MARITIME AND PORT AUTHORITY OF SINGAPORE
SHIPPING CIRCULAR TO SHIPOWNERS NO. 18 OF 2013

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Applicable to: This circular is for the attention of ship owners, managers, operators, agents, masters, crew members and surveyors

GUIDANCE ON SHIPBOARD OPERATIONAL MATTERS: CIRCULARS APPROVED BY THE 92ND SESSION OF THE MARITIME SAFETY COMMITTEE (MSC 92) OF IMO

Related circular: Shipping circular no. 17 of 2013 on *Resolutions adopted by the 92nd session of the Maritime Safety Committee (MSC 92) of IMO*

1. The Maritime Safety Committee of the International Maritime Organisation (IMO), at its 92nd session (12 to 21 June 2013), approved a number of circulars which provides guidance to improve the safety and efficiency of shipboard operations. This circular informs the Shipping Community of the MSC circulars, as listed below.

2. **Carriage of Solid Bulk Cargoes**

In conjunction with the adoption of amendment to the International Maritime Solid Bulk Cargoes (IMSBC) Code, MSC 92 approved the following MSC circulars related to the carriage of solid bulk cargoes.

a. MSC.1/Circ.1452 - Early implementation of amendments (02-13) to the International Maritime Solid Bulk Cargoes (IMSBC) Code

The circular encourages the early implementation of the amendments to the IMSBC Code adopted by MSC 92, in particular sections 4 and 8 relating to the assessment of acceptability of consignments for safe shipment, and the test procedures for cargoes which may liquefy. MPA encourages the application of the amendments in whole or in part where appropriate on a voluntary basis from 1 January 2014.

b. MSC.1/Circ.1453 - Guidelines for the submission of information and completion of the format for the properties of cargoes not listed in the IMSBC Code and their conditions of carriage

The circular provides guidance on the type and structure of information required for the carriage of cargoes not listed in the IMSBC Code to assess their suitability and conditions of carriage. Shipowners should note the voluntary application date of 1 January 2014 for amendment 02-13 to the IMSBC Code.

c. MSC.1/Circ.1454 - Guidelines for developing and approving procedures for sampling, testing and controlling the moisture content for solid bulk cargoes which may liquefy

The guidance aims to assist shippers in preparing procedures for sampling, testing and controlling moisture content, and also to assist competent authorities of loading ports when approving and checking the implementation of such procedures in accordance with the IMSBC Code. Shipowners should note the voluntary application date of 1 January 2014 for amendment 02-13 to the IMSBC Code.

d. MSC.1/Circ.1395/Rev.1 - Lists of solid bulk cargoes for which a fixed gas fire-extinguishing system may be exempted or for which a fixed gas fire-extinguishing system is ineffective

The circular updates the list of solid bulk cargoes for which a fixed gas fire-extinguishing system may be exempted or for which a fixed gas fire-extinguishing system is ineffective, and supersedes MSC/Circ.1395. MPA accepts the revised list and will be guided accordingly when approving related applications.

3. **Approval of Equivalents and Alternatives**

a. MSC.1/Circ.1455 - Guidelines for the approval of alternatives and equivalents as provided for in various IMO instruments

The circular provides guidance on the approval of alternative and/or equivalent design through a structured process that is both predictable and reliable. Shipowners, shipbuilders, designers and system manufacturers should approach the classification societies on application of the guidelines for Singapore ships. MPA will consider the application for approval on a case-by-case basis.

4. **Safety of Passenger Ships**

a. MSC.1/Circ.1446/Rev.2 - Recommended interim measures for passenger ship

The circular supersedes MSC.1/Circ.1446/Rev.1 and revises the operational safety measures to enhance the safety of passenger ships. Additional measures include harmonization of bridge procedures

between different operators, and best practices for stowage of additional lifejackets**.** Ferry operators should take into account the recommendations and implement them where practicable.

5. **Radiocommunications**

a. MSC.1/Circ.1460 on Guidance on the validity of radiocommunications equipment installed and used on ships

The World Radiocommunication Conference 2012 made extensive changes to appendices 17 and 18 of the Radio Regulations (RR). IMO acknowledges that incompatibility issues may exist between radiocommunication equipment installed on ships, and will require updates to application software and firmware to meet changes in IMO and ITU regulatory requirements. Ship owners and operators should take into consideration the guidance to ensure radiocommunication capability.

6. **Damage Stability Requirements**

a. MSC.1/Circ.1461 - Guidelines for verification of damage stability requirements for tankers

The Guidelines consist of two parts; guidelines for preparation and approval of tanker damage stability calculations which should be applied to oil tankers, chemical tankers and gas carriers constructed on or after 14 June 2013, and guidelines for operation and demonstration of damage stability compliance.

7. **List of Certificates to be Carried Onboard Ships, 2013**

a. FAL.2/Circ.127-MEPC.1/Circ.817-MSC.1/Circ.1462 - List of certificates and documents required to be carried on board ships

The joint circular deletes the “note” in the title of the annex to previous versions "All certificates to be carried on board must be originals", and replaces with “All certificates to be carried on board must be valid and drawn up in the form corresponding to the model where required by the relevant international convention or instrument”. The circular supersedes FAL.2/Circ.123-MEPC/Circ.769-MSC/Circ.1409.

8. **Periodical Survey**

a. MSC.1/Circ.1463 - Application of SOLAS regulations XII/3, XII/7 and XII/11

The circular clarifies on the meaning of the term “periodical survey” in relation to the application of SOLAS regulations XII/3, XII/7 and XII/11.The term is interpreted the same as "renewal survey" or "intermediate survey" of a ship, as referred to in SOLAS regulation I/10, as modified by the 1988 SOLAS Protocol.

9. Shipowners are urged to take note and where necessary, implement the recommendations in the circulars. They may approach the nine approved classification societies to seek further guidance.

10. Queries relating to this circular should be directed to Mr. Calvin Lee (Tel 6375-6269 or email calvin_lee@mpa.gov.sg).

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MSC.1/Circ.1452
9 July 2013

EARLY IMPLEMENTATION OF AMENDMENT 02-13 TO THE INTERNATIONAL MARITIME SOLID BULK CARGOES (IMSBC) CODE

1 The Maritime Safety Committee, at its ninety-second session (12 to 21 June 2013), in adopting resolution MSC.354(92) on *Amendments to the International Maritime Solid Bulk Cargoes (IMSBC) Code* and considering the proposal by the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers, at its seventeenth session, invited SOLAS Contracting Governments to implement the aforementioned amendment as soon as practicable, in particular sections 4 and 8, taking into account that the entry-into-force date of the amendment is expected to be 1 January 2015.

2 The relevant paragraphs of sections 4 and 8 of the amendment to the IMSBC Code are as follows:

"**Section 4 – Assessment of acceptability of consignments for safe shipment**

4.3.2 When a concentrate or other cargo which may liquefy is carried, the shipper shall provide the ship's master or his representative with a signed certificate of the TML, and a signed certificate or declaration of the moisture content, each issued by an entity recognized by the Competent Authority of the port of loading. The certificate of TML shall contain, or be accompanied by, the result of the test for determining the TML. The declaration of moisture content shall contain, or be accompanied by, a statement by the shipper that the moisture content is, to the best of his knowledge and belief, the average moisture content of the cargo at the time the declaration is presented to the master.

4.3.3 When a concentrate or other cargo which may liquefy is carried, procedures for sampling, testing and controlling moisture content to ensure the moisture content is less than the TML when it is on board the ship, shall be established by the shipper, taking account of the provisions of this Code. Such procedures shall be approved and their implementation checked by the competent authority of the port of loading[*]. The document issued by the competent authority stating that the procedures have been approved shall be provided to the master or his representative.

4.3.4 If the cargo is loaded on to the ship from barges, in developing the procedures under 4.3.3, the shipper shall include procedures to protect the cargo on the barges from any precipitation and water ingress.

[*] Refer to MSC.1/Circ.1454, *Guidelines for developing and approving procedures for sampling, testing and controlling the moisture content for solid bulk cargoes which may liquefy*.

4.4.3 For a concentrate or other cargo which may liquefy, the shipper shall facilitate access to stockpiles for the purpose of inspection, sampling and subsequent testing by the ship's nominated representative.

Section 8 – Test procedures for cargoes which may liquefy

8.4.2 If samples remain dry following a can test, the moisture content of the material may still exceed the Transportable Moisture Limit (TML)."

3 Member Governments are invited to bring this circular to the attention of all concerned, taking into account the voluntary application date of 1 January 2014, of the amendment to the IMSBC Code, pending its envisaged mandatory entry-into-force date of 1 January 2015.

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MSC.1/Circ.1453
9 July 2013

GUIDELINES FOR THE SUBMISSION OF INFORMATION AND COMPLETION OF THE FORMAT FOR THE PROPERTIES OF CARGOES NOT LISTED IN THE INTERNATIONAL MARITIME SOLID BULK CARGOES (IMSBC) CODE AND THEIR CONDITIONS OF CARRIAGE

1 The Maritime Safety Committee, at its ninety-second session (12 to 21 June 2013), in adopting resolution MSC.354(92) on *Amendments to the International Maritime Solid Bulk Cargoes (IMSBC) Code* and considering the proposal by the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers, at its seventeenth session, with regard to implementation of subsection 1.3.3 of the IMSBC Code, approved *Guidelines for the submission of information and completion of the format for the properties of cargoes not listed in the IMSBC Code and their conditions of carriage*, set out in the annex.

2 Member Governments are invited to bring the annexed Guidelines to the attention of all concerned, taking into account the voluntary application date of 1 January 2014 of amendment 02-13 of the IMSBC Code pending its envisaged mandatory entry-into-force date of 1 January 2015.

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ANNEX

GUIDELINES FOR THE SUBMISSION OF INFORMATION AND COMPLETION OF THE FORMAT FOR THE PROPERTIES OF CARGOES NOT LISTED IN THE INTERNATIONAL MARITIME SOLID BULK CARGOES (IMSBC) CODE AND THEIR CONDITIONS OF CARRIAGE

Foreword

When a cargo which is not listed in the International Maritime Solid Bulk Cargoes (IMSBC) Code is intended to be carried in bulk, the competent authority of the port of loading should provide to the master a certificate stating the characteristics of the cargo and the required conditions for carriage and handling of that shipment. The competent authority of the port of loading should also submit an application to the Organization to incorporate this solid bulk cargo into appendix 1 of the IMSBC Code. The format of this application should be as outlined in subsection 1.3.3 of the IMSBC Code. These Guidelines provide guidance on the type and structure of information which is required in the application.

General

The application should be supported as a minimum by relevant data such as may be contained in Material Safety Data Sheet (MSDS), Safety Data Sheet (SDS) or other relevant documentation. Applicants should therefore complete and submit the questionnaire in the appendix. Where applications indicate use of equipment or systems, references to relevant internationally agreed standards for such equipment or systems should be indicated.

1 Section "TENTATIVE BULK CARGO SHIPPING NAME"

This is the proposed Bulk Cargo Shipping Name (BCSN) to be identified in capital letters. When the cargo constitutes dangerous goods, the BCSN is to be supplemented with the United Nations (UN) number. Secondary names which are proposed to be indicated in appendix 4 "Index" of the IMSBC Code may also be listed in this section.

2 Section "Description"

This section should be used to specify the type of material, the manufacturing process, the raw material, the particle size and form, the colour, the composition of the material and its variability, the moisture content, properties of the cargo such as in/soluble in water, dusty, hygroscopic, and other specific characteristics.

3 Section "Characteristics"

3.1 The table specifying the characteristics of the cargo should be completed as follows:

3.2 Angle of repose: This box should be used to indicate the angle of repose for non-cohesive granular materials. If the evaluation of the properties of the material proved that the cargo is cohesive, the entry should be "Not applicable".

3.3 Bulk density: This box should be used to indicate the bulk density or the range of bulk density, as applicable, in kg/m^3.

3.4 Stowage factor: This box should be used to indicate the stowage factor or range of stowage factor, as applicable, in m^3/t.

3.5 **Size:** This box should be used to indicate the form and size or size-range of particles, pellets, lumps, etc., in mm and its variability, as applicable.

3.6 **Class:** This box should be used to indicate the hazard classification in accordance with section 9.2 of the IMSBC Code. If the cargo does not fall under Group B, the entry should be "Not applicable". In addition, if the cargo constitutes dangerous goods and has subsidiary risks, the subsidiary risks should be indicated.

3.7 **Group:** This box should be used to indicate the cargo group in accordance with subsection 1.7 of the IMSBC Code (possible entries are "A and B", "A", "B" or "C").

4 Section "Hazard"

4.1 This section should be used to specify the hazard(s) of the material relevant for sea transport, such as combustibility, toxicity, corrosivity, radiotoxicity, hygroscopy, liability to oxygen depletion, decomposition, self-heating, spontaneous ignition, liquefaction, emission of flammable and/or toxic gases or vapours, reactivity with water, fuel oil or other organic materials.

4.2 In case of non-hazardous cargo, write "No special hazards". If the cargo is non-combustible or constitutes a low fire-risk, write "This cargo is non-combustible or has a low fire-risk".

5 Section "Stowage and segregation"

5.1 This section should be used to specify the requirements for stowage and segregation of the cargo, such as separation from foodstuff, from wooden boundaries or from other cargoes, stowage away from sources of heat or ignition, away from fuel oil tanks, away from machinery space boundaries.

5.2 Furthermore this section should be used to stipulate requirements for fire/heat insulation for fuel oil tanks and machinery space bulkheads arranged adjacent to the cargo spaces, for resistance of cargo hold boundaries to fire and/or passage of liquids, for gas-tight machinery space bulkheads, for escaping gases away from accommodation spaces.

5.3 If no stowage and/or segregation requirements are appropriate, write "No special requirements".

6 Section "Hold cleanliness"

6.1 This section should give advice on the preparation of cargo spaces prior to loading, such as cleanliness and dryness of cargo spaces and bilge wells, washing with fresh or sea water, free from salt, provision of protective coating or lime-wash, removal of wooden dunnage.

6.2 If no requirement is necessary, write "No special requirements".

7 Section "Weather precautions"

7.1 This section should provide requirements relating to weather conditions and protective measures to be applied prior to and during loading and/or during unloading, such as moisture content of the cargo, prohibition of cargo handling during precipitation, closing of hatch covers.

7.2 If no requirement is necessary, write "No special requirements".

8 Section "Loading"

8.1 This section should be used to specify requirements and precautions during loading, such as trimming procedure, prevention of overstressing of the tank top, prevention of dust, dust control equipment, inerting of cargo spaces, gas and temperature measurement.

8.2 If no requirement is necessary, write "No special requirements".

9 Section "Precautions"

9.1 This section should be used to specify precautions to be taken prior to loading, such as protection of the ship and the crew from dust of the cargo, posting of "NO SMOKING" signs on deck, electrical equipment to be of certified safe type (explosion protection), removal of electrical links, spark arresting screens for ventilation openings, safety locking device for cargo space bilge lines, protection of bilge wells, gas-tightness of machinery space bulkheads, pressure test of fuel tanks adjacent to the cargo hold.

9.2 Furthermore this section should be used to describe specific conditions of the cargo prior to loading, such as permissible limits of temperature in stockpile, other conditions of stockpile and test certificates to be provided prior to loading, e.g. certificate of moisture content and transportable moisture limit, weathering certificate, exemption certificate.

9.3 If no requirement is necessary, write "No special requirements".

10 Section "Ventilation"

10.1 This section should be used to specify requirements for ventilation of cargo spaces (refer to section 3.5 of the IMSBC Code) with regard to the ventilation system and the operation of ventilation during the voyage.

10.2 If no requirement is necessary, write "No special requirements".

11 Section "Carriage"

11.1 This section should be used to specify requirements and instructions to be observed during the voyage, such as procedures and equipment for gas and temperature measurement, sealing of hatches, ventilators and other openings of cargo holds in order to prevent ingress of water or leaking of inert gas, maintaining an inert atmosphere, checking the cargo surface for liquefaction and decomposition, checking of cargo spaces for condensation, testing of the acidity of bilge water and instructions for bilge pumping, ventilating of cargo holds and adjacent spaces.

11.2 If no requirement is necessary, write "No special requirements".

12 Section "Discharge"

12.1 This section should be used to specify requirements to be observed prior to and during unloading, such as precaution for entry of personnel into cargo spaces, use of personnel protection, gas measurement, restrictions for bunkering or pumping of fuel oil, trimming of hardened cargo, prevention of dust, protection of the ship.

12.2 If no requirement is necessary, write "No special requirements".

13 Section "Clean-up"

13.1 This section should be used to specify requirements for cleaning up of cargo spaces and bilge wells, such as removal of cargo residues and spillages, decontamination, use of fresh water or seawater, use of personnel protection, precautions for the use of the shipborne bilge system.

13.2 If no requirement is necessary, write "No special requirements".

14 Section "Emergency Procedures"

14.1 The table specifying the emergency procedures should be completed for materials of Group B as follows.

14.2 Special emergency equipment to be carried: This box should be used to specify the special emergency equipment to be carried, such as protective clothing, self-contained breathing apparatuses, fire-fighting equipment. Otherwise, write "Nil".

14.3 Emergency Procedures: This box should be used to specify protective measures for entering the cargo spaces. Otherwise, write "Nil".

14.4 Emergency action in the event of fire: This box should be used to specify emergency action in the event of fire, such as supply or exclusion of air, use of water, CO_2 or whether a fixed gas fire-extinguishing system may be exempted, etc. Otherwise, write "Nil".

14.5 Medical First Aid: Reference should be made to the *Medical First Aid Guide (MFAG)*, as applicable.

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Appendix

IMO SOLID BULK CARGO INFORMATION REPORTING QUESTIONNAIRE

It is recommended to provide the following information, in addition to the information described in subsection 1.3.3 of the IMSBC Code.

Basic background information

- Are there other synonyms or trade names in use?
- How is it manufactured, how is it made, or where does it originate?
- What is it used for?
- Where is it produced? In what countries? In what volumes?
- What experience do you have with the cargo?

Basic cargo properties

The following information may be included in the Description section of the draft individual schedule.

- What colour is it?
- Does it have an odour?
- What form is the cargo in? What particle sizes?
- How much moisture is in the cargo? How much oil is in the cargo?
- How is it stored? Outside? Under cover?
- Does the cargo cake when wet?
- Is it a cohesive cargo or a free-flowing cargo?

Hazardous properties

For this section of the questionnaire, each answer should be supported by test data on multiple samples from difference sources. If a question is not applicable, a detailed explanation of why it is not applicable should be made.

- Does it meet the definition of dangerous goods (Hazard Classes 1-9)? Which hazard classes?
- Is the cargo easily ignitable, combustible or flammable?
- Can the cargo contribute to fire or accelerate a fire?
- Does the cargo self-heat? What causes the self-heating? Fungal or bacterial growth? Oxidation?
- Does the cargo react with water causing toxic or flammable gases to be released? Which gases? How toxic or flammable are the gases? What is the rate of evolution?
- Is the cargo toxic? Toxic by inhalation? Toxic by skin contact or ingestion? How toxic? Acute or chronic toxicity?

- Does the cargo exhibit any long-term health effects, such as carcinogenic, mutagenic or reprotoxic properties?
- Is the cargo a respiratory sensitizer?
- Does the cargo contain known pathogens?
- Does the cargo react with water reaction causing corrosion? Corrosion to eyes, skin, or metal? What is the rate of corrosion?
- Is the cargo corrosive without water? Corrosion to eyes, skin, or metal? What is the rate of corrosion?
- Is the cargo hazardous to the environment?
- Is the dust flammable or explosive?
- Can the cargo deplete oxygen in cargo spaces and adjacent spaces? By how much?
- Is the cargo incompatible with other cargoes or chemicals? Which cargoes or chemicals?
- Can the cargo liquefy during a voyage? What is the Transportable Moisture Limit (TML) of the cargo?

Operational questions

- How is the cargo loaded? Conveyor? Clam shell?
- Does the cargo need to be trimmed?
- What type of ship will be used? Bulk carrier? OBO? Self-unloading vessel? General cargo ship? Barge?
- What experience do you have carrying the cargo in bulk by vessel? By road and rail?
- Have there been any incidents when transporting the cargo as a result of the cargo properties or hazards?
- Are there any recommendations for tank or hold cleaning?

Emergency response questions

- In the event of a fire can the cargo be extinguished with water? CO_2?
- In the event of personal exposure what procedures should be followed?
- What happens in the event of an accidental release to water during transport?

Testing questions

- Which hazards have been assessed?
- Which tests were conducted?
- What were the results of these tests?
- What was the actual data from the tests?
- How many tests were conducted?
- What samples were tested? Are the samples representative of the cargo to be shipped?

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MSC.1/Circ.1454
9 July 2013

GUIDELINES FOR DEVELOPING AND APPROVING PROCEDURES FOR SAMPLING, TESTING AND CONTROLLING THE MOISTURE CONTENT FOR SOLID BULK CARGOES WHICH MAY LIQUEFY

1 The Maritime Safety Committee, at its ninety-second session (12 to 21 June 2013), in adopting resolution MSC.354(92) on *Amendments to the International Maritime Solid Bulk Cargoes (IMSBC) Code* and considering the proposal by the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers, at its seventeenth session, approved *Guidelines for developing and approving procedures for sampling, testing and controlling the moisture content for solid bulk cargoes which may liquefy*, as set out in the annex.

2 Member Governments are invited to bring the annexed Guidelines to the attention of all concerned, taking into account the voluntary application date of 1 January 2014 of amendment 02-13 of the IMSBC Code pending its envisaged mandatory entry-into-force date of 1 January 2015.

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ANNEX

GUIDELINES FOR DEVELOPING AND APPROVING PROCEDURES FOR SAMPLING, TESTING AND CONTROLLING THE MOISTURE CONTENT FOR SOLID BULK CARGOES WHICH MAY LIQUEFY

Foreword

These Guidelines, prepared by the Maritime Safety Committee of the International Maritime Organization (IMO) contain guidance on the preparation, approval and implementation of procedures for sampling, testing and controlling moisture content for solid bulk cargoes which may liquefy. These guidelines were developed as part of the work to ensure safe transport of such cargoes and to complement the provisions of the International Maritime Solid Bulk Cargoes (IMSBC) Code related to the assessment of acceptability of consignments (see section 4 of the IMSBC Code).

The main objectives of the Guidelines are:

- to assist shippers in preparing procedures for sampling, testing and controlling moisture content as required by paragraph 4.3.3 of the IMSBC Code; and

- to assist competent authorities of ports of loading when approving and checking the implementation of such procedures in accordance with paragraph 4.3.3 of the IMSBC Code.

1 Introduction

1.1 The IMSBC Code establishes international provisions for the safe loading, trimming, carriage and discharge of solid bulk cargoes when transported by sea, ensuring compliance with the provisions of the SOLAS Convention and identifies the risks associated with such cargoes with the aim of taking measures to minimize and to control them.

1.2 One of the risks identified is the risk associated with liquefaction of certain cargoes which may contain sufficient moisture to become fluid under the stimulus of compaction and the vibration which occurs during a voyage. Such cargoes are identified as Group A cargoes in the IMSBC Code.

1.3 Liquefaction may occur when the moisture content of the cargo exceeds the Transportable Moisture Limit (TML). Therefore, except for specially constructed or fitted cargo ships as described in subsection 7.3.2 of the IMSBC Code, it is particularly important to ensure that the moisture content is less than the TML of the cargo and to control its moisture content until it is on board the ship.

1.4 For this purpose, it is required by the IMSBC Code to determine by a test the acceptability of consignments for safe shipment. Considering that the determination of the acceptability is fundamental to avoid liquefaction during transport, the shipper should establish procedures for sampling, testing and controlling moisture content. These procedures should be approved and their implementation checked by the competent authority of the port of loading.

1.5 Sections 2, 3 and 4 of these guidelines contain guidance to develop such procedures for sampling, testing and the control of moisture content respectively.

2 Development of sampling procedures

2.1 The shipper should establish a sampling procedure to ensure that test samples used to determine the acceptability of consignments for safe shipment are representative of the consignments to be transported. Methods of sampling may vary since the character of the cargo and the form in which it is available will affect the method to be used. It is, therefore, of the utmost importance to describe accurately the sampling procedures.

2.2 The procedures should take into account the appropriate provisions of subsections 4.4 to 4.7 of the IMSBC Code.

2.3 The procedure should, at least, include provisions:

- to identify the consignment to be sampled;
- to identify the material (type, particle size distribution, composition) and to ensure that the consignment corresponds to the description of the material;
- to identify the appropriate time, frequency and place to take samples;
- to describe the method of sampling, including:
  - the number of subsamples or increments which are required;
  - the quantity of material to be taken (subsample or increment size);
  - the location where the subsamples or increments have to be taken in the consignment;
  - the method of combining the subsamples or increments to arrive at a representative sample;
  - the method to ensure that the moisture content of the representative sample will not be subject to variation; and
  - the method to ensure the traceability of the subsamples or increments and of the representative samples;
- on the equipment used for sampling and procedures for its maintenance, when necessary;
- to identify persons responsible for sampling and the description of their training to fulfil their responsibilities; and
- to identify a technical supervisor responsible for the implementation of the sampling procedures and the description of its training commensurate with its role and responsibilities.

2.4 Records of the following activities addressed in the procedure for testing should be kept and made available to the competent authority of the port of loading upon request:

- training;
- internal review to ensure that the procedure is applied correctly;

- forms where the traceability of the subsample and representative sample is ensured;

- maintenance of equipment for sampling, when necessary; and

- any modification to the procedure for testing.

Records should be kept for a period of time established by the competent authority of the port of loading in the working language of the shipper. If the language or languages used are not English, French or Spanish, a translation into one of these languages should be included.

3 Development of testing procedures

3.1 The shipper should establish a test procedure to determine the acceptability of its consignments for safe shipment.

3.2 The procedure should, at least, include:

- the description of the test method for determining the moisture content.

  Recognized international and national methods for determining moisture content for various materials are referred to in paragraph 1.1.4.4 of appendix 2 of the IMSBC Code;

- the description of the test method for determining the acceptability of consignments.

  Recommended methods for determining transportable moisture limit (TML) are given in appendix 2 of the IMSBC Code. However, it is recognized that, in some instances and taking into account the scope of each of the methods, they may not be suitable for the cargo to be transported.

  If the recommended methods are not suitable for the material in question, any alternative method for this material should be approved by the competent authority of the port of loading. When approving such method, the competent authority should make sure that this method gives reliable results data in order to characterize the risk of liquefaction of the cargo on board the ship. It should also be established that:

  - the method can easily be carried out and is reproducible;

  - the method gives compatible results at the ship level;

  - the method is consistent with feedback;

  - the method is capable of providing a safety margin with respect to the risk of liquefaction;

  - the method and its related transportability criteria to ensure that the moisture content of the consignment is less than the TML;

- the protocol to implement the test method:

  The protocol should be written in the working language of the persons responsible for testing. If the language or languages used is not English, French or Spanish, a translation into one of these languages should be included.

  The protocol should also include a periodic internal control procedure to ensure that the protocol is applied correctly:

- an example of the form where the consignment has to be identified and where the results to the test have to be reported;

- the list of the equipment to conduct the tests, the procedure to ensure the accurate calibration and maintenance of the equipment and the location(s) where the test is conducted;

- the list of persons responsible for testing and the description of their training to fulfil their responsibilities; and

- the name of the technical supervisor designated to be responsible for the implementation of the test procedure and the description of its training commensurate with its role and responsibilities.

3.3 Records of the following activities addressed in the procedure for testing should be kept and made available to the competent authority of the port of loading upon request:

- training;

- internal review to ensure that the protocol is applied correctly;

- forms where the consignments and results are reported;

- maintenance, calibration and testing of any testing equipment; and

- any modification of the procedure for testing.

Records should be kept for a period of time established by the competent authority of the port of loading in the working language of the shipper. If the language or languages used are not English, French or Spanish, a translation into one of these languages should be included.

4 Development of procedures for controlling moisture content

4.1 The shipper should establish a procedure for controlling moisture content to ensure that the moisture content is less than the TML when it is on board the ship. Once the moisture content has been measured, it is important to ensure that the moisture content remains below the TML. This procedure should be based on an analysis of all factors that may influence the moisture content between the production/extraction area and the ship.

4.2 The procedure should, at least, include:

- a description of the geographic configuration of the production/extraction area;

- a description of the location of the stockpiling/storage area, when applicable;

- a description of the method(s) to transport the consignment from the production/extraction area to the stockpiling/storage area or to the ship and, when applicable, from the stockpiling area to the ship and a description of the precautions taken during these transport operations to control moisture content of the consignment (such as: use of closed vehicles, suspension of certain operations and conveyor belts sloped and covered during rainfall);

- a description of the stockpiling/storage method(s), when applicable and of the precautions taken during stockpiling/storage (such as configuration of the pile to allow rain to run off) to control moisture content of the consignment;

- a description of the method(s) to load the cargo from shore to ship and precautions to protect the cargo from precipitation and water ingress (see paragraph 4.3.4 when loaded from barges);

- a description of the sampling operations between the production/extraction area and the ship to measure and report moisture content at different stages before being on board the ship (such as during stockpiling, conveyor transport, loading);

- a description of the conditions when the cargo is not authorized to be loaded and when the loading should be suspended on board the ship (moisture content greater than the TML, weather conditions);

- a description of the periodic internal control procedures to ensure that the procedure for controlling moisture content is applied; and

- a description of the human and material resources and of the awareness and training activities of the personnel involved to implement the procedure.

4.3 Records of the following activities addressed in the procedure for controlling moisture content should be kept and made available to the competent authority of the port of loading upon request:

- training;

- internal review to ensure that the procedure for controlling moisture content is applied correctly;

- weather conditions during which the procedure is applied; and

- any modification of the procedure for testing.

Records should be kept for a period of time established by the competent authority of the port of loading in the working language of the shipper. If the language or languages used are not English, French or Spanish, a translation into one of these languages should be included.

5 Approval of the procedures by the competent authority

5.1 According to paragraph 4.3.3 of the IMSBC Code, the procedures for sampling, testing and controlling moisture content should be approved and their implementation checked by the competent authority of the port of loading.

5.2 Before any transport of Group A cargoes, the shipper should establish the required procedures as described in sections 2 to 4 of these guidelines and should provide them well in advance to the competent authority of the port of loading for approval.

5.3 As defined in section 1.7 of the IMSBC Code, the competent authority means any national regulatory body or authority designated or otherwise recognized as such for any purpose in connection with the IMSBC Code. Contracting Governments are invited to inform the organization of the name and address of competent authorities in their country authorized to approve the procedures for dissemination through the GISIS database.

5.4 The procedures are subject to:

.1 an initial verification by the competent authority of the port of loading before the document required in paragraph 4.3.3 of the IMSBC Code is issued. This verification should ensure that the procedures comply with the provisions of the IMSBC Code and of these guidelines, the personnel involved have received appropriate training and the required equipment is available and in conformity with the description in the procedures;

.2 a renewal verification at intervals specified by the competent authority of the port of loading, but not exceeding five years. This verification should ensure that the approved procedures still comply with the applicable provisions of the IMSBC Code in force at the time of the renewal verification and are implemented by the shipper; and

.3 at least one intermediate verification. If only one intermediate verification is carried out, it should take place before the first anniversary date of the document required in paragraph 4.3.3 of the IMSBC Code. The intermediate verification should ensure that the procedures are implemented by the shipper.

5.5 The competent authority of the port of loading should determine which changes to approved procedures should not be implemented unless the relevant changes are approved.

5.6 A document should be issued after the initial and renewal verification in accordance with the provisions of paragraph 4.3.3 of the IMSBC Code by the competent authority of the port of loading. It should be issued for a period specified by the competent authority of the port of loading, which should not exceed five years.

5.7 The document should clearly identify the procedures involved and should include a statement to the effect that the competent authority has approved the procedures. It should be drawn up in a form corresponding to the model given in the appendix to these guidelines.

5.8 A copy of the document should be provided to the master or his representative in accordance with paragraph 4.3.3 of the IMSBC Code.

