the emergency source of power and it should be so arranged that the failure of any single light or cut in a lighting strip will not result in the marking being ineffective. Additionally, escape route signs and fire equipment location markings should be of photoluminescent material or marked by lighting. The Administration should ensure that such lighting or photoluminescent equipment has been evaluated, tested and applied in accordance with the FSS Code.

9.4.2 Two means of escape should be provided from each machinery space of category A. Ladders should be of steel or other equivalent material. In particular, one of the following provisions should be complied with:

- .1** two sets of ladders, as widely separated as possible, leading to doors in the upper part of the space, similarly separated and from which access is provided to the open deck. One of these ladders should be located within a protected enclosure that satisfies tables 9-1 and 9-2, category (4), from the lower part of the space it serves to a safe position outside the space. Self-closing fire doors of the same fire integrity standards should be fitted in the enclosure. The ladder should be fixed in such a way that heat is not transferred into the enclosure through non-insulated fixing points. The enclosure should have minimum internal dimensions of at least 800 mm by 800 mm, and should have emergency lighting provisions; or

- .2 one ladder leading to a door in the upper part of the space from which access is provided to the open deck. Additionally, in the lower part of the space, in a position well separated from the ladder referred to, a steel door capable of being operated from each side should be provided with access to a safe escape route from the lower part of the space to the open deck.

9.4.3 From machinery spaces other than those of category A, escape routes should be provided to the satisfaction of the Administration having regard to the nature and location of the space and whether persons are normally employed there.

9.4.4 Lifts should not be considered as forming one of the required means of escape.

9.4.5 Consideration should be given by the Administration to the siting of superstructures and deckhouses such that in the event of fire at the drill floor at least one escape route to the embarkation position and survival craft is protected against radiation effects of that fire as far as practicable.

9.4.6 Stairways and corridors used as a means of escape should meet the provisions of paragraph 13.3 of the FSS Code.

9.5 Fire safety systems

Fire safety systems should be in accordance with the FSS Code, as applicable.

9.6 Emergency escape breathing devices

9.6.1 Emergency escape breathing devices (EEBDs) should comply with the FSS Code. Spare emergency escape breathing devices should be kept on board to the satisfaction of the Administration.

9.6.2 Emergency escape breathing devices should be provided as follows:

- .1 In machinery spaces of category A containing internal combustion machinery used for main propulsion, EEBDs should be positioned as follows:
 - .1.1 one (1) EEBD in the engine control room, if located within the machinery space;
 - .1.2 one (1) EEBD in workshop areas. If there is, however, a direct access to an escape way from the workshop, an EEBD is not required; and
 - .1.3 one (1) EEBD on each deck or platform level near the escape ladder constituting the second means of escape from the machinery space (the other means being an enclosed escape trunk or watertight door at the lower level of the space).
 - .1.4 Alternatively, a different number or location may be determined by the Administration taking into consideration the layout and dimensions or the normal manning of the space.

- .2 For machinery spaces of category A other than those containing internal combustion machinery used for main propulsion, one (1) EEBD should, as a minimum, be provided on each deck or platform level near the escape ladder constituting the second means of escape from the space (the other means being an enclosed escape trunk or watertight door at the lower level of the space).
- .3 For other machinery spaces, the number and location of EEBDs are to be determined by the Administration.

9.7 Fire pumps, fire mains, hydrants and hoses

9.7.1 At least two independently driven power pumps should be provided, each arranged to draw directly from the sea and discharge into a fixed fire main. However, in units with high suction lifts, booster pumps and storage tanks may be installed, provided such arrangements will satisfy all the provisions of paragraphs 9.7.1 to 9.7.9.

9.7.2 At least one of the required pumps should be dedicated for fire-fighting duties and be available for such duties at all times.

9.7.3 The arrangements of the pumps, sea suction and sources of power should be such as to ensure that a fire in any one space would not put both the required pumps out of action.

9.7.4 The capacity of the required pumps should be appropriate to the fire-fighting services supplied from the fire main. Where more pumps than required are installed, their capacity should be to the satisfaction of the Administration.

9.7.5 Each pump should be capable of delivering at least one jet simultaneously from each of any two fire hydrants, hoses and 19 mm nozzles while maintaining a minimum pressure of 0.35 N/mm^2 at any hydrant. In addition, where a foam system is provided for protection of the helicopter deck, the pump should be capable of maintaining a pressure of 0.7 N/mm^2 at the foam installation. If the water consumption for any other fire protection or fire-fighting purpose should exceed the rate of the helicopter deck foam installation, this consumption should be the determining factor in calculating the required capacity of the fire pumps.

9.7.6 Where either of the required pumps is located in a space not normally manned and, in the opinion of the Administration, is relatively far removed from working areas, suitable provision should be made for remote start-up of that pump and remote operation of associated suction and discharge valves.

9.7.7 Except as provided in paragraph 9.7.2, sanitary, ballast, bilge or general service pumps may be accepted as fire pumps, provided that they are not normally used for pumping oil.

9.7.8 Every centrifugal pump which is connected to the fire main should be fitted with a non-return valve.

9.7.9 Relief valves should be provided in conjunction with all pumps connected to the fire main if the pumps are capable of developing a pressure exceeding the design pressure of the fire main, hydrants and hoses. Such valves should be so placed and adjusted as to prevent excessive pressure in the fire main system.

9.7.10 A fixed fire main should be provided and be so equipped and arranged as to meet the provisions of paragraphs 9.7.10 to 9.7.20.

9.7.11 The diameter of the fire main and water service pipes should be sufficient for the effective distribution of the maximum required discharge from the required fire pumps operating simultaneously.

9.7.12 With the required fire pumps operating simultaneously, the pressure maintained in the fire mains should be to the satisfaction of the Administration and be adequate for the safe and efficient operation of all equipment supplied therefrom.

9.7.13 The fire main should, where practicable, be routed clear of hazardous areas and be arranged in such a manner as to make maximum use of any thermal shielding or physical protection afforded by the structure of the unit.

9.7.14 The fire main should be provided with isolating valves located so as to permit optimum utilization in the event of physical damage to any part of the main.

9.7.15 The fire main should not have connections other than those necessary for fire-fighting purposes.

9.7.16 All practical precautions consistent with having water readily available should be taken to protect the fire main against freezing.

9.7.17 Materials readily rendered ineffective by heat should not be used for fire mains and hydrants unless adequately protected. The pipes and hydrants should be so placed that the fire hoses may be easily coupled to them.

9.7.18 A cock or valve should be fitted to serve each fire hose so that any fire hose may be removed while the fire pumps are operating.

9.7.19 The number and position of the hydrants should be such that at least two jets of water, not emanating from the same hydrant, one of which should be from a single length of fire hose, may reach any part of the unit normally accessible to those on board while the unit is being navigated or is engaged in drilling operations. A hose should be provided for every hydrant.

9.7.20 Fire hoses should be of material approved by the Administration and be sufficient in length to project a jet of water to any of the spaces in which they may be required to be used. Their maximum length should be to the satisfaction of the Administration. Every fire hose should be provided with a dual-purpose nozzle and the necessary couplings. Fire hoses, together with any necessary fittings and tools, should be ready for use at any time and should be kept in conspicuous positions near the water service hydrants or connections.

9.7.21 Fire hoses should have a length of at least 10 m, but not more than:

- .1** 15 m in machinery spaces;
- .2** 20 m in other spaces and open decks; and
- .3** 25 m for open decks with a maximum breadth in excess of 30 m.

9.7.22 Nozzles should comply with the following:

- .1 Standard nozzle sizes should be 12 mm, 16 mm and 19 mm or as near thereto as possible. Larger diameter nozzles may be permitted at the discretion of the Administration.
- .2 For accommodation and service spaces, a nozzle size greater than 12 mm need not be used.
- .3 For machinery spaces and exterior locations, the nozzle size should be such as to obtain the maximum discharge possible from two jets at the pressure specified in paragraph 9.7.5 from the smallest pump, provided that a nozzle size greater than 19 mm need not be used.

9.7.23 The surface unit should be provided with at least one international shore connection complying with SOLAS regulation II-2/10-2.1.7 and the FSS Code. Facilities should be available enabling such a connection to be used on any side of the unit.

9.8 Fire-extinguishing arrangement in machinery spaces and in spaces containing fired processes

9.8.1 In spaces where main or auxiliary oil-fired boilers and other fired processes of equivalent thermal rating are situated, or in spaces containing oil fuel units or settling tanks, the unit should be provided with the following:

- .1 One of the following fixed fire-extinguishing systems complying with SOLAS regulation II-2/10.4:
 - .1.1 a fixed pressure water-spraying system;
 - .1.2 a fixed gas fire-extinguishing system;
 - .1.3 a fixed high-expansion foam installation.

Where the machinery space and spaces containing fired processes are not entirely separate, or if fuel oil can drain from the latter spaces into the machinery space, the combined machinery space and fired process space should be considered as one compartment.

- .2 At least two approved portable foam extinguishers or equivalent in each space containing a fired process and each space in which a part of the oil fuel installation is situated. In addition, at least one extinguisher of the same description with a capacity of 9 l for each burner, whereby the total capacity of the additional extinguisher or extinguishers need not exceed 45 l for any one space.
- .3 A receptacle containing sand, sawdust impregnated with soda, or other approved dry material in such quantity as may be required by the Administration. An approved portable extinguisher may be provided as an alternative.

9.8.2 Spaces containing internal combustion machinery used either for main propulsion or for other purposes, when such machinery has a total power output of not less than 750 kW, should be provided with the following arrangements:

- .1 one of the fixed arrangements required by paragraph 9.8.1.1; and
- .2 one approved foam-type extinguisher of not less than 45 l capacity or equivalent in every engine space and one approved portable foam extinguisher for each 750 kW of engine power output or part thereof. The total number of portable extinguishers so supplied should be not less than two and need not exceed six.

9.8.3 The Administration should give special consideration to the fire-extinguishing arrangements to be provided in spaces not fitted with fixed fire-extinguishing installations containing steam turbines which are separated from boiler rooms by watertight bulkheads.

9.8.4 Where, in the opinion of the Administration, a fire hazard exists in any machinery space for which no specific provisions for fire-extinguishing appliances are prescribed in paragraphs 9.8.1 to 9.8.3, there should be provided in, or adjacent to, that space a number of approved portable fire extinguishers or other means of fire extinction to the satisfaction of the Administration.

9.9 Portable fire extinguishers in accommodation, service and working spaces

9.9.1 Except for the supplemental arrangements provided in paragraph 9.9.2, portable fire extinguishers in accommodation spaces, service spaces, control stations, machinery spaces of category A, other machinery spaces, cargo spaces, weather deck and other spaces should be provided in number and arrangement in accordance with the guidance provided by the Organization³⁰ to the satisfaction of the Administration.

9.9.2 Table 9-3 contains supplemental recommendations for number and distribution of additional portable fire extinguishers on mobile offshore drilling units. Where the recommendations in table 9-3 differ from the guidance provided by the Organization³⁰, the provisions of table 9-3 should be followed. In all cases, the selection of the fire extinguishing medium should be based on the fire hazard for the space protected.³¹ The classes of portable fire extinguishers in the table are only for reference.

³⁰ Refer to the Unified Interpretation of SOLAS chapter II-2 on the Number and Arrangement of Portable Fire Extinguishers on Board Ships, adopted by the Organization by MSC.1/Circ.1275.

³¹ Refer to the Improved Guidelines for Marine Portable Fire Extinguishers, adopted by the Organization by resolution A.951(23).

Table 9-3 – Recommended number and distribution of additional portable extinguishers

Type of Space	Minimum number of extinguishers ¹	Class(es) of extinguisher(s)
Space containing the controls for the main source of electrical power	1; and 1 additional extinguisher suitable for electrical fires when main switchboards are arranged in the space	A and/or C
Cranes: With electric motors/hydraulics	0	
Cranes: With internal combustion engine	2 (1 in cab and 1 at exterior of engine compartment)	B
Drill floor	2 (1 at each exit)	C
Helidecks	In accordance with section 9.16	B
Machinery spaces of category A	In accordance with section 9.8	B
Machinery spaces of category A which are periodically unattended	At each entrance in accordance with section 9.8 ²	B
Main switchboards	2 in the vicinity	C
Mud pits, Mud processing areas	1 for each enclosed space (Travel distance to an extinguisher not to exceed 10 m for open space)	B
¹ Minimum size should be in accordance with paragraph 3.1.1 of chapter 4 of the FSS Code. ² A portable extinguisher provided for that space may be located outside near the entrance to that space. A portable fire extinguisher placed outside near the entrance to that space may also be considered as satisfying the provisions for the space in which it is located.		

9.10 Fire detection and alarm system

9.10.1 An automatic fire detection and alarm system should be provided in all accommodation and service spaces. Accommodation spaces should be fitted with smoke detectors.

9.10.2 Sufficient manual fire alarm stations should be installed at suitable locations throughout the unit.

9.10.3 A fixed fire detection and fire alarm system should be installed in:

- .1 periodically unattended machinery spaces; and
- .2 machinery spaces where:
 - 2.1 the installation of automatic and remote control system and equipments has been approved in lieu of continuous manning of the spaces, and
 - 2.2 the main propulsion and associated machinery, including the main sources of electrical power, are provided with various degrees of automatic or remote control and are under continuous manned supervision from a control room.

9.11 Flammable gas detection and alarm system

9.11.1 A fixed automatic gas detection and alarm system should be provided to the satisfaction of the Administration so arranged as to monitor continuously all enclosed areas of the unit in which an accumulation of flammable gas may be expected to occur and capable of indicating at the main control point by aural and visual means the presence and location of an accumulation.

9.11.2 At least two portable gas monitoring devices should be provided, each capable of accurately measuring a concentration of flammable gas.

9.12 Hydrogen sulphide detection and alarm system

9.12.1 A fixed automatic hydrogen sulphide gas detection and alarm system should be provided to the satisfaction of the Administration so arranged as to monitor continuously the drilling area, mud processing area and well fluid test area of the unit and capable of giving audible and visual alarm at the main control points. If the alarm at the main control point is unanswered within 2 min, the toxic gas (hydrogen sulphide) alarm and the helideck status light under paragraph 13.5.25 should be automatically activated.