* * *

Appendix

(Identification of the competent authority) (State)

Approval Number:

Approval issued under the provisions of paragraph 4.3.3 of the
International Maritime Solid Bulk Cargoes (IMSBC) Code

Name and address of the shipper: .....

Port of loading: .....

Bulk cargo shipping name: .....

Reference of the procedure for sampling: .....

Reference of the procedure for testing: .....

Reference of the procedure for controlling moisture content: .....

Date of initial/renewal verification on which this approval is based: .....

This is to approve the procedures mentioned above and that they have been verified in accordance with MSC.1/Circ.1454 on Guidelines for developing and approving procedures for sampling, testing and controlling the moisture content for solid bulk cargoes which may liquefy

Specific remarks: .....

This approval is valid until .....…..…… subject to verifications in accordance with MSC.1/Circ.1454 on Guidelines for developing and approving procedures for sampling, testing and controlling the moisture content for solid bulk cargoes which may liquefy

Issued at: .....

Date of issue: .....

(Signature of the competent authority issuing the approval)

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MSC.1/Circ.1395/Rev.1
9 July 2013

LISTS OF SOLID BULK CARGOES FOR WHICH A FIXED GAS FIRE-EXTINGUISHING SYSTEM MAY BE EXEMPTED OR FOR WHICH A FIXED GAS FIRE-EXTINGUISHING SYSTEM IS INEFFECTIVE

1 The Maritime Safety Committee, at its sixty-fourth session (5 to 9 December 1994), agreed that there was a need to provide Administrations with guidelines regarding the provisions of SOLAS regulation II-2/10 concerning exemptions from the requirements for fire-extinguishing systems.

2 Consequently, the Committee approved MSC/Circ.671 whereby it agreed to:

.1 a list of solid bulk cargoes, for which a fixed gas fire-extinguishing system may be exempted (table 1) and recommended Member Governments to take into account the information contained in table 1 when granting exemptions under the provisions of SOLAS regulation II-2/10.7.1.4; and

.2 a list of solid bulk cargoes for which a fixed gas fire-extinguishing system is ineffective (table 2), and recommended that cargo spaces in a ship engaged in the carriage of cargoes listed in table 2 be provided with a fire-extinguishing system which provides equivalent protection. The Committee also agreed that Administrations should take account of the provisions of SOLAS regulation II-2/19.3.1 when determining suitable requirements for an equivalent fire-extinguishing system.

3 The Maritime Safety Committee, at its seventy-ninth session (1 to 10 December 2004), reviewed the above-mentioned tables and approved MSC.1/Circ.1146. The Committee decided that the annexed tables should be periodically reviewed and invited Member Governments to provide the Organization, when granting exemptions to ships for the carriage of cargoes not included in table 1, with data on the non-combustibility or fire risk properties of such cargoes. Member Governments were also requested to provide the Organization, when equivalent fire-extinguishing systems are required for the agreed carriage of cargoes not included in table 2, with data on the inefficiency of fixed gas fire-extinguishing systems for such cargoes.

4 The Maritime Safety Committee, at its eighty-ninth session (11 to 20 May 2011), noting the mandatory status of the IMSBC Code, reviewed the aforementioned lists of solid bulk cargoes to align certain names in the lists with those in the recent version of the IMDG Code and approved MSC/Circ.1395 on Lists of solid bulk cargoes for which a fixed gas fire-extinguishing system may be exempted or for which a fixed gas fire-extinguishing system is ineffective, superseding MSC.1/Circ.1146.

5 The Maritime Safety Committee, at its ninety-second session (12 to 21 June 2013), considering the proposal by the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers, at its seventeenth session, approved a revision to MSC.1/Circ.1395, as set out in tables 1 and 2 of the annex.

6 The purpose of this circular is to provide guidance to Administrations. It should not, however, be considered as precluding Administrations from their right to grant exemptions for cargoes not included in table 1 or to impose any conditions when granting such exemptions under the provisions of SOLAS regulation II-2/10.7.1.4.

7 This circular supersedes MSC.1/Circ.1395.

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ANNEX

TABLE 1

LIST OF SOLID BULK CARGOES FOR WHICH A FIXED GAS FIRE-EXTINGUISHING SYSTEM MAY BE EXEMPTED

1 Cargoes including, but not limited to, those listed in regulation II-2/10:

Ore
Coal (COAL and BROWN COAL BRIQUETTES)
Grain
Unseasoned timber

2 Cargoes listed in the International Maritime Solid Bulk Cargoes (IMSBC) Code, which are not combustible or constitute a low fire-risk, as follows:

.1 all cargoes not categorized into Group B in the IMSBC Code; and

.2 the following cargoes categorized into Group B in the IMSBC Code:

ALUMINA HYDRATE
ALUMINIUM SMELTING BY-PRODUCTS, UN 3170
(Both the names ALUMINIUM SMELTING BY-PRODUCTS or ALUMINIUM REMELTING BY-PRODUCTS are in use as proper shipping name)
ALUMINIUM FERROSILICON POWDER, UN 1395
ALUMINIUM SILICON POWDER, UNCOATED, UN 1398
CALCINED PYRITES (Pyritic ash)
CLINKER ASH, WET
COAL TAR PITCH
DIRECT REDUCED IRON (A) Briquettes, hot moulded
FERROPHOSPHORUS (including briquettes)
FERROSILICON, with more than 30% but less than 90% silicon, UN 1408
FERROSILICON, with 25% to 30% silicon, or 90% or more silicon
FLUORSPAR (calcium fluoride)
GRANULATED NICKEL MATTE (LESS THAN 2% MOISTURE CONTENT)
LIME (UNSLAKED)
LOGS
MAGNESIA (UNSLAKED)
PEAT MOSS
PETROLEUM COKE*
PITCH PRILL
PULP WOOD
RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY MATERIAL (LSA-1), UN 2912 (non-fissile or fissile – excepted)
RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECT(S) (SCO-I or SCO-II), UN 2913 (non-fissile or fissile – excepted)

* When loaded and transported under the provisions of the IMSBC Code.

ROUNDWOOD
SAW LOGS
SILICOMANGANESE
SULPHUR, UN 1350
TIMBER
VANADIUM ORE
WOODCHIPS, with moisture content of 15% or more
ZINC ASHES, UN 1435

.3 Cargoes assigned to the following generic Group B shipping schedules when they do not exhibit any self-heating, flammability, or water-reactive flammability hazards in accordance with the MHB tests and classification criteria contained in the Code:

METAL SULPHIDE CONCENTRATES

3 Solid bulk cargoes which are not listed in the IMSBC Code, provided that:

.1 they are assessed in accordance with section 1.3 of the Code;

.2 they do not present hazards of Group B as defined in the Code; and

.3 a certificate has been provided by the competent authority of the port of loading to the master in accordance with 1.3.2 of the Code.

TABLE 2

LIST OF SOLID BULK CARGOES FOR WHICH A FIXED GAS FIRE-EXTINGUISHING SYSTEM IS INEFFECTIVE AND FOR WHICH A FIRE-EXTINGUISHING SYSTEM GIVING EQUIVALENT PROTECTION SHALL BE AVAILABLE

The following cargoes categorized into Group B of the IMSBC Code:

ALUMINIUM NITRATE, UN 1438
AMMONIUM NITRATE, UN 1942 (with not more than 0.2% total combustible material, including any organic substance, calculated as carbon to the exclusion of any other added substance)
AMMONIUM NITRATE BASED FERTILIZER, UN 2067
AMMONIUM NITRATE BASED FERTILIZER, UN 2071
BARIUM NITRATE, UN 1446
CALCIUM NITRATE, UN 1454
LEAD NITRATE, UN 1469
MAGNESIUM NITRATE, UN 1474
POTASSIUM NITRATE, UN 1486
SODIUM NITRATE, UN 1498
SODIUM NITRATE AND POTASSIUM NITRATE, MIXTURE, UN 1499

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MSC.1/Circ.1455
24 June 2013

GUIDELINES FOR THE APPROVAL OF ALTERNATIVES AND EQUIVALENTS AS PROVIDED FOR IN VARIOUS IMO INSTRUMENTS

1 The Maritime Safety Committee, at its ninety-second session (12 to 21 June 2013), with a view to providing a consistent process for the coordination, review and approval of alternatives and equivalents with regard to ship and system design as allowed by the 1974 SOLAS Convention, as amended, and other mandatory IMO instruments, approved the annexed *Guidelines for the approval of alternatives and equivalents as provided for in various IMO instruments*.

2 Administrations and non-governmental organizations are invited to bring the annexed Guidelines to the attention of shipowners, shipbuilders, designers and system manufacturers.

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ANNEX

GUIDELINES FOR THE APPROVAL OF ALTERNATIVES AND EQUIVALENTS AS PROVIDED FOR IN VARIOUS IMO INSTRUMENTS

1 INTRODUCTION

1.1 Alternative and/or equivalent design

1.1.1 Prescriptive regulations may sometimes restrain the level of innovation that is feasible in design. An essential prerequisite for widespread use of innovative and the use of alternative and/or equivalent design is a predictable and reliable process of submitting and approving the design making full use of state of the art risk assessment tools and techniques.

1.1.2 There may be different levels of approval depending on how challenging the proposed alternative and/or equivalent design is in light of prescriptive regulations. Such designs may deviate from prescriptive requirements related to certain components, systems or functions or the whole ship. Alternative and/or equivalent design and approval is expected to be carried out only for ship functions, systems or components that either directly or indirectly proposes alternative ways of compliance with prevailing regulations.

1.1.3 One approach to the approval of an alternative and/or equivalent design is to compare the innovative design to existing designs to demonstrate that the design has an equivalent level of safety. In order to demonstrate an equivalent level of safety, functional requirements and performance criteria should be established for essential ship functions, which should be met by the alternative and/or equivalent design. An alternative approach could be to carry out a risk analysis of the alternative and/or equivalent design and compare it to overall risk evaluation criteria.

1.1.4 A structured approval processes is necessary in order to confirm that the alternative and/or equivalency design can obtain the required approval along with the necessary certificates related to statutory requirements for their intended operation. The Guidelines presented herein describe such a structured process that is predictable and reliable. By adhering to these Guidelines, Submitters and Administrations would be working in cooperation to evaluate that all aspects of safety and environmental protection are adequately assessed and controlled to an acceptable level. Furthermore it will facilitate innovation.

1.1.5 Currently, there are provisions in many IMO conventions for acceptance of alternatives and/or equivalents to prescriptive requirements in many areas of ship design and construction. In this context, the Organization has issued several guidelines, such as *Guidelines on alternative design and arrangements for fire safety* (MSC/Circ.1002), *Guidelines on alternative design and arrangements for SOLAS chapters II-1 and III* (MSC.1/Circ.1212) and *Interim guidelines for the approval of alternative methods of design and construction of oil tankers* (resolution MEPC.110(49)).

1.2 Application of these Guidelines

1.2.1 The Guidelines are intended for use of both Administrations and submitters when dealing with an approval request for an alternative and/or equivalent design and serve to provide guidance on a variety of aspects requiring consideration when applying such a process. This includes the process in general, shortlists of required documents and considerations hereto as well as assessments of necessary qualifications to complete the process successfully.

1.2.2 These Guidelines are intended for application when approving alternative and/or equivalency designs in general and specifically according to the provisions given for alternative design and arrangements in applicable statutory IMO instruments.

1.2.3 The Guidelines serve to outline the methodology for the analysis and approval process for which the approval of an alternative and/or equivalent design is sought.

1.2.4 When proposing an alternative design, one should keep in mind that the substitution of design measures to reduce risk with operational or procedural ones to claim equivalent safety needs to be thoroughly examined. Normally, this should not be permitted, and special care should be taken in order to confirm that design measures take priority over operational or procedural measures.

1.2.5 For the application of these Guidelines to be successful, all stakeholders, including the Administration or its designated representative, owners, operators, designers and classification societies, should be in continuous communication from the onset of a specific proposal. Usually the approval of an alternative and/or equivalent design requires significantly more time in calculation and documentation than a standard design that complies with prescriptive regulation. However, the potential benefits of this approach include more options, cost-effective designs for unique applications and an improved knowledge of safety critical elements and loss potential.

2 DEFINITIONS

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

2.1 *ALARP* (As Low As Reasonably Practicable) refers to a level of risk for which further investment of resources for risk reduction is not justified. When risk is reduced to ALARP, it is acceptable.

2.2 *ALARP area* refers to risks neither negligibly low nor intolerably high where a cost-benefit analysis is used to identify cost-effective risk control options.

2.3 *Approval* means that the Administration issues an approval certificate as proof of verification of compliance with the regulations, standards, rules, etc. which are aimed at ensuring safety against hazards to the ship, personnel, passengers and cargo, and against hazards to the environment.

> **Note:** For approval of alternative oil tanker designs according to MARPOL, regulation I/19(5), it is noted that the MEPC is the Approval Authority for the preliminary approval (referred to as approval in principle in MARPOL) of the concept design.

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

2.5 *Design team* is a team established by the owner, builder or designer, which may include, as the alternative design and arrangements demand, a representative of the owner, builder or designer and expert(s) having the necessary knowledge and experience for the specific evaluation at hand. Other members may include marine surveyors, ship operators, safety engineers, equipment manufacturers, human factor experts, naval architects and marine engineers.

2.6 *Failure mode* is the observed mechanism or manner in which a failure can occur.

2.7 *FME(C)A*. Failure Mode, Effect (and Criticality) Analysis.

2.8 *Preliminary design* is a design developed for the design preview and the first analysis phase. The preliminary design is a high-level design taking into account the general arrangement, major systems, components, etc.

2.9 *HazId*. Hazard identification, a process to find, list and characterize hazards.

2.10 *HazOp*. Hazard and operability study.

2.11 *Novel/new technology or design*. A new technology is a technology that has no documented track record in a given field of application, i.e. there is no documentation that can provide confidence in the technology from practical operations, with respect to the ability of the technology to meet specified functional requirements. This implies that a new technology is either:

.1 a technology that has no track record in a known field;

.2 a proven technology in a new environment; or

.3 a technology that has no track record in a new environment.

2.12 *Preliminary approval/approval of preliminary design* is the process by which the Administration issues a statement that a proposed concept design complies with the intent of the rules, regulations and/or appropriate criteria set by the Administration – even though the design may not be fully evolved. The preliminary approval is subject to a list of conditions that are addressed in the final design stage.

2.13 *Proven technology* has a documented track record in the field for a defined environment.

2.14 *Risk* is a measure of the likelihood that an undesirable event will occur together with a measure of the resulting consequence within a specified time, i.e. a combination of the frequency and the severity of the consequence (this can be either a quantitative or qualitative measure).

2.15 *Risk analysis* is the science of risks, their probability and consequence.

2.16 *Risk assessment* is an integrated array of analytical techniques, e.g. reliability, availability and maintainability engineering, statistics, decision theory, systems engineering, human behaviour, etc. that can successfully integrate diverse aspects of design and operation in order to assess risk.

2.17 *Risk evaluation criteria* are formally recognized objective criteria defining the acceptable risk.

2.18 *Risk-based design* is a design where the design process has been supported by a risk assessment or the design basis has resulted from a risk assessment. That is, it is a structured and systematic methodology aimed at ensuring safety performance and cost-effectiveness by using risk analysis and cost-benefit assessment.

2.19 *Risk control measure* is a means of controlling a single element or risk; typically, risk control is achieved by reducing either the consequences or the frequencies; sometimes it could be a combination of the two.

2.20 *Risk control option (RCO)* is a combination of risk control measures.

2.21 *Safety* is the absence of unacceptable levels of risk to life, limb and health (from non-wilful acts).

2.22 *Safety critical*. Containing an element of risk. Necessary to prevent a hazard.

2.23 *Final design*. Elaboration of the preliminary design. The final design complies with the results of the preliminary analysis, e.g. with respect to risk control options already identified, and the requirements of the Administration. The final design is developed on the basis of the statement by the Administration.

2.24 *Submitter* is an entity seeking approval of an alternative design and/or equivalent from the Administration, responsible for communicating with the administration for the submission and follow-up of the approval process.

3 QUALIFICATION REQUIREMENTS

This section of the Guidelines addresses requirements for key personnel involved in the different stages of the alternative and/or equivalent design approval process.

3.1 Stakeholders and target groups

The various main stakeholders and their involvement are indicated in the involvement map in figure 1. In this section, the anticipated need for qualifications of stakeholders, in order to accommodate risk-based approaches in ship design, construction, operation and approval, are based on the involvement of the different target groups.

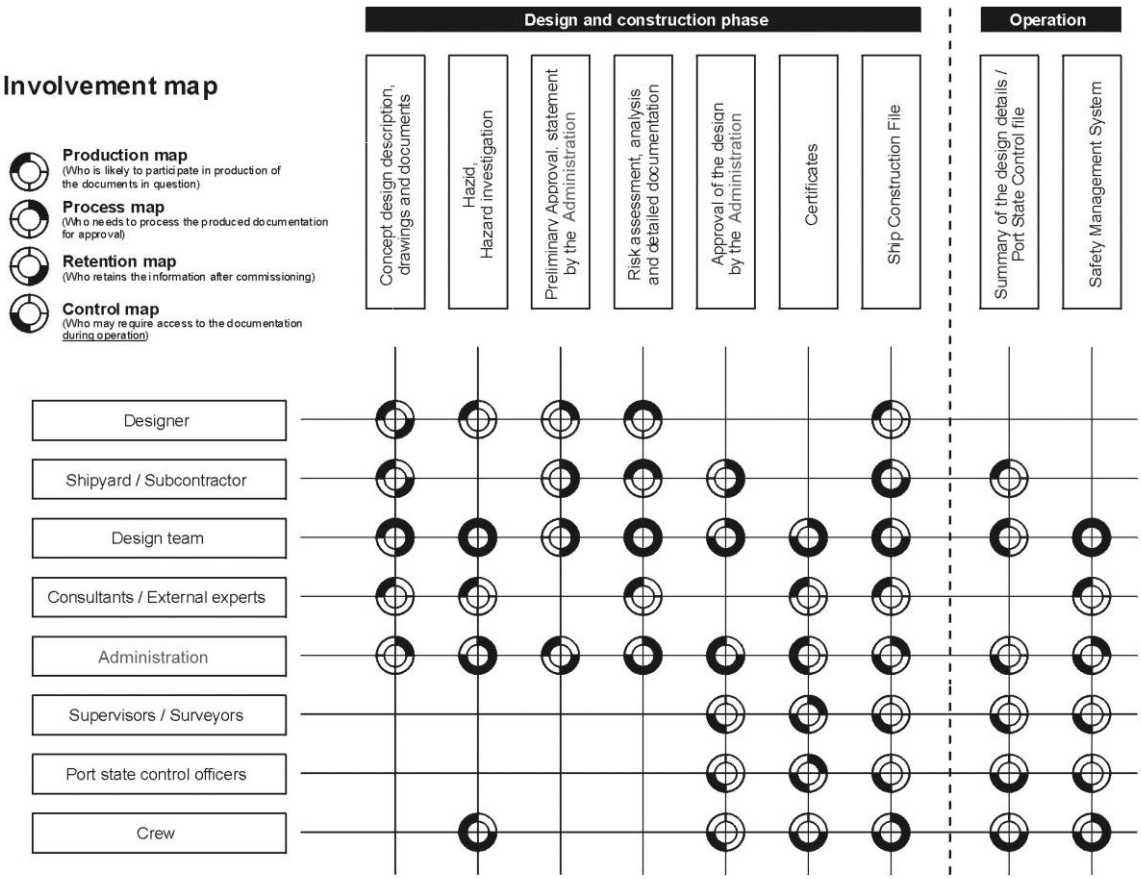

Figure 1: Combined involvement map

3.2 Design team

The design team is the entity (e.g. yard, supplier, owner and operator) that carries out the design development and analyses for the alternative and/or equivalent design. They need to be in a position to assess safety and environmental protection holistically and will also be responsible for the education of operations personnel, documentation on board and integration with the safety management system. Operational and technical experts in the relevant field or from similar operations should be involved and assist the design team in the review of hazards as well as supply expertise to the initial risk assessment sessions. Hence a high level of understanding of the concepts is required or will have to be drawn upon from external sources.

3.3 Designer

The designer is the developer of the design seeking approval. The designer should be familiar with alternative and/or equivalent design approaches in order to utilize them.

3.4 Yard or subcontractors

3.4.1 The yard/subcontractor's is part of the Submitter and provides information for the analyses carried out in order to achieve the approval by the Approval Authority.

3.4.2 The yard/subcontractor's main concern will be to have concise information at an early stage. Depending on the contract, an alternative and/or equivalent design may have both advantages and disadvantages. Yards and subcontractors need to be able to account for the differences in time allocation compared to conventional designs in order to be able to optimize their building schedule when placing subcontracts and when ordering auxiliary equipment. The new building schedule process and milestones will invariably be influenced by decisions made in the process.

3.5 Consultants and external experts

3.5.1 Consultants, organizations and external experts perform tests, analyses, simulation, software validation and validation of results and reviews of models used. It should be possible to obtain background information and credentials for the personnel responsible for performing the analyses, the tests or simulation. For certain types of tests, the personnel and/or institutes may also have to be certified. It may equally be considered whether adequate supervision is available and whether the provided supervision warrants a sound review of results.

3.5.2 Having a central verification task, they are anticipated to have expert level knowledge in their respective fields, and the organization, lab or enterprise they belong to should be able to provide references from similar operations for the personnel involved in a project.

3.6 Administrations

3.6.1 The Administration reviews the delivered documentation; states further requirements for documentation if necessary, can request verification of achieved results and eventually grants approval.

3.6.2 This means that the Administration needs to be in a position to assess whether the design has been sufficiently examined and whether any risks have been reduced acceptably and thus should have sufficient knowledge of the subject to evaluate the adequacy of the delivered information and the assumptions made. The Administration should make the final decision for applying these Guidelines to approve alternative and/or equivalent design, and the final responsibility of design approval rests with the Administration.

3.7 Supervisors and surveyors

3.7.1 Supervisors and surveyors include the owners´ supervisors and flag State surveyors. This group performs compliance verification in the construction phase and compliance review through the operational life of an alternative and/or equivalency.

3.7.2 Supervisors and surveyors will require an introduction to alternative and/or equivalent design approaches. An understanding should be developed that compliance is generally to be viewed as compliance with the intent of regulations, and not necessarily with prescriptive content.

3.8 Port State control officers

3.8.1 Port State control officers perform compliance review throughout the operational life of an alternative and/or equivalency when it calls at a port and is subjected to port State control, which has become an increasingly important instrument of enforcing rules and regulations.

3.8.2 Port State control officers need at least an introduction to the approaches equivalent to that given to supervisors and surveyors. It is necessary to promulgate knowledge on the way of work and to provide port State control officers with tools to assure the safety of an inspected ship. A port State control file and physical inspections along the same lines as the inspections performed by the crew can provide such tools and methods of gauging the safety of the ship if doubts prevail after reviewing the documentation.

3.9 Crew

3.9.1 The crew operating an alternative and/or equivalent design performs operational tasks, maintenance and inspection in accordance with the prevalent requirements, as stated in the management system on board.

3.9.2 The crew needs to comprehend the nature of the alternative and/or equivalency and any differences in operation as well as in maintenance and inspection routines compared to a standard feature. It is anticipated that the alternative and/or equivalency will be documented in the safety management system, and thus it is a part of familiarization routines.

4 PROCESS

4.1 The following process, illustrated in figure 2, is intended to describe the procedure for obtaining and maintaining approval of an alternative and/or equivalency taking into account the Submitter and the Administration. Even though the diagram in figure 2 may suggest a strictly linear or sequential process, this is not the intention, and it is important to note that each phase may be a series of iterations in a loop. As seen from figure 2, the process, which covers concept development through operation, includes the following milestones:

.1 development of a preliminary design;

.2 approval of preliminary design;

.3 development of final design;

.4 final design testing and analyses; and

.5 approval.

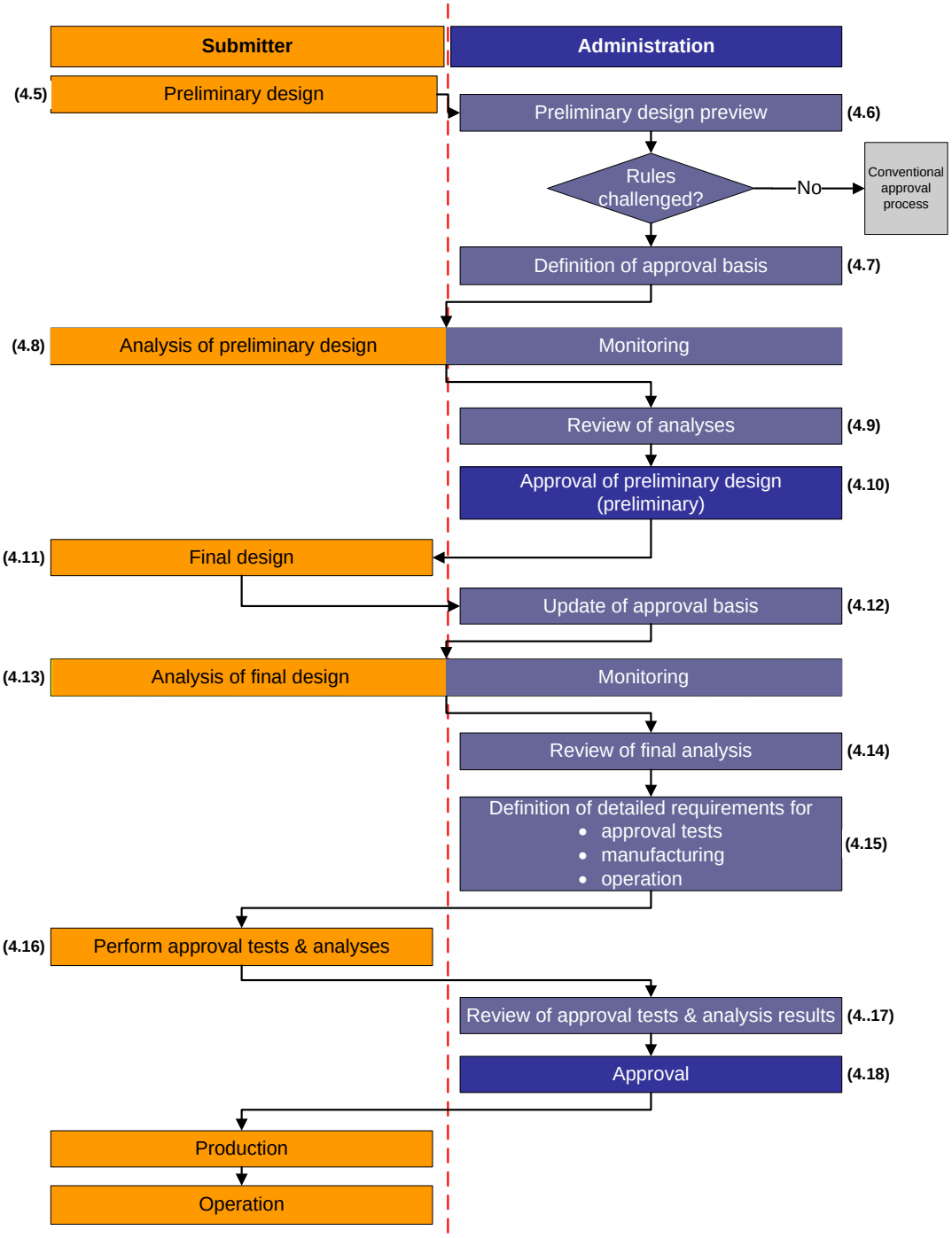

Figure 2: Design and Approval Process

4.2 The Submitter should approach the Administration early in the process in order to seek input from experts and specialist opinions on the use of an alternative and/or equivalency design – with the motivation of obtaining approval by the Administration. The details performed in each phase of the process shown in figure 2 may vary on a case by case basis depending on the design being considered or whether the Submitter is applying for preliminary or final approval. However, the basic process outlined in this document should be generally applicable to the approval of most alternatives and/or equivalencies.

4.3 When a recognized organization acts on behalf of the Administration:

.1 Administration's authorization requested by SOLAS regulation XI-1/1 should include the list of activities reserved to the Administration, such as:

.1 acceptance of, or exemption from, risk analysis (see paragraph 4.6.3);

.2 agreement on evaluation criteria (see paragraph 4.7.1);

.3 termination of the process because the evaluation criteria were not met (see paragraph 4.9.3); and

.4 final approval (see paragraph 4.19.1); and

.2 approvals should only be valid for the ships that were flagged by the Administration at the time the approval was issued.

4.4 Phases in the process

4.4.1 The submission and approval process for an alternative and/or equivalency design should be clear, transparent and well described in order to avoid misinterpretations. In the following sections, the phases of the process outlined in figure 2 are described taking into account the roles of the Administration and the Submitter.

4.4.2 The details of the process for an alternative and/or equivalency design depend also on the design process of the Submitter. The process shown in figure 2 was based on a design process covering preliminary and final design, both consecutively analyzed in the approval process. However, the Submitter may wish to carry out the approval process using a final design, i.e. without an analysis of a preliminary design. In such cases both parties may agree to skip the analysis of the Preliminary Design and adjust accordingly the approval process including the documentation of analyses. Independent of such details the approval process should consider among others the definition of the approval basis, the hazard identification, review of approval basis after HazId and quantitative risk assessment.

4.4.3 Documentation and the exchange of documents between the Administration and the Submitter are highlighted in the description of each phase. Results of assessments need to be fully documented in a manner readily accessible to a third party. A description of the documentation requirements for the submission and approval process is provided in section 6 of this document.

4.5 Preliminary Design Development Phase

4.5.1 In the first phase of the alternative and/or equivalency process the Preliminary design is carried out by the Submitter. A draft of the alternative and/or equivalent under consideration is developed, taking into account among other things general arrangement, components as well as the boundary conditions of the system, including physical boundaries and system interfaces.

4.5.2 The objective of this phase is to develop a common level of understanding of the proposed alternative and/or equivalent design to enable the subsequent tasks of the submission and approval process to be properly defined and carried out. Those rules, standards and/or regulations that are being challenged should be identified and thoroughly explained by the Submitter. Furthermore, prior to the start of the project, a selection may be made of the appropriate terminology and semantics. The definition of the terminology and semantics used in the approval process avoids misinterpretation and thus increases the efficiency of the process.

4.5.3 The Submitter submits the Preliminary design description addressing the above-mentioned aspects to the Administration.

4.6 Preliminary Design Preview Phase

4.6.1 In this phase, the Submitter organizes a Preliminary design preview meeting with the Administration in order to discuss the concept, relevant rules/guides/codes/standards as well as the further phases involved in the approval process.

4.6.2 The purpose of this meeting is to identify and describe items requiring special attention and to plan how these items are handled by the Administration and Submitter with respect to approval.

4.6.3 The aim of the Preliminary preview phase is also to decide whether the alternative and/or equivalency challenge any prescriptive rules, regulations or standards to such an extent that a risk analysis is required. The safety and environmental aspects of the alternative and/or equivalency design are crucial for this decision. If the Administration comes to the conclusion that there is no need of a risk analysis, the Submitter can follow a conventional approval process, to be determined by the Administration.

4.6.4 The decision whether the alternative and/or equivalency requires a risk-based analysis demonstrating that an equivalent level of safety may be reached by using table 1 to determine the degree of novelty. This decision needs to be transparently documented by the Administration (for the purpose of objectivity). Technology in category 1 is proven technology where proven methods for classification, tests, calculations and analyses may be used. Technology in categories 2-4 is defined as new technology and may follow the procedure described in this report. The distinction between categories 2, 3 and 4 makes it easier to focus on the areas of concern. The objective of using the categorization is to establish whether or not the alternative and/or equivalency design qualifies as a novel design and to gain a general understanding of the variation from proven designs. The categorization will also assist in defining the level of detail of the different analyses that will be required in the following phase.

Table 1: Categorization of new technology

		Technology status		
		Proven	Limited field history	New or unproven
Application Area		1	2	3
Known	0	1	2	3
New	1	2	3	4

4.6.5 The Preliminary design preview meeting should include relevant people from the Submitter and professionals from the different disciplines including risk assessment within or contracted by the Administration.

4.6.6 Ideally, the representatives of the Administration who take part in the initial Preliminary design preview meetings should also take part in the definition of the approval basis, monitor the subsequent analyses and follow the project until final approval in order to take advantage of the learning process that occurs throughout entire approval process.

4.6.7 During the Preliminary design preview phase, the Submitter may be required to submit the following documents:

.1 general description of alternative and/or equivalency;

.2 functional description of alternative and/or equivalency;

.3 identification of interfaces between alternative and/or equivalency and other systems/operations;

.4 preliminary general arrangement drawings;

.5 preliminary detail drawings, if required;

.6 list of codes and standards applied;

.7 risk assessment plans; and

.8 further design basis documents, if necessary.

4.7 Definition of Approval Basis Phase

4.7.1 Following the Preliminary design preview phase, the next phase is for the Administration to define the approval basis with respect to scope of analysis and evaluation criteria. In order to accomplish this, the Administration and the Submitter may have to meet one or several times to discuss the alternative and/or equivalency, its purpose and objectives, deviations from conventional approaches, relevant rules and regulations, possible deviations from or lack of rules and regulations, requirements that may not be covered by the rules, proposed operations and potential impact on other systems, components, etc. During this time, the alternative and/or equivalency will have to be well understood.

4.7.2 The Submitter and the Administration may also discuss plans for hazard identification, risk assessments and plans for testing and analyses. The scope and extent of the analysis (either qualitative or quantitative analysis or both) to be performed in the Analysis of Preliminary design phase (see paragraph 4.5) is agreed between the Submitter and the Administration considering the requirements of the Submitter with respect to the soundness of the preliminary approval.

4.7.3 A risk assessment plan should be developed to identify appropriate types of assessment techniques by Submitter. The plan should clearly state the proposed evaluation criteria and the basis for the criteria.

4.7.4 A testing and analysis plan should be developed to identify appropriate types of test and engineering analyses by Submitter. This plan is only a preliminary plan, as it will most likely be revised following the results of the analysis for the preliminary design phase.

4.7.5 The work performed within this phase will result in a document issued by the Administration describing the requirements and the formal process for achieving preliminary approval.

4.8 Analysis of Preliminary Design Phase

4.8.1 The scope of this phase is to conduct an analysis of the Preliminary design that has been specified in the previous phases of the process. The Submitter is responsible for facilitating all analyses agreed with the Administration. It is highly recommended to invite Administration representatives to attend the meetings to provide a close dialogue between the Administration and the Submitter in order to ensure that all relevant issues are taken into consideration. However, careful

consideration should be given to ensuring that their independence from the design team is maintained. The analysis of the preliminary design is a stepwise process monitored by the Administration that may be terminated in case so-called showstoppers are identified.

4.8.2 At a minimum, a HazId should be required in order to request for preliminary approval of the preliminary design. The Submitter will be required to arrange a HazId workshop, which is a structured brainstorming with the purpose of identifying all relevant hazards and their consequences and mitigating measures already included in the design. The HazId provides a unique meeting place for designers, engineers, operational and safety personnel as well as Administration representatives to discuss the alternative and/or equivalency and its associated hazards.

4.8.3 The benefits of including Administration representatives are:

.1 the Administration representatives will be able to point to issues relevant for approval that may be discussed;

.2 the Administration representatives may have expertise within certain areas of the design under consideration and therefore may be able to contribute by drawing attention to issues that may unintentionally have been left out of discussions; and

.3 the amount of questions and misunderstandings will be reduced during the review of the HazId and in the overall approval process.

4.8.4 Typically, results of the HazId will include the following:

.1 identified hazards associated with the alternative and/or equivalency design; and

.2 identified potential safeguards already included in the design.

4.8.5 The results of the HazId should be documented (HazId Report) by the Submitter and submitted to the Administration. A list of the participants in the HazId and their expertise and experience should be submitted to the Administration as well.

4.8.6 Depending on the scope defined by the Submitter and the Administration, the Preliminary design analysis may include a risk assessment. If so, a coarse risk model should be developed based on the HazId. The scope of the evaluation of risk control options depends on the outcome of the risk evaluation.

4.8.7 The scope related to the risk assessments at this phase will depend on the degree of novelty of the alternative and/or equivalency and the risk assessment plans defined during the Definition of Approval Basis Phase (see paragraph 4.1.3). Typically, the risk assessments will include the following (which is also documented and submitted to the Administration):

.1 ranking of hazards (identification of frequencies and consequences) and selection of hazards for risk model;

.2 development of a coarse risk model in order to perform quantitative analyses;

.3 description of data analysis, assumptions, uncertainties and sensitivities;

.4 assessment of the alternative and/or equivalency design by means of reference design;

.5 identification of issues, such as design casualty scenarios, that may require further analyses and testing; and

.6 identification of issues that may require special attention with respect to operations, accessibility and inspections.

4.8.8 The risk model may be developed using one of the well-established methods such as fault tree analyses, event tree analyses, Markov models, Bayesian networks, structural reliability analyses, etc. Description of the proposed qualitative and quantitative methods as well as the objectives, scope and basis of the assessments may be included in the risk assessment plan submitted at the time of Definition of Approval Basis Phase (see paragraph 4.1.3).

4.8.9 The work performed related to risk assessments will be documented by the Submitter and submitted to the Administration. The risk assessment will be included as the basis for approval, if required.

4.9 Review of Analysis for Preliminary Design Phase

4.9.1 During this phase the HazId performed in the previous phase will be formally reviewed by the Administration to ensure that:

.1 the HazId team was composed of qualified members;

.2 appropriate procedures for a HazId were followed; and

.3 all hazards are identified.

4.9.2 The HazId will further increase the understanding of the alternative and/or equivalency, and the list of requirements will be revised based on the findings from the HazId.

4.9.3 The risk model and the results of the evaluation, if considered in this phase, will be formally reviewed by the Administration. If the evaluation criteria cannot be fulfilled even with the implementation of risk control options, the approval process may be terminated at this point or may be restarted with a modified design.

4.9.4 Any risk control measures that may have been considered in the Preliminary design will be formally reviewed by the Administration.

4.10 Preliminary Approval Phase

4.10.1 The Submitter should seek approval of the Preliminary design from the Administration. The purpose of this is to verify that the alternative and/or equivalency is feasible and sound. The preliminary approval may therefore not be granted until all hazards and failure modes related to the design are identified and until control options (or plans for how to achieve control) of these hazards and failure modes are described. The following conditions should be satisfied prior to granting preliminary approval:

.1 no "showstoppers" were identified, otherwise a re-evaluation of the Preliminary Design phase and possibly improvements should be carried out; and

.2 the alternative and/or equivalency was found feasible and suitable for its expected application.

4.10.2 Such a preliminary approval may be useful with respect to project partners, financial institutions and additional regulatory agencies. The preliminary approval may also assist the Submitter in staying focused on the most important issues.

4.10.3 It should be noted that the issue of a preliminary approval statement by the Administration does not imply that final approval will be granted. However, at this stage, the underlying analyses (e.g. the risk analysis) may define the basis for design, sometimes referred to as the design basis or the design specification. A preliminary approval statement can facilitate the formal clarification of these aspects.

4.10.4 The basis for preliminary approval may consist of:

.1 a description of the alternative and/or equivalency, its specifications, its functional requirements, its operation and maintenance, health, safety and environmental issues, its interface with other systems, etc.;

.2 preliminary drawings;

.3 specifications of codes and standards applied (including specification of the applicable classification rules or part of rules);

.4 specification of the applicable administration requirements;

.5 hazard identification results;

.6 risk assessment plans or results of risk assessment for preliminary design, including evaluation method, evaluation metrics and evaluation criteria;

.7 design casualty scenarios;

.8 testing and analyses plans;

.9 special requirements for the project; and

.10 description of the approval process.

4.10.5 The preliminary approval should be issued with a set of conditions outlining the requirements and necessary steps the Submitter needs to satisfy and a list of documents that will be required in order to achieve final approval.

4.11 Final Design Phase

4.11.1 Following the preliminary approval, the Submitter will advance into the next phase of the project, this involves the Final design and subsequently required risk assessments, testing and analyses. These phases are more detailed versions of the phases prior to preliminary approval. It will result in an increased understanding of the alternative and/or equivalency design features, and both the Submitter and the Administration will gain confidence in the design as the level of accuracy increases.

4.11.2 The objective of this phase is to elaborate the preliminary design to a corresponding Final design. This Final design complies with the results of the preliminary analysis with respect to risk control options already identified and the requirements of the Administration. The final design is developed on the basis of the statement by the Administration.

4.12 Update of Approval Basis Phase

As previously discussed, the preliminary approval is issued with a set of conditions outlining the requirements and necessary steps the Submitter should satisfy in order to achieve final approval. Following the risk assessment, if done for the preliminary design and subsequent final design phase, the Submitter's Final design phase and the risk assessment of the preliminary design, the level of understanding of the alternative and/or equivalency has increased. The preliminary approval conditions may be revised as a result. That is, the requirements to be met in order to achieve final approval will be described in more detail. In addition, as the Submitter is in the process of selecting testing and analysis methods, the Administration will have an opportunity to guide and potentially specify explicit requirements for this selection.

4.13 Analysis of Final Design Phase

4.13.1 The tasks to be performed in this phase are similar to the analysis of the Preliminary design. In a first sub-phase, a review of the analysis of the preliminary design is performed to determine the difference between Preliminary design and Final design in order to specify the scope of the analyses that have to be considered in this phase. Thus, this analysis phase may contain an update of the HazId, a quantitative risk analysis and risk evaluation.

4.13.2 The requirements related to the risk assessment of the final design will be based on the novelty of the design, the risk assessment plans defined for the previous phase and the differences between the preliminary and the final design. Typically, the risk assessment will address the following:

.1 identified hazards associated with the alternative and/or equivalency (update of preliminary analysis);

.2 identified potential safeguards already considered in the design;

.3 identification of frequencies and consequences associated with the hazards, and the resulting risks;

.4 a precise risk model in order to perform quantitative analyses;

.5 description of data references, assumptions, uncertainties and sensitivities;

.6 comparison of risk levels with evaluation criteria;

.7 identification of potential risk reducing measures;

.8 cost-benefit assessments in order to select the most appropriate risk reducing measures;

.9 description of selected risk reducing measures;

.10 re-evaluation of risk taking into account the additional risk reducing measures and comparison with evaluation criteria;

.11 identification of issues that may require further analyses and testing; and

.12 identification of issues that may require special attention with respect to operations, accessibility and inspections.

4.13.3 The work performed related to risk assessments should be documented and submitted in a timely manner to the Administration in order for them to stay informed of the processes and to provide feedback, if necessary. The results of the risk assessments shall be the basis for consideration of final approval, if required.

4.14 Review of Analysis for Final Design Phase

All results of the analyses for the Final design will be reviewed by the Administration.

4.15 Definition of Detailed Requirements Phase

Detailed requirements will be defined for the alternative and/or equivalency design by the Administration and the Submitter jointly on the basis of the results of the quantitative risk analyses in order to achieve approval. These requirements address the following topics:

.1 approval tests: testing and analysis methods required to confirm assumptions used for the quantitative risk analysis;

.2 approval numerical calculations/simulations: numerical results required to demonstrate quantitative performance;

.3 manufacturing: level of quality control during manufacturing and installation; and

.4 operation: operational limits and maintenance, including definition of operation and maintenance procedures, as well as data acquisition and assessment during operation.

4.16 Perform Approval Tests and Analyses Phase

4.16.1 If required, further engineering analyses are used to verify that the design is feasible with respect to intentions and overall safety in all phases of operation. That is, the analyses and tests will ensure that the alternative and/or equivalency will meet expectations from a functional and safety point of view, including environmental protection. The engineering analyses are performed by the Submitter. Models used for the analyses, input data and results are documented and submitted to the Administration for review.

4.16.2 The types and extent of the analyses and tests required depend on the level of novelty, confidence in analyses and the extent of experience with similar concepts. While the objectives of the analyses are primarily to verify function and reliability, additional objectives of the tests are also to obtain data for analyses and verify the results obtained from analytical methods. The analyses and tests are meant to demonstrate additional safety margins compared to target limits defined in the design basis. The tests are performed in accordance with the requirements. The Administration should oversee these tests with experts in relevant areas.

4.16.3 Submittals required with respect to the analyses and tests include:

.1 statements of relevant codes and standards applied and deviations made to their application;

.2 selection of appropriate evaluation criteria used to assess the design;

.3 design calculations;

.4 analyses reports (including objectives, scope, assumptions, results, conclusions and recommendations);

.5 test/simulation reports, including descriptions of modelling/test set-up, as well as objectives, scope, results, analyses, conclusions and recommendations; and

.6 error and uncertainty assessments.

4.17 Review of Approval Tests and Analyses Phase

The Administration needs to review both the manner in which the analyses and tests are performed and the result itself. The results of the analyses and testing need to fulfil the test purpose and scope previously defined in the analysis and test plan. The attendance of an Administration representative at appropriate stages in the testing process is recommended and should be planned for and agreed as part of the definition of detailed requirements as described in paragraph 4.15.

4.18 Final Approval

4.18.1 The Final Approval phase will cover typical approval submittals, such as drawings, specifications, and support documentation, in addition to the submissions specified at the time of achieving preliminary approval.

4.18.2 At the time of approval, all potential hazards and failure modes for the alternative and/or equivalency will have been assessed versus evaluation criteria, to a level of confidence necessary to grant final approval.

4.18.3 In most cases, approval of the alternative and/or equivalency will involve conditions related to in-service surveys, inspections, monitoring, and possibly testing. In most cases, the conditions will be fixed already during the design phase. As experience accumulates and confidence in the alternative and/or equivalency is gained, these additional conditions and requirements may be relaxed.

4.18.4 Following final approval, in the construction and in-service phase the Administration needs assurance that knowledge related to the alternative and/or equivalency features is fed into the quality control process. In order to achieve this, communication between the approval team and the survey team is strongly encouraged.

4.18.5 All documents and drawings required to be submitted by the Submitter are verified by the Approval Authority.

4.19 Communication between Administration and the Submitter

4.19.1 Throughout the process, continuous communication between the Administration and the Submitter is important. As seen from the discussions in this section the process requires the Administration and the Submitter to work together on a number of occasions:

.1 design preview: In order to decide whether the alternative and/or equivalency requires observance of the approval process as outlined in this document or whether a conventional process can be followed, the Administration and the Submitter will need to meet and discuss the preliminary design developed by the Submitter;

.2 definition of approval basis: In order to define the approval basis, the Administration and the Submitter will need to meet one or several times to discuss the concept, applicable codes/standards/rules/etc., plans for risk assessments (including decision of which evaluation criteria to utilize) and plans for testing and engineering analyses. The definition of evaluation criteria may require additional meetings with the Administration to discuss and evaluate the selected criteria;

.3 monitoring of analysis of Preliminary design: the Administration may participate in the HazId for all alternative and/or equivalency designs. Furthermore, if a risk assessment and an identification of risk control options are agreed at this stage between the Administration and the Submitter, the Administration may monitor the activities of the Submitter;

.4 review of analysis of Preliminary design: The Administration reviews the results of the analyses for the Preliminary design;

.5 approval of Preliminary design: The preliminary approval will be given with a set of conditions that are to be met to achieve full approval. The Administration and the Submitter need to arrange a meeting to discuss the steps forward in the process;

.6 update of approval basis: In order to consider the results of the analyses performed for the preliminary design and the information provided by the specific design in the further risk analysis process, the approval basis is updated;

.7 review of analysis of Final design: The Administration reviews and eventually evaluates the necessary risk assessments necessary to satisfy the conditions outlined in the approval for the preliminary design;

.8 definition of detailed requirements: There may be a need to arrange a meeting to discuss the final design and results from the risk assessments and to further detail or revise the conditions given together for the approval of the final design;

.9 review of approval tests and analyses: The Submitter submits the required documentation and evidence of the testing and analyses to the Administration. Whether or not a meeting is required depends on the complexity of the testing and analyses; and

.10 final Approval: The approval certificate may be issued with some additional conditions assigned, such as additional survey scope and frequency, condition monitoring, or requirements related to maintenance and inspection. There should be a meeting between the Administration and the Submitter when issuing the approval certificate. During this phase, there may be a need for additional documents and drawings to be submitted to the Administration.

5 EVALUATION CRITERIA

5.1 General

5.1.1 The expected safety performance of the alternative and/or equivalent design should be quantitatively specified in the form of the evaluation criteria. As stated in section 4, the approval of alternatives and/or equivalencies requires the development, review, and selection of appropriate evaluation criteria. Before evaluation the alternative and/or equivalent design, the Submitter and the Administrationneed to agree on established evaluation criteria.

5.1.2 Following the design preview phase, the Submitter and the Administration will need to develop the evaluation criteria to be applied and an assessment plan which clearly states the agreed evaluation criteria and its basis.

5.1.3 Safety objectives and functional requirements available in IMO instruments should be taken into consideration when developing the evaluation criteria.

5.2 Evaluation criteria

5.2.1 The basic principle for the evaluation criterion should be "safety equivalence". This means that the alternative and/or equivalent will be designed so that it will perform its intended safety related function(s) in a manner that is equivalent to or better than the prescriptive requirement it is deviating from. The evaluation criterion used for the evaluation of the alternative/equivalent design shall be specified either on basis of prescriptive requirements or an equivalent, regulations compliant design. Therefore, the safety level of the prescriptive requirement should be made explicit to enable a comparison with the safety level of the alternative and/or equivalent design.

5.2.2 Depending on the area to which the approval of the alternative and or equivalent design is being sought, the evaluation criteria could fall into one or more of the following categories:

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

.2 damage to ship structure and related systems – These criteria address the impact that a casualty might have on a ship structure, mechanical systems, electrical systems, fire protection systems, etc. These criteria may represent physical effects of an accident.

.3 damage to the environment – These criteria address the impact of an accident on the atmosphere and the marine environment.

5.2.3 The evaluation criterion can be also specified by means of performance criteria characterizing the safety level of IMO regulations. In that case the performance criterion should be developed, taking into consideration the intent of the regulations and related mandatory instruments (e.g. mandatory codes and standards), if any.

5.2.4 The purpose of the analyses is to verify that a design with reasonable confidence will perform its intended safety related function(s) when necessary and in a manner equivalent to or better than the prescriptive IMO requirements.

5.2.5 The analysis used to show that the alternative design and arrangements provide the equivalent level of safety to the prescriptive IMO requirements should follow an established approach to safety design. This approach should be based on sound science and engineering practice incorporating widely accepted methods, empirical data, calculations, correlations and computer models as contained in engineering textbooks and technical literature. The general process of analysis is outlined in section 4 of these Guidelines.

5.2.6 For alternative design falling into areas where no appropriate IMO regulations or other relevant industry standard exist the evaluation criteria may be specified by means of risk acceptance and agreed with Administration.

5.2.7 Risk analysis is the calculation of probabilities and consequences for the event examined and the conversion of these into a risk metric (i.e. a measurable value, risk acceptance criterion, evaluation criterion, safety level, etc.) based on which decisions may be taken.

5.2.8 This approach may address the risk to human life, including injuries and ill health, and the risk to the environment. Other types of risk could also be covered, as appropriate to the design of the alternative and/or equivalency in question.

5.2.9 Different risk metrics for each type of risks can be employed and typically the following types of evaluation criteria are used:

.1 individual and societal risk; and

.2 risk to crew, passengers and people ashore, as appropriate.

5.2.10 The above are criteria for total risk (e.g. fatalities from fire, collision, structural damage, etc.) as opposed to criteria for individual hazards or individual risks. For the risk assessment of structural issues of ships, among others, it may be necessary to develop acceptance criteria for individual failure modes (limit states) of ships (e.g. failure due to fatigue of steel plates). This may also be necessary when examining the satisfaction or not of acceptance criteria for individual functional requirements relating to the structure of ships, its global and local strength, etc. Such risk evaluation criteria for individual hazards of ship structures and individual failure modes have not been developed nor established to date.

5.2.11 The risk acceptance criteria should be preferably specified by IMO or by the Administration otherwise.

5.3 Special considerations

5.3.1 In those cases where it may not be possible to define the evaluation criteria during the Preliminary Design phase, the Submitter and Administration should agree on the strategy for defining such criteria.

5.3.2 If the evaluation criteria cannot be fulfilled the approval process should be either terminated or restarted with a modified design.

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

5.3.4 The *Revised Guidelines for Formal Safety Assessment (FSA) for use in the IMO rule-making process* (MSC-MEPC.2/Circ.12) contains information on risk acceptance evaluation criteria.

6 DOCUMENTATION REQUIREMENTS

6.1 Documentation

6.1.1 The approval process for an alternative and/or equivalency is different from a conventional approval process, and therefore the documentation process needs to be clear, transparent and well described to avoid misinterpretations. As illustrated in figure 2, documentation may comprise, but is not limited to, the following:

6.1.1.1 From Submitter to Approval Authority:

.1 design documents:

.1 description of the alternative and/or equivalency design, including design basis;

.2 functional description;

.3 identification of interfaces between the design and other systems/operations (compliant with regulations);

.4 preliminary general arrangement drawings;

.5 preliminary detail drawings of subsystems (if available);

.6 list of codes and standards that are considered to be applied;

.7 risk assessment plans;

.8 testing and analysis plans; and

.9 further design basis documents, as necessary;

.2 analysis reports for assessment of preliminary design:

.1 identified hazards;

.2 safeguards included in the design;

.3 evaluation criteria applied;

.4 issues that may require further analyses and testing;

.5 description of analysis method applied, including the details of workshop conducted; If analysis for preliminary design includes a risk analysis;

.6 frequencies and consequences associated with the hazards and resulting risks;

.7 risk models;

.8 data references, expert judgments, assumptions, uncertainties and sensitivities;

.9 cost-benefit assessments;

.10 selected risk reducing measures;

.11 design casualty scenarios;

.12 issues that may require further analyses and testing; and

.13 information on the participated experts in the analysis;

.3 issues that may require special attention with respect to operations, accessibility and inspections;

.4 description of final design (including revisions to "preliminary design description" submittals);

.5 analysis reports for assessment of final design – including information regarding:

.1 as specified for assessment of preliminary design;

.6 analyses and testing reports – including information regarding:

.1 statements of relevant codes and standards applied, and deviations made to their application;

.2 selection of appropriate evaluation criteria used to assess the design;

.3 design calculations;

.4 analyses reports (including objectives, scope, assumptions, results, conclusions and recommendations);

.5 test reports, including descriptions of modeling/test set-up, as well as test objectives, scope, results, analyses, conclusions and recommendations; and

.6 error and uncertainty assessments; and

.7 design specifications:

.1 underlying analyses, testing and calculations that define the basis for design; and

.2 additional documents and drawings – including final general arrangement drawing and final detailed drawings of subsystems.

6.1.1.2 From Administration to Submitter:

.1 description of approval requirements and process;

.2 preliminary approval statement with conditions (if analysis of preliminary design is performed);

.3 description of detailed requirements;

.4 statement of approval of design specifications; and

.5 certificate with conditions.

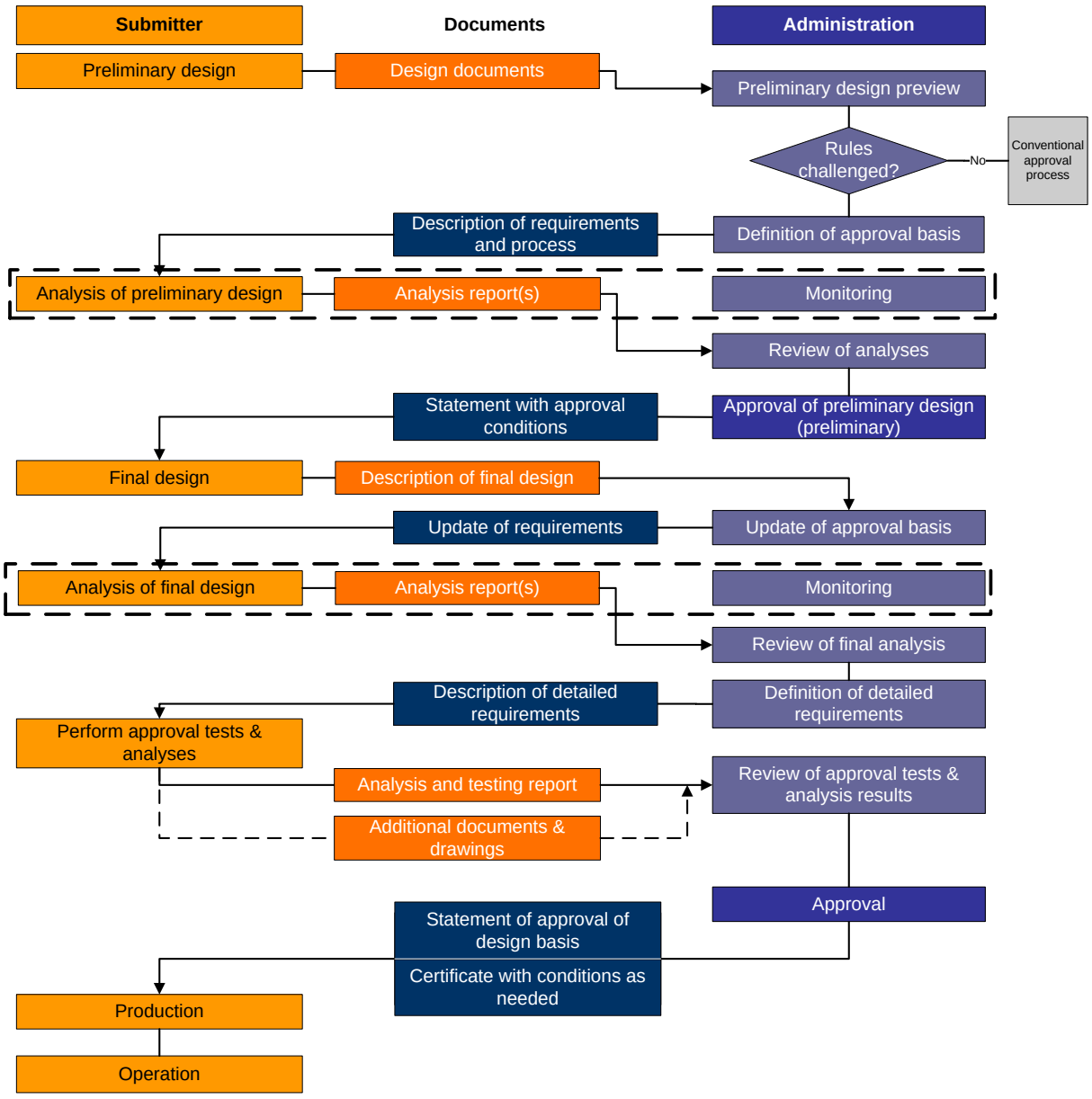

Figure 3: Documentation flowchart for the approval procedure

6.1.1.3 Documentation that is required to be exchanged between the Administration and the Submitter in the approval process is summarized in figure 3, and this chapter of the Guidelines outlines requirements pertaining to this documentation.

6.1.1.4 The document requirements described in this section are considered as minimum. According to the complexity and features of subjected design development, slight modifications of the requirements could be required. In this case, the modifications should be conducted on the basis of the agreement between the Administration and the Submitter.

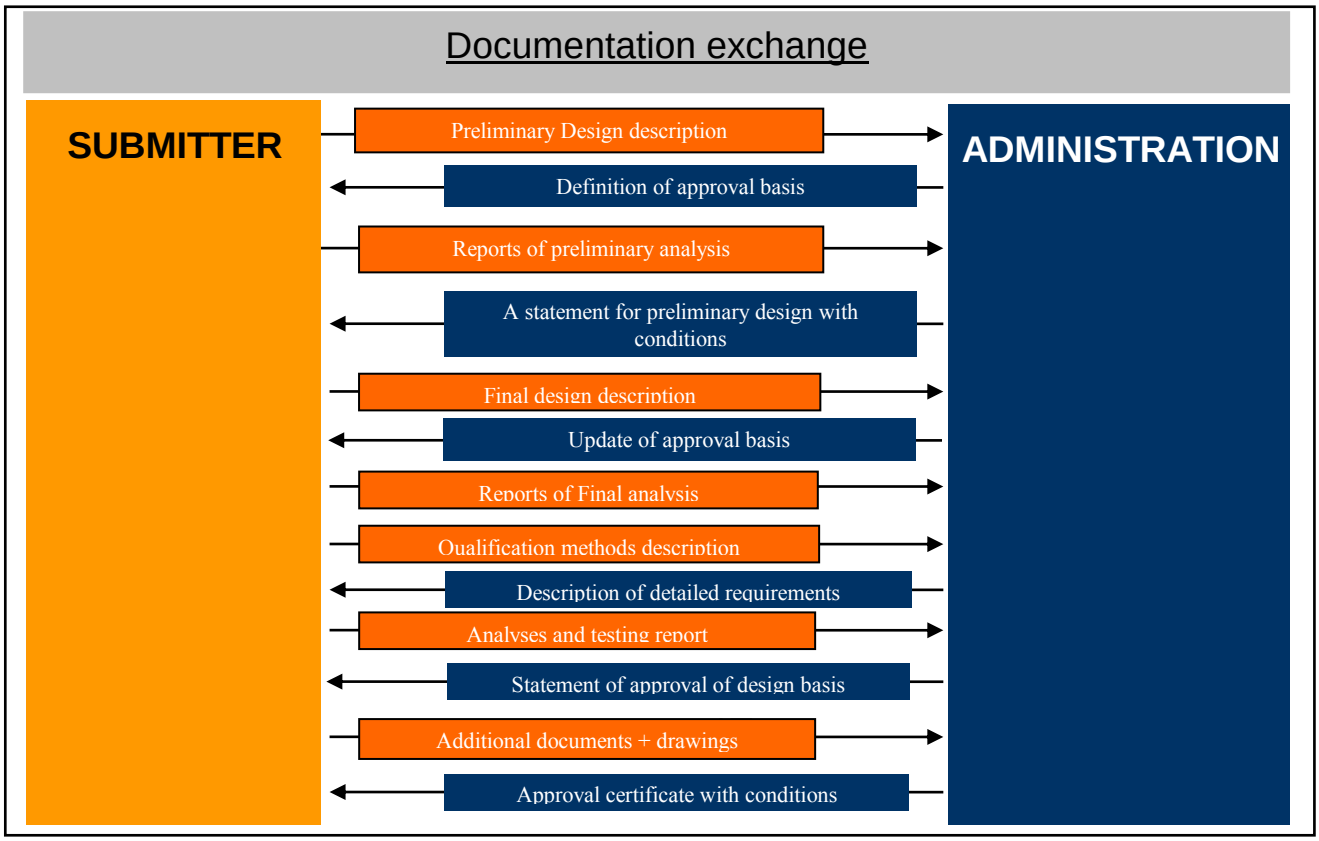

Figure 4: Documentation exchange between Administration and Submitter for risk-based approval

6.2 Approval guidance

6.2.1 A matrix as shown in table 2 may be applied for guidance to the Submitter when performing preliminary estimates on the extent of work to be performed and submitted for approval. The matrix has two axes: one referring to the level of novelty in the design (project category); the other referring to requirements in the risk assessment and to the amount of documentation (row A-E). The level of novelty may be determined by using table 1 from section 4. The following paragraphs are explanatory notes to the approval matrix.

6.2.2 Header row: Project category

In order to rank the novelty of a design, the categorization from table 1 from section 4 may be used.

6.2.3 Row A: Basic risk assessment (HazId)

This row contains information on description of hazards to individuals, arising from a specific setup or operation. Reference can be made to existing practice; hazards may be ranked in qualitative terms or semi quantitative terms.

6.2.4 Row B: Further analysis requirements

6.2.4.1 Due to the difference in complexity in each of the various designs, differentiation in the documentation requirements is:

.1 semi-quantitative risk assessment: A qualitative or quantitative estimates (range categories) of frequencies and consequences of an activity or operation. Scenarios are described and categorized according to their probability and impact;

.2 quantitative risk assessment: A numerical description of frequency and consequence of defined hazards through a specific operation or activity. The risk levels are represented numerically to be compared with agreed criteria. Varying levels of detail in the quantitative risk assessment may be required.