9.12.2 At least two portable hydrogen sulphide gas monitoring devices should be provided on the unit.

9.13 Fire-fighters' outfits

9.13.1 At least two fire-fighters' outfits complying with the relevant requirements of the FSS Code should be provided, each with portable instruments for measuring oxygen and flammable vapour concentrations acceptable to the Administration.

9.13.2 Two spare charges should be provided for each required breathing apparatus. Units that are equipped with suitably located means for fully recharging the air cylinders free from contamination need carry only one spare charge for each required apparatus.

9.13.3 The fire-fighters' outfits should be kept ready for use in an easily accessible location that is permanently and clearly marked. They should be stored in two or more widely separated locations.

9.14 Recharging of air cylinders

9.14.1 The apparatus for recharging air cylinders, if provided, should have its power supplied from the emergency supply or be independently diesel-powered, or be so constructed or equipped that the air cylinders may be used immediately after recharging.

9.14.2 The apparatus should be suitably located in a sheltered space above main deck level on the unit.

9.14.3 Intakes for air compressors should draw from a source of clean air.

9.14.4 The air should be filtered after compression to eliminate compressor oil contamination.

9.14.5 The recharging capacity should meet the requirements of SOLAS regulation II-2/10.10.2.6.

9.14.6 The equipment and its installation should be to the satisfaction of the Administration.

9.15 Arrangements in machinery and working spaces

9.15.1 Means should be provided for stopping ventilating fans serving machinery and working spaces and for closing all doorways, ventilators, annular spaces around funnels and other openings to such spaces. These means should be capable of being operated from outside such spaces in case of fire.

9.15.2 Machinery driving forced and induced draught fans, electric motor pressurization fans, oil fuel transfer pumps, oil fuel unit pumps and other similar fuel pumps should be fitted with remote controls situated outside the space concerned so that they may be stopped in the event of a fire arising in the space in which they are located.

9.15.3 Every oil fuel suction pipe from a storage, settling or daily service tank situated above the double bottom should be fitted with a cock or valve capable of being closed from outside the space concerned in the event of a fire arising in the space in which such tanks are situated. In the special case of deep tanks situated in any shaft or pipe tunnel, valves on the tanks should be fitted but control in the event of fire may be effected by means of an additional valve on the pipeline or lines outside the tunnel or tunnels.

9.16 Provisions for helicopter facilities

9.16.1 This section provides additional measures in order to address the fire safety objectives for units fitted with facilities for helicopters and meets the following functional provisions:

- .1** helideck structure should be adequate to protect the unit from the fire hazards associated with helicopter operations;
- .2** fire-fighting appliances should be provided to adequately protect the unit from the fire hazards associated with helicopter operations;
- .3** refuelling facilities and operations should provide the necessary measures to protect the unit from the fire hazards associated with helicopter operations; and
- .4** helicopter facility operation manuals, which may be included in the operation manual under chapter 14 of this Code, and training should be provided.

9.16.2 The construction of the helidecks should be of steel or other equivalent materials. If the helideck forms the deckhead of a deckhouse or superstructure, it should be insulated to "A-60" class standard. If the Administration permits aluminium or other low melting point metal construction that is not made equivalent to steel, the following provisions should be satisfied:

- .1** if the helideck is cantilevered over the side of the unit, after each fire that may have an effect on the structural integrity of the helideck or its supporting structures, the helideck should undergo a structural analysis to determine its suitability for further use; and
- .2** if the helideck is located above the unit's deckhouse or similar structure, the following conditions should be satisfied:

- .2.1 the deckhouse top and bulkheads under the helideck should have no openings;
- .2.2 windows under the helideck should be provided with steel shutters; and
- .2.3 after each fire on the helideck or supporting structure the helideck should undergo a structural analysis to determine its suitability for further use.

9.16.3 A helideck should be provided with both a main and an emergency means of escape and access for fire fighting and rescue personnel. These should be located as far apart from each other as is practicable and preferably on opposite sides of the helideck.

9.16.4 In close proximity to the helideck, the following fire-fighting appliances should be provided and stored near the means of access to that helideck:

- .1 at least two dry powder extinguishers having a total capacity of not less than 45 kg but not less than 9 kg each;
- .2 carbon dioxide extinguishers of a total capacity of not less than 18 kg or equivalent;
- .3 a foam application system consisting of monitors or foam-making branch pipes capable of delivering foam to all parts of the helideck in all weather conditions in which the helideck is intended to be available for helicopter operations. The minimum capacity of the foam production system will depend upon the size of the area to be protected, the foam application rate, the discharge rates of installed equipment and the expected duration of application:
 - .3.1 a minimum application rate of 6 l/m^2 within a circle having a diameter equal to the *D*-value;
 - .3.2 a minimum of 5 min discharge capability should be provided;
 - .3.3 foam delivery at the minimum application rate should start within 30 s of system activation;
- .4 the principal agent should be suitable for use with salt water and conform to performance standards not inferior to those acceptable to the Organization;³²
- .5 at least two nozzles of an approved dual-purpose type (jet/spray) and hoses sufficient to reach any part of the helideck;
- .6 in addition to the provisions of section 9.13, two fire-fighter's outfits; and
- .7 at least the following equipment should be stored in a manner that provides for immediate use and protection from the elements:

³² Refer to the International Civil Aviation Organization Airport Services Manual, part 1, Rescue and Fire Fighting, chapter 8, Extinguishing Agent Characteristics, paragraph 8.1.5, Foam Specifications table 8-1, level 'B'.

- .7.1 adjustable wrench;
- .7.2 blanket, fire-resistant;
- .7.3 cutters, bolt, 600 mm;
- .7.4 hook, grab or salving;
- .7.5 hacksaw, heavy duty complete with six spare blades;
- .7.6 ladder;
- .7.7 lift line 5 mm diameter and 30 m in length;
- .7.8 pliers, side-cutting;
- .7.9 set of assorted screwdrivers;
- .7.10 harness knife complete with sheath; and
- .7.11 crowbar.

9.16.5 Drainage facilities in way of helidecks should be:

- .1 constructed of steel or other arrangements providing equivalent fire safety;
- .2 lead directly overboard independent of any other system; and
- .3 designed so that drainage does not fall onto any part of the unit.

9.16.6 Where the unit has helicopter refuelling, the following provisions should be complied with:

- .1 a designated area should be provided for the storage of fuel tanks which should be:
 - .1.1 as remote as is practicable from accommodation spaces, escape routes and embarkation stations; and
 - .1.2 isolated from areas containing a source of vapour ignition;
- .2 the fuel storage area should be provided with arrangements whereby fuel spillage may be collected and drained to a safe location;
- .3 tanks and associated equipment should be protected against physical damage and from a fire in an adjacent space or area;
- .4 where portable fuel storage tanks are used, special attention should be given to:
 - .4.1 design of the tank for its intended purpose;
 - .4.2 mounting and securing arrangements;

- .4.3 electric bonding; and
- .4.4 inspection procedures;
- .5 storage tank fuel pumps should be provided with means which permit shutdown from a safe remote location in the event of a fire. Where a gravity-fuelling system is installed, equivalent closing arrangements should be provided to isolate the fuel source;
- .6 the fuel pumping unit should be connected to one tank at a time. The piping between the tank and the pumping unit should be of steel or equivalent material, as short as possible, and protected against damage;
- .7 electrical fuel pumping units and associated control equipment should be of a type suitable for the location and potential hazards;
- .8 fuel pumping units should incorporate a device which will prevent over-pressurization of the delivery or filling hose;
- .9 equipment used in refuelling operations should be electrically bonded; and
- .10 "NO SMOKING" signs should be displayed at appropriate locations.

9.17 Storage of gas cylinders

9.17.1 Where more than one cylinder of oxygen and more than one cylinder of acetylene are carried simultaneously, such cylinders should be arranged in accordance with the following:

- .1 Permanent piping systems for oxyacetylene systems are acceptable provided that they are designed having due regard to standards and codes of practice to the satisfaction of the Administration.
- .2 Where two or more cylinders of each gas are intended to be carried in enclosed spaces, separate dedicated storage rooms should be provided for each gas.
- .3 Storage rooms should be constructed of steel, and be well ventilated and accessible from the open deck.
- .4 Provision should be made for the expeditious removal of cylinders in the event of fire.
- .5 "NO SMOKING" signs should be displayed at the gas cylinder storage rooms.
- .6 Where cylinders are stowed in open locations means should be provided to:
 - .6.1 protect cylinders and associated piping from physical damage;
 - .6.2 minimize exposure to hydrocarbons; and
 - .6.3 ensure suitable drainage.

9.17.2 Fire-extinguishing arrangements for the protection of areas or spaces where such cylinders are stored should be to the satisfaction of the Administration.

9.18 Fire control plan

A fire control plan complying with SOLAS regulation II-2/15.2.4 should be permanently exhibited.

9.19 Operational readiness and maintenance

9.19.1 The following functional provisions should be met:

- .1** gas detection systems, fire protection systems and fire-fighting systems and appliances should be maintained ready for use; and
- .2** gas detection systems, fire protection systems and fire-fighting systems and appliances should be properly tested and inspected.

9.19.2 At all times while the unit is in service, the provisions of paragraph 9.19.1 should be complied with. A unit is not in service when:

- .1** it is in for repairs or lay up (either at anchor or in port) or in dry-dock;
- .2** it is declared not in service by the owner or the owner's representative.

9.19.3 Operational readiness

- .1** The following gas detection and fire protection systems should be kept in good order so as to ensure their intended performance if a fire occurs:
 - .1.1** structural fire protection including fire-resisting divisions and protection of openings and penetrations in these divisions;
 - .1.2** fire detection and fire alarm systems;
 - .1.3** gas detection and alarm systems; and
 - .1.4** means of escape systems and appliances.
- .2** Fire-fighting systems and appliances and portable gas detection systems should be kept in good working order and readily available for immediate use. Portable extinguishers which have been discharged should be immediately recharged or replaced with an equivalent unit.

9.19.4 Maintenance, testing and inspections

- .1** Maintenance, testing and inspections should be carried out based on the guidelines developed by the Organization³³ and in a manner having due regard to ensuring the reliability of fire-fighting systems and appliances.

³³ Refer to the Guidelines on maintenance and inspection of fire protection systems and appliances (MSC/Circ.850).

- .2 The maintenance plan should be kept on board the unit and be available for inspection whenever required by the Administration.
- .3 The maintenance plan should include at least the following fire protection systems and fire-fighting systems and appliances, where installed:
 - .3.1 fire mains, fire pumps and hydrants including hoses, nozzles and international shore connections;
 - .3.2 fixed fire detection and fire alarm systems;
 - .3.3 fixed fire-extinguishing systems and other fire-extinguishing appliances;
 - .3.4 automatic sprinkler, fire detection and fire alarm systems;
 - .3.5 ventilation systems including fire and smoke dampers, fans and their controls;
 - .3.6 emergency shut down of fuel supply;
 - .3.7 fire doors including their controls;
 - .3.8 general emergency alarm systems;
 - .3.9 emergency escape breathing devices;
 - .3.10 portable fire extinguishers including spare charges or spare extinguishers;
 - .3.11 portable hydrogen sulphide gas detection monitoring devices;
 - .3.12 portable flammable gas and oxygen monitoring devices;
 - .3.13 gas detection and alarm systems; and
 - .3.14 fire-fighter's outfits.
- .4 The maintenance programme may be computer-based.

CHAPTER 10

LIFE-SAVING APPLIANCES AND EQUIPMENT

10.1 General

Definitions

10.1.1 For the purpose of this chapter, unless expressly provided otherwise, the terms used, relating to life-saving appliances, are as defined in SOLAS regulation III/3.

Evaluation, testing and approval of life-saving appliances

10.1.2 Life-saving appliances should be evaluated, tested and approved, as provided in SOLAS regulations III/4 and III/5.

New and novel life-saving appliances

10.1.3 New and novel life-saving appliances should meet the applicable provisions of SOLAS chapter III, including those for servicing and maintenance.

Life-saving appliances

10.1.4 All life-saving appliances should comply with the applicable SOLAS regulations.

10.1.5 All lifeboats should be fire-protected in accordance with the LSA Code.

10.2 Alternative design and arrangements

When alternative design or arrangements deviate from the prescriptive provisions of the Code, an engineering analysis, evaluation and approval of the design and arrangements should be carried out in accordance with SOLAS regulation III/38 based on the Guidelines developed by the Organization.³⁴

10.3 Survival craft

Surface units

10.3.1 Each unit should carry, on each side of the unit, one or more lifeboats complying with the requirements of the LSA Code of such aggregate capacity as will accommodate the total number of persons on board. Alternatively, the Administration may accept one or more free-fall lifeboats, complying with the requirements of section 4.7 of the LSA Code, capable of being free-fall launched over the end of the unit of such aggregate capacity as will accommodate the total number of persons on board.

10.3.2 In addition, each unit should carry a liferaft or liferafts, complying with the requirements of the LSA Code and approved to the actual operating height, capable of being launched on either side of the unit and of such aggregate capacity as will accommodate the total number of

³⁴ Refer to the Guidelines on alternative design and arrangements for SOLAS chapters II-1 and III (MSC.1/Circ.1212).

persons on board. If the liferaft or liferafts cannot be readily transferred for launching on either side of the unit, the total capacity available on each side should be sufficient to accommodate the total number of persons on board.

10.3.3 Where the survival craft are stowed in a position which is more than 100 m from the stem or stern, each unit should carry, in addition to the liferafts as provided in paragraph 10.3.2, a liferaft stowed as far forward or aft, or one as far forward and another as far aft, as is reasonable and practicable. Notwithstanding paragraph 10.6.6, such liferaft or liferafts may be securely fastened so as to permit manual release.

Self-elevating and column-stabilized units

10.3.4 Each unit should carry lifeboats complying with the requirements of the LSA Code, installed in at least two widely separated locations on different sides or ends of the unit. The arrangement of the lifeboats should provide sufficient capacity to accommodate the total number of persons on board if:

- .1** all the lifeboats in any one location are lost or rendered unusable; or
- .2** all the lifeboats on any one side, any one end, or any one corner of the unit are lost or rendered unusable.

10.3.5 In addition, each unit should carry liferafts complying with the requirements of the LSA Code and approved to the actual operating height, of such aggregate capacity as will accommodate the total number of persons on board.

10.3.6 In the case of a self-elevating unit where, due to its size or configuration, lifeboats cannot be located in widely separated locations to satisfy paragraph 10.3.4, the Administration may permit the aggregate capacity of the lifeboats to accommodate the total number of persons on board. However, the liferafts under paragraph 10.3.5 should be served by liferaft launching appliances or marine evacuation systems complying with the requirements of the LSA Code.

10.4 Survival craft muster and embarkation arrangements

10.4.1 If separate, muster stations should be provided close to the embarkation stations. Each muster station should have sufficient space to accommodate all persons assigned to muster at that station, but at least 0.35 m² per person.

10.4.2 Muster and embarkation stations should be readily accessible from accommodation and work areas.

10.4.3 Muster and embarkation stations should be adequately illuminated by emergency lighting.

10.4.4 Alleyways, stairways and exits giving access to the muster and embarkation stations should be adequately illuminated by emergency lighting.

10.4.5 Davit-launched survival craft muster and embarkation stations should be so arranged as to enable stretcher cases to be placed in survival craft.

10.4.6 Survival craft embarkation arrangements should be so designed that:

- .1 lifeboats can be boarded and launched directly from the stowed position;
- .2 davit-launched liferafts can be boarded and launched from a position immediately adjacent to the stowed position or from a position to which the liferaft is transferred prior to launching in compliance with paragraph 10.6.5; and
- .3 where necessary, means should be provided for bringing the davit-launched liferaft against the unit's side and holding it alongside so that persons can be safely embarked.

10.4.7 At least two widely separated fixed metal ladders or stairways should be provided extending from the deck to the surface of the water. The fixed metal ladders or stairways and sea areas in their vicinity should be adequately illuminated by emergency lighting.

10.4.8 If fixed ladders cannot be installed, alternative means of escape with sufficient capacity to permit all persons on board to descend safely to the waterline should be provided.

10.5 Survival craft launching stations

Launching stations should be in such positions as to ensure safe launching having particular regard to clearance from any exposed propeller or steeply overhanging portions of the hull. As far as possible, launching stations should be located so that survival craft can be launched down a straight side of the unit, except for:

- .1 survival craft specially designed for free-fall launching; and
- .2 survival craft mounted on structures intended to provide clearance from lower structures.

10.6 Stowage of survival craft

10.6.1 Each survival craft should be stowed:

- .1 so that neither the survival craft nor its stowage arrangements will interfere with the operation of any other survival craft or rescue boat at any other launching station;
- .2 as near the water surface as is safe and practicable;
- .3 in a state of continuous readiness so that two crew members can carry out preparations for embarkation and launching in less than 5 min;
- .4 fully equipped as required by the LSA Code; however, in the case of units operating in areas such that, in the opinion of the Administration, certain items of equipment are unnecessary, the Administration may allow these items to be dispensed with;
- .5 as far as practicable, in a secure and sheltered position and protected from damage by fire and explosion.

10.6.2 A survival craft or davit-launched liferaft should be so positioned that the survival craft or raft is upon embarkation at least 2 m above the waterline when the unit is in the limiting damaged condition determined in accordance with section 3.4.

10.6.3 Where appropriate, the unit should be so arranged that lifeboats, in their stowed positions, are protected from damage by heavy seas.

10.6.4 Lifeboats should be stowed attached to launching appliances.

10.6.5 Liferafts should be so stowed as to permit manual release of one raft or container at a time from their securing arrangements.

10.6.6 Davit-launched liferafts should be stowed within reach of the lifting hooks, unless some means of transfer is provided which is not rendered inoperable within the limits of trim and list prescribed in chapter 3 for any damaged condition or by unit motion or power failure.

10.6.7 Each liferaft, other than those in paragraph 10.3.3, should be stowed with the weak link of its painter permanently attached to the unit and with a float-free arrangement complying with the requirements of the LSA Code so that the liferaft will float free of any structure and, if inflatable, inflates automatically should the unit sink.

10.7 Survival craft launching and recovery arrangements

10.7.1 Launching appliances complying with the requirements of the LSA Code should be provided for all lifeboats and davit-launched liferafts.

10.7.2 Launching and recovery arrangements should be such that the appliance operator on the unit is able to observe the survival craft at all times during launching and lifeboats during recovery.

10.7.3 Only one type of release mechanism should be used for similar survival craft carried on board the unit.

10.7.4 Preparation and handling of survival craft at any one launching station should not interfere with the prompt preparation and handling of any other survival craft or rescue boat at any other station.

10.7.5 Falls, where used, should be long enough for the survival craft to reach the water with the unit under unfavourable conditions, such as maximum air-gap, lightest transit or operational condition or any damaged condition, as described in chapter 3.

10.7.6 During preparation and launching, the survival craft, its launching appliance and the area of water into which it is to be launched should be adequately illuminated by emergency lighting.

10.7.7 Means should be available to prevent any discharge of fluids on to survival craft during abandonment.

10.7.8 All lifeboats required for abandonment by the total number of persons permitted on board, should be capable of being launched with their full complement of persons and equipment within 10 min from the time the signal to abandon the unit is given.

10.7.9 Manual brakes should be so arranged that the brake is always applied unless the operator, or a mechanism activated by the operator, holds the brake control in the “off” position.

10.7.10 Each survival craft should be so arranged as to clear each leg, column, footing, brace, mat and each similar structure below the hull of a self-elevating unit and below the upper hull of a column-stabilized unit, with the unit in an intact condition. The Administration may allow a reduction in the total number of survival craft when the unit is in the transit mode and the number of personnel on board has been reduced. In such cases, sufficient survival craft to meet the provisions of this chapter, including section 10.3, should be available for use by those personnel remaining on board.

10.7.11 In any case of damage specified in chapter 3, lifeboats with an aggregate capacity of not less than 100% of persons on board should, in addition to meeting all other provisions regarding the launching and stowage contained in this chapter, be capable of being launched clear of any obstruction.

10.7.12 Consideration should be given to the location and orientation of the survival craft with reference to MODU design such that clearance of the unit is achieved in an efficient and safe manner having due regard to the capabilities of the survival craft.

10.7.13 Notwithstanding the requirement of paragraph 6.1.2.8 of the LSA Code, the speed of lowering need not be greater than 1 m/s.

10.8 Rescue boats

Each unit should carry at least one rescue boat complying with the requirements of the LSA Code. A lifeboat may be accepted as a rescue boat, provided that it and its launching and recovery arrangements also comply with the requirements for a rescue boat.

10.9 Stowage of rescue boats

Rescue boats should be stowed:

- .1 in a state of continuous readiness for launching in not more than 5 min;
- .2 if of an inflated type, in a fully inflated condition at all times;
- .3 in a position suitable for launching and recovery;
- .4 so that neither the rescue boats nor their stowage arrangements will interfere with the operation of any survival craft at any other launching station;
- .5 in compliance with section 10.6, if they are also lifeboats.

10.10 Rescue boat embarkation, launching and recovery arrangements

10.10.1 The rescue boat embarkation and launching arrangements should be such that the rescue boat can be boarded and launched in the shortest possible time.

10.10.2 Launching arrangements should comply with section 10.7.

10.10.3 Rapid recovery of the rescue boat should be possible when loaded with its full complement of persons and equipment. If the rescue boat is also a lifeboat, rapid recovery should be possible when loaded with its lifeboat equipment and the approved rescue boat complement of at least six persons.

10.10.4 Rescue boat embarkation and recovery arrangements should allow for safe and efficient handling of a stretcher case. Foul weather recovery strops should be provided for safety if heavy fall blocks constitute a danger.

10.11 Lifejackets

10.11.1 A lifejacket complying with the requirements of the LSA Code, paragraphs 2.2.1 or 2.2.2 should be provided for every person on board the unit. In addition, a sufficient number of lifejackets should be stowed in suitable locations for those persons who may be on duty in locations where their lifejackets are not readily accessible. In addition, sufficient lifejackets should be available for use at remotely located survival craft positions to the satisfaction of the Administration.

10.11.2 Each lifejacket should be fitted with a lifejacket light complying with the requirements of the LSA Code.

10.12 Immersion suits and anti-exposure suits

10.12.1 Each unit should carry an immersion suit complying with the requirements of the LSA Code, and of an appropriate size, for each person on board. In addition:

- .1** a sufficient number of immersion suits should be stowed in suitable locations for those persons who may be on duty in locations where their immersion suits are not readily accessible; and
- .2** sufficient immersion suits should be available for use at remotely located survival craft positions to the satisfaction of the Administration.

10.12.2 In lieu of immersion suits as required by paragraph 10.12.1, an anti-exposure suit complying with the LSA Code, of an appropriate size, should be provided for every person assigned to crew the rescue boat or assigned to a marine evacuation system party.

10.12.3 Immersion suits and anti-exposure suits need not be carried if the unit is constantly in operation in warm climates³⁵ where, in the opinion of the Administration, they are unnecessary.

10.13 Lifebuoys

10.13.1 At least eight lifebuoys of a type complying with the LSA Code should be provided on each unit. The number and placement of lifebuoys should be such that a lifebuoy is accessible from exposed locations. Surface units should carry not less than the number of lifebuoys prescribed in the following table:

³⁵ Refer to the Guidelines for assessment of thermal protection (MSC/Circ.1046).

Length of unit in metres	Minimum number of lifebuoys
Under 100	8
100 and under 150	10
150 and under 200	12
200 and over	14

10.13.2 Not less than one-half of the total number of lifebuoys should be provided with self-igniting lights of an approved electric battery type complying with the LSA Code. Not less than two of these should also be provided with self-activating smoke signals and be capable of quick release from the navigating bridge, main control station, or a location readily available to operating personnel. Lifebuoys with lights and those with lights and smoke signals should be equally distributed along the accessible portions of the perimeter of the unit and should not be the lifebuoys provided with lifelines in compliance with the provisions of paragraph 10.13.3. Lifebuoys fitted with self-igniting lights or self-activating smoke signals should be located outside hazardous areas.

10.13.3 At least two lifebuoys in widely separated locations should each be fitted with a buoyant lifeline, the length of which should be at least one-and-a-half times the distance from the deck of stowage to the waterline at light draught or 30 m, whichever is greater. For self-elevating drilling units, consideration should be taken of the maximum height above the waterline, and for other drilling units the lightest operating condition. The lifeline should be so stowed that it can easily run out.

10.13.4 Each lifebuoy should be marked in block capitals of the Roman alphabet with the name and port of registry of the unit on which it is carried.

10.14 Radio life-saving appliances

Two-way VHF radiotelephone apparatus

10.14.1 All lifeboats should carry a two-way VHF radiotelephone apparatus. In addition, at least two such apparatuses should be available on the MODU, so stowed that they can be rapidly placed in any liferaft. All two-way VHF radiotelephone apparatus should conform to performance standards not inferior to those adopted by the Organization.³⁶

Search and rescue locating device

10.14.2 All lifeboats should carry a search and rescue locating device. In addition, at least two search and rescue locating devices should be available on the MODU, so stowed that they can be rapidly placed in any liferaft. All search and rescue locating devices should conform to performance standards not inferior to those adopted by the Organization.³⁷

³⁶ Refer to the Performance standards for survival craft two-way VHF radiotelephone apparatus, adopted by the Organization by resolution A.809(19), and to regulation III/6.2.1.2 of the 1988 SOLAS amendments which may be applied to units.

³⁷ Refer to the Recommendation on performance standards for survival craft radar transponders for use in search and rescue operations, adopted by the Organization by resolution A.802(19), and the Performance standards for survival craft AIS search and rescue transmitters (AIS-SART) for use in search and rescue operations, adopted by the Organization by resolution MSC.246(83).

10.15 Distress flares

Not less than 12 rocket parachute flares complying with the LSA Code should be carried and be stowed on or near the navigating bridge. If the unit does not have a navigating bridge, the flares should be stowed in a location acceptable to the Administration.

10.16 Line-throwing appliances

A line-throwing appliance complying with the requirements of the LSA Code should be provided.

10.17 Operating instructions

Illustrations and instructions should be provided on or in the vicinity of survival craft and their launching controls and should:

- .1 illustrate the purpose of controls and the procedures for operating the appliance and give relevant instructions or warnings;
- .2 be easily seen under emergency lighting conditions; and
- .3 use symbols in accordance with the recommendations of the Organization.³⁸

10.18 Operational readiness, maintenance and inspections

Operational readiness

10.18.1 Before the unit leaves port and at all times during operation and transit, all life-saving appliances should be in working order and ready for immediate use.

Maintenance

10.18.2 Instructions for on-board maintenance of life-saving appliances complying with SOLAS regulation III/36 should be provided and maintenance should be carried out accordingly.

10.18.3 The Administration may accept, in lieu of the instructions in paragraph 10.18.2, a planned maintenance programme which includes the requirements of SOLAS regulation III/36.

10.18.4 Maintenance, testing and inspections of life-saving appliances should be carried out based on the guidelines developed by the Organization³⁹ and in a manner having due regard to ensuring reliability of such appliances.

10.18.5 Falls used in launching should be inspected periodically³⁹ with special regard for areas passing through sheaves, and renewed when necessary due to deterioration of the falls or at intervals of not more than five years, whichever is the earlier.

³⁸ Refer to the Symbols related to life-saving appliances and arrangements adopted by the Organization by resolution A.760(18), as amended by resolution MSC.82(70).

³⁹ Refer to Measures to prevent accidents with lifeboats (MSC.1/Circ.1206/Rev.1).

Spares and repair equipment

10.18.6 Spares and repair equipment should be provided for life-saving appliances and their components which are subject to excessive wear or consumption and need to be replaced regularly.