6.2.4.2 If a semi-quantitative risk assessment describes and suggests reduction of risks to a satisfactory level, then requirements for quantitative assessments may be redundant.

6.2.5 Row C: Qualifications of analysts

The Submitter will, to a certain extent, be able to perform or substantially contribute to a basic risk assessment by means of own qualified personnel. In-depth analysis, however, may require specific expertise in the field.

6.2.6 Row D: Applied rules and guidance

This element reflects the various sources of potentially applicable regulations and guidance on specific requirements in each case.

6.2.7 Row E: Potential additional tests, surveys and compliance control

This addresses anticipated follow-up activities after construction.

6.2.8 Row F: Review by third party

This addresses the review of the alternative design or equivalency study by independent expert peers. The higher the degree of novelty and/or risk level, the more detailed the review should be.

6.3 General considerations

6.3.1 In the following, general issues and procedural considerations are dealt with. Prevalently, the responsibility for ensuring documentation quality rests with the Submitter. A party wishing to enter into the approval process may therefore preferably have safety and quality management systems in place for their own processes as well as for subcontracted processes, as this substantially supports a controllable documentation. Basic formal issues have to be followed, ensuring document control and facilitating the adherence to any existing or future management systems. Such formal issues include stating on the submitted papers:

- project title and document title
- responsible person(s), including company and contact information
- scope statement/project description
- project identification number
- distribution list
- authorization signatures
- date
- revision number/letter
- other controlling documents/processes, if necessary

Table 2 – THE APPROVAL MATRIX

Project Category	**Known application of proven technology (conventional process)**	**Known application of a technology with a limited field history/New application of proven technology**	**New application of a technology with a limited field history/Known application of a new or unproven technology**	**New application of novel or unproven technology**	**Activity performed by:**
Requirements	**(1)**	**(2)**	**(3)**	**(4)**	
A) Basic risk assessment	Not required	Required (unless rule challenge deemed insignificant or of negligible impact on safety and environment)	Required	Required	Submitter (yard, supplier)
B) Further analysis requirements	Not required	Depending on basic risk assessment outcome. Hazards medium or high, if any, may be examined further, at least by semi-quantified analysis	Semi-quantified assessment. All hazards medium and high may be examined by means of quantified analysis	Quantified risk assessment to all risk contributions (due to the novelty of the design, it may not be possible to rank such hazards credibly. Hence, all may be examined in depth)	Submitter in cooperation with the Administration
C) Qualifications of analysts	N/A	Operational experience General knowledge of risk assessment techniques	Operational experience. In-depth experience with risk assessment. Some knowledge of analysis techniques	Operational experience Risk assessment and analysis experts	N/A

Project Category **Requirements**	**Known application of proven technology (conventional process)** **(1)**	**Known application of a technology with a limited field history/New application of proven technology** **(2)**	**New application of a technology with a limited field history/Known application of a new or unproven technology** **(3)**	**New application of novel or unproven technology** **(4)**	**Activity performed by:**
D) Applied rules and guidance	Existing prescriptive rules (SOLAS, MARPOL, relevant codes, national, regional and international legislation, prescriptive class rules)	Existing prescriptive rules where no rule challenge prevails (SOLAS, MARPOL, relevant codes, national, regional and international legislation, prescriptive class rules) applicable standards if available from other industrial sectors, class guidance on risk-based approval as applicable	IMO circulars on alternative arrangements, class guidance on risk-based approval, other relevant industry standards	IMO circulars on alternative arrangements, class guidance on risk-based approval	N/A
E) Potential additional tests, surveys and compliance control (after commissioning)	As per Safety Management System (SMS) and existing regulation	Internal surveying. Additional review at safety related events subject to recording and corrective action	Internal/external surveying, recording and additional intermediate surveys of risk-based features, if deemed necessary	Continuous monitoring and review subject to reporting to the Administration until a sufficient level of experience is gained	Submitter (operator)
F) Review by third party	Considered	Considered	Considered	Recommended	N/A

6.3.2 Drawings and layouts

6.3.2.1 Any design detail deviating from conventional best practice should be described comprehensively to facilitate a full understanding of the extent of the novel type equipment or detail with intended design basis including environmental conditions and operational scheme.

6.3.2.2 Safety critical details have to be documented.

6.3.3 Design parameters

All parameters applied in the design process should be explicit. Processes may be presented as diagrams or described in prose. The method (how) and stage (when) of application should be clear from the description.

6.3.4 Requirements for risk control measures

6.3.4.1 For alternative designs the acceptable risk level will typically be set by a regulation compliant reference design (see sections 4 and 5).

6.3.4.2 In the absence of a regulation compliant reference design to compare with, the evaluation criteria may be specified by means of risk analysis. Identified risk levels will usually be categorized to belong to three categories: intolerable risks which should be reduced, negligible risks which do not require any action, and risks in the ALARP area which should be reduced to as low as reasonably practicable.

6.3.4.3 If several possible options can efficiently reduce the same risk, the passive options, which are usually more verifiable and reliable, should be chosen. As a majority of incidents are strongly influenced by human error and operational faults, the team may seek solutions that minimize potential human error, if at all viable and efficient.

6.3.4.4 If risk control measures are operational, then their implementation into management systems should be documented, to ensure that the crew is fully informed and familiar of such special measures.

6.3.5 Reporting format

6.3.5.1 The documentation of the project prerequisites, any assumptions and exclusions made, the HazId, the risk assessment, (if any), recommendations and conclusions as per the approval process may take several forms, all with their own advantages and drawbacks, such as:

.1 PC based work sheets and documents;

.2 technical reports; and

.3 programs tailored to the purpose.

6.3.5.2 Regardless of the format, the content should be verifiable. Also, as the HazId and ensuing conclusions will be reviewed during follow-up meetings, means of document control should be applied to ensure that only controlled versions of the information yielded are distributed.

6.3.6 Calculation/analysis requirements

6.3.6.1 When making decisions based on analysis techniques, care should be taken to evaluate their adequacy. This requires expertise on various types of risk assessment methods to ensure that the most suitable will be selected for the application in question. As is deductible from prior elaborations, the level of novelty/regulation challenge is variable and, depending hereon, the most suitable methodologies may also vary.

6.3.6.2 Below are nine reminders when performing in-depth risk analyses:

.1 apply best industry practice and be consistent with IMO FSA Guidelines when selecting risk assessment techniques;

.2 perform a high-level assessment of the design type for which approval is sought;

.3 ensure that the specific risk assessment (based on the generic high-level assessment) meets the requirements for methodology and depth level acceptable by the Approval Authority;

.4 ensure that the applied model reflects the as built and operated ship or system as accurately as possible. If necessary, the process should be conducted iteratively, as the design process progresses, to ensure all safety critical aspects are covered;

.5 apply assumptions on a sound basis and perform frequency and consequence analyses based on relevant and consistent data;

.6 check for consistency between the level of detail in the assessment and the assumed risk control measures and the system safety testing and -management program (programmed maintenance, safety management systems), especially if such assumed control- or mitigating measures are of an operational character;

.7 include internal and external events in the analysis;

.8 include normal operational modes as well as states of emergency in the analysis; and

.9 include sensitivity analysis, uncertainty analysis and importance measures.

6.3.7 Errors and uncertainties

6.3.7.1 To be able to compute or determine the different parameters which are to be applied in the risk analysis or which are found in any form of design equation, it is necessary to have access to various types of data.

6.3.7.2 Uncertainty reflects either lack of knowledge about the actual value of a variable (epistemic uncertainty) or variability intrinsic to the parameter (aleatory uncertainty). In standard risk assessment methods, however, uncertainties involved can be accounted for within the method (e.g. conservative assumptions).

6.3.7.3 Although uncertainty on variables may be considerable, expected values can be estimated. Therefore, it may be sensible to choose a reasonable estimate reference. Choosing values implying the worst conceivable case could result in an exaggerated picture of the risks involved.

6.3.7.4 To examine the impact of specific variables on the final results, a sensitivity analysis should be carried out, where the effect of for example doubling the value of a variable may be examined to decide whether the originally selected values are conservative enough or if they deserve a more precise/detailed analysis or not.

6.3.7.5 Hence the following issues which may require investigation at any given stage require consideration:

.1 variation in the input data;

.2 the impact of simplifications/assumptions of problems;

.3 the effects of various characteristics of the scenarios; and

.4 the reliability of systems.

6.3.7.6 Variables which are found to have a major impact in the sensitivity analysis may justify a more conservative or precise approach than variables of lesser importance. The sensitivity analysis may indicate the variables of major impact and how uncertainties of such variables are handled.

6.4 Preliminary design description

6.4.1 A design description comprises the material available on the design, including any risk-based features, describing the project to the extent possible in this phase, as follows. Such a description comprises many elements which are of importance in relation to the understanding of the approval procedure. This section provides guidance on documentation to be submitted as well as considerations by the Administration upon receipt.

6.4.2 Procedural intent, initial considerations

6.4.2.1 Description of the alternative and/or equivalency design

High-level description of the design submitted for approval, including the documentation quoted in the documentation section. Definition of the design basis comprising various environmental conditions, intended goal (objectives) of the design and operational scheme (including operational limitations) should be clarified.

6.4.2.2 Functional description

The scope of the design in operation must be described in detail.

6.4.2.3 Identification of interfaces between the alternative and/or equivalency and other systems/operations

This applies only to project categories 2-4, table 2.

6.4.2.4 Design approval basis documents

The design approval basis documents outline how initial owner requirements are met and provide information on tools applied, statements of preliminary tests/simulations performed and ensuing decision support processes.

6.4.2.5 Preliminary general arrangement drawing

Provides an overview with dimensions of the project (identical to conventional process).

6.4.2.6 Preliminary detail drawing of subsystems

Provides an overview of the systems and their function within the ship (identical to conventional process).

6.4.2.7 List of codes and standards applied

The list of codes and standards applied is needed for transparency. If ambiguity exists on the applicability of any codes and standards adhered to, statements of further intended examinations to document applicability of such standards or intentions of testing to marine codes or standards may be submitted with the documentation as per below.

6.4.2.8 Risk assessment plans

This applies only to project categories 2-4, table 2. This describes risk assessment as deemed necessary by the Submitter. This allows the Administration to evaluate whether the detail level contemplated is sufficient. The effort applied and the detail of assessment and analysis depend on experience with the design (or similar designs) in the intended application.

6.4.2.9 Testing and analysis plan

This applies to project categories 1 to 4, table 2. Any plans for testing or analysing materials, structures or systems which require documentation beyond what is currently available. Tests may be substituted by documentation of the material or system having a track record in another but relevant field.

6.4.2.10 High-level conclusion

Provides a brief summary, conveying the options to commence the detailed process.

6.4.3 Documentation to be delivered

Description of the alternative and/or equivalency design

6.4.3.1 The Submitter supplies (the examples below refer to risk-based ship design):

.1 preliminary main dimensions, preliminary overall shape and configuration, calculations of weights, hydrostatics, stability calculations, etc.;

.2 speed, capacity and any further relevant particulars;

.3 material data sheets for materials planned for use during construction, particularly where restrictions on the application of such materials exist; and

.4 a list of regulations challenged at this stage, if any, to the best knowledge of the Submitter.

6.4.3.2 The Administration previews to provide verification of the documentation on:

.1 whether the description supplied is sufficient information to commence the process; and

.2 whether agreement exists on the identified list of regulations challenged.

Functional description

6.4.3.3 The Submitter supplies:

.1 description of modes of operation and intended area of service;

.2 specific operational parameters, including estimates of limitations bearing in mind any novel characteristics;

.3 function statements and planned inherent safety features (electric/hydraulic, power packs, redundancies, overload switches), main pressures and voltages where applicable; and

.4 drawings, wiring diagrams and piping plans as well as presumed maintenance and operating requirements.

6.4.3.4 The Administration previews to provide verification of the documentation on whether all safety critical functions and processes have been included and described concisely.

Identification of interfaces between alternatives and/or equivalencies and other operations

6.4.3.5 The Submitter supplies a description of the items where alternative design features are deemed to interact with conventional features.

6.4.3.6 The Administration previews to provide verification of the documentation on:

.1 whether all potential items of interaction are included and described to a comprehensive level of detail; and

.2 whether all identified rules challenged as shown in the list are addressed and the potential impacts described.

Design approval basis documents

6.4.3.7 The Submitter supplies:

.1 identification of the design parameters, addressing the nature of operational requirements;

.2 the principles underlying the design; and

.3 calculations and descriptions of assumptions made, including limitations.

6.4.3.8 The Administration previews to provide verification of the documentation on:

.1 whether the design approval basis documents are considered to be complete;

.2 whether safety has been considered and included as a design parameter;

.3 whether simplifications applied when analysing the design provide an adequate level of accuracy; and

.4 whether tools applied in the process are approved or subject to approval.

6.4.3.9 Preliminary general arrangement drawings: identical to conventional approval process.

6.4.3.10 Preliminary detail drawing of subsystems: identical to conventional approval process.

List of Codes and standards applied

6.4.3.11 The Submitter supplies:

.1 codes or standards adhered to;

.2 scope of codes and standards adhered to;

.3 requirements challenged in the alternative and/or equivalency ship design;

.4 type approvals achieved for components or subsystems, if any; and

.5 documentation of applicability of any code or standard, as well as any exemption, deviation or non-compliance.

6.4.3.12 The Administration previews to provide verification of the documentation on:

.1 whether standards complied with are relevant and sufficient;

.2 whether applicability is documented to the satisfaction of the Administration;

.3 whether certificates or statements of compliance are available and up to date; and

.4 whether required examinations are carried out by accredited bodies or labs.

Risk assessment

6.4.3.13 The Submitter supplies:

.1 risk assessment as deemed necessary by the Submitter in accordance with the assessment of deviation from a conventional design;

.2 a description of proposed risk evaluation criteria;

.3 a description of risk assessment with regard hereto, including statement on techniques of choice, the applicability of techniques, tools, and proposed preliminary depth level; and

.4 a list of proposed participants in the risk assessment team and their qualifications.

6.4.3.14 The Administration previews to provide verification of the documentation on:

.1 whether the risk assessment planned by the Submitter would provide an adequate level of assessment and analysis;

.2 whether the evaluation criteria chosen are acceptable;

.3 whether the techniques chosen by the Submitter are adequate for the scope of assessment/analysis; and

.4 whether the aggregate qualifications of the risk assessment team are considered adequate for the task.

Testing and analysis plan

6.4.3.15 The Submitter supplies:

.1 tests and analyses plans to validate the applicability of materials or systems for their intended use; and

.2 statements of methods and details of labs performing tests and analyses to validate materials or systems.

6.4.3.16 The Administration previews to provide verification of the documentation on:

.1 whether all relevant materials and systems will be tested or analysed;

.2 whether methods are acceptable; and

.3 whether the labs performing the tests are recognized and accredited or subject to accreditation within a reasonable time frame.

High-level conclusion

6.4.3.17 The Administration supplies the following to the Submitter:

.1 high-level conclusion of the preview (acceptable/conditionally acceptable/not acceptable);

.2 statement of areas which may contain further challenges;

.3 terms of adherence to intended approval method (viability considerations); and

.4 evaluation of the time frame for approval, if possible.

6.4.3.18 Queries by the Administration, preceding preliminary approval:

.1 Does the design description supply sufficient information to give a broad understanding of the project?

.2 Does the Approval Authority agree with the rules applicable and challenged (potential further rule challenge)?

.3 Is it possible to initiate the process on the basis of the documentation submitted and available?

.4 Have provisions for dealing with any instances yet to be evaluated been considered?

.5 Do these provisions appear adequate?

.6 Do all stakeholders participating in the process understand the implications in terms of resources assigned, time limits, etc.?

6.5 Definition of approval basis

6.5.1 Procedural intent

6.5.1.1 As a consequence of reviewing the documentation supplied and based on the results from the preview of the documentation, the Administration is in a position to define the approval basis:

.1 if regulation challenges are negligible or their impact minor (subject to exemption by the Administration), the design can be approved by means of a conventional process; and

.2 if regulation challenges or the impact of challenge is significant, an approval process in accordance with this Guideline should be followed.

6.5.1.2 The sequence takes place based on the outcome from the preview. First, it consists of an evaluation by the Administration of which elements or operational circumstances (if not all) of the project may be covered by the risk analysis to be compiled. Also, if any elements exist which may be approvable by means of simpler methods, this information is rendered to the Submitter. In principle, this step in the process requires the owner to have selected an Administration, as the design should be subject to the requirements given internationally, regionally and nationally.

6.5.1.3 The Administration may detail appropriate or equivalent requirements and standards to serve as means of compliance, along with the requirements for the risk analysis. This evaluation eventually leads to a detailed description of the imposed requirements, the necessary process, and the selected means of compliance, which is submitted to the customer responsible for the documentation of compliance with the requirements imposed and implementing improvement measures where necessary or requested by the supervising body.

6.5.2 Documentation to be delivered

6.5.2.1 The Administration supplies the following to the Submitter:

.1 Statement from the Administration on those operations which should be evaluated in depth through the risk assessment;

.2 Concise statement from the Administration on intended sets of regulations/standards and processes applicable to the project;

.3 The segments (if any) which may be subject to simple compliance with existing regulations; and

.4 Summary conditions of compliance and approval from the Administration.

6.5.2.2 Queries by the Administration preceding preliminary approval:

.1 Are all operational phases considered, either by standard compliance verification or by evaluation through risk analysis?

.2 Are alternative industry standards, which may have been chosen, relevant and applicable?

.3 Have evaluation criteria been assigned?

6.6 Analysis of preliminary design (including the HazId report)[1]

6.6.1 Procedural intent

6.6.1.1 For alternative and/or equivalent designs (unless the regulation challenges are deemed insignificant or of negligible impact in terms of safety), a HazId will always be required, as it fulfills the requirement that the basic risk assessment should address the parameters of the submitted design known to this point and evaluate where further scrutiny is justified and necessary.

6.6.1.2 The Submitter should consider:

.1 statements of main conclusions from initial meetings, including key elements of risk that may be examined further;

.2 description of HazId procedure applied;

.3 documentation in support of any assumptions made;

.4 documentation of existing safeguards and control measures;

.5 plans and means for proposed safeguards and control measures;

.6 levels of agreement within the team and the qualifications and experience of the participated members;

.7 points of discussion and further examination, including further analysis and applicable techniques;

.8 needs for further in-depth examination of historical evidence/expert judgment or calculations; and

.9 sources of information.

6.6.1.3 When receiving the HazId report and monitoring the session(s), the Administration may consider:

.1 whether safety issues have been comprehensively covered (whereas commercial risks in this context are beyond the scope of the Administration);

.2 whether all relevant, conceivable scenarios have been considered, ranked and prioritized;

[1] Consider remarks on process made in section 4.

.3 whether the composition of the HazId team ensures that all relevant areas of expertise are represented and heard in the process, both from a scientific, theoretical, operational and practical standpoint;

.4 whether the qualifications and experience of the participants are verifiable upon request;

.5 whether existing and proposed safeguards and control measures are adequate and viable. (The adequate reduction of risk to acceptable level, or plans to perform such reduction in the Final design process, is a condition of preliminary approval.); and

.6 whether identified significant hazards can be adequately analysed and reduced by means of the planned detailed risk analysis processes.

6.6.1.4 The Administration reserves the right to request further participants if certain areas of expertise or experience have not been adequately covered by the team composition as described (an Administration representative may participate to ensure that potential comments from the Administration to the Submitter are covered to the maximum extent possible).

6.6.1.5 The HazId further serves to clarify and rank all identified hazards. As mentioned above, the HazId is a meticulous, formalized brainstorming process, documenting any contributory factors impacting on safety critical elements. The documentation derived from the process is submitted to the Administration.

6.6.1.6 If the expert group does not agree on the prioritization of scenarios (or at any other stage where expert judgment is applied), the level of disagreement may be reflected and documented where the scope would be to achieve a "good" level of consensus within the expert group performing the task.

6.6.2 Documentation to be delivered

6.6.2.1 The Submitter supplies the following to the Administration:

.1 full HazId report (also see recommendations in the FSA Guidelines), including the following:

.1 prioritized lists of hazards and scenarios (ranking);

.2 causal sequences considered; and

.3 documentation on background information applied (historical data, sources, impacts, effects, relevance);

.2 desired field verifications of measures;

.3 related or equivalent systems or subsystems (can equivalence be applied/documented at any given instance);

.4 details of the qualifications of the HazId team members as well as the project team members (to ensure the application of sound operational principles and adequate expertise within the team);

.5 details on how and based on which evidence consequences and probabilities have been ranked; and

.6 any supporting documentation which may potentially validate estimates during the HazId.

6.6.2.2 Queries by the Administration preceding preliminary approval:

.1 To what extent are known and standardized techniques applied in the identification of hazards and which techniques have been applied?

.2 Have all relevant areas of expertise contributed to achieve the most comprehensive overview possible?

.3 To what extent is the data material (such as material applied for the evaluation of frequencies and consequences) relevant (i.e. derived from similar industries)?

.4 To what extent can reliance be placed in the applicability of the data?

.5 Are references made to all applied information sources to enable fact-checking?

.6 Have criteria for individual risk and societal risk been accepted.

6.7 Preliminary approval statement with conditions

6.7.1 Procedural intent

6.7.1.1 Following the achievement of a satisfactory level of confidence in the design, a statement of preliminary approval (of the design as evaluated to this point) may be issued to the Submitter, taking into account any limitations and conditions of later approval of the detailed design.

6.7.1.2 The Administration has to consider a description of requirements, in accordance with the outcome and the results from the design preview, identifying information gaps, conditions resting on further information or analysis as well as any further queries identified during preview.

6.7.1.3 The report from the HazId is submitted to the Administration for review, thereby assuring that all hazard aspects which may be found to be safety critical are covered and accounted for. Final approval may still be conditional or pending if the agreed safety standards are not reached or if certain aspects of the design are inadequately documented.

6.7.1.4 Particular requirements prevail with regards to the ensuing risk assessment session, quoted evaluation criteria and further risk assessment.

6.7.1.5 The statement to the Submitter at this point will concern*:*

.1 the Final design characteristics with requirements for any areas of particular concern identified;

.2 requirements for the Final risk analyses to be performed in the next step of the process (project categories 2-4);

.3 assumptions in the high-level process to be verified through the detailed design sequences;

.4 required test and analysis results; and

.5 required additional general documentation describing the ship as needed prior to final approval (manuals, system specifications, data sheets).

6.7.1.6 The conditions imposed depend on the outcome of the "definition of approval basis" phase along with the HazId; some conditions will be a consequence of the determination of major hazards resulting from novel features, whereas other conditions result from the project moving from a high/preliminary level to a specific detailed level of examination.

6.7.2 Documentation to be delivered

6.7.2.1 The Administration supplies the following to the Submitter: preliminary approval statement, with any conditions as applicable, including requirements for further risk analyses.

6.7.2.2 Queries by the Administration:

.1 Are the conditions of final approval stated in a manner that adequately explains the need for their fulfillment?

.2 Are the conditions reasonably and rationally argued for?

6.7.2.3 If no medium or high risks have been identified in the basic risk assessment at the preliminary stage, and the Administration has no further queries hereto, the process will continue as a conventional approval process. Hence, all segments described hereafter concern project categories 2-4, as applicable.

6.7.2.4 If the Administration considers the identified risks to be unacceptable, and/or proposed risk reduction measures are considered impractical, the Administration can refuse supplying a preliminary approval statement, citing appropriate reasons for the rejection.

6.8 Description of Final design, risk assessment report review and qualification method description

The following applies to project categories 2-4, as appropriate.

6.8.1 Procedural intent

6.8.1.1 Upon receipt of the preliminary approval statement, the description of the final design may commence. The final design elements and the scenarios imposed by the operational conditions will at this stage be subject to a risk assessment of all vital/safety critical elements.

6.8.1.2 The risk assessment is to live up to the detail level necessary to examine risks with respect to the evaluation criteria as well as follow acceptable methods (qualification of the methodology should be part of the report submitted).

6.8.1.3 Initially, the required level of detail mainly depends on the novelty impact of the issue addressed. In order to avoid possible conflict of interest, it is recommended that the party setting the requirements to the risk assessment and eventually approving it is not the party performing and delivering it.

6.8.1.4 The Submitter has to consider:

.1 all relevant IMO guidance documents;

.2 further information, plans and drawing details in the course of such information being produced;

.3 documentation on any previously unidentified risks, rendered evident by the increased comprehensiveness of the design, analysis of such risks and, and information on the analysis methods selected;

.4 risk assessments performed and submitted, supplying sufficient information to render both method and content transparent to an external auditor (without requiring redundant documentation, testing or analysis from the Submitter);

.5 applied evaluation criteria (relative, qualitative or quantitative), examined and explained. If a reference design exists, or equivalent arrangements can be found, then relative criteria should be applied;

.6 a description of sources of frequency and consequence estimates, documenting relevance for the design in question;

.7 statement on assumptions, exclusions, limitations and uncertainties;

.8 a description of further planned tests and analyses of materials and systems; and

.9 all calculations performed and historical data applied may be obtainable and reproducible by an independent third party to ensure that the methods and techniques are sufficiently robust and remain objective.

6.8.1.5 The Administration has to consider:

.1 whether relevant guidance have been taken into account;

.2 whether the documentation supplied renders a complete picture of the design to the extent known at the given stage;

.3 whether all previously and newly identified risks have been analysed:

.1 by means of applicable/approved tools;

Analyses performed by means of new tools may be considered, but observing that application of such tools may generate a request for further independent verification of the tools or independent analysis with alternative tools.

.2 by personnel with adequate knowledge and experience. The adequacy of personnel qualifications depends on the required analysis depth level;

.3 at an adequate depth level. The analysis may yield information to support confidence in the safety of the design and document risks being compliant with evaluation criteria agreed at the highest level possible;

.4 by means of adequate techniques. As stated, a HazId prevails as a minimum basic requirement. (Further analysis to be conducted if and as required if a qualitative evaluation does not provide for conclusive confidence in the safety of the design, e.g. HazOp, what-if, FMECA, etc., as applicable to the level and extent of the design or system assessed, the adequacy of technique chosen may be explained.); and

.5 sequentially and iteratively to ensure that any potential new or altered elements of risk are covered as the design process progresses;

.4 whether agreement prevails on the selected evaluation criteria;

.5 whether assumptions, exclusions and limitations are justified and whether the approach is sufficiently robust to retain confidence in the design;

.6 whether the applied risk control options are considered effective and viable;

.7 whether historical/statistical data is as recent as possible and is relevant for the application;

.8 whether the numerical tools used are fit and validated for purpose; and

.9 whether evidence prevails that intended or planned further tests and analyses will have an acceptable outcome.

6.8.2 Documentation to be delivered

6.8.2.1 The Submitter supplies the following to the Approval Authority:

.1 description of risk model(s), calculations and analyses (methodology, frequency and consequence estimates, sensitivity analysis, limitations of methods, assumptions made, reproducibility/falsification tests applicable);

.2 basic source information (related work tasks, the origin of database material and its applicability, source of FN-diagram figures on societal risk, sources of individual risk, fatalities, lost time accidents, evaluation/evaluation criteria (for subsidiary operations/ship system operations));

.3 clear indication where and how expert judgment was applied (where no data is available);

.4 level of agreement in the expert group (concordance, see FSA Guidelines);

.5 applicable risk control options and associated considerations, including the analysis efficiency of proposed options;

.6 error/uncertainty/sensitivity discourse; and

.7 main risk contributory factors.

6.8.2.2 Queries by the Administration preceding approval:

.1 Are the models used of an approvable methodology (recognized risk assessment techniques, adequate for the task)?

.2 If requirements exist from the definition of approval basis stage (such as certain safety features or margins), does the documentation comply with these requirements as well as with the design specification?

.3 Has an acceptable methodology and degree of consensus been achieved when applying expert judgment?

.4 Can the results be reproduced by a third party having knowledge of the case?

.5 Have limitations of the methodologies applied been accounted for?

.6 Have all main risk contributory factors been accounted for and evaluated?

.7 Is the documentation supplied clear, transparent, complete and adequate for its purpose (i.e. is the information supplied sufficient for a person of adequate knowledge in the field to comprehend it by means of the sources and methodologies quoted)?

.8 Have issues of interaction effects or interface issues been considered (among other things aggravating or mitigating conditions)?

6.9 Definition and description of detailed requirements

The following applies to project categories 2-4, as appropriate.

6.9.1 Procedural intent

6.9.1.1 The description of detailed requirements is based on the outcome of the risk assessment review, as per above, and refers to the detailed design and the qualification of method descriptions provided by the Submitter.

6.9.1.2 The Administration has to consider:

.1 a description of further requirements emanating from the review of the risk assessment, including conditions of approval, resting on outstanding test results, further analysis requirements, or revised measures for risk reduction, including operational requirements throughout the lifetime of the ship and/or any specific requirements with regard to manufacturing, maintenance and monitoring;

.2 conditions of approval are linked to the outcome of tests, reports, detail drawings and achievement of third party approval, where applicable; and

.3 to detail requirements, relative to the steps leading to the preliminary approval. A risk control measure may correspond to a detailed requirement, or a number of detailed, technical requirements may be required to achieve the intended safety standard in the design.

6.9.2 Documentation to be delivered

6.9.2.1 The Administration delivers the following to the Submitter:

.1 concise reference to facilitate the adherence to imposed standards or regulations;

.2 statement of options of compliance (if one exists); and

.3 drawings, measurements, tables, written documentation on equipment specifications.

6.9.2.2 Queries by the Administration preceding approval:

.1 Is the system well evaluated bearing in mind the intended life cycle of the ship in terms of maintenance, availability of spare parts, repair and reliability?

.2 Which risk control measures form the basis of the chosen regulatory option; do the risk control measures build on design/engineering improvements and, hence, will they be based on inherent safety or on operational and organizational changes?

.3 Have any such organizational or operational requirements been sufficiently documented, such as to become part of a safety management system?

.4 Has assessment taken place of effects of novel designs interacting with the equipment and manning needed on board (tools, measuring equipment)?

.5 If general industry standards are applied, are certificates and reports made available?

6.9.2.3 The description, documented as per above, is submitted to the customer, who is obliged to answer, qualify and document any open queries as well as to perform any additional tests, analyses and improvements, which are submitted upon request.

6.10 Statement of approval of design basis

Upon delivery of the necessary documentation as stated in the previous paragraphs, the statement of approval of the design basis will be issued to the Submitter by the Administration.

6.11 Analysis and testing reports/additional documentation

The following applies to project categories 2-4, as appropriate.

6.11.1 Procedural intent

6.11.1.1 The Submitter has to consider: The submitted documentation has the scope of covering any remaining open questions of principal significance, such as previously untested methods, materials or applied processes.

6.11.1.2 Reports of tests (as agreed in the preliminary approval phase) may be delivered at this stage, along with any other relevant documentation stated as necessary to gain full comprehension of the project.

6.11.2 Documentation to be delivered

6.11.2.1 The Submitter delivers the following to the Administration:

.1 test reports;

.2 results of further analyses conducted as a consequence of the detailing of the design and the increased understanding of the design;

.3 detailed drawings of the design, equally as a consequence of detailing;

.4 tabulated values, achieved figures, measurements;

.5 possible errors and uncertainties in the applied methods; and

.6 additional drawings.

6.11.2.2 Queries by the Administration preceding approval:

.1 Has the criticality of any errors or uncertainties (with sensitivity analysis) been considered?

.2 Have any novel processes, materials or methods been documented to an extent granting adequate reliability?

.3 Does all documentation submitted live up to formal requirements (such as readability, comprehensiveness, language, documented audit trail)?

.4 Are test methods of a nature which is trusted or sufficiently documented elsewhere to be relied upon?

6.12 Issuance of Certificate of Approval with conditions

This includes approval of documents, drawings and submission of approval to the Submitter. The following is applicable to project categories 2-4, as appropriate.