Weekly inspections

10.18.7 The following tests and inspections should be carried out weekly:

- .1** all survival craft, rescue boats and launching appliances should be visually inspected to ensure that they are ready for use. The inspection should include, but not be limited to, the condition of hooks, their attachment to the lifeboat and checking that the on-load release gear is properly and completely reset;
- .2** all engines in lifeboats and rescue boats should be run ahead and astern for a total period of not less than 3 min, provided the ambient temperature is above the minimum temperature required for starting and running the engine. During this period of time, it should be demonstrated that the gear box and gear box train are engaging satisfactorily. If the special characteristics of an outboard motor fitted to a rescue boat would not allow it to be run other than with its propeller submerged for a period of 3 min, a suitable water supply may be provided;
- .3** lifeboats, except free-fall lifeboats, should be moved from their stowed position, without any persons on board, to the extent necessary to demonstrate satisfactory operation of launching appliances, if weather and sea conditions so allow; and
- .4** the general alarm system should be tested.

Monthly inspections

10.18.8 Inspection of the life-saving appliances, including lifeboat equipment and emergency lighting, should be carried out monthly using the checklist required by SOLAS regulation III/36 to ensure that they are complete and in good order. All lifeboats, except free-fall lifeboats, should be turned out from their stowed position without any persons on board, if weather and sea conditions so allow. A report of the inspection should be entered in the logbook.

Servicing of inflatable liferafts, inflatable lifejackets, marine evacuation systems and maintenance and repair of inflated rescue boats

10.18.9 Every inflatable liferaft, inflatable lifejacket and marine evacuation system should be serviced:

- .1** at intervals not exceeding 12 months, provided where in any case this is impracticable, the Administration may extend this period to 17 months;
- .2** at an approved servicing station which is competent to service them, maintains proper servicing facilities and uses only properly trained personnel⁴⁰; and

⁴⁰ Refer to the Recommendation on conditions for the approval of servicing stations for inflatable liferafts, adopted by the Organization by resolution A.761(18).

- .3 in addition to or in conjunction with the servicing intervals of marine evacuation systems under paragraph 10.18.9.1, each marine evacuation system should be deployed from the ship on a rotational basis at intervals to be agreed by the Administration provided that each system is to be deployed at least once every six years.

10.18.10 All repairs and maintenance of inflated rescue boats should be carried out in accordance with the manufacturer's instructions. Emergency repairs may be carried out on board the unit; however, permanent repairs should be carried out by an approved servicing station.

Periodic servicing of hydrostatic release units

10.18.11 Hydrostatic release units, other than disposable hydrostatic release units, should be serviced:

- .1 at intervals not exceeding 12 months, provided where in any case this is impracticable the Administration may extend this period to 17 months⁴¹;
- .2 at a servicing station which is competent to service them, maintains proper servicing facilities and uses only properly trained personnel.

Periodic servicing of launching appliances and on-load release gear

10.18.12 Periodic servicing of launching appliances and on-load release gear

- .1 Launching appliances should be:
 - .1.1 maintained in accordance with instructions for on-board maintenance in paragraph 10.18.2;
 - .1.2 subject to a thorough examination at the annual surveys in section 1.6; and
 - .1.3 upon completion of the examination referred to in paragraph 10.18.12.1.2, subjected to a dynamic test of the winch brake at maximum lowering speed. The load to be applied should be the mass of the survival craft or rescue boat without persons on board, except that, at intervals not exceeding five years, the test should be carried out with a proof load of 1.1 times the mass of the survival craft or rescue boat and its full complement of persons and equipment.
- .2 Lifeboat or rescue boat on-load release gear, including free-fall lifeboat release systems should be:
 - .2.1 maintained in accordance with instructions for on-board maintenance in paragraph 10.18.2;

⁴¹ Refer to Servicing of life-saving appliances and radiocommunication equipment under the harmonized system of survey and certification (HSSC) (MSC/Circ.955).

CHAPTER 11

RADIOCOMMUNICATION AND NAVIGATION

11.1 General

The purpose of this chapter is to provide minimum provisions for navigation equipment and for distress and safety radiocommunications between mobile offshore drilling units and coast stations, ships and supporting aircraft.

11.2 Training

Training should be provided to personnel responsible for radio communications in the use of IMO Standard Marine Communication Phrases.⁴³

11.3 Self-propelled units

Each unit should comply with the applicable provisions concerning radio stations for cargo ships in SOLAS chapter IV.⁴⁴

11.4 Non-self-propelled units under tow

11.4.1 The provisions for non-self-propelled units under tow when manned depend upon the radio installations fitted in the towing ship, as set out in paragraphs 11.4.2 and 11.4.3.

11.4.2 In cases where the towing ship complies fully with all applicable requirements concerning radiocommunications for ships prescribed in SOLAS chapter IV, the unit under tow when manned should:

- .1** be fitted with VHF facilities as required by SOLAS regulations IV/7.1.1⁴⁵ and 7.1.2 and with MF facilities as required by regulations IV/9.1.1 and 9.1.2;
- .2** be fitted with the satellite EPIRB or EPIRB required by SOLAS regulation IV/7.1.6, as appropriate, for the area in which the unit is being towed; and
- .3** be fitted with equipment for automatic reception of navigational and meteorological warnings in accordance with SOLAS regulations IV/7.1.4 and IV/7.1.5, as appropriate.

11.4.3 In cases where the towing ship does not comply fully with the applicable requirements concerning radiocommunications for ships prescribed in SOLAS chapter IV, the unit under tow when manned should comply with all the applicable provisions concerning radiocommunications prescribed in SOLAS chapter IV.⁴⁵

⁴³ Refer to IMO Standard Marine Communication Phrases, adopted by the Organization by resolution A.918(22).

⁴⁴ All requirements of SOLAS chapter IV referring to “from the position the ship is normally navigated” should be applied as meaning “from the position the MODU is normally navigated”.

⁴⁵ All requirements of SOLAS chapter IV referring to “from the position the ship is normally navigated” should be applied as meaning “from a position which is continuously manned and which is controlling the MODU while under tow”.

11.5 Units stationary at the site or engaged in drilling operations

11.5.1 Each unit, while stationary at the site, including when engaged in drilling operations, should comply with all requirements prescribed in SOLAS chapter IV that are applicable to a ship sailing through the same area.⁴⁶ Each unit should also report its position to the relevant World-Wide Navigational Warning Service (WWNWS) NAVAREA Coordinator when arriving on-site, in order for a Navigational Warning to be broadcast⁴⁷. Additionally, units should inform the NAVAREA Coordinator when departing from that site, in order for the broadcast to be cancelled.

11.5.2 On units which do not have a navigation bridge, it should be possible to initiate transmission of the distress alerts by the radio installation specified in SOLAS regulations IV/10.1.1, IV/10.1.2, IV/10.1.4, IV/10.2.1 and IV/10.2.3, as applicable, from a position in an accessible and protected area which is acceptable to the Administration.

11.5.3 If the acoustic noise level in a room fitted with operating controls for radio equipment is so high or could be so high, during particular operating conditions, that it may disturb or prevent proper use of the radio equipment, then adequate noise protection should be provided by mechanical or other means, in association with the operating controls for the radio equipment.

11.6 Helicopter communications

In order to ensure communication with helicopters, MODUs should carry an aeromobile VHF radiotelephone station complying with the relevant requirements of ICAO⁴⁸ and suitable for communication with helicopters in its area of operation.

11.7 Internal communications

All types of MODUs should be fitted with efficient means of communication between the control room, the bridge (if provided) and position or positions fitted with facilities for operation of radio equipment.

11.8 Performance standards

All radio equipment should be of a type approved by the Administration issuing the licence. Such equipment should conform to appropriate performance standards not inferior to those adopted by the Organization.⁴⁹

⁴⁶ All requirements of SOLAS chapter IV referring to “from the position at which the ship is normally navigated” should be applied as meaning “from a position (or from the positions) which is continuously manned and which is controlling the MODU while stationary at the site including its drilling operations (i.e. normally the control room)”.

⁴⁷ Refer to the World-wide navigational warning service, adopted by the Organization by resolution A.706(17), as amended.

⁴⁸ Refer to Volume 3, Part II of Annex 10, and Part III, section II of Annex 6 to the ICAO Convention.

⁴⁹ Refer to the following performance standards adopted by the Organization:

- .1 Resolution A.525(13): Performance standards for narrow-band direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ships.
- .2 Resolution A.694(17): General requirements for shipborne radio equipment forming part of the global maritime distress and safety system (GMDSS) and for electronic navigational aids.

(continued on next page)

11.9 Survey of the radio station

11.9.1 The radio station of a unit should be subject to survey as specified below:

- .1 by the Administration which issues the licence or its authorized representative before the radio station is put into service;
- .2 when the unit is moved and comes under the administrative control of another coastal State a survey may be carried out by that State or its authorized representative;
- .3 within three months before or after the anniversary date of the MODU Code certificate, a periodical survey carried out by an officer of the Administration and/or the coastal State or their respective authorized representative.

11.9.2 Satellite EPIRBs should be serviced at intervals not exceeding five years, to be performed by an approved shore-based maintenance facility.

(continued from previous page)

- .3 Resolution A.808(19): Performance standards for ship earth stations capable of two-way communications; resolution A.570(14): Type approval of ship earth stations, and resolution MSC.130(75): Performance standards for Inmarsat ship earth stations capable of two-way communications.
- .4 Resolution A.803(19): Performance standards for shipborne VHF radio installations capable of voice communication and digital selective calling, as amended, and resolution MSC.68(68), annex 1.
- .5 Resolution A.804(19): Performance standards for shipborne MF radio installations capable of voice communication and digital selective calling, as amended, and resolution MSC.68(68), annex 2.
- .6 Resolution A.806(19): Performance standards for shipborne MF/HF radio installations capable of voice communication, narrow-band direct-printing and digital selective calling, as amended, and resolution MSC.68(68), annex 3.
- .7 Resolution A.810(19): Performance standards for float-free satellite emergency position-indicating radio beacons (EPIRBs) operating on 406 MHz; and resolution MSC.120(74): Adoption of amendments to performance standards for float-free satellite emergency position-indicating radio beacons (EPIRBs) operating on 406 MHz (resolution A.810(19)) (see also resolution A.696(17): Type approval of satellite emergency position-indicating radio beacons (EPIRBs) operating in the COSPAS-SARSAT system).
- .8 Resolution A.802(19): Performance standards for survival craft radar transponders for use in search and rescue operations.
- .9 Resolution A.805(19): Performance standards for float-free VHF emergency position-indicating radio beacons.
- .10 Resolution A.807(19): Performance standards for Inmarsat-C ship earth stations capable of transmitting and receiving direct-printing communications, as amended, and resolution MSC.68(68), annex 3, and resolution A.570(14): Type approval of ship earth stations.
- .11 Resolution A.664(16): Performance standards for enhanced group call equipment.
- .12 Resolution A.812(19): Performance standards for float-free satellite emergency position-indicating radio beacons operating through the geostationary Inmarsat satellite system on 1.6 GHz.
- .13 Resolution A.662(16): Performance standards for float-free release and activation arrangements for emergency radio equipment.
- .14 Resolution A.699(17): System performance standard for the promulgation and co-ordination of maritime safety information using high-frequency narrow-band direct printing.
- .15 Resolution MSC.148(77): Adoption of the revised performance standards for narrow-band direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ships (NAVTEX).
- .16 Resolution A.811(19): Performance standards for a shipborne integrated radiocommunication system (IRCS) when used in the GMDSS.
- .17 Resolution MSC.80(70), annex 1: Performance standards for on-scene (aeronautical) two-way portable VHF radiotelephone apparatus.

11.9.3 The Administration may recognize the coastal State as its authorized representative.

11.9.4 In every case when an authorized representative of the coastal State carries out an inspection, a report should be issued and kept with the radio documents, and a copy, if requested, should be forwarded to the Administration.

11.10 Navigation equipment

11.10.1 All units should comply with SOLAS chapter V.

11.10.2 Administrations may exempt units from navigation equipment carriage requirements, in accordance with SOLAS regulation V/3.

CHAPTER 12

LIFTING DEVICES, PERSONNEL AND PILOT TRANSFER

12.1 Cranes

12.1.1 Each crane, including its supporting structure, which is used for the transfer of material, equipment or personnel between the unit and attending vessels should be of a design and construction to the satisfaction of the Administration and adequate for the service intended in accordance with the requirements of a recognized classification society or with national or international standards or codes.

12.1.2 Cranes should be so located and protected as to reduce to a minimum any danger to personnel, due regard being paid to moving parts or other hazards. Their design should have regard to the materials used in construction, the working conditions to which they will be subjected and the environmental conditions. Adequate provisions should be made to facilitate cleaning, inspection and maintenance.

12.1.3 Consideration should be given to the failure mode for each crane in the event of extreme overload so that the crane operator is exposed to minimum danger.

12.1.4 An officer of the Administration or a duly authorized person or organization should survey the installation of each crane, with particular regard to its supporting structure.

12.1.5 After each crane has been erected on board, and before it is placed in service, operational and load tests should be conducted. These tests should be witnessed and verified by an officer of the Administration or a duly authorized person or organization. A record of these tests and other information concerning initial certification should be readily available.

12.1.6 Each crane should be examined at intervals not exceeding 12 months. It should be further tested and recertified, at intervals not exceeding five years, or after substantial alteration or repairs. These tests should be witnessed and verified by an officer of the Administration or a duly authorized person or organization. A record of these examinations, tests and certifications should be readily available.

12.1.7 Cranes used for loading and discharging of offshore supply vessels should be furnished with rating tables or curves which take into account the dynamics associated with the unit's and vessel's motions.

12.1.8 Except when loads are determined and marked prior to lifting, each crane should be fitted, to the satisfaction of the Administration, with a safety device to give the crane operator a continuous indication of hook load and rated load for each radius. The indicator should give a clear and continuous warning when approaching the rated capacity of the crane.

12.1.9 The Administration should give consideration to the installation of limit switches to provide for the safe operation of the crane.

12.1.10 A crane manual should be provided for each crane and should be readily available. This manual should contain full information concerning:

- .1 design standard, operation, erection, dismantling and transportation;
- .2 all limitations during normal and emergency operations with respect to safe working load, safe working moment, maximum wind, maximum heel and trim, design temperatures and braking systems;
- .3 all safety devices;
- .4 testing of the emergency lowering system for personnel transfer, if fitted;
- .5 diagrams for electrical, hydraulic and pneumatic systems and equipment;
- .6 materials used in construction, welding procedures and extent of non-destructive testing; and
- .7 guidance on maintenance and periodic inspection.

12.2 Lifting and hoisting equipment

12.2.1 All lifting and hoisting equipment, including its supporting structure, should be of a design and construction to the satisfaction of the Administration and adequate for the service intended in accordance with the requirements of a recognized classification society or with national or international standards or codes.

12.2.2 Information on the rated capacity of all lifting and hoisting equipment, developed in accordance with national or international standards or codes, should be available on the unit.

12.3 Personnel lifts

12.3.1 Personnel lifts should be of a design acceptable to the Administration and adequate for the service intended.

12.3.2 The construction and installation should be surveyed by an officer of the Administration or a duly authorized person or organization. The inspections should be carried out on installation and at intervals not exceeding 12 months and certificates or reports should be readily available.

12.3.3 Each lift car in a column of a column-stabilized unit should provide for an emergency exit with an escape ladder in the hoistway.

12.4 Personnel and pilot transfer

12.4.1 All personnel transfer nets or platforms should be designed and constructed to the satisfaction of the Administration.

12.4.2 A personnel transfer net or platform may be used to satisfy the pilot transfer arrangement required by SOLAS regulation V/23.

12.5 Drilling derricks

The design of each drilling derrick and its supporting structure should be to the satisfaction of the Administration. The rated capacity for each reeving should be included in the operating manual.

CHAPTER 13

HELICOPTER FACILITIES⁵⁰

13.1 General

Each helideck should be of sufficient size and located so as to provide a clear take-off and approach to enable the largest helicopter using the helideck to operate under the most severe conditions anticipated for helicopter operations.

13.2 Definitions

13.2.1 *Final approach and take-off area (FATO)* is a defined area over which the final phase of the approach manoeuvre to hover or landing of the helicopter is intended to be completed and from which the take-off manoeuvre is intended to be commenced.

13.2.2 *Limited obstacle sector (LOS)* is a sector extending outward which is formed by that portion of the 360° arc, excluding the obstacle-free sector, the centre of which is the reference point from which the obstacle-free sector is determined. Obstacles within the limited obstacle sector are limited to specified heights.

13.2.3 *Obstacle* is any object, or part thereof, that is located on an area intended for the movement of a helicopter on a helideck or that extends above a defined surface intended to protect a helicopter in flight.

13.2.4 *Obstacle-free sector* is a complex surface originating at, and extending from, a reference point on the edge of the FATO of a helideck, comprised of two components, one above and one below the helideck for the purpose of flight safety within which only specified obstacles are permitted.

13.2.5 *Touchdown and lift-off area (TLOF)* is a dynamic load-bearing area on which a helicopter may touch down or lift off. For a helideck it is presumed that the FATO and the TLOF will be coincidental.

13.3 Construction

13.3.1 The helideck should be of a design and construction, adequate for the intended service and for the appropriate prevailing climatic conditions, approved to the satisfaction of the Administration.

13.3.2 Except as provided for in paragraph 13.3.3, the helideck should meet the following provisions, with reference to the ICAO Convention, Annex 14, Volume II (Heliports), taking into account the type of helicopter used, the conditions of wind, turbulence, sea state, water temperature and icing conditions:

⁵⁰ Reference is made to regulations of national civil aviation authorities in the unit's area of operation, applicable international standards of the International Civil Aviation Organization (ICAO) and recommended practices developed in accordance with the Memorandum of Understanding between IMO and ICAO.

- .1 the helideck should be of sufficient size to contain an area within which can be drawn a circle of diameter not less than D for single main rotor helicopters;
- .2 a helideck obstacle-free sector should comprise of two components, one above and one below helideck level (see figure 13-1):
 - .2.1 above helideck level: The surface should be a horizontal plane level with the elevation of the helideck surface that subtends an arc of at least 210° with the apex located on the periphery of the D reference circle extending outwards to a distance that will allow for an unobstructed departure path appropriate to the helicopter(s) the helideck is intended to serve; and
 - .2.2 below helideck level: Within the (minimum) 210° arc, the surface should additionally extend downward at a 5:1 falling gradient from the edge of the safety net below the elevation of the helideck to water level for an arc of not less than 180° that passes through the centre of the FATO and outwards to a distance that will allow for safe clearance from the obstacles below the helideck in the event of an engine failure for the type of helicopter(s) the helideck is intended to serve (see figure 13-1);
- .3 for single main rotor helicopters, within the 150° LOS out to a distance of $0.12 D$, measured from the point of origin of the LOS, objects should not exceed a height of 0.25 m above the helideck. Beyond that arc, out to a distance of an additional $0.21 D$, the maximum obstacle height is limited to a gradient of one unit vertically for each two units horizontally originating at a height of $0.05 D$ above the level of the helideck (see figure 13-2⁵¹);
- .4 objects the function of which requires that they be located on the helideck within the FATO should be limited to landing nets (where required) and certain lighting systems and should not exceed the surface of the landing area by more than 0.025 m. Such objects should only be present provided they do not cause a hazard to helicopter operations; and
- .5 operations by tandem main rotor helicopters should be specially considered by the Administration.

13.3.3 For benign climates as determined by the coastal State, taking into account the type of helicopter used, the conditions of wind, turbulence, sea state, water temperature and icing conditions, the helideck should meet the following:

- .1 the helideck should be of sufficient size to contain a circle of diameter no less than $0.83 D$;
- .2 a helideck obstacle-free sector shall comprise of two components, one above and one below helideck level (see figure 13-1):

⁵¹ Where the dynamic load bearing area of the helideck enclosed by the *FATO* perimeter marking is a shape other than circular, the extent of the LOS segments are represented as lines parallel to the perimeter of the landing area rather than arcs. Figure 13-2 has been constructed on the assumption that an octagonal helideck is provided.

- .2.1 above helideck level: The surface should be a horizontal plane level with the elevation of the helideck surface that subtends an arc of at least 210° with the apex located on the periphery of the D reference circle extending outwards to a distance that will allow for an unobstructed departure path appropriate to the helicopter(s) the helideck is intended to serve, and
- .2.2 below helideck level: Within the (minimum) 210° arc, the surface should additionally extend downward at a 5:1 falling gradient from the edge of the safety net below the elevation of the helideck to water level for an arc of not less than 180° that passes through the centre of the FATO and outwards to a distance that will allow for safe clearance from the obstacles below the helideck in the event of an engine failure for the type of helicopter(s) the helideck is intended to serve (see figure 13-1);
- .3 for single main rotor helicopters, within $0.415 D$ to $0.5 D$ objects should not exceed a height of 0.025 m. Within the 150° LOS out to a distance of $0.12 D$, measured from the point of origin of the LOS, objects should not exceed a height of 0.05 m above the helideck. Beyond that arc, out to a distance of an additional $0.21 D$, the LOS rises at a rate of one unit vertically for each two units horizontally originating at a height of $0.05 D$ above the level of the helideck (refer to figure 13-3⁵²);
- .4 objects the function of which requires that they be located on the helideck within the FATO should be limited to landing nets (where required) and certain lighting systems and should not exceed the surface of the landing area by more than 0.025 m. Such objects should only be present provided they do not cause a hazard to helicopter operations; and
- .5 operations by tandem main rotor helicopters should be specially considered by the Administration.

13.3.4 The helideck should have a skid-resistant surface.

13.3.5 Where the helideck is constructed in the form of a grating, the underdeck should be such that the ground effect is maintained.

13.4 Arrangements

13.4.1 The helideck should have recessed tie-down points for securing a helicopter.

13.4.2 The periphery of the helideck should be fitted with a safety net except where structural protection exists. The net should be inclined upwards at an angle of 10° and outwards from below the edge of the helideck to a horizontal distance of 1.5 m and should not rise above the edge of the deck.

13.4.3 The helideck should have both a main and an emergency personnel access route located as far apart from each other as practicable.

⁵² Where the dynamic load bearing area of the helideck enclosed by the FATO perimeter marking is a shape other than circular, the extent of the LOS segments are represented as lines parallel to the perimeter of the landing area rather than arcs. Figure 13-3 has been constructed on the assumption that an octagonal helideck is provided.

13.4.4 Reference should be made to paragraph 9.16.5 concerning helideck drainage.

13.5 Visual aids

Wind direction indicator

13.5.1 A wind direction indicator should be located on the unit which, in so far as is practicable, indicates the wind conditions over the TLOF in such a way as to be free from the effects of airflow disturbances caused by nearby objects or rotor downwash. It should be visible from a helicopter in flight or in a hover over the helideck. Where the TLOF may be subject to a disturbed air flow then additional wind direction indicators located close to the area should be provided to indicate the surface wind on those areas. Placement of the wind direction indicators should not compromise obstacle-protected surfaces.

13.5.2 Units on which night helicopter operations take place should have provisions to illuminate the wind direction indicators.

13.5.3 A wind direction indicator should be a truncated cone made of lightweight fabric and should have the following minimum dimensions:

Length	1.2 m
Diameter (larger end)	0.3 m
Diameter (smaller end)	0.15 m

13.5.4 The colour of the wind direction indicator should be so selected as to make it clearly visible and understandable from a height of at least 200 m above the heliport, having regard to background. Where practicable, a single colour, preferably white or orange, should be used. Where a combination of two colours is required to give adequate conspicuity against changing backgrounds, they should preferably be orange and white, or red and white, and should be arranged in five alternate bands the first and last band being the darker colour.

Heliport identification marking

13.5.5 A heliport identification marking should be located at the centre of the touchdown/positioning marking described in paragraphs 13.5.12 to 13.5.14. It should consist of a white “H” that is 4 m high, 3 m wide, with a stroke width of 0.75 m.

D-value marking

13.5.6 The actual *D*-value of the helideck should be painted on the helideck inboard of the chevron provided in accordance with paragraph 13.5.15 in alphanumeric symbols of 0.1 m in height.

13.5.7 The helideck *D*-value should also be marked around the perimeter of the helideck in the manner shown in figure 13-5 in a colour contrasting (preferably white: avoid black or grey for night use) with the helideck surface. The *D*-value should be to the nearest whole number with 0.5 rounded down, e.g., 18.5 marked as 18. Markings for some helicopters may require special consideration.⁵³

⁵³ Helidecks designed specifically for AS332L2 and EC 225 helicopters, each having a *D*-value of 19.5 m, should be rounded up to 20 in order to differentiate between helidecks designed specifically for L1 models.

Maximum allowable mass marking

13.5.8 A maximum allowable mass marking should be located within the TLOF and so arranged as to be readable from the preferred final approach direction, i.e. towards the obstacle-free sector origin.

13.5.9 The maximum allowable mass marking should consist of a two- or three-digit number followed by a letter “t” to indicate the allowable helicopter mass in tonnes (1,000 kg). The marking should be expressed to one decimal place, rounded to the nearest 100 kg. Where States require that a maximum allowable weight is indicated in pounds, the marking should consist of a two- or three-digit number to indicate the allowable helicopter weight in thousands of pounds, rounded to the nearest 1,000 pounds.

13.5.10 The height of the figures should be 0.9 m with a line width of approximately 0.12 m and be in a colour (preferably white) which contrasts with the helideck surface. Where possible the mass marking should be well separated from the installation identification marking in order to avoid possible confusion on recognition.

TLOF perimeter marking

13.5.11 The TLOF perimeter marking should be located along the perimeter of the TLOF and should consist of a continuous white line with a width of at least 0.3 m. TLOF perimeter markings are typically for a 1 *D* or 0.83 *D* value (see figures 13-2 and 13-3).

Touchdown/positioning marking

13.5.12 A touchdown/positioning marking should be located so that when the pilot’s seat is over the marking the whole of the undercarriage will be within the TLOF and all parts of the helicopter will be clear of any obstacle by a safe margin.

13.5.13 The centre of the touchdown/positioning marking should be concentric to the centre of the TLOF.⁵⁴

13.5.14 A touchdown/positioning marking should be a yellow circle and have a line width of 1 m. The inner diameter of the circle should be half the *D*-value of the largest helicopter for which the TLOF is designed.

Helideck obstacle-free sector marking

13.5.15 Except as provided in paragraph 13.5.16, a helideck obstacle-free sector marking should be located on the TLOF perimeter marking and indicated by the use of a black chevron, each leg being 0.8 m long and 0.1 m wide forming the angle in the manner shown in figure 13-5. The obstacle-free sector marking should indicate the origin of the obstacle-free sector, the directions of the limits of the sector and the verified *D*-value of the helideck. Should there not be room to place the chevron where indicated, the chevron marking, but not the point of origin, may be displaced towards the circle centre.

⁵⁴ The marking may be offset away from the origin of the obstacle-free sector by no more than 0.1 *D* where an aeronautical study indicates such offsetting to be beneficial, provided that the offset marking does not adversely affect the safety of operations.

13.5.16 For a helideck less than $1 D$ (i.e. a helideck meeting paragraph 13.3.3), a helideck obstacle free sector marking should be located at a distance from the centre of the TLOF equal to the radius of the largest circle which can be drawn in the TLOF or $0.5 D$ whichever is greater.

13.5.17 The height of the chevron should equal the width of the TLOF perimeter marking, but should be not less than 0.3 m. The chevron should be black in colour and may be painted on top of the TLOF perimeter marking in paragraph 13.5.11.

Unit identification markings

13.5.18 The name of the unit should be clearly displayed on unit identification panels located in such positions that the unit can be readily identified from the air and sea from all normal angles and directions of approach. The height of the figures should be at least 0.9 m with a line width of approximately 0.12 m. The unit identification panels should be highly visible in all light conditions and located high up on the unit (e.g., on the derrick). Suitable illumination should be provided for use at night and in conditions of poor visibility.