6.12.1 Procedural intent

6.12.1.1 Provided all outstanding information is submitted as required, the Administration may approve the design.

6.12.1.2 Conditions are applicable to the ship or system being constructed, meaning that approval of a ship is conditional on the rectification of any queries or outstanding issues remaining from the design phase.

6.12.1.3 At all times both preliminary requirements and case-by-case system requirements can prevail. Prerequisites for approval may thus vary with the project in question. Once the design is approved, its operability in a controllable process remains to be reviewed and surveyed at intervals to be defined. Conclusively, certificate of approval may be granted, and the construction process can ensue.

6.12.1.4 The approval serves to give the Submitter a statement of compliance with the statutory requirements, as defined by means of the above process, and is in this respect not substantially different from a traditional approval, even if the approval process leading up to the issuance is different. The certificate can contain as conditions which appropriate in-service measures should be implemented before the ship enters into service.

6.12.1.5 Provided the documentation lives up to the given requirements, the design approval process as such is concluded.

6.12.1.6 Unless risks of the subjected design have been demonstrated that they are capable of being controlled within the acceptable risk level through the proposed risk reduction measures, the Administration can refuse issuing the Certificate of Approval.

6.12.2 Remaining documentation to be delivered

6.12.2.1 The Submitter supplies the following to the Administration:

.1 certificates of process compliance with industry standards (applicability being verifiable). Such certification from other authorities may be deemed acceptable, at the discretion of the Administration;

.2 Safety assurance documentation, including any evaluation criteria with their justification agreed within the company or sector, as applicable;

.3 technical documentation relating to the project in question. Technical documentation submitted for review should contain the following information, as a minimum;

.4 details of application for any system or subsystem operated and requiring approval;

.5 specifications, including limitations, disclaimers and tolerances;

.6 material data sheets and/or manufacture certificates where applicable;

.7 the quality assurance system applied to maintain the conditions prevalent at the time of certification;

.8 any pertinent or historical test or analysis data, if these are to be considered in the survey plan; and

.9 installation manuals, maintenance procedures and operational plans.

6.12.2.2 The Administration delivers the following to the Submitter:

.1 statement of approval of design basis;

.2 certificates of approval with conditions as needed; and

.3 other certificates.

6.12.2.3 Queries by the Administration preceding release into service:

.1 whether provisions to rectify or mitigate any conditions are in place; and

.2 whether inspection of compliance through the construction phase has been adequately planned and documented.

7 OPERATION

7.1 Requirements pertaining to the operation of ships that have approved alternatives and/or equivalencies

7.1.1 This section of the Guidelines considers special requirements that apply to the operation of ships with approved alternatives and/or equivalencies onboard. In particular, the requirements for documentation on board such ships are addressed as well as requirements for change of flag.

7.1.2 Depending on the particular design of the alternative and/or equivalency, conditions for maintaining the safety level intended during the design approval may be imposed on ship operation. Such conditions may be restrictions and limitations on the type of operations and trades the ship can engage in or it may be additional safety procedures or measures that need to be in place. Any operational conditions should be determined during the approval process and be based on the outcome of the HazId and the risk assessments undertaken as a part of the process described in these Guidelines, and they should be clearly documented and communicated to relevant parties.

7.1.3 If, during the operational phase, the initial assumptions made during the design approval are changed, i.e. a change of any aspects of the operation that may influence the risk, it may be necessary to repeat the part of the risk assessment with the adjusted assumptions. Such needs and the extent of work needed will be dependent on the risk-based features, the assumptions changed and the operation of the ship and may be decided by the relevant administration.

7.1.4 During the operational phase, inspections and surveys on these ships will be performed as on conventional ships. It is therefore important that the features of the alternative and/or equivalent design and possible operational conditions are taken into account and understood by the Administration. Thus, clear documentation on the alternative and/or equivalent design should be kept on board. In the following, the requirements for onboard documentation are outlined.

7.1.5 Amendments to the Safety Management System may be required to integrate the evaluation of any changes in the risk levels. Recurring review of the operational environment may be a requirement and this may be stipulated as an element in the periodic company review and masters' review.

7.2 Onboard documentation requirements

7.2.1 All ships are required to carry documentation and certificates on board by current regulations. Some documentation and certificates are required for all ships, whereas others are required for specific ship types. In this section of the Guidelines, only additional documentation requirements for ships with alternatives and/or equivalencies are addressed. This covers both current documentation that will be affected by the alternative and/or equivalency and additional documentation and certificates that need to be developed.

7.2.2 In general, the following documentation should exist:

.1 certificates (see paragraph 6.12.2.2) stating that the ship has an alternative and/or equivalency, including condition of approval, if any; and

.2 information on the alternative and/or equivalent design, comprising of the following:

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

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

.3 list of IMO regulations affected;

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

.5 test, inspection and maintenance requirements.

7.2.3 Where appropriate, the details of onboard documentation are to be consistent with relevant Ship Construction File (SCF) requirements.

7.3 Change of flag

7.3.1 Granting equivalence and exemption from the prescriptive rules rests solely with the Administration. This has the implication that risk assessments and assumptions made, scenarios applied and the original basis of the risk profile to evaluate the alternative features are to be submitted from the previous to the new Administration, including any subsequent revisions.

7.3.2 The new Administration will examine the documentation, and will decide if it is acceptable.

7.3.3 The new Administration may request an independent validation of prerequisites, original parameters and review of the risk profile to verify whether the original parameters still hold and the originally applied criteria remain acceptable.

7.4 IMO reporting

7.4.1 The Administration that approves an alternative and/or equivalent design should submit detailed relevant information to the IMO, based on the form set out in the appendix, as appropriate, for circulation to the Member Governments. This information should enable Member Governments to trace the basis of the decision but not infringe upon any Intellectual Property Rights and it should comprise, as a minimum:

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

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

.3 list of IMO regulations affected;

.4 summary of the results of the engineering and risk analysis, and basis for approval (including criteria, standard, etc.);

.5 description of any model used in the risk and engineering analysis (including risk models as well as computational software), and the verification procedure used during the model development;

.6 description of any design casualty scenarios and related software simulations, tests and trials made during the approval process;

.7 test, inspection and maintenance requirements for the operational phase; and

.8 condition of approval, if any.

7.4.2 Additional requirements with respect to reporting to IMO may be specified in the regulations permitting the application of alternatives and/or equivalencies.

7.5 Inspections and surveys

7.5.1 Alternative and/or equivalent design approval should specify if survey intervals are coincident with those relevant to prescriptive requirements or if different intervals are needed.

7.5.2 Survey and inspection of a ship which has alternatives and/or equivalencies will be required similar to those for conventionally designed ships, and flag state inspection and port State control need to be performed. Thus, surveyors need an understanding of the alternatives and/or equivalencies, which may be promoted by means of on board documentation and certificates, as relevant. Proper authoritative documentation may provide the surveyor with evidence that the ship has been built and maintained in a satisfactory manner.

7.5.3 A port State control officer, in addition to checking certificates and documentation, may opt to perform a detailed inspection to obtain objective evidence that the ship is in a proper condition. Ships which are built to different standards or requirements than prescriptive regulations may be inspected against the onboard documentation. Such documentation may also provide guidance with regard to elements adequate for inspection and with regard to gauging points on system and operation details.

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Appendix

REPORT ON THE APPROVAL OF ALTERNATIVE DESIGN AND ARRANGEMENTS FOR

……

The Government of ……. has approved on …… an alternative design and arrangement in accordance with provisions of regulation ……of the ……., as described below:

Name of ship .....

Port of registry .....

Ship type .....

IMO Number .....

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

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

.3 list of IMO regulations affected;

.4 summary of the results of the engineering and risk analysis, and basis for approval (including criteria, standard, etc.);

.5 description of any model used in the risk and engineering analysis (including risk models as well as computational software), and the verification procedure used during the model development;

.6 description of any design casualty scenarios and related software simulations, tests and trials made during the approval process;

.7 test, inspection and maintenance requirements for the operational phase; and

.8 condition of approval, if any.

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MSC.1/Circ.1446/Rev.2
8 August 2013

RECOMMENDED INTERIM MEASURES FOR PASSENGER SHIP COMPANIES TO ENHANCE THE SAFETY OF PASSENGER SHIPS

1 The Maritime Safety Committee, at its ninetieth session (16 to 25 May 2012), having considered the interim recommendations made by Member States and non-governmental organizations in consultative status submitted in response to the request of the Secretary-General, in the light of the loss of the **Costa Concordia**, agreed that Member States should recommend that passenger ship companies conduct a review of operational safety measures to enhance the safety of passenger ships.

2 The recommendations on operational measures for companies owning and/or operating passenger ships were initially provided in the annex to MSC.1/Circ.1446. At its ninety-first session (26 to 30 November 2012), the Committee revised these recommendations by dissemination of MSC.1/Circ.1446/Rev.1.

3 At its ninety-second session (12 to 21 June 2013), the Committee further revised the recommendations, as set out in the annex.

4 Member States are invited to use the annexed recommendations on a voluntary basis, and to bring them to the attention of owners, operators and other parties concerned, as appropriate.

5 The present circular supersedes MSC.1/Circ.1446/Rev.1.

***

ANNEX

RECOMMENDED INTERIM MEASURES FOR PASSENGER SHIP COMPANIES TO ENHANCE THE SAFETY OF PASSENGER SHIPS

Lifejackets on board passenger ships

1 Companies owning and/or operating passenger ships, except ro-ro passenger ships, should consider whether to carry an additional number of lifejackets in excess of those required in accordance with SOLAS regulations III/7 and III/22, in public spaces, at the muster/assembly stations, on deck or in lifeboats. Where lifejackets required in accordance with SOLAS regulations III/7 and III/22 are not already stowed in the vicinity of muster/assembly stations, further additional lifejackets should be stowed in the vicinity of muster/assembly stations, in a manner as to be readily accessible for distribution in the event of an emergency.

2 Companies owning and/or operating passenger ships should consider provision of lifejackets that are of a similar design and can be donned by passengers in a similar manner with the intent of avoiding confusion when donning lifejackets.

3 Companies owning and/or operating passenger ships should review their arrangements in fulfilling the requirements in SOLAS regulation III/7.2.2, when lifejackets are stowed in passenger cabins, in order to ensure the lifejacket location is visible under all possible lighting conditions.

Emergency instructions for passengers

4 Companies owning and/or operating passenger ships should review the adequacy of the dissemination and communication of the emergency instructions on board their ships, taking into account the number of languages likely to be understood by the passengers on board.

5 Companies owning and/or operating passenger ships should also consider extending the use of an accompanying video for passenger emergency instruction notices, where appropriate. It is also recommended that emergency information cards are made available for passengers, on request, that complement the information required by SOLAS.

Common elements of musters and emergency instructions

6 Notwithstanding the requirements of SOLAS chapter III on musters and emergency instructions to be provided for passengers, companies owning and/or operating passenger ships should consider including the following common elements into their passenger muster and emergency instructions:

.1 when and how to don a lifejacket;

.2 description of emergency signals and appropriate responses in the event of an emergency;

.3 location of lifejackets;

.4 where to muster when the emergency signal is sounded;

.5 method of accounting for passenger attendance at musters both for training and in the event of an actual emergency;

.6 how information will be provided in an emergency;

.7 what to expect if the master orders an evacuation of the ship;

.8 what additional safety information is available;

.9 instructions on whether passengers should return to cabins prior to mustering, including specifics regarding medications, clothing, and lifejackets;

.10 description of key safety systems and features;

.11 emergency routing systems and recognizing emergency exits; and

.12 who to seek out for additional information.

7 Companies owning or operating passenger ships should have policies and procedures in place to promote passenger participation in emergency training and drills required by SOLAS regulation III/19 and encouraged by regulation III/30.

Passenger muster policy

8 On a ship engaged on a voyage where passengers are scheduled to be on board for more than 24 hours, it is recommended that the muster of newly-embarked passengers should take place prior to the departure at every port of embarkation. In cases where new passengers arrive after the above muster has been completed, they should be promptly provided with individual or group safety briefings[1].

9 To support the Master in preparing or revising the Muster List, companies owning and/or operating passenger ships should consider adopting a process that positively matches each crew member assigned to emergency duties with any required training and/or certification, whether by regulations or company policy. Such process may include the use of a paper-based or automated system on board that can effectively prevent assignment of a crew member to an emergency duty where the crew member is not trained or certified for such duty.

Access of personnel to the navigating bridge and avoiding distractions

10 Companies owning and/or operating passenger ships should ensure that bridge access control and bridge organization policies are developed and harmonized. To avoid disruptions and distractions of bridge team members in accomplishing their direct and indirect duties during any period of restricted manoeuvring, or while manoeuvring in conditions that the master or company bridge procedures/policy deems to require increased vigilance (e.g. arrival/departure from port, heavy traffic, poor visibility), it is recommended that access to the bridge should be limited to those with operational or operationally-related functions during these periods. Companies operating passenger ships are recommended to take policy steps to prevent distractions of watchkeeping personnel during these periods.

[1] MSC 92 adopted amendments to SOLAS regulation III/19 on requirements for musters, which will come into force on 1 January 2015.

Harmonization of bridge navigational procedures

11 Companies owning and/or operating passenger ships should adopt a policy that bridge navigational procedures should be harmonized as much as possible across their fleet or fleets, taking into account any unique operating characteristics.

Voyage planning

12 Companies owning and/or operating passenger ships and their masters should take steps to ensure that the ship's voyage plan has taken into account the *Guidelines for voyage planning* (resolution A.893(21)) and, if appropriate, the *Guidelines on voyage planning for passenger ships operating in remote areas* (resolution A.999(25)), including addressing the conditions under which changes to the plan are consistent with company policies.

13 Any deviation from the voyage plan should follow the guidance of resolution A.893(21)[2].

Recording the nationality of persons on board

14 In order to facilitate the effective and immediate availability of key information on passengers in the event of an emergency situation, in addition to the information required by SOLAS regulation III/27, companies owning and/or operating passenger ships should consider ensuring that the nationality of each person on board is also provided.

Lifeboat loading for training purposes

15 Companies owning and/or operating passenger ships should consider adopting a policy[3] that at least one lifeboat is to be filled with crew members equal in number to its certified number of occupants at least every six months. Under such a policy:

.1 for safety considerations, the loading of lifeboats for training purposes is to be performed only while the boat is waterborne and the boat should be lowered and raised with only the minimum number of crew on board, taking into account annex 2 to the Measures to prevent accidents with lifeboats (MSC.1/Circ.1206/Rev.1);

.2 lifejackets should be worn;

.3 all lifeboat crew and embarkation/boarding station crew are to be required to attend the lifeboat loading drill; and

.4 if not placed inside the lifeboat, those crew members are to observe the filling of the lifeboat to its certified number of people.

[2] Additional guidance can be found in the *ICS Bridge Procedures Guide.*

[3] Such a policy should apply to ships with crew sizes of 300 or greater, with lifeboats installed. Ships with crew sizes of less than 300 should conduct similar and equivalent training drills, at appropriate intervals, that are consistent with operational and safety considerations.

Securing heavy objects

16 Companies owning and/or operating passenger ships should adopt a policy to incorporate procedures into their Safety Management Systems (SMS) to help ensure the securing of heavy objects either permanently, when not in use, or during heavy/severe weather, as appropriate. Under this policy, a person or persons should oversee a deck-by-deck inspection to identify unsecured and potentially hazardous heavy objects. Integral to the procedures should be a list of identified objects which have a significant potential to cause injury.

17 Practices and procedures for securing heavy objects should be monitored by each Head of Department and/or as otherwise specified by the ship's command structure, and during routine shipboard inspections and audits.

Inclinometer data for the VDR

18 Companies owning and/or operating passenger ships are encouraged to investigate means of providing rolling motion data to the VDR.

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MSC.1/Circ.1460
24 June 2013

GUIDANCE ON THE VALIDITY OF RADIOCOMMUNICATIONS EQUIPMENT INSTALLED AND USED ON SHIPS

1 The Maritime Safety Committee, at its ninety-second session (12 to 21 June 2013), taking into account the recommendation of the Sub-Committee on Radiocommunications and Search and Rescue at its seventeenth session (21 to 25 January 2013), having recognized concerns that incompatibility may exist between radiocommunication equipment installed on ships, and the revised frequencies and channelling arrangements for the maritime HF and VHF bands as contained in appendices 17 and 18 to the Radio Regulations (RR) – Edition 2012, approved this *Guidance on the validity of radiocommunications equipment installed and used on ships*.

2 The World Radiocommunication Conference 2012 made extensive changes to appendices 17 and 18 of the RR. Whilst these changes do not affect the GMDSS, they do affect the use of other frequencies that would be used by services such as Port Operations and VTS.

3 The RR provisions apply as from the dates of application indicated in article 59 and resolution 98 of the RR. Timely action is required by ships to ensure that radiocommunication equipment complies with the RR. Replacement of operating hardware may be necessary to meet the changed requirements.

4 According to the *Performance standards for shipborne VHF radio installations capable of communication and digital selective calling* (resolution A.803(19)), the equipment should comply with the Radio Regulations.

5 Attention is drawn to MSC.1/Circ.1389, which contains *Guidance on procedures for updating shipborne navigation and communication equipment*, and that updates to application software and firmware to meet changes in IMO and ITU regulatory requirements were needed.

6 To ensure GMDSS communication capability, HF radiocommunication equipment capable of operating narrow-band direct printing (NBDP) should be updated so that following the first radio survey after 1 January 2017 it meets the channelling arrangements reflected in sections II and III of part B in appendix 17 of the RR.

7 Radiocommunication equipment, other than HF radiocommunication equipment capable of operating NBDP, does not necessarily need to be updated by the first radio survey after 1 January 2017, but may be updated appropriately in accordance with the decisions of the Administration.

8 Member Governments are invited to bring this information to the attention of the appropriate national authorities and all other parties concerned.

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MSC.1/Circ.1461
8 July 2013

GUIDELINES FOR VERIFICATION OF DAMAGE STABILITY REQUIREMENTS FOR TANKERS

1 The Maritime Safety Committee, at its ninety-second session (12 to 21 June 2013), having considered the proposal of the Sub-Committee on Stability and Load Lines and on Fishing Vessels Safety, at its fifty-fifth session (18 to 22 February 2013), approved the *Guidelines for verification of damage stability requirements for tankers*, as set out in the annex.

2 The Guidelines consist of two parts, as follows:

.1 part 1: *Guidelines for preparation and approval of tanker damage stability calculations*. This part should be applied to oil tankers, chemical tankers and gas carriers constructed on or after 14 June 2013.

.2 part 2: *Guidelines for operation and demonstration of damage stability compliance*. This part should be applied to all oil tankers, chemical tankers and gas carriers.

3 Member Governments are invited to bring the annexed Guidelines to the attention of all parties concerned.

***

ANNEX

GUIDELINES FOR VERIFICATION OF DAMAGE STABILITY REQUIREMENTS FOR TANKERS

PART 1

GUIDELINES FOR PREPARATION AND APPROVAL OF TANKER DAMAGE STABILITY CALCULATIONS

Guideline for scope of damage stability verification on new oil tankers, chemical tankers and gas carriers[1]

1 APPLICATION

These Guidelines are intended for oil tankers, chemical tankers and gas carriers constructed on or after 14 June 2013.

2 REFERENCE

2.1 IMO general instruments

.1 SOLAS chapter II-1, regulations 4.1, 4.2, 5-1 and 19;

.2 Part B, chapter 4 of the International Code on Intact Stability, 2008 (2008 IS Code), adopted by resolution MSC.267(85), as amended;

.3 Adoption of amendments to the Protocol of 1988 relating to the International Convention on Load Lines, 1966 (resolution MSC.143(77)), regulations 27(2), 27(3), 27(11), 27(12) and 27(13)[1];

.4 Explanatory notes to SOLAS chapter II-1 subdivision and damage stability regulations (resolution MSC.281(85));

.5 *Recommendation on a standard method for evaluating cross-flooding arrangements* (resolution MSC.245(83));

.6 *Revised Recommendation on a standard method for evaluating cross-flooding arrangements* (resolution MSC.362(92));

.7 Guidelines on interpretation of the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) and the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) and Guidelines for the uniform application of the survival requirements of the IBC and IGC Codes (MSC/Circ.406/Rev.1);

.8 Guidelines for damage control plans and information to the master (MSC.1/Circ.1245); and

.9 Guidelines for the approval of stability instruments (annex, section 4) (MSC.1/Circ.1229).

[1] The application of regulation 27 of the 1988 Load Lines Protocol is explained in appendix 1.

2.2 Instrument applicable to oil tankers

MARPOL Annex I, regulation 28.

2.3 Instruments applicable to gas carriers

.1 International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code), chapter 2, paragraphs 2.1, 2.4, 2.5, 2.6.2, 2.6.3, 2.7, 2.8 and 2.9; and

.2 Guidelines on Interpretation of the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) and the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) and Guidelines for the Uniform Application of the Survival Requirements of the IBC and IGC Codes (MSC/Circ.406/Rev.1).

2.4 Instruments applicable to chemical tankers

.1 International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code), chapter 2, paragraphs 2.1, 2.4, 2.5, 2.6.2, 2.7, 2.8 and 2.9; and

.2 Guidelines on Interpretation of the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) and the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) and Guidelines for the Uniform Application of the Survival Requirements of the IBC and IGC Codes (MSC/Circ.406/Rev.1).

3 GENERAL

3.1 Education and training

3.1.1 Plan approval of staff engaged in damage stability verification of new oil tankers, chemical tankers and gas carriers should have as minimum the following formal educational background:

.1 a degree or equivalent from a tertiary institution recognized within the field of marine engineering or naval architecture; and

.2 competent in the English language commensurate with their work.

3.1.2 Plan approval of staff engaged in damage stability verification of new oil tankers, chemical tankers and gas carriers should be trained according to theoretical and practical modules defined by the Administration or recognized organization (RO) acting on its behalf, to acquire and develop general knowledge and understanding applicable to the above-mentioned types of ship and stability assessment according to the IMO instruments referred to in section 2 above.

3.1.3 Methods of training may include monitoring, testing, etc. on a regular basis according to the Administration or RO's system. Evidence of training provided should be documented.

3.1.4 Updating of qualification may be done through the following methods:

.1 self-study;

.2 extraordinary seminars in case of significant changes in the international conventions, codes, etc.; and

.3 special training on specific work, which is determined by a long absence of practical experience.

3.1.5 Maintenance of qualification should be verified at annual performance review.

3.2 Scope of stability verification

3.2.1 The scope of damage stability verification is determined by the required damage stability standards (applicable damage stability criteria) and aims at providing the ship's master with a sufficient number of approved loading conditions to be used for the loading of the ship. In general, for non-approved loading conditions (by the Administration or RO acting on its behalf), approved KG/GM limit curve(s) or approved stability instrument software satisfying the stability requirements (intact and damage) for the draught range to be covered, should be used to verify compliance on board.

3.2.2 Within the scope of the verification determined as per the above, all damage scenarios specified by the relevant regulations should be determined and assessed, taking into account the damage stability criteria.

3.2.3 Damage stability verification and approval requires a review of submitted calculations and supporting documentation with independent check calculations to confirm that damage stability calculation results comply with relevant stability criteria.

3.2.4 Examination and approval of the stability instrument software installed on board (and to be used for assessing intact and damage stability) should also be carried out. A stability instrument comprises hardware and software. The accuracy of the computation results and actual ship data used by the software is to be verified.

3.3 Assumptions

3.3.1 For all loading conditions, the initial metacentric height and the righting lever curve should be corrected for the effect of free surfaces of liquids in tanks.

3.3.2 Superstructures and deckhouses not regarded as enclosed can be taken into account in stability calculations up to the angle at which their openings are flooded. Flooding points (including windows) incapable of weathertight closure are to be included in any list determined in accordance with paragraph 3.4.2.6. Full compliance with residual stability criteria must be achieved before any such point becomes immersed.

3.3.3 When determining the righting lever (GZ) of the residual stability curve, the constant displacement (lost buoyancy) method of calculation should be used (see section 6.1).

3.3.4 Conditions of loading and instructions provided by the submitter for use of the applicable KG/GM limit curve(s) and variation of loading patterns and representative cargoes are taken to be representative of how the ship will be operated.

3.4 Documentation to be submitted for review

3.4.1 *Presentation of documents*

The documentation should begin with the following details: principal dimensions, ship type, designation of intact conditions, designation of damage conditions and pertinent damaged compartments, KG/GM limit curve(s).

3.4.2 *General documents and supporting information*

.1 lines plan, plotted or numerically;

.2 hydrostatic data and cross curves of stability (including drawing of the buoyant hull);

.3 definition of watertight compartments with moulded volumes, centres of gravity and permeability;

.4 layout plan (watertight integrity plan) for the watertight compartments with all internal and external opening points including their connected sub-compartments, and particulars used in measuring the spaces, such as general arrangement plan and tank plan;

.5 Stability Booklet/Loading Manual including at least fully loaded homogeneous condition at summer load line draught (departure and arrival) and other intended operational conditions[2];

.6 coordinates of opening points with their level of tightness (e.g. weathertight, unprotected)[2], including reference to the compartment that the opening is connected to;

.7 watertight door location;

.8 cross- and down-flooding devices and the calculations thereof according to resolution MSC.245(83) or MSC.362(92), as appropriate, with information about diameter, valves, pipe lengths and coordinates of inlet/outlet. Cross- and down-flooding should not be considered for the purpose of achieving compliance with the stability criteria (see also section 9.2);

.9 pipes in damaged area when the breaching of these pipes results in progressive flooding (see section 10.1);

.10 damage extents and definition of damage cases; and

.11 any initial conditions or restrictions which have been assumed in the derivation of critical KG or GM data, and which must therefore be met in service.

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[2] For the purpose of making a submission of stability information for approval, the minimum number of loading conditions which should be submitted for approval is a function of the mode of operation intended for the ship. MSC/Circ.406/Rev.1 offers guidance in this respect, and identifies the concepts of the "dedicated service tanker" and "parcel tanker" for the purpose of undertaking stability approval of ships certified under the IBC and IGC Codes and the appropriate treatment of ships assigned tropical freeboards.

[3] Details of watertight, weathertight and unprotected openings should be included in the Damage Control Plan and Damage Control Booklet in accordance with MSC.1/Circ.1245.

The cases and extent of progressive flooding assumed in the damage stability analysis should be indicated in the Damage Control Booklet and the Documents for Submission in accordance with the annex to resolution MSC.281(85). Arrangements to prevent further flooding are to be indicated on the Damage Control Plan and in the Damage Control Booklet.

3.4.3 *Special documents*

3.4.3.1 *Documentation*

.1 Design documentation: damage stability calculations (including residual stability curves), the arrangements, configuration and contents of the damaged compartments, and the distribution, relative densities and the free surface effect of liquids.

.2 Operational documentation: loading and stability information booklet (stability booklet), Damage Control Plan; and Damage Control Booklet.

3.4.3.2 *Special consideration*

For intermediate flooding stages before cross-flooding (see sections 6.8 and 9.2) or before progressive flooding (see section 6.9), an appropriate scope of the documentation covering the aforementioned items is needed in addition. The intermediate stages for cargo outflow and seawater inflow should be checked. If any stability criteria during intermediate stages shows more severe values than in the final stage of flooding, these intermediate stages should also be submitted.

4 OPERATING LIMITS – DESCRIPTIONS/ASSUMPTIONS

In considering the scope of the verification to be conducted, consideration of the operating limits is needed.

The following loading options should be permitted:

.1 service loading conditions identical to the approved loading conditions of the stability booklet (see section 4.2); or

.2 service loading conditions complying with the approved intact and damage stability limiting curves (where provided) (see section 4.3); or

.3 service loading conditions which have been checked with an approved stability instrument with the capability to perform damage stability calculations (Type 2 or Type 3 of the IS Code and MSC.1/Circ.1229) either based on KG/GM limit curve(s) or based on direct damage stability assessment (see section 4.5).

If the above-mentioned proof of compliance is not possible, then the intended loading conditions should be either prohibited or be submitted for specific approval to the Administration or RO acting on its behalf. Suitable instructions to this effect should be included in the stability booklet/loading manual.

An approved loading condition is one which has been specifically examined and endorsed by the Administration/RO.

4.1 Specific loading patterns

4.1.1 Ship-specific design loading patterns and loading restrictions should be clearly presented in the stability booklet. The following items should be included:

.1 any required and intended loading conditions (including the ones corresponding to multiple freeboards when so assigned to the ship), i.e. symmetrical/ unsymmetrical, homogeneous/alternating or ballast/ partial/full;

.2 types (e.g. oil, noxious liquid substances and LNG) of liquid cargo allowed to be carried;

.3 restrictions to different liquid loads to be carried simultaneously;

.4 range of permissible densities of liquid loads to be carried; and

.5 minimum tank filling levels required to achieve compliance with the applicable stability criteria.

4.1.2 For the verification of damage stability all loading conditions presented in the stability booklet except for ballast, light ship and docking conditions are to be examined.

4.2 Range of permissible loading conditions

In the absence of stability software and KG/GM limit curve(s), in lieu of approved specific loading conditions, a matrix clearly defining any allowable ranges of loading parameters (draught, trim, KG, cargo loading pattern and SG) that the ship is allowed to load whilst remaining in compliance with the applicable intact and damage stability criteria can be developed for the stability booklet when a greater degree of flexibility than that afforded by approved specific loading conditions is needed. If this information is to be used, it should be in an approved form.

4.3 KG/GM Limit curve(s)[4]

4.3.1 Where KG/GM limit curves are provided, a systematic investigation of damage survival characteristics should be undertaken by making calculations to obtain the minimum required GM or maximum allowable KG at a sufficient number of draughts within the operating range to permit the construction of a series of curves of "required GM" or "allowable KG" in relation to draught and cargo tank content in way of the damage. The curves must be sufficiently comprehensive to cover operational trim requirements.

4.3.2 The verification of KG/GM limit curves should be conducted without any free surface correction. The actual loading condition uses the free surface correction (see section 6.5) when comparing actual and allowable KG values.

4.3.3 It is to be noted that any change of filling level, draught, trim, or cargo density might have a major influence to the results of a damage case; therefore the following items should be considered carefully for the calculation of the KG/GM limit curves:

.1 intact and damage stability criteria applicable to the ship;

.2 the maximum required damage extent and lesser extents of damage which provide the most severe damage cases;

[4] To avoid difficulties associated with developing suitable KG/GM limit curves and their restriction on operational capacity, it is recommended that an approved Type 3 stability software is fitted on board.

.3 draught range of the ship (up to tropical freeboard if required);

.4 trim range of the ship (see section 6.6);

.5 full and empty cargo tanks;

.6 partially filled cargo tanks (consideration of increments as necessary);

.7 minimum tank fillings in tonnes if required;

.8 maximum/minimum densities of cargoes; and

.9 ballast tank filling levels as necessary to achieve compliance.

4.3.4 Damage stability calculations, on which the KG/GM limit curve(s) is(are) based, should be performed at the design stage. The KG/GM limit curve(s) drawn out taking stability criteria (intact and damage) into account should be inserted in the stability booklet.

4.4 Initial heel

The stability booklet should contain a note for the master to avoid initial heel greater than 1 degree. A steady heeling angle may have a major influence on the stability of the ship especially in the case of damage.

4.5 Direct calculation on board (stability instrument)

4.5.1 Any stability software installed on board should cover all stability requirements (intact and damage) applicable to the ship.

4.5.2 The following types of stability softwares, if approved by an Administration or RO acting on its behalf (according to the 2008 IS Code and MSC.1/Circ.1229), are applicable for the calculation of service-loading conditions for tank ships:

.1 Type 2: Checking intact and damage stability on basis of a KG/GM limit curve(s) or previously approved loading conditions; and

.2 Type 3: Checking intact and damage stability by direct application of pre-programmed damage cases for each loading condition, including capability for calculation of intermediate damage stages.

4.5.3 The software should be approved by the Administration or RO acting on its behalf. The stability instrument is not a substitute for the approved stability documentation, but used as a supplement to facilitate stability calculations.

4.5.4 Sufficient damages, taking into account lesser damages, and variation of draft, cargo density, tank-loading patterns and extents of tank filling should be performed to ensure that for any possible loading condition the most onerous damages have been examined according to relevant stability criteria.

4.5.5 The methodologies for determining compliance with relevant stability criteria should be as set out in these Guidelines.

5 Hull and compartment modelling tolerances

5.1 Acceptable tolerances should be in accordance with table 1. Where two values are provided for the permissible tolerances, the per cent deviation is allowable as long as it does not exceed the following linear value for the particular hull form dependent parameter.

5.2 Deviation from these tolerances should not be accepted unless the Administration or RO acting on its behalf considers that there is a satisfactory explanation for the difference and that there will be no adverse effect on the capability of the ship to comply with the stability criteria.

5.3 No deviation is generally allowed for input data; however, small differences associated with calculation rounding or abridged input data are acceptable.

Table 1 (relevant parts of MSC.1/Circ.1229 are reproduced)

Hull form dependent	**Tolerances**
Displacement	2%
Longitudinal centre of buoyancy, from AP	1%/50 cm max
Vertical centre of buoyancy	1%/5 cm max
Transverse centre of buoyancy	0.5% of B/5 cm max
Longitudinal centre of flotation, from AP	1%/50 cm max
Moment to trim 1 cm	2%
Transverse metacentric height	1%/5 cm max
Longitudinal metacentric height	1%/50 cm max
Cross curves of stability	5 cm
Compartment dependent	**Tolerances**
Volume or deadweight	2%
Longitudinal centre of gravity, from AP	1%/50 cm max
Vertical centre of gravity	1%/5 cm max
Transverse centre of gravity	0.5% of B/5 cm max
Free surface moment	2%
Level of contents	2%

Deviation in % = [(base value – applicant's value)/base value] x 100

where the "base value" may be taken from the approved stability information or the computer model.

6 Methodology

6.1 Method of analysis

6.1.1 Independent analysis uses the "constant displacement"/"lost buoyancy" method.

6.1.2 Within the scope of damage stability analysis with the deterministic approach, depending on the subdivision of the ship, the result of applying the standard of damage as specified in the applicable requirements is the creation of a number of damage cases, where one or more compartments are open to sea.

6.1.3 The compartment(s), once damaged, are not considered as contributing to the buoyancy of the ship. Consequently, a new condition of equilibrium occurs. In order to define the new equilibrium condition and to assess the stability of the ship after damage the lost buoyancy/constant displacement method is used.

6.1.4 The new floating position can be determined by assuming that the damaged displacement is equal to the intact displacement (constant displacement) minus the weight of liquids which were contained in the damaged compartments.

6.1.5 Due to the lost buoyancy of the damaged compartment(s), the remaining intact ship has to compensate by sinkage, heel and trim until the damaged displacement is reached. Once the equilibrium has been reached and the final waterline is determined, the metacentric height (GM), the righting lever curves (GZ) and the centre of gravity positions (KG), can be calculated in order to verify the stability of the ship against the applicable requirements.

6.1.6 For the intermediate stages of flooding and the equalization with compartments cross-connected by small ducts, i.e. not opened to the sea directly, the added weight method is used.

6.2 Arguments used in calculations

The arguments used in the calculation for the verification of damage stability are the following:

.1 trim: The calculation should be done for the ship freely trimming;

.2 heel angle at equilibrium: The heel angle at equilibrium, due to unsymmetrical flooding, should not exceed the maximum values as indicated in the applicable requirements. Concerning the range of positive righting levers (GZ), this should be calculated beyond the position of equilibrium to the extent as so required by the applicable requirements;

.3 free surface of liquid: For the calculation of the position of the centre of gravity (KG), the metacentric height (GM) and the righting lever curves (GZ), the effect of the free surfaces of liquids (see section 6.5) should be taken into account;

.4 immersion of weathertight and unprotected openings (see sections 6.7 and 10.1)

Unprotected openings:

The positive range of righting levers is calculated from the angle of equilibrium until the angle of immersion of the unprotected openings leading to intact spaces;

Weathertight points: see paragraph 10.1.2;

.5 progressive flooding through internal pipes: in case of damage of an internal pipe which is connected to an undamaged compartment, the undamaged compartment should also be flooded, unless arrangements are fitted (e.g. check valves or valves with remote means of control), which can prevent further flooding of the undamaged compartments;

.6 permeabilities: care should be taken to apply the permeabilities as specified in the applicable regulations. Special attention should be paid in case compartments which are separated by weathertight boundaries are modeled

as one compartment. This simplified method of modeling the compartments should apply only to compartments belonging to the same category (same permeability); and

.7 heel angles for the calculation of the GZ curve: evaluation of damage stability criteria should generally be determined from data calculated over a range of angles from 0 to 60 degrees. It is recommended to use an increment not exceeding 5 degrees.

6.3 Adjustments for cargo run-off

6.3.1 In cases where the damage involves the cargo hold, it is assumed that cargo is flowing out and that water ingress starts. During the intermediate stages of flooding it is considered that both cargo and seawater are existing in the damaged tank (see section 9.3).

6.3.2 At the final stage it is assumed that the cargo is completely lost and that the tank is filled with seawater up to the level of the waterline.

6.3.3 The impact on the stability of the ship, due to the inflow and outflow of liquid cargo is also dependent on the following parameters:

.1 the density of the cargo: liquid cargo with density greater than 0.95 t/m^3 should be considered as heavy liquid cargo. In case of lesser vertical extent of damage, i.e. damage above the tank top (see appendix 4), the release of heavy liquid cargo might lead to large angle of heel on the intact side of the ship. Depending on intact draught and cargo tank filling level, outflow of cargo of lesser density may also cause heel to the opposite side; and

.2 the permeability of the cargo space, taking into account that permeabilities smaller than those specified in the applicable rules can be applied, if justified.

6.4 Handling of permeabilities

6.4.1 Permeability of a space means the ratio of the volume within that space, which should be assumed to be occupied by water to the total volume of that space. The total volume should be calculated to moulded lines, and no reduction in total volume should be taken into account due to structural members (i.e. stiffeners, etc.). Account of structural members is taken in the applicable permeabilities (see also MSC/Circ.406/Rev.1, paragraph 3.11).

6.4.2 Depending on the applicable requirements, the permeabilities assumed for spaces flooded as a result of damage should be as shown in table 2.

Table 2

Spaces	Permeabilities			
	MARPOL	ICLL [1)]	IBC	IGC
Appropriated to stores	0.6	0.95	0.6	0.6
Occupied by accommodation	0.95	0.95	0.95	0.95
Occupied by machinery	0.85	0.85	0.85	0.85
Voids	0.95	0.95	0.95	0.95
Intended for consumable liquids	0 to 0.95*	0.95	0 to 0.95*	0 to 0.95*
Intended for other liquids	0 to 0.95*	0.95	0 to 0.95*	0 to 0.95*

* The permeability of partially filled compartments should be consistent with the amount of liquid carried in the compartment.

1) Regarding application of ICLL damage stability requirements refer to appendix 1.

6.4.3 Whenever damage penetrates a tank containing liquids, it should be assumed that the contents are completely lost from that compartment and replaced by seawater up to the level of the final plane of equilibrium.

6.4.4 Other figures for permeability may be used for the damaged case both during cargo run-off and the final equilibrium condition under the following provisions:

.1 the detailed calculations and the arguments used for determining the permeability of the compartment(s) in question, is to be included in the damage stability booklet;

.2 the water tightness/resistance to water pressure and the means by which internal fittings/material are secured to the tank should substantiate the use of such fittings/material in reducing the permeability of a compartment. Where a ship is fitted with significant quantities of cargo insulation, the permeabilities of the relevant cargo spaces and/or the void spaces surrounding such cargo spaces may be calculated by excluding the volume of insulation material in those spaces from the flooded volume, provided that the insulating material is shown to comply with the following conditions:

.1 it is impermeable to water under hydrostatic pressure at least corresponding to the pressure caused by the assumed flooding;

.2 it will not crush or break up due to hydrostatic pressure at least corresponding to the pressure caused by the assumed flooding;

.3 it will not deteriorate or change its properties over the long term in the environment anticipated in the space it is installed;

.4 it is highly resistant to the action of hydrocarbons, where relevant; and

.5 it will be adequately secured so that it will remain in position if subjected to collision damage and consequent displacement, distortion of its supporting and retaining structure, repeated rapid ingress and outflow of seawater and the buoyant forces caused by immersion following flooding;

.3 the applied permeability should reflect the general conditions of the ship throughout its service life, rather than specific loading conditions; and

.4 permeabilities other than those indicated in table 2 should be considered only in cases, where it is evident that there is a significant discrepancy between the values shown in the regulations and the actual values (i.e. due to specific tank structure or insulating material).

6.5 Free surface calculation (upright, as ship heels and after cargo run-off)

With respect to the approval of actual loading conditions the following should be applied:

6.5.1 The free surfaces of liquids lead to the increase of the centre of gravity (KG) and the reduction of the metacentric height (GM) and the righting arm (GZ curve) of the ship. Therefore corrections should be made, taking into account the change of the centre of gravity of the ship due to the moving of the centre of gravity of the liquids. Depending on the filling level, free surfaces can exist in tanks with consumable liquids, seawater ballast and liquid cargo.

6.5.1.1 For consumable liquids account on the free surfaces should be taken whenever the filling level is equal to or less than 98 per cent:

.1 In calculating the free surface effects in tanks containing consumable liquids, it should be assumed that for each type of liquid at least one transverse pair or a single centreline tank has a free surface and the tank or combination of tanks taken into account should be those where the effect of free surfaces is the greatest.

.2 Taking into account subparagraph .1, the free surfaces should correspond to the maximum value attainable between the filling levels envisaged.

6.5.1.2 During ballasting between departure and arrival condition, the correction for the free surfaces should correspond to the maximum value attainable between the filling levels envisaged. This applies also for the situation where in the departure condition the filling level of a ballast tank is 0 per cent and in the arrival 100 per cent (or the opposite).

6.5.1.3 For the category of liquids referred to under paragraphs 6.5.1.1 and 6.5.1.2, intermediate loading conditions may be considered as an alternative, as deemed necessary, covering the stage where the free surfaces are the greatest. It may be calculated with varying free surface moments (i.e. actual liquid transfer moments), taking into account actual heel and trim, depending on the interval angles of the GZ curve. This is a more accurate method.

6.5.1.4 Except as indicated in regulation 27(11)(v) of the 1988 Load Lines Protocol, for liquid cargo the effect of free surface should be taken into account for the filling level equal to or smaller than 98 per cent. If the filling level is fixed actual free surfaces can be applied. The following two methods can be used for the calculation of the GZ curve, taking into account the effect of the free surface moments for the intact compartments:

.1 Calculation with constant effect of free surfaces, without taking into account the change in heel and trim, for the interval angles of the GZ curve.

.2 Calculation with varying free surface moments, actual liquid transfer moments, taking into account actual heel and trim, depending on the interval angles of the GZ curve (see appendix 2).

6.5.2 For the damaged compartments, whenever the damage is involving cargo tanks, account should be taken of the following:

.1 the impact on the stability of the ship due to the outflow of cargo and ingress of seawater can be verified with the calculation of the intermediate stages of flooding (see section 9); and

.2 at the final equilibrium the free surface correction should exclude the free surface moment of the lost cargo.

6.5.3 The free surface effect should be calculated at an angle of heel of 5° for each individual compartment or as per paragraph 6.5.1.3.

6.6 Treatment of operational trim

6.6.1 For the assumed damage and the resultant damage cases, the damage stability should be assessed for all anticipated conditions of loading and variations in draught and trim.

6.6.2 Significant trim values (greater than 1% L_{pp}) can appear in the aft/fore part of the ship in the departure and arrival condition. In that case, damage cases involving the aft/fore part of the ship might be critical for achieving compliance with the applicable criteria. In order to limit the trim, ballast water is used during the voyage, as deemed necessary. Under the provision of paragraphs 6.5.1.2 and 6.5.1.3, for taking account of the free surface effect during ballasting, if intermediate stages of the voyage are considered, then the loading conditions representing these stages should be also calculated for damage stability.

6.7 Down-flooding points

6.7.1 Down-flooding point is the lower edge of any opening through which progressive flooding may take place. Such openings should include air pipes, ventilators and those which are closed by means of weathertight doors or hatch covers and may exclude those openings closed by means of watertight manhole covers and flush scuttles, small watertight cargo tank hatch covers which maintain the high integrity of the deck, remotely operated watertight sliding doors, and sidescuttles of non-opening type.

6.7.2 All openings through which progressive flooding may take place should be defined: both weathertight and unprotected. As an alternative, it might be accepted to consider only the most critical openings, which are considered to be the openings with the lowest vertical position and close to the side shell. Concerning the longitudinal position it depends on the aft or fore trim of the initial condition and the trim after damage at equilibrium. Unprotected openings should not be immersed within the minimum range of righting-lever curve required for the ship. Within this range, the immersion of any of the openings capable of being closed weathertight may be permitted.

6.8 Cross-flooding time

6.8.1 Cross-flooding time should be calculated in accordance with the *Recommendation on a standard method for evaluating cross-flooding arrangements* (resolutions MSC.245(83) or MSC.362(92), as appropriate).

6.8.2 If complete fluid equalization occurs in 60 s or less, the equalized tank should be assumed flooded with the tanks initially to be flooded and no further calculations need to be carried out. Otherwise, the flooding of tanks assumed to be initially damaged and equalized tank should be carried out in accordance with section 9.2. Only passive open cross-flooding arrangements without valves should be considered for instantaneous cases.

6.8.3 Where cross-flooding devices are fitted, the safety of the ship should be demonstrated in all stages of flooding (see sections 9.2 and 10). Cross-flooding equipment, if installed, should have the capacity to ensure that the equalization takes place within 10 min.

6.8.4 Tanks and compartments taking part in such equalization should be fitted with air pipes or equivalent means of sufficient cross-section to ensure that the flow of water into the equalization compartments is not delayed.

6.8.5 Spaces which are linked by ducts of a large cross-sectional area may be considered to be common, i.e. the flooding of these spaces should be interpreted as instantaneous flooding with the equalization of duration of less than 60 s.

6.9 Progressive flooding (internal/external) (see also sections 10.1 and 10.2)

6.9.1 Progressive flooding is the flooding of compartments situated outside of the assumed extent of damage. Progressive flooding may extend to compartments, other than those assumed flooded, through down-flooding points (i.e. unprotected and weathertight openings), pipes, ducts, tunnels, etc.

6.9.2 The flooding of compartment(s) due to progressive flooding occurring in a predictable and sequential manner through a down-flooding point which is submerged below the damage waterline may be permitted provided all intermediate stages and the final stage of flooding meet the required stability criteria.

6.9.3 Minor progressive flooding through the pipes situated within the assumed extent of damage may be permitted by the Administration, provided the pipes penetrating a watertight subdivision have a total cross-sectional area of not more than 710 mm^2 between any two watertight compartments.

6.9.4 If the opening (unprotected or fitted with a weathertight means of closure) connects two spaces, this opening should not be taken into account if the two connected spaces are flooded or none of these spaces are flooded. If the opening is connected to the outside, it should not be taken into account only if the connected compartment is flooded.

7 EXTENTS OF DAMAGE CONSIDERED

7.1 Maximum extents

The following provisions regarding the maximum extent and the character of the assumed damage should be applied:

Table 3

.1	**Side damage:**	MARPOL/IBC/IGC	ICLL (Type A ships)
.1.1	Longitudinal extent:	1/3 $L^{2/3}$ or 14.5 m, whichever is less	Single compartment between adjacent transverse bulkheads as specified in ICLL paragraph 12(d) [1)]
.1.2	Transverse extent:	B/5 or 11.5 m, whichever is less (measured inboard from the ship's side at right angles to the centreline at the level of the summer load line)	B/5 or 11.5, whichever is the lesser (measured inboard from the side of the ship perpendicularly to the centreline at the level of the summer load waterline) [1)]
.1.3	Vertical extent:	upwards without limit (measured from the moulded line of the bottom shell plating at centreline)	From baseline upwards without limit
.2	**Bottom damage [2)]:**	MARPOL/IBC/IGC	
		For 0.3 L from the forward perpendicular of the ship	**Any other part of the ship**
.2.1	Longitudinal extent:	1/3 $L^{2/3}$ or 14.5 m, whichever is less	1/3 $L^{2/3}$ or 5 m, whichever is less
.2.2	Transverse extent:	B/6 or 10 m, whichever is less	B/6 or 5 m, whichever is less
.2.3	Vertical extent:	MARPOL/IBC: B/15 or 6 m, whichever is less (measured from the moulded line of the bottom shell plating at centreline) IGC: B/15 or 2 m, whichever is less (measured from the moulded line of the bottom shell plating at centreline)	MARPOL/IBC: B/15 or 6 m, whichever is less (measured from the moulded line of the bottom shell plating at centreline) IGC: B/15 or 2 m, whichever is less (measured from the moulded line of the bottom shell plating at centreline)
.3	**Bottom raking damage [3)]:**	MARPOL	
.3.1	Longitudinal extent:	in tankers of 75,000 tonnes deadweight and above: 0.6 L(m) measured from the forward perpendicular of the ship	
		in tankers of less than 75,000 tonnes deadweight: 0.4 L(m) measured from the forward perpendicular of the ship	
.3.2	Transverse extent:	B/3 anywhere in the bottom	
.3.3	Vertical extent:	Breach of the outer hull	

1) See appendix 3.

2) Bottom damage is not required in the ICLL.

3) Bottom raking damage is required only for oil tankers of 20,000 tonnes deadweight and above.

7.2 Lesser extents

7.2.1 If any damage of a lesser extent than the maximum damage specified in table 3 would result in a more severe condition, such damage should be considered (see section 4.5.4).

7.2.2 In the case of a gas carrier, local side damage anywhere in the cargo area extending inboard 760 mm measured normal to the hull shell should be considered, and transverse bulkheads should be assumed damaged when also required by the applicable subparagraphs of section 2.8.1 of the IGC Code.

7.3 Rationale for reviewing lesser extents including symmetrical vs. unsymmetrical tank arrangement/geometry – Calculation on weakest side

7.3.1 For a given loading condition, the following examples of damages of a lesser extent may result in a more severe situation than that caused by the maximum damage specified in table 3:

.1 Example of damage on double bottom tanks with watertight centre girder:

.1 Damage of a lesser extent which could occur at the bottom plate of the ship, without damaging the centre girder, will lead to flooding of the double bottom tank on one side of the ship only. This is the case of unsymmetrical flooding. For the same location, damage of a maximum extent would cause damage on the centre girder and therefore flooding of the double bottom tanks on both sides. This is the case of symmetrical flooding (see appendix 4).

.2 Compared to the symmetrical flooding in the case of maximum damage extent, unsymmetrical flooding of spaces, caused by damage of a lesser extent might lead to a more severe situation. Of course, in case of non-watertight centre girder, the effect of damage of lesser and maximum extent would be the same.

.2 Example of damage with lesser vertical extents:

Damage starting from above a tank top would flood the spaces only above the double bottom (see appendix 4). This may result in a more onerous residual stability or heeling angle.

7.3.2 Taking into account the above examples, it is necessary to review damages of lesser extents considering the symmetrical or unsymmetrical nature of tank arrangements of the ship and geometry of the ship. The ship's damage stability is to be ensured, in the most severe or weakest case of damage of lesser extents.

8 RATIONALE APPLIED FOR LOADING PATTERN EVALUATION

For damage stability calculations of tank ships the following effects due to different loading methods should be taken into account in determining the scope of verification and specific cases of damage to be investigated.

8.1 Homogeneous vs. alternate/partial loading

8.1.1 For homogeneous loading conditions, the damage to cargo tanks may have a major effect on residual stability. Outflow of the loaded cargo liquids (and less inflow of seawater) may reduce the ships' displacement and cause heel to opposite side of the damage. For alternate loading conditions the residual stability depends on the damaged cargo tank. Damage to a fully loaded cargo tank might cause reduction of the initial displacement and heel to the opposite side, but damage on an empty cargo tank might cause the opposite effect. For the damage to two adjacent cargo tanks, one filled and one empty, the total effect might be less severe due to two (partly) neutralizing effects.

8.1.2 Partial loading of liquid cargo tanks will cause a high free surface moment when the surface does not intersect with the tank overhead and will increase the heel in case of damage. However, reductions of the initial displacement and heel to the opposite side may not be as significant. Trim to the ship as a consequence of damage can be significant due to many partially-filled cargo tanks.

8.2 Symmetrical and unsymmetrical loading pattern

In general damage stability calculations should be performed for both ship sides. However, the damage stability calculation for one side of the ship may be accepted for symmetrical load (alternate, homogeneous, full, partial or empty), if the ship and all openings are also symmetrical and initial heel to portside or starboard is zero.

8.3 MSC/Circ.406/Rev.1

Additional information regarding intact and damage stability matters for tank ships can be found in MSC/Circ.406/Rev.1, which also recommends application of the *Guidelines for the Uniform Application of the Survival Requirements of the Bulk Chemical Code* (BCH Code) and the Gas Carrier Code (GC Code) to the IBC and IGC Codes.

9 INTERMEDIATE STAGES OF FLOODING INCLUDING EQUALIZATION, IF ANY, AND CARGO RUN-OFF

Intermediate stages of flooding cover the flooding process from the commencement of flooding up to but excluding the final equilibrium damage condition (see also paragraph 3.4.3.2). Intermediate stages should be comprehensively checked for all ships at the design appraisal stage.

9.1 Basis for checking intermediate stages of flooding and minimum stability criteria applied

The stability criteria applicable to the final equilibrium stage should also be satisfied for all intermediate stages. If any stability criteria during intermediate stages shows more severe values than in the final stage of flooding, these intermediate stages should also be submitted.

9.2 Number of intermediate stages considered

9.2.1 A sufficient number of intermediate stages should be examined for all damage cases. It is generally recommended to apply 5 intermediate stages of flooding (see also sections 6.8, 6.9 and 10.1).

9.2.2 If the ship is equipped with non-instantaneous (greater than 60 s) passive equalization arrangements or non-passive equalization arrangements of any size, the following procedure is to be used:

.1 compliance with the relevant criteria should be demonstrated without using equalization arrangements for intermediate and final stages; and

.2 for subsequent equalization, additional two intermediate stages and final stages the compliance should also be demonstrated.

9.3 Cargo outflow and flood water inflow

9.3.1 During intermediate flooding stages a practical method of calculating the floating position and residual righting moments is the added weight method where the intact condition is corrected for the weights of inflowing floodwater and outflowing cargo.

9.3.2 During each stage an assumed amount of added floodwater and/or cargo outflow should be used. The following method is recommended:

.1 for a loaded tank, an equal loss of liquid cargo mass and equal inflow of floodwater mass at each stage resulting in a total loss of liquid cargo at and total inflow of floodwater to the final damage equilibrium waterline; and

.2 for an empty tank, an equal inflow of floodwater mass at each stage resulting in total inflow of floodwater to the final damage equilibrium waterline.

See appendix 5 for example calculation.

9.3.3 Alternative methods may be accepted, for example:

.1 For a loaded tank the loss of liquid cargo mass and inflow of floodwater mass is based on a linear change of total tank content density over each intermediate stage from pure cargo at the intact condition to pure floodwater at the final damage equilibrium waterline.

.2 For an empty tank an increasing depth of water at each stage based on the difference between the depth of water in the tank and the depth to the waterline in way of the tank, divided by the number of remaining stages, resulting in total inflow of floodwater to the final damage equilibrium waterline.

9.3.4 Noting that calculation of stability in the final damage condition assumes both the liquid cargo and the buoyancy of the damaged spaces to be lost, it is therefore considered both reasonable and consistent to base the residual GZ curve at each intermediate stage on the intact displacement minus total liquid cargo loss at each stage.

9.4 Treatment of free surface and KG adjustment

9.4.1 Taking due account of the requirements of paragraph 6.5.1.1, it is generally recommended to apply actual liquid transfer moments for all tank-filling levels in determining compliance with the relevant damage stability criteria through direct calculations of actual loading conditions.

9.4.2 With regard to the treatment of free surfaces of flooded spaces and, noting that there will be combinations of empty and loaded tanks within the damaged extent, all damaged compartments should be considered individually flooded during the intermediate stages – i.e. individual free surfaces. (The compartments are considered open to the sea in the final damage condition.)

10 FINAL STAGE OF FLOODING*

10.1 Watertight and weathertight integrity

10.1.1 The mandatory instruments referenced in section 2 require the final waterline, taking into account sinkage, heel and trim, to be below the lower edge of any opening through which progressive flooding may take place. Such openings shall include air pipes (irrespective of closing devices) and those which are closed by means of weathertight doors or hatch covers and may exclude those openings closed by means of watertight manhole covers and flush scuttles, small watertight cargo tank hatch covers which maintain the high integrity of the deck, remotely operated watertight sliding doors, and sidescuttles of the non-opening type.

10.1.2 Within the required range of residual stability, the immersion of any of the openings listed above and other openings capable of being closed weathertight may be permitted.

10.1.3 In the final equilibrium condition watertight escape hatches should not be submerged below the equilibrium damage waterline and should be treated as weathertight openings[5].

10.1.4 For an emergency generator room the lowest point of the room should remain above the final equilibrium damage waterline. Any opening leading to this room should be treated as unprotected or weathertight, as applicable.

10.1.5 The following principles apply:

.1 Watertight doors under the final waterline after flooding

All watertight doors under the final waterline after flooding should be remotely operated sliding watertight doors. Installation of a hinged watertight door (e.g. between the steering gear compartment and engine room) is subject to acceptance by the Administration.

.2 Progressive flooding due to damage or submersion of air pipes

Progressive flooding may be accepted subject to the air pipes leading to relatively small compartments which are progressively flooded in a predictable and sequential manner in which all intermediate stages of flooding (with the exception on no progressive flooding) and the final stage of flooding meet the required stability criteria.

.3 Watertight doors on the aft wall of forecastle under the final waterline after flooding.

10.1.6 Hinged watertight doors at the aft bulkhead of a forecastle space are permitted to be submerged after damage only when possible progressive flooding is limited to one relatively small compartment which is progressively flooded in a predictable and sequential manner in which all intermediate stages of flooding (with the exception of no progressive flooding) and the final stage of flooding meet the required stability criteria. No further progressive flooding is permitted beyond the initial flooding of the forecastle. This approach is only permitted after all other options, such as increasing the sill height, relocating the door, only providing access from above, have been shown to be unworkable in practice.

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* Refer to the Explanatory notes to the SOLAS chapter II-1 subdivision and damage stability regulations (resolution MSC.281(85)).

5 This specification applies only to the escapes from spaces other than tanks.

10.2 Unprotected openings

Residual GZ curves should be terminated at the lowest angle of submersion of an unprotected opening.

* * *

Appendix 1

DAMAGE STABILITY REQUIREMENTS APPLICABLE TO NEW OIL TANKERS, CHEMICAL TANKERS AND GAS CARRIERS

SHIP TYPE	ASSIGNED FREEBOARD	LENGTH	RULES
OIL TANKER [1)]	Type "A" ship with assigned freeboard less than type "B"	L ≤ 150 m	MARPOL, ANNEX I
		L > 150 m	MARPOL, ANNEX I + ICLL, reg.27
	Not less than type "B"	Regardless of length	MARPOL, ANNEX I
LIQUEFIED GAS CARRIER [1)]	Type "A" ship with assigned freeboard less than type "B"	L ≤ 150 m	IGC
		L > 150 m	IGC + ICLL, reg.27
	Not less than type "B"	Regardless of length	IGC
CHEMICAL TANKER [1)]	Type "A" ship with assigned freeboard less than type "B"	L ≤ 150 m	IBC
		L > 150 m	IBC + ICLL, reg.27
	Not less than type "B"	Regardless of length	IBC

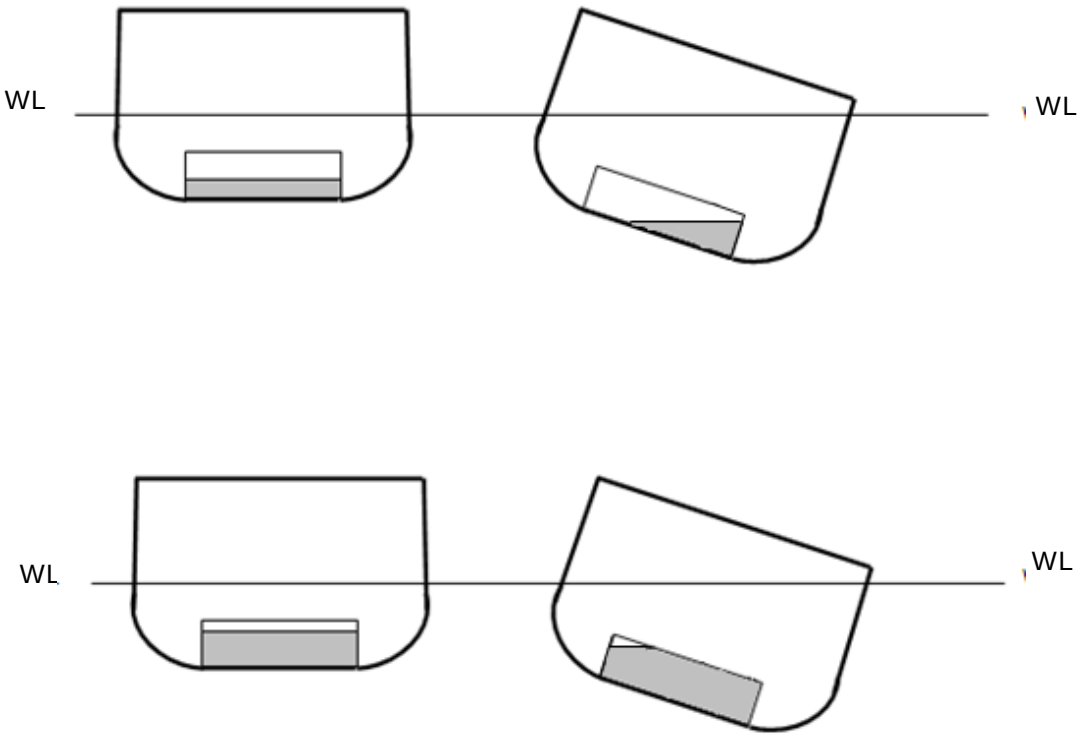
[1)] Ships complying with the above regulations do not need to comply with the damage stability requirements of SOLAS chapter II-1, part B-1.

* * *

Appendix 2

EXPLANATORY NOTES TO THE FREE SURFACE CALCULATION WITH VARYING FREE SURFACE MOMENTS, ACTUAL LIQUID TRANSFER MOMENTS, TAKING INTO ACCOUNT ACTUAL HEEL AND TRIM, DEPENDING ON THE INTERVAL ANGLES OF THE GZ CURVE

In the figure below it is shown that the free surface moments can be reduced significantly, depending on the filling level and on the heel. Therefore calculations according to the actual liquid transfer moment represent a more realistic situation. In cases where the effect of free surfaces has a significant impact (i.e. large tanks) this method provides a more realistic account and can be used for the calculations of damage stability.