13.5.19 The unit's name should be provided on the helideck and be positioned on the obstacle side of the touchdown/positioning marking with characters not less than 1.2 m in height and in a colour contrasting with the background.

Perimeter lights

13.5.20 The perimeter of the TLOF should be delineated by green lights visible omnidirectionally from on or above the landing area. These lights should be above the level of the deck but should not exceed 0.25 m in height for helidecks sized in accordance with paragraph 13.3.2 and 0.05 m in height for helidecks sized in accordance with paragraph 13.3.3. The lights should be equally spaced at intervals of not more than 3 m around the perimeter of the TLOF, coincident with the white line delineating the perimeter in paragraph 13.5.10. In the case of square or rectangular decks there should be a minimum of four lights along each side including a light at each corner of the TLOF. Flush fitting lights may be used at the inboard (150° limited obstacle sector origin) edge of the TLOF where there is a need to move a helicopter or large equipment off the TLOF.

13.5.21 Perimeter lights should meet the chromaticity characteristics given in table 13-1, and the vertical beam spread and intensity characteristics given in table 13-2.

Table 13-1 – Perimeter lighting chromaticity

Yellow boundary	$x = 0.36 - 0.08y$
White boundary	$x = 0.65y$
Blue boundary	$y = 0.9 - 0.171x$

Table 13-2 – Green perimeter lighting intensity

Elevation	Intensity (cd)
0° – 90°	60 max [*]
>20° – 90°	3 min
>10° – 20°	15 min
0° – 10°	30 min
Azimuth	+180° -180°

* If higher intensity lighting is provided to assist in conditions of poor visibility during daylight, it should incorporate a control to reduce the intensity to not more than 60 cd for night use.

Helideck floodlights

13.5.22 Helideck floodlights should be located so as to avoid glare to pilots, and provision should be made for periodically checking their alignment. The arrangements and aiming of floodlights should be such that helideck markings are illuminated and that shadows are kept to a minimum. Floodlights should conform to the same height limitations specified in paragraph 13.5.20 for perimeter lights.

Obstacle marking and lighting

13.5.23 Fixed obstacles and permanent equipment, such as crane booms or the legs of self-elevating units, which may present a hazard to helicopters, should be readily visible from the air during daylight. If a paint scheme is necessary to enhance identification by day, alternate black and white, black and yellow, or red and white bands are recommended, not less than 0.5 m nor more than 6 m wide.

13.5.24 Omnidirectional red lights of at least 10 cd intensity should be fitted at suitable locations to provide the helicopter pilot with visual information on objects which may present a hazard to helicopters and on the proximity and height of objects which are higher than the landing area and which are close to it or to the limited obstacle sector boundary. Such lighting should comply with the following:

- .1** Objects which are more than 15 m higher than the landing area should be fitted with intermediate red lights of the same intensity spaced at 10 m intervals down to the level of the landing area (except where such lights would be obscured by other objects).
- .2** Structures such as flare booms and towers may be illuminated by floodlights as an alternative to fitting the intermediate red lights, provided that such lights should be arranged such that they will illuminate the whole of the structure and not interfere with the helicopter pilot's night vision.
- .3** On self-elevating units the leg(s) nearest the helideck may be illuminated by floodlights as an alternative to fitting the intermediate red lights, provided that such lights should be arranged such that they will not interfere with the helicopter pilot's night vision.

- .4 Alternative equivalent technologies to highlight dominant obstacles in the vicinity of the helideck may be utilized in accordance with the recommendations of the ICAO.

13.5.25 An omnidirectional red light of intensity 25 to 200 cd should be fitted to the highest point of the unit and, in the case of self-elevating units, as near as practicable to the highest point of each leg. Where this is not practicable (e.g., flare towers) the light should be fitted as near to the extremity as possible.

Status lights

13.5.26 Status lights should be installed to provide warning that a condition exists on the unit which may be hazardous for the helicopter or its occupants. The status lights should be a flashing red light⁵⁵ (or lights), visible to the pilot from any direction of approach and on any landing heading. The system should be automatically initiated when the toxic gas alarm under paragraph 5.7.2 is initiated as well as being capable of manual activation at the helideck. It should be visible at a range in excess of the distance at which the helicopter may be endangered or may be commencing a visual approach. The status light system should:

- .1 be installed either on or adjacent to the helideck. Additional lights may be installed in other locations on the unit where this is necessary to meet the requirement that the signal be visible from all approach directions, i.e. 360° in azimuth;
- .2 have an effective intensity of at least 700 cd between 2° and 10° above the horizontal and at least 176 cd at all other angles of elevation;
- .3 be provided with a facility to enable the output of the lights (if and when activated) to be dimmed to an intensity not exceeding 60 cd while the helicopter is landed on the helideck;
- .4 be visible from all possible approach directions and while the helicopter is landed on the helideck, regardless of heading with a vertical beam spread as describe above;
- .5 use lights that are ‘red’ as defined by ICAO⁵⁶;
- .6 flash at a rate of 120 flashes per minute and, if two or more lights are needed to meet this requirement, they should be synchronised to ensure an equal time gap (to within 10%) between flashes. Provision should be made to reduce the flash rate to 60 flashes per minute should a helicopter be on the helideck. The maximum duty cycle should be no greater than 50%;
- .7 have facilities at the helideck to manually override the automatic activation of the system;

⁵⁵ The aeronautical meaning of a flashing red light is either “do not land, aerodrome not available for landing” or “move clear of landing area”.

⁵⁶ Reference is made to the ICAO Convention, Annex 14, Volume 1, Appendix 1, Colours for aeronautical ground lights.

- .8 reach full intensity in not less than three seconds at all times;
- .9 be designed so that no single failure will prevent the system operating effectively. In the event that more than one light unit is used to meet the flash rate requirement, a reduced flash frequency of at least 60 flashes per minute is acceptable in the failed condition for a limited period; and
- .10 where supplementary 'repeater' lights are employed for the purposes of achieving the 'on deck' 360° coverage in azimuth, these should have a minimum intensity of 16 cd and a maximum intensity of 60 cd for all angles of azimuth and elevation.

13.6 Motion sensing system

Vessel motions represent a potential hazard to helicopter operations. Surface units should be equipped with an electronic motion-sensing system capable of measuring or calculating the magnitude and rate of pitch roll and heave at the helideck about the true vertical datum. A motion-sensing system display should be located at the aeromobile VHF radiotelephone station provided in accordance with section 11.6, so that this information may be relayed to the helicopter pilot. The form of the report should be agreed with the aeronautical service provider.

13.7 Exemptions

Administrations should consider exemptions from or equivalencies to the provisions of this chapter regarding markings and landing aids when:

- .1 the Administration is provided with evidence that the coastal State in whose waters the MODU is operating has notified the ICAO of differences to its requirements for visual aids; or
- .2 the Administration is provided with evidence that the coastal State in whose waters the MODU is operating has established requirements for visual aids that differ from the provisions of this chapter.