* * *

Appendix 3

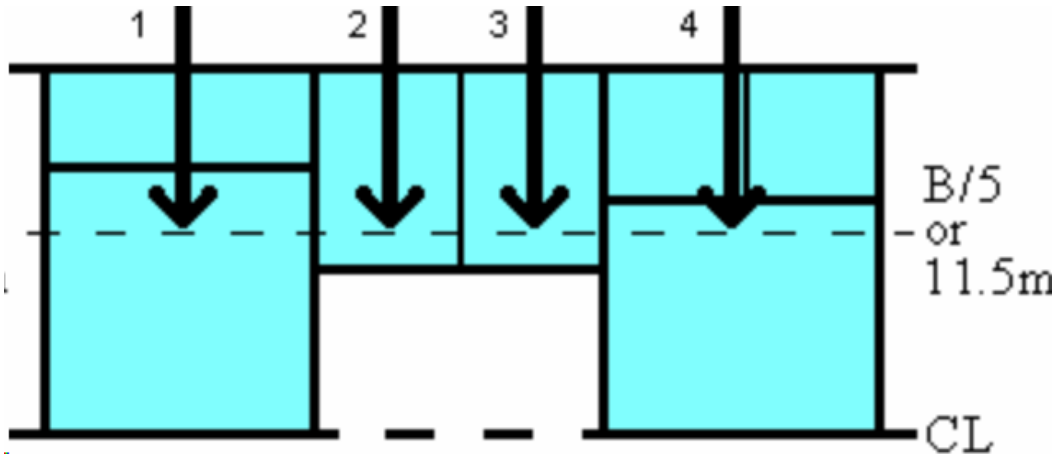
DESCRIPTION OF THE LONGITUDINAL EXTENT OF DAMAGE ACCORDING TO ICLL PROTOCOL 1988, REGULATION 27(12)(d)

The longitudinal extent of one compartment may vary depending on whether transversal wing tank bulkheads exceed B/5 (or 11.5 m, whichever is less) or not, see the damages of sketch below.

1. Normal B/5 or 11.5 m damage;

2. and 3. Transverse bulkhead exceeding B/5 or 11.5 m undamaged (two single one compartment damage cases); and

4. Transverse bulkhead not exceeding B/5 or 11.5 m damaged (one single one compartment damage case).



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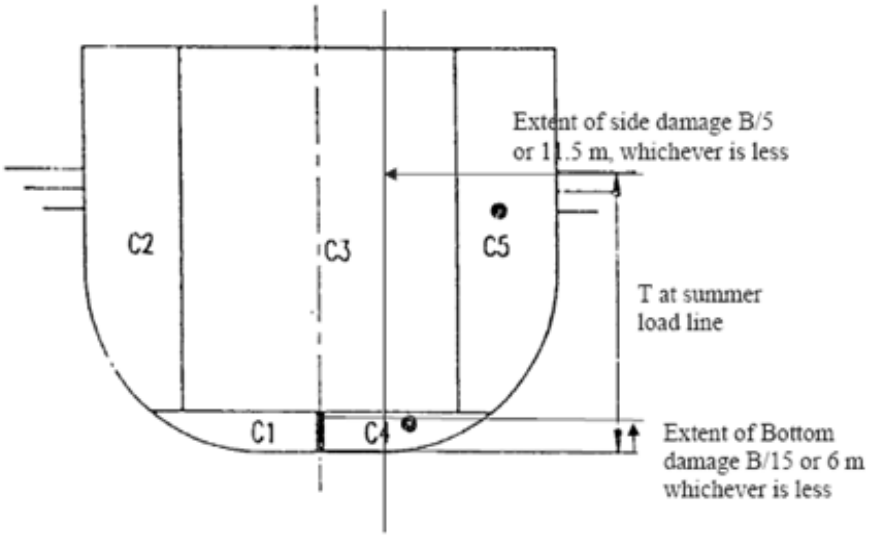
Appendix 4

EXAMPLE ON HOW TO DEFINE DAMAGES OF LESSER EXTENT



1. SIDE DAMAGE
1.1 Damaged compartments for maximum extent:

1.1.1 C5, C3, C4

1.2 Damaged compartments for lesser extent:
1.2.1 C5
1.2.2 C5, C4
1.2.3 C3, C5

2. BOTTOM DAMAGE
2.1 Damaged compartments for maximum extent:

2.1.1 C4, C1

2.2 Damaged compartments for lesser extent:

2.2.1 C4

* * *

Appendix 5

EXAMPLE CALCULATION OF THE LOSS OF LIQUID CARGO MASS AND INFLOW OF FLOODWATER MASS

Initial filling = 540 tonnes at SG = 1.800

Final filling at equilibrium = 240 tonnes at SG = 1.025

Stage	Assumed total mass in compartment	Assumed mass at original SG	Assumed mass of sea water	Total volume assumed in compartment	SG assumed in compartment
0	540	540	0	300.0	1.800
1	490	450	40	289.0	1.695
2	440	360	80	278.0	1.583
3	390	270	120	267.1	1.460
4	340	180	160	256.1	1.328
5	290	90	200	245.1	1.183
6	240	0	240	234.1	1.025

GUIDELINES FOR VERIFICATION OF DAMAGE STABILITY FOR TANKERS

PART 2

GUIDELINES FOR OPERATION AND DEMONSTRATION OF DAMAGE STABILITY COMPLIANCE

Compliance with damage stability regulations

1 APPLICATION

These Guidelines are intended for oil tankers, chemical tankers and gas carriers.

2 BACKGROUND

2.1 Scope of Guidelines

2.1.1 These Guidelines have been developed primarily to provide tanker masters, the Company, owners, managers, operators, etc. with information and guidance on compliance with the requirements of damage stability and on providing verification of such compliance to relevant authorities.

2.1.2 The master should be supplied with information appertaining to the stability of the tanker under various conditions of service. The basic requirements for provision of stability information under SOLAS, MARPOL and the IBC and IGC Codes are shown in table 1 below.

Table 1

Ship type	Regulation
Cargo ships of 80 m in length and upwards*, keel laid on or after 1 January 2009	SOLAS 2009, chapter II-1, regulation 5-1
Cargo ships over 100 m in length*, constructed on or after 1 February 1992 and cargo ships 80 m in length and up, but not over 100 m*, constructed on or after 1 July 1998	SOLAS 90, chapter II-1, regulation 25-1
Oil tankers of 150 gross tonnage and above, delivered after 31 December 1979	MARPOL, Annex I, regulation 28
Ships carrying dangerous chemicals or noxious liquid substances in bulk, keel laid on or after 1 July 1986	IBC Code, chapter 2, regulation 2.2.5
Ships carrying liquefied gases in bulk, constructed on or after 1 October 1994	IGC Code, chapter 2, regulation 2.2.5

2.1.3 References to "approved loading conditions" made within this document include those as defined in the annex.

2.1.4 However, the provision of limiting operational GM or KG data is not always practicable for tankers and such data may not be provided. In this case the advice at SOLAS chapter II-1, regulation 5-1(5), applies.

2.1.5 Considerations on the scope and type of stability information are given in the annex.

2.2 Introduction

2.2.1 Responsibility

2.2.1.1 It is required under MARPOL and SOLAS to ensure that the ship is loaded in accordance with all relevant stability criteria, prior to proceeding to sea. This responsibility is identified in the relevant provisions of SOLAS and MARPOL. There are additional provisions and requirements for certificates issued under the IBC and IGC Codes.

2.2.1.2 It is a requirement of paragraph 1.2.3 of the ISM Code that all ships to which the SOLAS Convention applies shall be operated in a manner which ensures compliance with all international instruments, national and other legislation which applies to them.

2.2.1.3 This provision covers the need for tankers to be operated in a manner which ensures compliance with the damage stability requirements of MARPOL Annex I, or the IBC and IGC Codes, as applicable.

2.2.1.4 Section 7 of the ISM Code further obliges the operating company to ensure there are adequate procedures in place to ensure compliance with these requirements, including the use of checklists as appropriate, and that any task is only undertaken by duly qualified personnel.

2.2.1.5 Such operating procedures should include the maintenance of adequate records to demonstrate to internal and external ISM auditors and to PSC inspectors, that all relevant mandatory requirements are being met during service of the ship.

2.2.1.6 These Guidelines are also relevant to ships to which chapter IX of the SOLAS Convention does not apply, and it is recommended that operational guidance on board should be to an equivalent standard to that provided for such ships, having regard to the extension of MARPOL Annex I and the IBC and IGC Codes to ships of less than SOLAS Convention size.

2.2.1.7 Tankers carrying oil and chemicals are assessed against different damage stability criteria, and therefore the verification should be confirmed against the appropriate criteria.

2.2.1.8 In order to understand this issue, the terms Intact Stability, Damage Stability and Stability in the Damaged Condition should be understood and are explained below.

2.2.2 Compliance with intact stability

2.2.2.1 The International Code on Intact Stability, 2008 (2008 IS Code), adopted by resolution MSC.267(85), provides information and criteria which must be complied with by cargo and passenger ships. This Intact Stability information is provided to the master as per SOLAS chapter II-1, regulation 5-1.

2.2.2.2 During normal operations the intact stability of a ship is assessed by either using an intact stability function attached to a loading or stability instrument or by manual calculations.

2.2.2.3 Compliance with intact stability shall be demonstrated before proceeding to sea and evidence of this documented.

2.2.3 Compliance with damage stability

2.2.3.1 Damage stability requirements in SOLAS chapter II-1, parts B-1 to B-4, as applicable, must be complied with, where applicable, by all cargo ships above 80 m length other than those which are required to comply with subdivision and damage stability regulations in other IMO instruments.

2.2.3.2 Oil tankers, chemical tankers and gas carriers complying with the damage stability provisions of MARPOL Annex I, the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) and the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code), are not required to comply with the damage stability requirements of SOLAS chapter II-1, part B-1.

2.2.3.3 Information provided to the master in the form of a stability booklet contains loading conditions (including ballast conditions) which have been verified to ensure compliance with both intact and damage stability requirements relative to its ship type. When the tanker is in an operational condition which is not covered by one of the loading conditions contained in the stability booklet, then compliance with damage stability must be verified prior to proceeding to sea and evidence of this documented (refer to the 2008 IS Code).

2.2.4 Stability of the ship in the damaged condition

2.2.4.1 This is the residual stability of the ship after an actual damage to its structure, and consequent flooding, has occurred. Damages of varying size and layout are evaluated during approval of stability information, up to the damage of maximum extent, as defined within the regulations which apply to a particular ship.

2.2.4.2 Compliance with basic intact stability criteria does not necessarily ensure compliance with damage stability requirements and intact stability characteristics well in excess of the statutory minimum may be necessary for a particular loading condition to ensure compliance with damage stability.

2.2.4.3 Compliance with damage stability requirements should always be verified prior to sailing, and is required to ensure a ship shall survive a damage of any extent up to the maximum extent required by the regulations which apply to it, should such a damage occur. Use of a shore side contractor, retained to provide emergency evaluation and assistance in the event that a damage does occur in service, is not an accepted means to make such pre-departure verification.

2.2.4.4 It is important to note that in the event of **any** damage occurring to the ship which requires reporting to the flag Administration, port State and recognized organization (RO), specialist advice should always be sought to verify the continued structural integrity.

3 COMPLIANCE

It is the responsibility of the master to ensure the ship is loaded in accordance with the applicable intact and damaged stability criteria during all operational cargo conditions. The master may also be required to demonstrate compliance with these stability criteria to different surveying and inspecting authorities. Regulations governing damage stability requirements are contained in various instruments developed by the IMO (refer to the annex for further detail).

3.1 Compliance with regulations

The master will need to be provided with sufficient information to demonstrate the ship is loaded in a manner which will ensure compliance with the relevant regulations which apply to its type, size and age. Information to be provided should include:

.1 Load Line information;

.2 shear force and bending moments information;

.3 KG, draught and trim information;

.4 intact stability information; and

.5 damage stability information.

4 METHODS TO DEMONSTRATE VERIFICATION OF COMPLIANCE

There are various methods available to the master which can be used to demonstrate compliance with the regulations, as follows:

.1 to load the ship only in accordance with the approved loading conditions as given in the approved Stability Information Booklet (refer to the annex); or

.2 where the ship is not loaded in accordance with an approved loading condition from the approved Stability Information Booklet, obtain approval from the Administration or RO acting on its behalf for the proposed loading condition. It is recommended in this case that the accuracy of the verified loading condition is validated by cross-checking the predicted floating position with the observed condition by recording of actual draught readings; or

.3 where the ship is not loaded in accordance with an approved loading condition from the approved Stability Information Booklet, when authorized by the Administration (or RO acting on its behalf), obtain confirmation from the shore-based operating company that the proposed loading condition complies. It is recommended in this case that the accuracy of the verified loading condition is validated by cross-checking the predicted floating position with the observed condition by recording of actual draught readings; or

.4 where the 2008 IS Code, chapter 4, or MSC.1/Circ.1229 Type 2 (or equivalent) stability software is employed to verify damage stability compliance, this may be undertaken on board the ship or at an authorized shore location;

.5 to use an approved stability instrument or other acceptable method to verify that intact stability and damage stability criteria are satisfied for this operating condition. When an approved stability instrument is used for such verification, then use of this programme must be authorized by the Administration or RO acting on its behalf. Approved stability programmes may be approved as the 2008 IS Code and MSC.1/Circ.1229 damage stability software of Type 2 or Type 3; or

.6 the use of simplified stability data, for example, an approved range of loading conditions, curves of maximum KG or minimum allowable GM, to demonstrate compliance, noting that where such simplified data are used it is necessary to ensure that any restrictions applied in their development are also fulfilled in the actual loading condition being assessed. Use of simplified intact stability data for this purpose is not sufficient and verification must also be made against approved damage stability data.

5 WHEN COMPLIANCE IS NOT INITIALLY DEMONSTRATED

The master should not sail until the ship is in full compliance with all stability requirements. In a situation where it has not been possible to demonstrate compliance by any of the previously mentioned methods, there are a number of choices available, as follows:

.1 to adjust the loading of the ship so that it complies with an approved condition from the ship's approved Stability Information Booklet (refer to the annex); or

.2 to adjust the loading of the ship until the stability instrument shows that compliance has been achieved, whilst ensuring that all other requirements of the voyage such as load line and strength requirements are met; or

.3 to contact the shore-based operating company when authorized by the Administration (or RO acting on its behalf) and request assistance in the calculation of the intact and damage stability for an adjusted loading condition to ensure compliance with the regulations. It is recommended in this case that the accuracy of the verified loading condition is validated by cross-checking the predicted floating position with the observed condition by recording of actual draught readings; or

.4 to contact the RO acting on behalf of the Administration and request assistance in the calculation of the intact and damage stability for an adjusted loading condition to ensure compliance with the regulations. It is recommended in this case that the accuracy of the verified loading condition is validated by cross-checking the predicted floating position with the observed condition by recording of actual draught readings.

6 DOCUMENTATION WHICH MAY BE USED TO DEMONSTRATE VERIFICATION OF COMPLIANCE WITH DAMAGE STABILITY REQUIREMENTS

This section of the Guidelines is intended to assist all parties interested in verifying compliance with damage stability requirements.

6.1 Verification of compliance with damage stability requirements should be documented in accordance with the company's operating procedures and the company's safety management system. This should include a method of retaining manual calculations and/or stability instrument printouts used to verify compliance, so that this information can be provided to third parties, such as company auditors, surveyors or port State control inspectors. It is recommended that records are retained on board for a minimum of three years to ensure they are available at the next Safety Management Certificate (SMC) audit.

6.2 The following documentation may be used to demonstrate compliance with damage stability requirements when available on board the ship:

6.2.1 In the case where the ship is loaded in accordance with an approved loading condition from the approved stability information.

.1 Approved stability information (if approval is subject to conditions given by letter or in a design appraisal document, a copy of this letter or document in addition).

.2 Approved damage stability calculations (if approval is subject to conditions given by letter or in a design appraisal document, a copy of this letter or document in addition).

.3 The actual recorded loading condition.

.4 Confirmation of the approved loading condition upon which compliance is based.

Comparison of the two conditions should confirm that the live loading condition lies within the acceptable tolerances defined by the Administration; refer to the annex, paragraph 4.

6.2.2 In the case where a ship is loaded to a condition which is not an approved loading condition, and the verification is made on board using a manual check of critical GM/KG data.

.1 Approved stability information (if approval is subject to conditions given by letter or in a design appraisal document, a copy of this letter or document in addition).

.2 Approved damage stability calculations which incorporate critical damage GM/KG data, where these critical data clearly indicate if their derivation is dependent upon any initial assumptions or restrictions in the loading condition (if approval is subject to conditions given by letter or in a design appraisal document, a copy of this letter or document in addition).

.3 The actual recorded loading condition.

.4 Confirmation that the recorded loading condition complies with any initial assumptions or restrictions used to simplify derivation of the critical damaged GM/KG data.

.5 Check calculation or record sheets confirming the GM/KG of the recorded loading condition meets the approved critical damage GM/KG data for all relevant damage cases, including lesser cases (such as one compartment damage cases for two compartment ships), where relevant.

6.2.3 In the case where a ship is loaded to a condition which is not an approved loading condition, and the verification is made ashore using a manual check of critical GM/KG data.

.1 Approved stability information (if approval is subject to conditions given by letter or in a design appraisal document, a copy of this letter or document in addition).

.2 Approved damage stability calculations which incorporate critical damage GM/KG data, where these critical data clearly indicate if their derivation is dependent upon any initial assumptions or restrictions in the loading condition (if approval is subject to conditions given by letter or in a design appraisal document, a copy of this letter or document in addition).

.3 Authorization from the Administration or RO acting on its behalf accepting the use of critical GM/KG data at the shore office to verify damage stability.

.4 The actual recorded loading condition and evidence of transmission of this loading condition to the shore office for approval.

.5 Confirmation that the recorded loading condition complies with any initial assumptions or restrictions used to simplify derivation of the critical damaged GM/KG data. This check may not be made by the stability software and a manual check must be made in this case.

.6 Check calculation or record sheets confirming the GM/KG of the recorded loading condition meets the approved critical damage GM/KG data for all relevant damage cases, including lesser cases (such as one compartment damage cases for two compartment ships) where relevant.

6.2.4 In the case where a ship is loaded to a condition which is not an approved loading condition, and the verification is made on board against critical GM/KG data using a stability instrument of the 2008 IS Code and MSC.1/Circ.1229 Type 2 (or an equivalent standard specified by the Administration or RO acting on its behalf).

.1 Approved stability information (if approval is subject to conditions given by letter or in a design appraisal document, a copy of this letter or document in addition).

.2 Approved damage stability calculations which incorporate critical damage GM/KG data, where these critical data clearly indicate if their derivation is dependent upon any initial assumptions or restrictions in the loading condition (if approval is subject to conditions given by letter or in a design appraisal document, a copy of this letter or document in addition).

.3 The actual recorded loading condition.

.4 Confirmation that the actual recorded loading condition complies with any initial assumptions or restrictions used to simplify derivation of the critical damaged GM/KG data. This check may not be made by a stability instrument and a manual check must be made in this case.

.5 Authorization from the Administration or RO acting on its behalf accepting the use of a stability instrument to verify conditions of loading on board the ship.

.6 Copy of any approval for the stability instrument specified in the authorization issued by the Administration or RO acting on its behalf.

.7 Evidence of any check calculations specified in the authorization issued by the Administration or RO acting on its behalf to demonstrate that the stability instrument remains accurate.

.8 Output data from the stability instrument confirming the GM/KG of the recorded loading condition meets the approved critical damage GM/KG data for all relevant damage cases, including lesser cases (such as one compartment damage cases for two compartment ships), where relevant.

6.2.5 In the case where a ship is loaded to a condition which is not an approved loading condition, and the verification is made ashore against critical GM/KG data using a stability instrument of the 2008 IS Code and MSC.1/Circ.1229 Type 2 (or an equivalent standard specified by the Administration or RO acting on its behalf).

.1 Approved stability information (if approval is subject to conditions given by letter or in a design appraisal document, a copy of this letter or document in addition).

.2 Approved damage stability calculations which incorporate critical damage GM/KG data, where these critical data clearly indicate if their derivation is dependent upon any initial assumptions or restrictions in the loading condition (if approval is subject to conditions given by letter or in a design appraisal document, a copy of this letter or document in addition).

.3 The recorded loading condition and evidence of transmission of this loading condition to the shore office for approval.

.4 Confirmation that the recorded loading condition complies with any initial assumptions or restrictions used to simplify derivation of the critical damaged GM/KG data. This check may not be made by the stability instrument and a manual check must be made in this case.

.5 Authorization from the Administration or RO acting on its behalf accepting the use of the stability instrument to verify conditions of loading on board the ship.

.6 Copy of any approval for the stability instrument specified in the authorization issued by the flag State or RO.

.7 Output data from the stability instrument confirming the GM/KG of the recorded loading condition meets the approved critical damage GM/KG data for all relevant damage cases, including lesser cases (such as one compartment damage cases for two compartment ships) where relevant.

6.3 In the case where a ship is loaded to a condition which is not an approved loading condition, and the verification is made by submission of this loading condition directly to the Administration or RO acting on its behalf for approval.

.1 Approved stability information (if approval is subject to conditions given by letter or in a design appraisal document, a copy of this letter or document in addition).

.2 Approved damage stability calculations (if approval is subject to conditions given by letter or in a design appraisal document, a copy of this letter or document in addition).

.3 The recorded loading condition and evidence of transmission of this loading condition to the Administration or RO acting on its behalf for approval.

.4 Response from the Administration or RO acting on its behalf confirming that the loading condition has been verified for compliance with damage stability and is approved for departure.

6.4 In the case where a ship is loaded to a condition which is not an approved loading condition, and the verification is made on board using stability instrument of the 2008 IS Code and MSC.1/Circ.1229 Type 3 (or an equivalent standard specified by the flag State or RO).

.1 Approved stability information (if approval is subject to conditions given by letter or in a design appraisal document, a copy of this letter or document in addition).

.2 Approved damage stability calculations (if approval is subject to conditions given by letter or in a design appraisal document, a copy of this letter or document in addition).

.3 The actual recorded loading condition.

.4 Authorization from the Administration or RO acting on its behalf accepting the use of the stability instrument to verify conditions of loading on board the ship, and a copy of any documentation referred to by the authorization.

.5 Evidence of any check calculations specified in the authorization issued by the Administration or RO acting on its behalf to demonstrate that the stability instrument remains accurate.

.6 Output data from the stability instrument confirming the loading condition meets intact and damage stability. All relevant damage cases should be considered.

6.5 In the case where a ship is loaded to a condition which is not an approved loading condition, and the verification is made ashore using stability software of the 2008 IS Code and MSC.1/Circ.1229, Type 3 (or an equivalent standard specified by the Administration or RO acting on its behalf).

.1 Approved stability information (if approval is subject to conditions given by letter or in a design appraisal document, a copy of this letter or document in addition).

.2 Approved damage stability calculations (if approval is subject to conditions given by letter or in a design appraisal document, a copy of this letter or document in addition).

.3 The recorded loading condition and evidence of transmission of this loading condition to the shore office for approval.

.4 Authorization from the Administration or RO acting on its behalf accepting the use of the stability instrument at the shore office to verify conditions of loading on board the ship.

.5 Copy of any approval for the stability software specified in the authorization issued by the Administration or RO acting on its behalf.

.6 Output data from the stability software confirming the loading condition meets intact and damaged stability. All relevant damage cases should be considered.

6.6 In the case where a ship is loaded to a condition which is within an approved range of loading conditions:

.1 Approved stability information (if approval is subject to conditions given by letter or in a design appraisal document, a copy of this letter or document in addition).

.2 Approved damage stability calculations (if approval is subject to conditions given by letter or in a design appraisal document, a copy of this letter or document in addition).

.3 The actual recorded loading condition.

.4 Confirmation of the approved range of loading conditions being applied and that all parameters of loading defined within this range fall within the prescribed limits.

* * *

Appendix

DEFINITIONS AND INTERPRETATIONS

1 A *stability instrument* is an instrument installed on board a particular ship by means of which it can be ascertained that stability requirements specified for the ship in the Stability Booklet are met in any operational loading condition. A stability instrument comprises hardware and software.

2 There are three types of stability software, details of which are provided in chapter 4 of part B of the 2008 IS Code and MSC.1/Circ.1229. A brief description of the three types is as follows. Three types of calculations performed by stability software are acceptable depending upon a ship's stability requirements:

Type 1: Software calculating intact stability only (for ships not required to meet a damage stability criterion);

Type 2: Software calculating intact stability and checking damage stability on the basis of a limit curve (e.g. for ships which apply to SOLAS chapter II-1, part B-1 damage stability calculations, etc.) or previously approved loading conditions; and

Type 3: Software calculating intact stability and damage stability by direct application of pre-programmed damage cases for each loading condition (for some tankers, etc.).

3 Approved loading condition

3.1 In relation to a tanker certified under MARPOL Annex I or the IBC or IGC Codes, an approved loading condition is a unique individual condition of loading, taking account of the combination of lightship and all individual deadweight items, which has been verified by the Administration or RO acting on its behalf as complying with both intact and damage stability criteria, and is approved for use in the service of the ship.

3.2 The approval of an individual loading condition is granted for the purpose of loading to that unique condition and cannot be taken to confer any acceptance or approval of other loading conditions which vary from it, given that the margin of compliance against the applicable intact or damage stability criteria may be zero.

3.3 Loading conditions which are verified in service and shown to lie within the boundary of an approved range of loading conditions or approved limiting KG/GM curves shall also be regarded as approved loading conditions.

3.4 Loading conditions which are verified using an approved stability instrument authorized by the Administration or RO acting on its behalf should also be regarded as approved loading conditions.

4 Loading "in accordance with", "closely to" or "not significantly different from" an approved loading condition

4.1 For tankers which do not have an approved stability instrument, an approved range of loading conditions or critical GM or KG data, which enable damage stability verification of the live loading condition to be made on board prior to departure, loading should always be made strictly in accordance with an approved loading condition unless the loading condition is first verified as compliant by the Administration or RO acting on its behalf prior to departure.

4.2 However, to permit practical operation of such tankers, having regard to small variations in cargo SG, stores and minor tank fillings, it is considered necessary to permit some variation in loading from an approved condition.

4.3 In this respect, it is recommended that a vessel which loads within the boundary provided by an approved pair of departure and arrival conditions, derived from a fixed distribution of cargo and ballast, may be considered to be loaded in accordance with these conditions.

4.4 To satisfy this recommendation, the live loading condition should fall within the following limits:

.1 displacement, to fall within the range of displacements of the approved departure and arrival conditions;

.2 KG/GM (corrected for free surface) to fall below a value determined by linear interpolation at the live condition displacement between the approved departure and arrival conditions used to verify damage stability compliance; and

.3 trim, to fall within the range of trims described by those of the approved departure and arrival conditions.

4.5 No further relaxations or deviation should be allowed, unless specifically approved by the Administration.

5 Approved range of loading conditions

5.1 It is acceptable to load to a condition of loading which is defined within a range of approved loading conditions.

5.2 For an approved range of loading conditions to be valid it must offer a clear indication how cargoes and ballast are to be loaded.

5.3 In this respect, all parameters of loading defined within an approved range of loading conditions must be fully complied with for a vessel to be considered correctly loaded within it.

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FAL.2/Circ.127
MEPC.1/Circ.817
MSC.1/Circ.1462
1 July 2013

LIST OF CERTIFICATES AND DOCUMENTS REQUIRED TO BE CARRIED ON BOARD SHIPS, 2013

1 The Facilitation Committee, at its thirty-eighth session (8 to 12 April 2013), the Marine Environment Protection Committee, at its sixty-fifth session (13 to 17 May 2013), and the Maritime Safety Committee, at its ninety-second session (12 to 21 June 2013), approved the List of certificates and documents required to be carried on board ships, 2013, as set out in the annex.

2 This work was carried out in accordance with the provisions of section 2 of the annex to the FAL Convention concerning formalities required of shipowners by public authorities on the arrival, stay and departure of ships. It is reiterated that these provisions should not be read as precluding a requirement for the presentation for inspection by the appropriate authorities of certificates and other documents carried by the ship pertaining to its registry, measurement, safety, manning, classification and other related matters.

3 Due to amendments to relevant instruments since the issuance of FAL.2/Circ.123-MEPC/Circ.769-MSC/Circ.1409, the list has been revised to take account of the relevant provisions of the aforementioned amendments.

4 This circular lists only the certificates and documents that are required under IMO instruments and it does not include certificates or documents required by other international organizations or governmental authorities.

5 This circular should not be used in the context of port State control inspections for which convention requirements should be referred to.

6 Member Governments are invited to note the information provided in the annex and take action as appropriate.

7 This circular supersedes FAL.2/Circ.123-MEPC/Circ.769-MSC/Circ.1409.

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ANNEX

CERTIFICATES AND DOCUMENTS REQUIRED TO BE CARRIED ON BOARD SHIPS, 2013

(Note: All certificates to be carried on board must be valid and drawn up in the form corresponding to the model where required by the relevant international convention or instrument.)