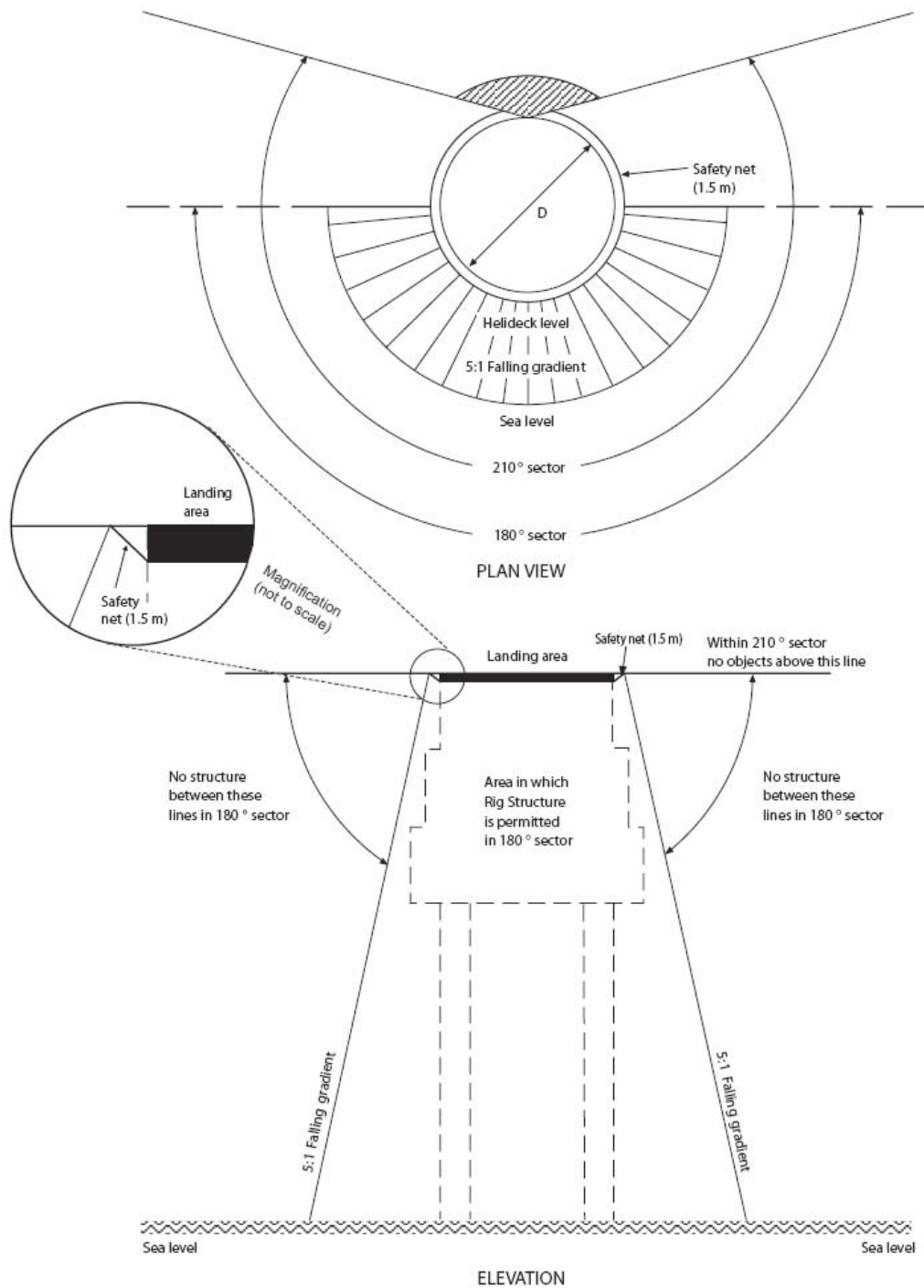


Figure 13-1 – Obstacle free areas – below landing area level

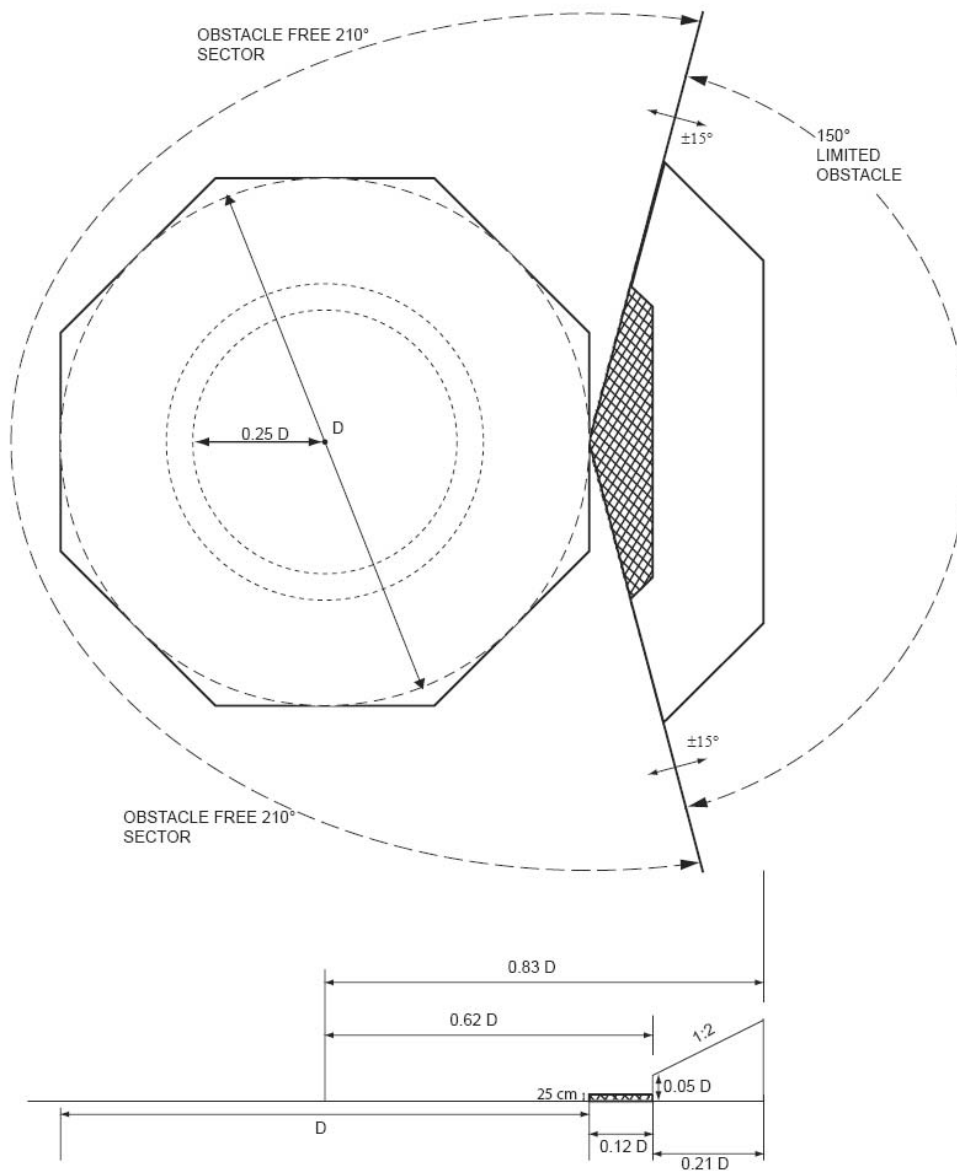


Figure 13-2 – Helideck obstacle limitation sector: single main rotor helicopters

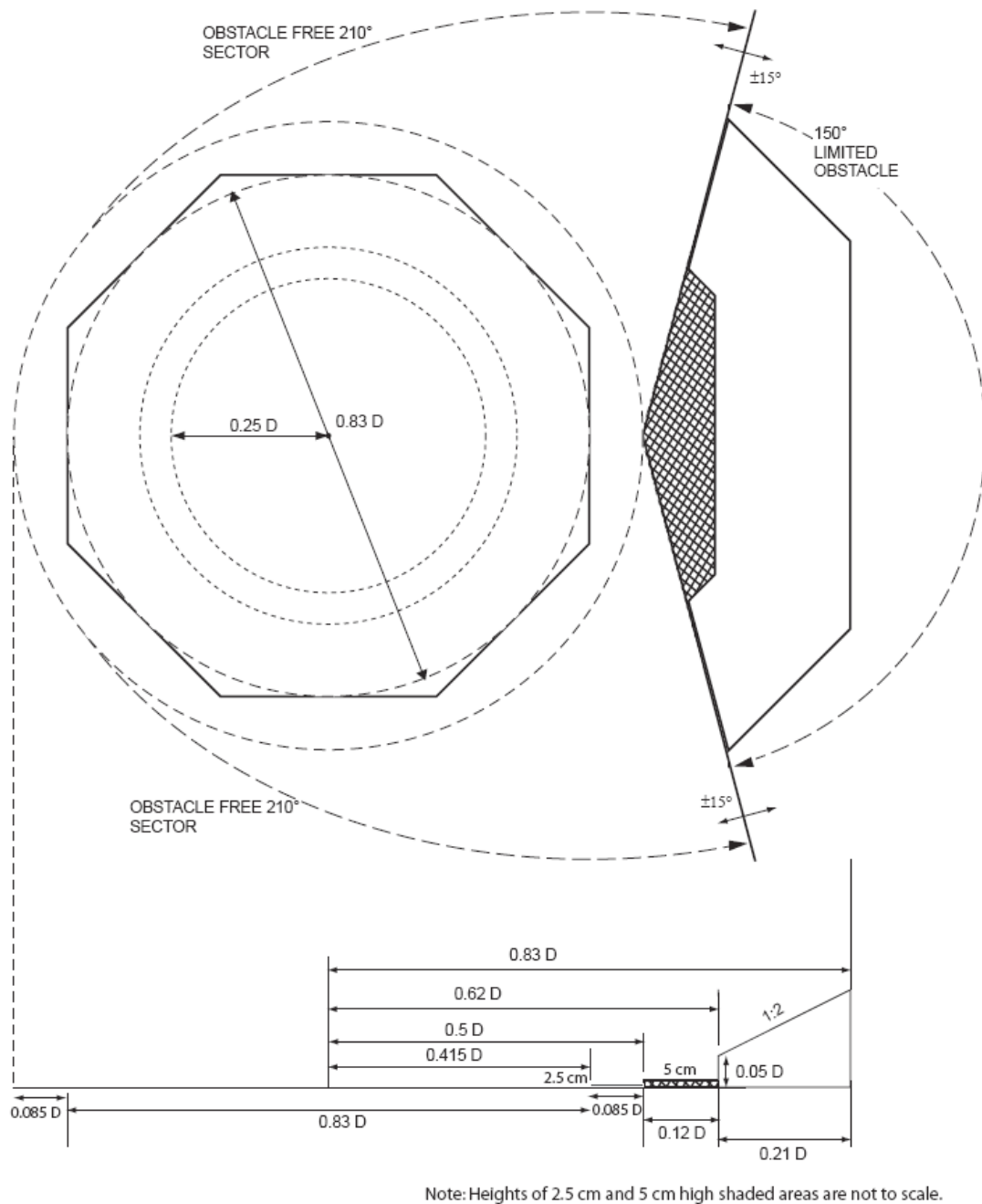


Figure 13-3 – Helideck obstacle limitation sector: single main rotor helicopters for benign climate conditions as accepted by the coastal State

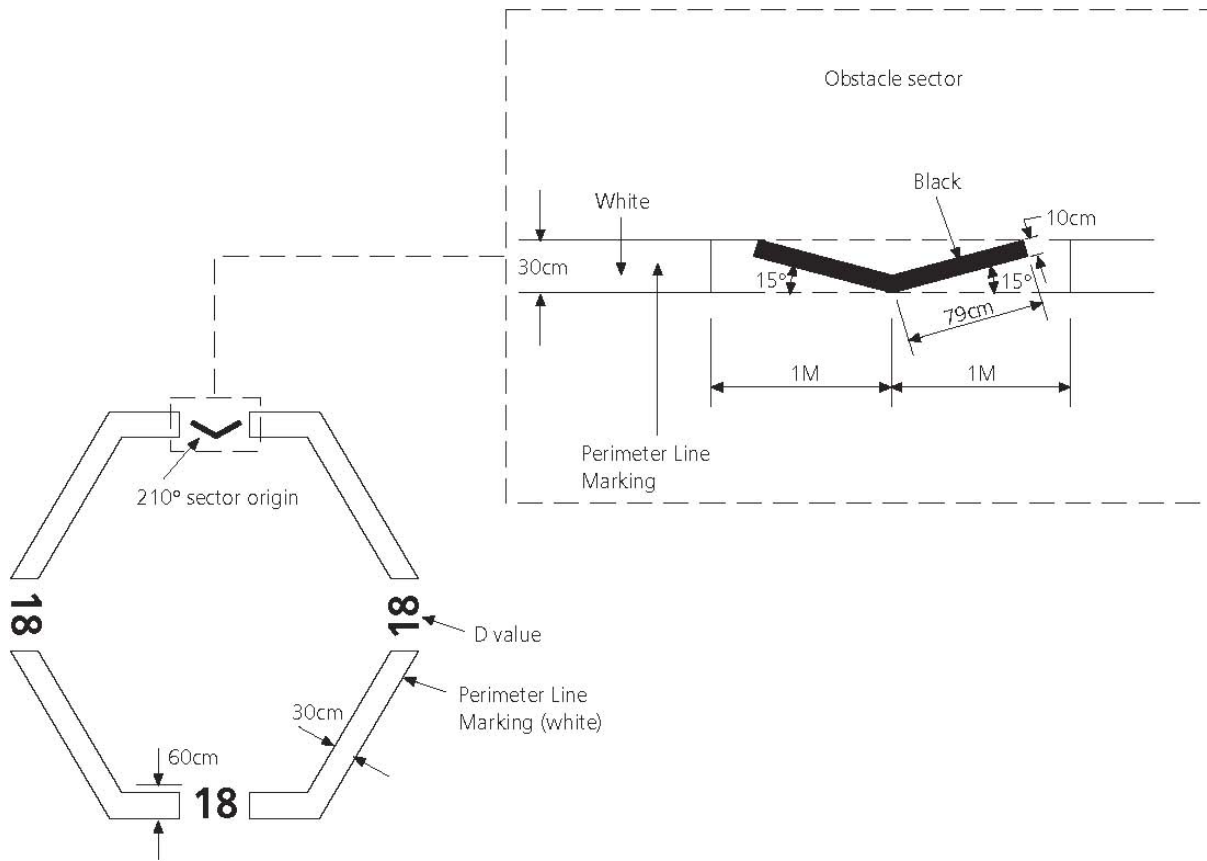


Figure 13-4 – Obstacle-free sector marking

CHAPTER 14

OPERATIONS

14.1 Operating manuals

14.1.1 Operating manuals containing guidance for the safe operation of the unit for both normal and envisaged emergency conditions, approved by the Administration, should be provided on board and be readily available to all concerned. The manuals should, in addition to providing the necessary general information about the unit, contain guidance on and procedures for the operations that are vital to the safety of personnel and the unit. The manuals should be concise and be compiled in such a manner that they are easily understood. Each manual should be provided with a contents list, an index and wherever possible be cross-referenced to additional detailed information which should be readily available on board.

14.1.2 The operating manual for normal operations should include the following general descriptive information, where applicable:

- .1 a description and particulars of the unit;
- .2 a chain of command with general responsibilities during normal operation;
- .3 limiting design data for each mode of operation, including draughts, air gap, wave height, wave period, wind, current, sea and air temperatures, assumed seabed conditions, and any other applicable environmental factors, such as icing;
- .4 a description of any inherent operational limitations for each mode of operation and for each change in mode of operation;
- .5 the location of watertight and weathertight boundaries, the location and type of watertight and weathertight closures and the location of downflooding points;
- .6 the location, type and quantities of permanent ballast installed on the unit;
- .7 a description of the general emergency, toxic gas (hydrogen sulphide), combustible gas, fire alarm and abandon unit signals;
- .8 for self-elevating units, information regarding the preparation of the unit to avoid structural damage during the setting or retraction of legs on or from the seabed or during extreme weather conditions while in transit, including the positioning and securing of legs, cantilever drill floor structures and drilling equipment or materials which might shift position;
- .9 light ship data together with a comprehensive listing of the inclusions and exclusions of semi-permanent equipment;
- .10 stability information setting forth the allowable maximum height of the centre of gravity in relation to draught data or other parameters based upon compliance with the intact and damage criteria;

- .11 a capacity plan showing the capacities and the vertical, longitudinal and transverse centres of gravity of tanks and bulk material stowage spaces;
- .12 tank sounding tables or curves showing capacities, the vertical, longitudinal and transverse centres of gravity in graduated intervals and the free surface data of each tank;
- .13 acceptable structural deck loadings;
- .14 identification of helicopters suited for the design of the helideck and any limiting conditions of operation;
- .15 identification and classification of hazardous areas on the unit;
- .16 description and limitations of any on-board computer used in operations such as ballasting, anchoring, dynamic positioning and in trim and stability calculations;
- .17 description of towing arrangements and limiting conditions of operation;
- .18 description of the main power system and limiting conditions of operation; and
- .19 a list of key plans and schematics.

14.1.3 The operating manual for normal operations should also include, where applicable:

- .1 guidance for the maintenance of adequate stability and the use of the stability data;
- .2 guidance for the routine recording of lightweight alterations;
- .3 examples of loading conditions for each mode of operation and instructions for developing other acceptable loading conditions, including the vertical components of the forces in the anchor cables;
- .4 for column-stabilized units, a description, schematic diagram and guidance for the operation of the ballast system and of the alternative means of ballast system operation, together with a description of its limitations, such as pumping capacities at various angles of heel and trim;
- .5 a description, schematic diagram, guidance for the operation of the bilge system and of the alternative means of bilge system operation, together with a description of its limitations, such as draining of spaces not directly connected to the bilge system;
- .6 fuel oil storage and transfer procedures;
- .7 procedures for changing modes of operation;
- .8 guidance on severe weather operations and time required to meet severe storm conditions, including provisions regarding lowering or stowage of equipment, and any inherent operational limitations;

- .9 description of the anchoring arrangements and anchoring or mooring procedures and any limiting factors;
- .10 personnel transfer procedures;
- .11 procedures for the arrival, departure and fuelling of helicopters;
- .12 limiting conditions of crane operations;
- .13 description of the dynamic positioning systems and limiting conditions of operation;
- .14 procedures for ensuring that the requirements of applicable international codes for the stowage and handling of dangerous and radioactive materials are met;
- .15 guidance for the placement and safe operation of the well testing equipment. The areas around possible sources of gas release should be classified in accordance with section 6.1 for the duration of well test operations;
- .16 procedures for receiving vessels alongside; and
- .17 guidance on safe towing operations such as to reduce to a minimum any danger to personnel during towing operations.

14.1.4 The operating manual for emergency operations should include, where applicable:

- .1 description of fire-extinguishing systems and equipment;
- .2 description of the life-saving appliances and means of escape;
- .3 description of the emergency power system and limiting conditions of operation;
- .4 a list of key plans and schematics which may be useful during emergency situations;
- .5 general procedures for deballasting or counterflooding and the closure of all openings which may lead to progressive flooding in the event of damage;
- .6 guidance for the person in charge in determining the cause of unexpected list and trim and assessing the potential affects of corrective measures on unit survivability, i.e. strength, stability, buoyancy, etc.;
- .7 special procedures in the event of an uncontrolled escape of hydrocarbons or hydrogen sulphide, including emergency shutdown;
- .8 guidance on the restoration of mechanical, electrical and ventilation systems after main power failure or emergency shutdown; and
- .9 ice alert procedures.

14.1.5 The information provided in the operating manuals should, where necessary, be supported by additional material provided in the form of plans, manufacturers' manuals and other data necessary for the efficient operation and maintenance of the unit. Detailed information provided in manufacturers' manuals need not be repeated in the operating manuals. The information should be referenced in the operating manual, readily identified, located in an easily accessible place on the unit and be available at all times.

14.1.6 Operating and maintenance instructions and engineering drawings for ship machinery and equipment essential to the safe operation of the ship should be written in a language understandable by those officers and crew members who are required to understand such information in the performance of their duties.

14.2 Helicopter facilities

14.2.1 The operating manual for normal operations under paragraph 14.1.3 should include a description and a checklist of safety precautions, procedures and equipment requirements.

14.2.2 If refuelling capability is to be provided, the procedures and precautions to be followed during refuelling operations should be in accordance with recognized safe practices and contained in the operations manual.

14.2.3 Fire-fighting personnel, consisting of at least two persons trained for rescue and fire-fighting duties, and fire-fighting equipment should be immediately available when the helicopter is about to land, landing, refuelling, or during take-off.

14.2.4 Fire-fighting personnel should be present during refuelling operations. However, the fire-fighting personnel should not be involved with refuelling activities.

14.3 Material safety data sheets

Units carrying oil fuel, as defined in regulation 1 of Annex I of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, should be provided with material safety data sheets, based on the recommendations developed by the Organization⁵⁷, prior to the bunkering of oil fuel.

14.4 Dangerous goods

14.4.1 Dangerous goods should be stored safely and appropriately according to the nature of the goods. Incompatible goods should be segregated from one another.

14.4.2 Explosives which present a serious risk should be stored in a suitable magazine which should be kept securely closed. Such explosives should be segregated from detonators. Electrical apparatus and cables in any compartment in which it is intended to store explosives should be designed and used so as to minimize the risk of fire or explosion.

14.4.3 Flammable liquids which give off dangerous vapours and flammable gases should be stored in a well-ventilated space or on deck.

⁵⁷ Refer to the Recommendation for material safety data sheets (MSDS) for MARPOL Annex I cargoes and marine fuel oils, adopted by the Organization by resolution MSC.150(77), as may be amended.

14.4.4 Substances which are liable to spontaneous heating or combustion should not be carried unless adequate precautions have been taken to prevent the outbreak of fire.

14.4.5 Radioactive substances should be stored and handled in a safe manner.

14.5 Pollution prevention

Provision should be made such that the unit can comply with the requirements of international conventions in force.

14.6 Transfer of material, equipment or personnel

14.6.1 Transfer operations, including the weights of loads to be handled, any limiting conditions of operation and emergency procedures should be discussed and agreed between personnel on the unit and on attending vessels prior to commencement of such transfers. Direct communications should be maintained with the crane operator throughout such operations.

14.6.2 Where appropriate to the operation, the unit should be equipped with at least two independent means for mooring attending vessels. The mooring positions should be such that sufficient crane capacity in terms of lift and outreach is available to handle loads in a safe manner.

14.6.3 The arrangement of mooring attachments on the unit to facilitate transfer operations should have regard to the risk of damage should the attending vessel come in contact with the unit.

14.6.4 The mooring arrangements and procedures should be such as to reduce to a minimum any danger to personnel during mooring operations.

14.6.5 The mooring lines between the unit and the attending vessel should, as far as practicable, be arranged so that if a line breaks, danger to personnel on both the attending vessel and the unit is minimized.

14.6.6 Discharges from the unit, such as those from the sewage system or ventilation from bulk tanks, should be arranged so that they minimize danger to personnel on the deck of attending vessels.

14.7 Diving systems

14.7.1 Diving systems, if provided, should be installed, protected and maintained so as to minimize, so far as practicable, any danger to personnel or the unit, due regard being paid to fire, explosion or other hazards.

14.7.2 Diving systems should be designed, constructed, maintained and certified in accordance with a national or international standard or code acceptable to the Administration⁵⁸, which may be employed for fixed diving systems, if provided.

⁵⁸ Refer to the Code of safety for diving systems, 1995, adopted by the Organization by resolution A.831(19).

14.8 Safety of navigation

14.8.1 The requirements of the Convention on the International Regulations for Preventing Collisions at Sea in force should apply to each unit except when stationary and engaged in drilling operations.

14.8.2 Each unit when stationary and engaged in drilling operations should comply with the requirements for the safety of navigation of the coastal State in whose territorial sea or on whose continental shelf the unit is operating.

14.8.3 Each unit when stationary and engaged in drilling operations should inform the national hydrographic office concerned about its position in latitude and longitude, together with the approximate duration of the operation so as to facilitate the promulgation of a temporary Notice to Mariners. Details of future movements of units should also be passed to national hydrographic offices so that temporary Notices may be promulgated before a unit gets underway.

14.9 Emergency procedures

Person in charge

14.9.1 The person on each unit to whom all personnel on board are responsible in an emergency should be clearly defined. This person should be designated by title by the owner or operator of the unit or the agent of either of them.

14.9.2 The person in charge should be well acquainted with the characteristics, capabilities and limitations of the unit. This person should be fully cognizant of his responsibilities for emergency organization and action, for conducting emergency drills and training, and for keeping records of such drills.

Manning of survival craft and supervision

14.9.3 There should be a sufficient number of trained persons on board for mustering and assisting untrained persons.

14.9.4 There should be a sufficient number of certificated persons on board for launching and operating the survival craft to which personnel are assigned.

14.9.5 Certificated persons should be placed in command and as second-in-command of each lifeboat.

14.9.6 The person in command of the lifeboat and the second-in-command should have a list of all persons assigned to the boat and should see that persons under their command are acquainted with their duties.

14.9.7 Every lifeboat should have a person assigned who is capable of operating the lifeboat radio equipment.

14.9.8 Every lifeboat should have a person assigned who is capable of operating the engine and carrying out minor adjustments.

14.9.9 The person in charge of the unit should ensure the equitable distribution of persons referred to in paragraphs 14.9.3, 14.9.4 and 14.9.5 among the unit's survival craft.

Muster list

14.9.10 Muster lists should be exhibited in conspicuous places throughout the unit including the control rooms and accommodation spaces. Muster lists should be drawn up in the working language or languages of the crew.

14.9.11 The muster list should specify details of the general alarm system signals and also the action to be taken in all operating modes by every person when these alarms are sounded, indicating the location to which they should go and the general duties, if any, they would be expected to perform.

14.9.12 The following duties should be included in the muster list:

- .1** closing of the watertight doors, fire doors, valves, vent inlets and outlets, scuppers, sidescuttles, skylights, portholes and other similar openings in the unit;
- .2** equipping of the survival craft and other life-saving appliances;
- .3** preparation and launching of survival craft;
- .4** general preparation of other life-saving appliances;
- .5** muster of visitors;
- .6** use of communication equipment;
- .7** manning of fire parties assigned to deal with fires;
- .8** special duties assigned in respect to the use of fire-fighting equipment and installations;
- .9** emergency duties on the helicopter deck; and
- .10** special duties assigned in the event of an uncontrolled escape of hydrocarbons or hydrogen sulphide, including emergency shutdown.

14.9.13 The muster list should specify substitutes for key persons who may become disabled, taking into account that different emergencies may call for different actions.

14.9.14 The muster list should show the duties assigned to regularly assigned personnel in relation to visitors in case of emergency.

14.9.15 Each unit should have a current muster list revised as necessary to reflect any procedural changes.

14.9.16 In deciding on the level of detail to be included in the muster list, account should be taken of information available in other documents, e.g., operating manual.

14.10 Emergency instructions

Illustrations and instructions should be conspicuously displayed at muster stations, control positions, working spaces and accommodation spaces to inform all on board of:

- .1 the method of donning lifejackets; and
- .2 the method of donning immersion suits, if applicable.

14.11 Training manual and onboard training aids

A training manual and onboard training aids complying with the relevant requirements of SOLAS regulations II-2/15 and III/35 should be provided and relevant information made available to each person on board.

14.12 Practice musters and drills

14.12.1 One abandon unit drill and one fire drill should be conducted every week. Drills should be so arranged that all personnel participate in a drill at least once a month. A drill should take place within 24 h after a personnel change if more than 25% of the personnel have not participated in abandon unit and fire drills on board that particular unit in the previous month. The Administration may accept other arrangements that are at least equivalent for those units for which this is impracticable.

14.12.2 Drills and exercises should be conducted in accordance with the recommendations of the Organization.⁵⁹

14.12.3 Different lifeboats should, as far as practicable, be lowered in compliance with the provisions of paragraph 14.12.2 at successive drills.

14.12.4 Drills should, as far as practicable, be conducted as if there were an actual emergency and should include at least the following:

- .1 the functions and use of the life-saving appliances; and
- .2 except for free-fall lifeboats, starting of engines and lowering of at least one lifeboat and, at least once every three months when conditions permit, launching and manoeuvring with the assigned operating crew on board.

14.12.5 As far as is reasonably practicable, rescue boats, including lifeboats which are also rescue boats, should be launched each month with their assigned crew aboard and manoeuvred in the water. In all cases these provisions should be complied with at least once every three months.

14.12.6 For lifeboats, except for lifeboats that are also rescue boats, the provisions of SOLAS regulation III/19.3.3.3 should be applied.

14.12.7 In the case of a lifeboat arranged for free-fall launching, the provisions of SOLAS regulation III/19.3.3.4 should be applied.

⁵⁹ Refer to the Recommendations on training of personnel on mobile offshore units, adopted by the Organization by resolution A.891(21).

14.13 Onboard training and instructions⁶⁰

14.13.1 All persons should be provided with familiarization training in accordance with the recommendations of the Organization.

14.13.2 All persons should be provided with training in personal safety and emergency response commensurate with their assigned duties in accordance with the recommendations of the Organization.

14.14 Records

14.14.1 An official log or tour record⁶¹ in a format acceptable to the Administration should be maintained on board the unit to include a record of:

- .1 inspection of lifesaving equipment under paragraph 10.18.8; and
- .2 drills and exercises under paragraph 14.9.2 and section 14.12.

14.14.2 If not included in the official log or tour record, the following additional information or records should be maintained for a period acceptable to the Administration:

- .1 survey record under section 1.6;
- .2 inspection and maintenance records related to means of access under paragraph 2.2.3.1.8;
- .3 light ship data alterations log under paragraph 3.1.4;
- .4 testing records and equipment changes for anchors and related equipment under paragraph 4.12.2;
- .5 maintenance, inspection and testing records relating to fire-fighting equipment under paragraph 9.19.4;
- .6 maintenance records related to life-saving equipment under section 10.18;
- .7 inspections of cranes under paragraphs 12.1.5 and 12.1.6;
- .8 rated capacities of lifting and hoisting equipment under paragraph 12.2.2; and
- .9 muster lists under paragraph 14.9.10.

14.14.3 A copy of the documentation, as approved by the Administration, indicating that any alternative design and arrangements comply with sections 4.2, 5.2, 9.1 and 10.2 of this Code should be carried on board the unit.

⁶⁰ Refer to the Recommendations on training of personnel on mobile offshore units, adopted by the Organization by resolution A.891(21).

⁶¹ Refer to the International Association of Drilling Contractors' Daily Drilling Report.

Appendix

*Model form of Mobile Offshore Drilling Unit
Safety Certificate (2009)*

**MOBILE OFFSHORE DRILLING UNIT
SAFETY CERTIFICATE (2009)**

(Official seal)

(State)

Issued under the provisions of the

IMO CODE FOR THE CONSTRUCTION AND EQUIPMENT
OF MOBILE OFFSHORE DRILLING UNITS, 2009

under the authority of the Government of

.....
(full designation of the State)

by

*(full official designation of the competent person or
organization authorized by the Administration)*

Distinctive identification (name or number)	Type (section 1.3 of the Code)	Port of registry

Date on which keel was laid or unit was at
a similar stage of construction or on which
major conversion was commenced

THIS IS TO CERTIFY:

- 1 That the above-mentioned unit has been duly surveyed in accordance with the applicable provisions of the Code for the Construction and Equipment of Mobile Offshore Drilling Units, 2009.
- 2 That the survey showed that the structure, equipment, fittings, radio station arrangements and materials of the unit and the condition thereof are in all respects satisfactory and that the unit complies with the relevant provisions of the Code.

3 That the life-saving appliances provide for a total number of persons and no more as follows:

.....

4 That, in accordance with section 1.4 of the Code, the provisions of the Code are modified in respect of the unit in the following manner:

.....

5 That this unit has been issued with an approval for the continuous survey techniques under paragraph 1.6.4 of the Code in lieu of renewal and intermediate surveys in respect of:

Hull

Machinery

.....
*signature and seal of approving
authority*

.....
*date of continuous survey
programme approval*

This certificate is valid until day of 20

Issued at
(place of issue of certificate)

.....
(date of issue)

.....
*signature of authorized official
issuing the certificate*

.....
(seal or stamp of the issuing authority, as appropriate)

Endorsement for annual and intermediate surveys

This is to certify that, at a survey under section 1.6 of the Code, this unit was found to comply with the relevant provisions of the Code.

Annual survey: signed
(signature of authorized official)

place

date

(seal or stamp of authority, as appropriate)

Annual/intermediate survey: signed
(signature of authorized official)

place

date

(seal or stamp of authority, as appropriate)

Annual/intermediate survey: signed
(signature of authorized official)

place

date

(seal or stamp of authority, as appropriate)

Annual survey: signed
(signature of authorized official)

place

date

(seal or stamp of authority, as appropriate)

**Annual/intermediate survey in accordance with
paragraph 1.6.11.7.3 of the Code**

Annual survey: signed
(signature of authorized official)
place
date
(seal or stamp of authority, as appropriate)

Endorsement for the dry-dock survey

This is to certify that, at a survey under section 1.6 of the Code, this unit was found to comply with the relevant provisions of the Code.

First inspection: signed
(signature of authorized official)
place
date
(seal or stamp of authority, as appropriate)

Second inspection: signed
(signature of authorized official)
place
date
(seal or stamp of authority, as appropriate)

**Endorsement to extend the certificate if valid for less than five years
where paragraph 1.6.11.3 of the Code applies**

This unit complies with the relevant provisions of the Code, and this certificate should, in accordance with paragraph 1.6.11.3 of the Code, be accepted as valid until

signed
(signature of authorized official)

place

date

(seal or stamp of authority, as appropriate)

**Endorsement where the renewal survey has been completed
and paragraph 1.6.11.4 of the Code applies**

This unit complies with the relevant provisions of the Code, and this certificate should, in accordance with paragraph 1.6.11.4 of the Code, be accepted as valid until

signed
(signature of authorized official)

place

date

(seal or stamp of authority, as appropriate)

**Endorsement to extend the validity of the certificate until reaching the port of survey
where paragraph 1.6.11.5 of the Code applies**

This certificate should, in accordance with paragraph 1.6.11.5 of the Code, be accepted until

signed
(signature of authorized official)

place

date

(seal or stamp of authority, as appropriate)

**Endorsement for the advancement of the anniversary date
where paragraph 1.6.11.7 of the Code applies**

In accordance with paragraph 1.6.11.7 of the Code, the new anniversary date is

signed
(signature of authorized official)

place

date

(seal or stamp of authority, as appropriate)

In accordance with paragraph 1.6.11.7 of the Code, the new anniversary date is

signed
(signature of authorized official)

place

date

(seal or stamp of authority, as appropriate)