No.	Contents	Reference
1	**All ships to which the referenced convention applies**	
	International Tonnage Certificate (1969) An International Tonnage Certificate (1969) shall be issued to every ship, the gross and net tonnage of which have been determined in accordance with the Convention.	Tonnage Convention, article 7
	International Load Line Certificate An International Load Line Certificate shall be issued under the provisions of the International Convention on Load Lines, 1966, to every ship which has been surveyed and marked in accordance with the Convention or the Convention as modified by the 1988 LL Protocol, as appropriate.	LL Convention, article 16; 1988 LL Protocol, article 16
	International Load Line Exemption Certificate An International Load Line Exemption Certificate shall be issued to any ship to which an exemption has been granted under and in accordance with article 6 of the Load Line Convention or the Convention as modified by the 1988 LL Protocol, as appropriate.	LL Convention, article 6; 1988 LL Protocol, article 16
	Coating Technical File A Coating Technical File, containing specifications of the coating system applied to dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers of 150 m in length and upwards, record of the shipyard's and shipowner's coating work, detailed criteria for coating sections, job specifications, inspection, maintenance and repair, shall be kept on board and maintained throughout the life of the ship.	SOLAS 1974, regulation II-1/3-2; Performance standard for protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers (resolution MSC.215(82))

No.	Contents	Reference
	Construction drawings A set of as-built construction drawings and other plans showing any subsequent structural alterations shall be kept on board a ship constructed on or after 1 January 2007.	SOLAS 1974, regulation II-1/3-7; MSC/Circ.1135 on As-built construction drawings to be maintained on board the ship and ashore
	Ship Construction File A Ship Construction File with specific information should be kept on board oil tankers of 150 m in length and above and 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 July 2016; .2 in the absence of a building contract, the keels of which are laid or which are at a similar stage of construction on or after 1 July 2017; or .3 the delivery of which is on or after 1 July 2020 shall carry a Ship Construction File containing information in accordance with regulations and guidelines, and updated as appropriate throughout the ship's life in order to facilitate safe operation, maintenance, survey, repair and emergency measures.	SOLAS 1974, regulation II-1/3-10; MSC.1/Circ.1343 on Guidelines for the information to be included in a Ship Construction File
	Stability information Every passenger ship regardless of size and every cargo ship of 24 m and over shall be inclined on completion and the elements of their stability determined. The master shall be supplied with stability information containing such information as is necessary to enable him, by rapid and simple procedures, to obtain accurate guidance as to the stability of the ship under varying conditions of service to maintain the required intact stability and stability after damage. For bulk carriers, the information required in a bulk carrier booklet may be contained in the stability information.	SOLAS 1974, regulations II-1/5 and II-1/5-1; LL Convention; 1988 LL Protocol, regulation 10

No.	Contents	Reference
	Damage control plans and booklets On passenger and cargo ships, there shall be permanently exhibited plans showing clearly for each deck and hold the boundaries of the watertight compartments, the openings therein with the means of closure and position of any controls thereof, and the arrangements for the correction of any list due to flooding. Booklets containing the aforementioned information shall be made available to the officers of the ship.	SOLAS 1974, regulation II-1/19; MSC.1/Circ.1245
	Minimum safe manning document Every ship to which chapter I of the Convention applies shall be provided with an appropriate safe manning document or equivalent issued by the Administration as evidence of the minimum safe manning.	SOLAS 1974, regulation V/14.2
	Fire safety training manual A training manual shall be written in the working language of the ship and shall be provided in each crew mess room and recreation room or in each crew cabin. The manual shall contain the instructions and information required in regulation II-2/15.2.3.4. Part of such information may be provided in the form of audio-visual aids in lieu of the manual.	SOLAS 1974, regulation II-2/15.2.3
	Fire control plan/booklet General arrangement plans shall be permanently exhibited for the guidance of the ship's officers, showing clearly for each deck the control stations, the various fire sections together with particulars of the fire detection and fire alarm systems and the fire-extinguishing appliances, etc. Alternatively, at the discretion of the Administration, the aforementioned details may be set out in a booklet, a copy of which shall be supplied to each officer, and one copy shall at all times be available on board in an accessible position. Plans and booklets shall be kept up to date; any alterations shall be recorded as soon as practicable. A duplicate set of fire control plans or a booklet containing such plans shall be permanently stored in a prominently marked weathertight enclosure outside the deckhouse for the assistance of shoreside fire-fighting personnel.	SOLAS 1974, regulations II-2/15.2.4 and II-2/15.3.2
	Onboard training and drills record Fire drills shall be conducted and recorded in accordance with the provisions of regulations III/19.3 and III/19.5.	SOLAS 1974, regulation II-2/15.2.2.5

No.	Contents	Reference
	Fire safety operational booklet The fire safety operational booklet shall contain the necessary information and instructions for the safe operation of the ship and cargo handling operations in relation to fire safety. The booklet shall be written in the working language of the ship and be provided in each crew mess room and recreation room or in each crew cabin. The booklet may be combined with the fire safety training manuals required in regulation II-2/15.2.3.	SOLAS 1974, regulation II-2/16.2
	Maintenance plans The maintenance plan shall include the necessary information about fire protection systems and fire-fighting systems and appliances as required under regulation II-2/14.2.2. For tankers, additional requirements are referred to in regulation II-2/14.4.	SOLAS 1974, regulations II-2/14.2.2 and II-2/14.4
	Training manual The training manual, which may comprise several volumes, shall contain instructions and information, in easily understood terms illustrated wherever possible, on the life-saving appliances provided in the ship and on the best methods of survival. Any part of such information may be provided in the form of audio-visual aids in lieu of the manual.	SOLAS 1974, regulation III/35
	Nautical charts and nautical publications Nautical charts and nautical publications for the intended voyage shall be adequate and up to date. An electronic chart display and information system (ECDIS) is also accepted as meeting the chart carriage requirements of this subparagraph.	SOLAS 1974, regulations V/19.2.1.4 and V/27
	International Code of Signals and a copy of Volume III of IAMSAR Manual All ships required to carry a radio installation shall carry the International Code of Signal; all ships shall carry an up-to-date copy of Volume III of the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual.	SOLAS 1974, regulation V/21
	Records of navigational activities All ships engaged on international voyages shall keep on board a record of navigational activities and incidents including drills and pre-departure tests. When such information is not maintained in the ship's logbook, it shall be maintained in another form approved by the Administration.	SOLAS 1974, regulations V/26 and V/28.1

No.	Contents	Reference
	Manoeuvring booklet The stopping times, ship headings and distances recorded on trials, together with the results of trials to determine the ability of ships having multiple propellers to navigate and manoeuvre with one or more propellers inoperative, shall be available on board for the use of the master or designated personnel.	SOLAS 1974, regulation II-1/28
	Material Safety Data Sheets (MSDS) 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.	SOLAS 1974, regulation VI/5-1; resolution MSC.286(86)
	AIS test report The Automatic Identification System (AIS) shall be subjected to an annual test by an approved surveyor or an approved testing or servicing facility. A copy of the test report shall be retained on board and should be in accordance with a model form set out in the annex to MSC.1/Circ.1252	SOLAS 1974, regulation V/18.9; MSC.1/Circ.1252
	Certificates for masters, officers or ratings Certificates for masters, officers or ratings shall be issued to those candidates who, to the satisfaction of the Administration, meet the requirements for service, age, medical fitness, training, qualifications and examinations in accordance with the provisions of the STCW Code annexed to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978. Formats of certificates are given in section A-I/2 of the STCW Code. Certificates must be kept available in their original form on board the ships on which the holder is serving.	STCW 1978, article VI, regulation I/2; STCW Code, section A-I/2

No.	Contents	Reference
	Records of hours of rest Records of daily hours of rest of seafarers shall be maintained on board.	STCW Code, section A-VIII/1; Maritime Labour Convention, 2006; Seafarers' Hours of Work and the Manning of Ships Convention, 1996 (No.180); IMO/ILO Guidelines for the development of tables of seafarers' shipboard working arrangements and formats of records of seafarers' hours of work or hours of rest *Note: The Maritime Labour Convention, 2006 shall come into force on 20/08/2013.*
	International Oil Pollution Prevention Certificate An international Oil Pollution Prevention Certificate shall be issued, after survey in accordance with regulation 6 of Annex I of MARPOL, to any oil tanker of 150 gross tonnage and above and any other ship of 400 gross tonnage and above which is engaged in voyages to ports or offshore terminals under the jurisdiction of other Parties to MARPOL . The certificate is supplemented with a Record of Construction and Equipment for Ships other than Oil Tankers (Form A) or a Record of Construction and Equipment for Oil Tankers (Form B), as appropriate.	MARPOL Annex I, regulation 7
	Oil Record Book Every oil tanker of 150 gross tonnage and above and every ship of 400 gross tonnage and above other than an oil tanker shall be provided with an Oil Record Book, Part I (Machinery space operations). Every oil tanker of 150 gross tonnage and above shall also be provided with an Oil Record Book, Part II (Cargo/ballast operations).	MARPOL Annex I, regulations 17 and 36

No.	Contents	Reference
	Shipboard Oil Pollution Emergency Plan Every oil tanker of 150 gross tonnage and above and every ship other than an oil tanker of 400 gross tonnage and above shall carry on board a Shipboard Oil Pollution Emergency Plan approved by the Administration.	MARPOL Annex I, regulation 37; resolution MEPC.54(32), as amended by resolution MEPC.86(44)
	International Sewage Pollution Prevention Certificate An International Sewage Pollution Prevention Certificate shall be issued, after an initial or renewal survey in accordance with the provisions of regulation 4 of Annex IV of MARPOL, to any ship which is required to comply with the provisions of that Annex and is engaged in voyages to ports or offshore terminals under the jurisdiction of other Parties to the Convention.	MARPOL Annex IV, regulation 5; MEPC/Circ.408
	Garbage Management Plan Every ship of 100 gross tonnage and above and every ship which is certified to carry 15 persons or more shall carry a garbage management plan which the crew shall follow.	MARPOL Annex V, regulation 10; resolution MEPC.71(38); MEPC/Circ.317
	Garbage Record Book Every ship of 400 gross tonnage and above and every ship which is certified to carry 15 persons or more engaged in voyages to ports or offshore terminals under the jurisdiction of other Parties to the Convention and every fixed and floating platform engaged in exploration and exploitation of the seabed shall be provided with a Garbage Record Book.	MARPOL Annex V, regulation 10
	Voyage data recorder system – certificate of compliance The voyage data recorder system, including all sensors, shall be subjected to an annual performance test. The test shall be conducted by an approved testing or servicing facility to verify the accuracy, duration and recoverability of the recorded data. In addition, tests and inspections shall be conducted to determine the serviceability of all protective enclosures and devices fitted to aid location. A copy of the certificate of compliance issued by the testing facility, stating the date of compliance and the applicable performance standards, shall be retained on board the ship.	SOLAS 1974, regulation V/18.8

No.	Contents	Reference
	Cargo Securing Manual All cargoes other than solid and liquid bulk cargoes, cargo units and cargo transport units, shall be loaded, stowed and secured throughout the voyage in accordance with the Cargo Securing Manual approved by the Administration. In ships with ro-ro spaces, as defined in regulation II-2/3.41, all securing of such cargoes, cargo units and cargo transport units, in accordance with the Cargo Securing Manual, shall be completed before the ship leaves the berth. The Cargo Securing Manual is required on all types of ships engaged in the carriage of all cargoes other than solid and liquid bulk cargoes, which shall be drawn up to a standard at least equivalent to the guidelines developed by the Organization.	SOLAS 1974, regulations VI/5.6 and VII/5; MSC.1/Circ.1353
	Document of Compliance A document of compliance shall be issued to every company which complies with the requirements of the ISM Code. A copy of the document shall be kept on board.	SOLAS 1974, regulation IX/4; ISM Code, paragraph 13
	Safety Management Certificate A Safety Management Certificate shall be issued to every ship by the Administration or an organization recognized by the Administration. The Administration or an organization recognized by it shall, before issuing the Safety Management Certificate, verify that the company and its shipboard management operate in accordance with the approved safety management system.	SOLAS 1974, regulation IX/4; ISM Code, paragraph 13
	International Ship Security Certificate (ISSC) or **Interim International Ship Security Certificate** An International Ship Security Certificate (ISSC) shall be issued to every ship by the Administration or an organization recognized by it to verify that the ship complies with the maritime security provisions of SOLAS chapter XI-2 and part A of the ISPS Code. An interim ISSC may be issued under the ISPS Code, part A, section 19.4.	SOLAS 1974, regulation XI-2/9.1.1; ISPS Code, part A, section 19 and appendices.

No.	Contents	Reference
	Ship Security Plan and associated records Each ship shall carry on board a ship security plan approved by the Administration. The plan shall make provisions for the three security levels as defined in part A of the ISPS Code. Records of the following activities addressed in the ship security plan shall be kept on board for at least the minimum period specified by the Administration: .1 training, drills and exercises; .2 security threats and security incidents; .3 breaches of security; .4 changes in security level; .5 communications relating to the direct security of the ship such as specific threats to the ship or to port facilities the ship is, or has been, in; .6 internal audits and reviews of security activities; .7 periodic review of the ship security assessment; .8 periodic review of the ship security plan; .9 implementation of any amendments to the plan; and .10 maintenance, calibration and testing of any security equipment provided on board, including testing of the ship security alert system.	SOLAS 1974, regulation XI-2/9; ISPS Code. part A, sections 9 and 10
	Continuous Synopsis Record (CSR) Every ship to which chapter I of the Convention applies shall be issued with a Continuous Synopsis Record. The Continuous Synopsis Record provides an onboard record of the history of the ship with respect to the information recorded therein.	SOLAS 1974, regulation XI-1/5
	International Anti-fouling System Certificate Ships of 400 GT and above engaged in international voyages, excluding fixed or floating platforms, FSUs, and FPSOs, shall be issued after inspection and survey an international Anti-fouling System Certificate together with a Record of Anti-fouling Systems.	AFS Convention, regulation 2(1) of annex 4
	Declaration on Anti-fouling System Ships of 24 m or more in length, but less than 400 GT engaged in international voyages, excluding fixed or floating platforms, FSUs, and FPSOs, shall carry a declaration signed by the owner or owner's authorized agents. Such a declaration shall be accompanied by appropriate documentation (such as a paint receipt or a contractor invoice) or contain appropriate endorsement.	AFS Convention, regulation 5(1) of annex 4

No.	Contents	Reference
	International Air Pollution Prevention Certificate Ships constructed before the date of entry into force of the Protocol of 1997 shall be issued with an International Air Pollution Prevention Certificate. Any ship of 400 gross tonnage and above engaged in voyages to ports or offshore terminals under the jurisdiction of other Parties and platforms and drilling rigs engaged in voyages to waters under the sovereignty or jurisdiction of other Parties to the Protocol of 1997 shall be issued with an International Air Pollution Prevention Certificate.	MARPOL Annex VI, regulation 6
	International Energy Efficiency Certificate An International Energy Efficiency Certificate for the ship shall be issued after a survey in accordance with the provisions of regulation 5.4 to any ships of 400 gross tonnage and above before that ship may engage in voyages to ports or offshore terminals under the jurisdiction of other Parties.	MARPOL Annex VI, regulation 6
	Ozone-depleting Substances Record Book Each ship subject to MARPOL Annex VI, regulation 6.1 that has rechargeable systems that contain ozone-depleting substances shall maintain an ozone-depleting substances record book.	MARPOL Annex VI, regulation 12.6
	Fuel Oil Changeover Procedure and Logbook (record of fuel changeover) Those ships using separate fuel oils to comply with MARPOL Annex VI, regulation 14.3 and entering or leaving an emission control area shall carry a written procedure showing how the fuel oil changeover is to be done. The volume of low-sulphur fuel oils in each tank as well as the date, time and position of the ship when any fuel oil changeover operation is completed prior to the entry into an emission control area or commenced after exit from such an area shall be recorded in such logbook as prescribed by the Administration.	MARPOL Annex VI, regulation 14.6
	Manufacturer's Operating Manual for Incinerators Incinerators installed in accordance with the requirements of MARPOL Annex VI, regulation 16.6.1 shall be provided with a Manufacturer's Operating Manual, which is to be retained with the unit.	MARPOL Annex VI, regulation 16.7
	Bunker Delivery Note and Representative Sample Bunker Delivery Note and representative sample of the fuel oil delivered shall be kept on board in accordance with requirements of MARPOL Annex VI, regulations 18.6 and 18.8.1.	MARPOL Annex VI, regulations 18.6 and 18.8.1

No.	Contents	Reference
	Ship Energy Efficiency Management Plan (SEEMP) All ships of 400 gross tonnage and above, excluding platforms (including FPSOs and FSUs) and drilling rigs, regardless of their propulsion, shall keep on board a ship specific Ship Energy Efficiency Management Plan (SEEMP). This may form part of the ship's Safety management System (SMS).	MARPOL Annex VI, regulation 22; MEPC.1/Circ.795
	EEDI Technical File Applicable to ships falling into one or more of categories in MARPOL Annex VI, regulations 2.25 to 2.35.	MARPOL Annex VI, regulation 20
	Technical File Every marine diesel engine installed on board a ship shall be provided with a Technical File. The Technical File shall be prepared by the applicant for engine certification and approved by the Administration, and is required to accompany an engine throughout its life on board ships. The Technical File shall contain the information as specified in paragraph 2.4.1 of the NO_x Technical Code.	NO_x Technical Code, paragraph 2.3.4
	Record Book of Engine Parameters Where the Engine Parameter Check method in accordance with paragraph 6.2 of the NO_x Technical Code is used to verify compliance, if any adjustments or modifications are made to an engine after its pre-certification, a full record of such adjustments or modifications shall be recorded in the engine's Record Book of Engine Parameters.	NO_x Technical Code, paragraph 2.3.7
	Exemption Certificate[1] When an exemption is granted to a ship under and in accordance with the provisions of SOLAS 1974, a certificate called an Exemption Certificate shall be issued in addition to the certificates listed above.	SOLAS 1974, regulation I/12; 1988 SOLAS Protocol, regulation I/12
	LRIT conformance test report A Conformance test report should be issued, on satisfactory completion of a conformance test, by the Administration or the ASP who conducted the test acting on behalf of the Administration and should be in accordance with the model set out in appendix 2 of MSC.1/Circ.1307.	SOLAS 1974, regulation V/19-1; MSC.1/Circ.1307

[1] SLS.14/Circ.115, Add.1, Add.2 and Add.3 refer to the issue of exemption certificate.

No.	Contents	Reference
	Noise Survey Report Applicable to new ships of 1,600 gross tonnage and above, excluding dynamically supported crafts, high-speed crafts, fishing vessels, pipe-laying barges, crane barges, mobile offshore drilling units, pleasure yachts not engaged in trade, ships of war and troopships, ships not propelled by mechanical means, pile driving vessels and dredgers. A noise survey report shall always be carried on board and be accessible for the crew. For existing ships, refer to section "Other certificates and documents which are not mandatory – Noise Survey Report" (resolution A.468(XII).	SOLAS 1974, regulation II-1/3-12; Code on noise levels on board ships, section 4.3 *Note: The above mandatory requirements are expected to enter into force on 1/7/2014*
	Ship-specific Plans and Procedures for Recovery of Persons from the Water All ships shall have ship-specific plans and procedures for recovery of persons from the water. Ships constructed before 1 July 2014 shall comply with this requirement by the first periodical or renewal safety equipment survey of the ship to be carried out after 1 July 2014, whichever comes first. Ro-ro passenger ships which comply with regulation III/26.4 shall be deemed to comply with this regulation. The Plans and Procedures should be considered as a part of the emergency preparedness plan required by paragraph 8 of the ISM Code.	SOLAS 1974 regulation, III/17-1; Resolution MSC.346(91); MSC.1/Circ.1447 *Note: The above mandatory requirements are expected to enter into force on 1/7/2014*
2	**In addition to the certificates listed in section 1 above, passenger ships shall carry:**	
	Passenger Ship Safety Certificate A certificate called a Passenger Ship Safety Certificate shall be issued after inspection and survey to a passenger ship which complies with the requirements of chapters II-1, II-2, III, IV and V and any other relevant requirements of SOLAS 1974. A Record of Equipment for the Passenger Ship Safety Certificate (Form P) shall be permanently attached.	SOLAS 1974, regulation I/12; 1988 SOLAS Protocol, regulation I/12

No.	Contents	Reference
	Special Trade Passenger Ship Safety Certificate, Special Trade Passenger Ship Space Certificate A Special Trade Passenger Ship Safety Certificate issued under the provisions of the Special Trade Passenger Ships Agreement, 1971. A certificate called a Special Trade Passenger Ship Space Certificate shall be issued under the provisions of the Protocol on Space Requirements for Special Trade Passenger Ships, 1973.	STP 71, rule 5 SSTP 73, rule 5
	Search and rescue cooperation plan Passenger ships to which chapter I of the Convention applies shall have on board a plan for cooperation with appropriate search and rescue services in event of an emergency.	SOLAS 1974, regulation V/7.3
	List of operational limitations Passenger ships to which chapter I of the Convention applies shall keep on board a list of all limitations on the operation of the ship, including exemptions from any of the SOLAS regulations, restrictions in operating areas, weather restrictions, sea state restrictions, restrictions in permissible loads, trim, speed and any other limitations, whether imposed by the Administration or established during the design or the building stages.	SOLAS 1974, regulation V/30
	Decision support system for masters In all passenger ships, a decision support system for emergency management shall be provided on the navigation bridge.	SOLAS 1974, regulation III/29
3	**In addition to the certificates listed in section 1 above, cargo ships shall carry:**	
	Cargo Ship Safety Construction Certificate A certificate called a Cargo Ship Safety Construction Certificate shall be issued after survey to a cargo ship of 500 gross tonnage and over which satisfies the requirements for cargo ships on survey, set out in regulation I/10 of SOLAS 1974, and complies with the applicable requirements of chapters II-1 and II-2, other than those relating to fire-extinguishing appliances and fire-control plans.	SOLAS 1974, regulation I/12; 1988 SOLAS Protocol, regulation I/12

No.	Contents	Reference
	Cargo Ship Safety Equipment Certificate A certificate called a Cargo Ship Safety Equipment Certificate shall be issued after survey to a cargo ship of 500 gross tonnage and over which complies with the relevant requirements of chapters II-1 and II-2, III and V and any other relevant requirements of SOLAS 1974. A Record of Equipment for the Cargo Ship Safety Equipment Certificate (Form E) shall be permanently attached.	SOLAS 1974, regulation I/12; 1988 SOLAS Protocol, regulation I/12
	Cargo Ship Safety Radio Certificate A certificate called a Cargo Ship Safety Radio Certificate shall be issued after survey to a cargo ship of 300 gross tonnage and over, fitted with a radio installation, including those used in life-saving appliances, which complies with the requirements of chapter IV and any other relevant requirements of SOLAS 1974. A Record of Equipment for the Cargo Ship Safety Radio Certificate (Form R) shall be permanently attached.	SOLAS 1974, regulation I/12, as amended by the GMDSS amendments; 1988 SOLAS Protocol, regulation I/12
	Cargo Ship Safety Certificate A certificate called a Cargo Ship Safety Certificate may be issued after survey to a cargo ship which complies with the relevant requirements of chapters II-1, II-2, III, IV and V and other relevant requirements of SOLAS 1974 as modified by the 1988 SOLAS Protocol, as an alternative to the Cargo Ship Safety Construction Certificate, Cargo Ship Safety Equipment Certificate and Cargo Ship Safety Radio Certificate. A Record of Equipment for the Cargo Ship Safety Certificate (Form C) shall be permanently attached.	1988 SOLAS Protocol, regulation I/12
	Document of authorization for the carriage of grain and grain loading manual A document of authorization shall be issued for every ship loaded in accordance with the regulations of the International Code for the Safe Carriage of Grain in Bulk. The document shall accompany or be incorporated into the grain loading manual provided to enable the master to meet the stability requirements of the Code.	SOLAS 1974, regulation VI/9; International Code for the Safe Carriage of Grain in Bulk, section 3
	Certificate of insurance or other financial security in respect of civil liability for oil pollution damage A certificate attesting that insurance or other financial security is in force shall be issued to each ship carrying more than 2,000 tonnes of oil in bulk as cargo. It shall be issued or certified by the appropriate authority of the State of the ship's registry after determining that the requirements of article VII, paragraph 1, of the CLC Convention have been complied with.	CLC 1969, article VII

No.	Contents	Reference
	Certificate of insurance or other financial security in respect of civil liability for bunker oil pollution damage Certificate attesting that insurance or other financial security is in force in accordance with the provisions of this Convention shall be issued to each ship of greater than 1,000 GT after the appropriate authority of a State Party has determined that the requirements of article 7, paragraph 1 have been complied with. With respect to a ship registered in a State Party such certificate shall be issued or certified by the appropriate authority of the State of the ship's registry; with respect to a ship not registered in a State Party it may be issued or certified by the appropriate authority of any State Party. A State Party may authorize either an institution or an organization recognized by it to issue the certificate referred to in paragraph 2.	Bunker Convention 2001, article 7
	Certificate of insurance or other financial security in respect of civil liability for oil pollution damage A certificate attesting that insurance or other financial security is in force in accordance with the provisions of the 1992 CLC Convention shall be issued to each ship carrying more than 2,000 tonnes of oil in bulk as cargo after the appropriate authority of a Contracting State has determined that the requirements of article VII, paragraph 1, of the Convention have been complied with. With respect to a ship registered in a Contracting State, such certificate shall be issued by the appropriate authority of the State of the ship's registry; with respect to a ship not registered in a Contracting State, it may be issued or certified by the appropriate authority of any Contracting State.	CLC 1992, article VII
	Enhanced survey report file Bulk carriers and oil tankers shall have a survey report file and supporting documents complying with paragraphs 6.2 and 6.3 of annex A and annex B of resolution A.744(18) – Guidelines on the enhanced programme of inspections during surveys of bulk carriers and oil tankers. *Note: refer to requirements of survey report file and supporting documents for bulk carriers and oil tankers as referred to in paragraphs 6.2 and 6.3 of annex A/annex B, part A/part B, 2011 ESP Code.*	SOLAS 1974, regulation XI-1/2; resolution A.744(18) *Note: The 2011 ESP Code is expected to come into force on 1/1/2014 and to supersede resolution A.744(18)*

No.	Contents	Reference
	Record of oil discharge monitoring and control system for the last ballast voyage Subject to the provisions of paragraphs 4 and 5 of regulation 3 of MARPOL Annex I, every oil tanker of 150 gross tonnage and above shall be equipped with an oil discharge monitoring and control system approved by the Administration. The system shall be fitted with a recording device to provide a continuous record of the discharge in litres per nautical mile and total quantity discharged, or the oil content and rate of discharge. The record shall be identifiable as to time and date and shall be kept for at least three years.	MARPOL Annex I, regulation 31
	Oil Discharge Monitoring and Control (ODMC) Operational Manual Every oil tanker fitted with an Oil Discharge Monitoring and Control system shall be provided with instructions as to the operation of the system in accordance with an operational manual approved by the Administration.	MARPOL Annex I, regulation 31; resolution A.496(XII); resolution A.586(14); resolution MEPC.108(49)
	Cargo Information The shipper shall provide the master or his representative with appropriate information, confirmed in writing, on the cargo, in advance of loading. In bulk carriers, the density of the cargo shall be provided in the above information.	SOLAS 1974, regulations VI/2 and XII/10; MSC/Circ.663
	Ship Structure Access Manual This regulation applies to oil tankers of 500 gross tonnage and over and bulk carriers, as defined in regulation IX/1, of 20,000 gross tonnage and over, constructed on or after 1 January 2006. A ship's means of access to carry out overall and close-up inspections and thickness measurements shall be described in a Ship structure access manual approved by the Administration, an updated copy of which shall be kept on board.	SOLAS 1974, regulation II-1/3-6
	Bulk Carrier Booklet To enable the master to prevent excessive stress in the ship's structure, the ship loading and unloading solid bulk cargoes shall be provided with a booklet referred to in SOLAS regulation VI/7.2. The booklet shall be endorsed by the Administration or on its behalf to indicate that SOLAS regulations XII/4, 5, 6 and 7, as appropriate, are complied with. As an alternative to a separate booklet, the required information may be contained in the intact stability booklet.	SOLAS 1974, regulations VI/7 and XII/8; Code of Practice for the Safe Loading and Unloading of Bulk Carriers (BLU Code)

No.	Contents	Reference
	Crude Oil Washing Operation and Equipment Manual (COW Manual) Every oil tanker operating with crude oil washing systems shall be provided with an Operations and Equipment Manual detailing the system and equipment and specifying operational procedures. Such a Manual shall be to the satisfaction of the Administration and shall contain all the information set out in the specifications referred to in regulation 35 of Annex I of MARPOL.	MARPOL Annex I, regulation 35; resolution MEPC.81(43)
	Condition Assessment Scheme (CAS) Statement of Compliance, CAS Final Report and Review Record A Statement of Compliance shall be issued by the Administration to every oil tanker which has been surveyed in accordance with the requirements of the Condition Assessment Scheme (CAS) and found to be in compliance with these requirements. In addition, a copy of the CAS Final Report which was reviewed by the Administration for the issue of the Statement of Compliance and a copy of the relevant Review Record shall be placed on board to accompany the Statement of Compliance.	MARPOL Annex I, regulations 20 and 21; resolution MEPC.94(46); resolution MEPC.99(48); resolution MEPC.112(50); resolution MEPC.131(53); resolution MEPC.155(55)
	Subdivision and stability information Every oil tanker to which regulation 28 of Annex I of MARPOL applies shall be provided in an approved form with information relative to loading and distribution of cargo necessary to ensure compliance with the provisions of this regulation and data on the ability of the ship to comply with damage stability criteria as determined by this regulation.	MARPOL Annex I, regulation 28
	STS Operation Plan and Records of STS Operations Any oil tanker involved in STS operations shall carry on board a plan prescribing how to conduct STS operations (STS operations Plan) not later than the date of the first annual, intermediate or renewal survey of the ship to be carried out on or after 1 January 2011. Each oil tanker's STS operations plan shall be approved by the Administration. The STS operations plan shall be written in the working language of the ship. Records of STS operations shall be retained on board for three years and be readily available for inspection.	MARPOL Annex I, regulation 41
	VOC Management Plan A tanker carrying crude oil, to which MARPOL Annex VI, regulation 15.1 applies, shall have on board and implement a VOC Management Plan.	MARPOL Annex VI, regulation 15.6

No.	Contents	Reference
4	**In addition to the certificates listed in sections 1 and 3 above, where appropriate, any ship carrying noxious liquid chemical substances in bulk shall carry:**	
	International Pollution Prevention Certificate for the Carriage of Noxious Liquid Substances in Bulk (NLS Certificate) An international pollution prevention certificate for the carriage of noxious liquid substances in bulk (NLS Certificate) shall be issued, after survey in accordance with the provisions of regulation 8 of Annex II of MARPOL, to any ship carrying noxious liquid substances in bulk and which is engaged in voyages to ports or terminals under the jurisdiction of other Parties to MARPOL. In respect of chemical tankers, the Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk and the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk, issued under the provisions of the Bulk Chemical Code and International Bulk Chemical Code, respectively, shall have the same force and receive the same recognition as the NLS Certificate.	MARPOL Annex II, regulation 8
	Cargo record book Ships carrying noxious liquid substances in bulk shall be provided with a Cargo Record Book, whether as part of the ship's official log book or otherwise, in the form specified in appendix II to Annex II.	MARPOL Annex II, regulation 15.2
	Procedures and Arrangements Manual (P & A Manual) Every ship certified to carry noxious liquid substances in bulk shall have on board a Procedures and Arrangements Manual approved by the Administration.	MARPOL Annex II, regulation 14; resolution MEPC.18(22)
	Shipboard Marine Pollution Emergency Plan for Noxious Liquid Substances Every ship of 150 gross tonnage and above certified to carry noxious liquid substances in bulk shall carry on board a shipboard marine pollution emergency plan for noxious liquid substances approved by the Administration.	MARPOL Annex II, regulation 17

No.	Contents	Reference
5	**In addition to the certificates listed in sections 1 and 3 above, where applicable, any chemical tanker shall carry:**	
	Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk A certificate called a Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk, the model form of which is set out in the appendix to the Bulk Chemical Code, should be issued after an initial or periodical survey to a chemical tanker engaged in international voyages which complies with the relevant requirements of the Code. *Note: The Code is mandatory under Annex II of MARPOL for chemical tankers constructed before 1 July 1986.* **or**	BCH Code, section 1.6; BCH Code, as modified by resolution MSC.18(58), section 1.6
	International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk A certificate called an International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk, the model form of which is set out in the appendix to the International Bulk Chemical Code, should be issued after an initial or periodical survey to a chemical tanker engaged in international voyages, which complies with the relevant requirements of the Code. *Note: The Code is mandatory under both chapter VII of SOLAS 1974 and Annex II of MARPOL for chemical tankers constructed on or after 1 July 1986.*	IBC Code, section 1.5; IBC Code as modified by resolutions MSC.16(58) and MEPC.40(29), section 1.5
6	**In addition to the certificates listed in sections 1 and 3 above, where applicable, any gas carrier shall carry:**	
	Certificate of Fitness for the Carriage of Liquefied Gases in Bulk A certificate called a Certificate of Fitness for the Carriage of Liquefied Gases in Bulk, the model form of which is set out in the appendix to the Gas Carrier Code, should be issued after an initial or periodical survey to a gas carrier which complies with the relevant requirements of the Code.	GC Code, section 1.6

No.	Contents	Reference
	International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk A certificate called an International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk, the model form of which is set out in the appendix to the International Gas Carrier Code, should be issued after an initial or periodical survey to a gas carrier which complies with the relevant requirements of the Code. *Note: The Code is mandatory under chapter VII of SOLAS 1974 for gas carriers constructed on or after 1 July 1986.*	IGC Code, section 1.5; IGC Code, as modified by resolution MSC.17(58), section 1.5
7	**In addition to the certificates listed in sections 1, and 2 or 3 above, where applicable, any high-speed craft shall carry:**	
	High-Speed Craft Safety Certificate A certificate called a High-Speed Craft Safety Certificate shall be issued after completion of an initial or renewal survey to a craft which complies with the requirements of the 1994 HSC Code or the 2000 HSC Code, as appropriate.	SOLAS 1974, regulation X/3; 1994 HSC Code, section 1.8; 2000 HSC Code, section 1.8
	Permit to Operate High-Speed Craft A certificate called a Permit to Operate High-Speed Craft shall be issued to a craft which complies with the requirements set out in paragraphs 1.2.2 to 1.2.7 of the 1994 HSC Code or the 2000 HSC Code, as appropriate.	1994 HSC Code, section 1.9; 2000 HSC Code, section 1.9
8	**In addition to the certificates listed in sections 1, and 2 or 3 above, where applicable, any ship carrying dangerous goods shall carry:**	
	Document of compliance with the special requirements for ships carrying dangerous goods The Administration shall provide the ship with an appropriate document as evidence of compliance of construction and equipment with the requirements of regulation II-2/19 of SOLAS 1974. Certification for dangerous goods, except solid dangerous goods in bulk, is not required for those cargoes specified as class 6.2 and 7 and dangerous goods in limited quantities.	SOLAS 1974, regulation II-2/19.4

No.	Contents	Reference
9	**In addition to the certificates listed in sections 1, and 2 or 3 above, where applicable, any ship carrying dangerous goods in packaged form shall carry:**	
	Dangerous goods manifest or stowage plan Each ship carrying dangerous goods in packaged form shall have a special list or manifest setting forth, in accordance with the classification set out in the IMDG Code, the dangerous goods on board and the location thereof. Each ship carrying dangerous goods in solid form in bulk shall have a list or manifest setting forth the dangerous goods on board and the location thereof. A detailed stowage plan, which identifies by class and sets out the location of all dangerous goods on board, may be used in place of such a special list or manifest. A copy of one of these documents shall be made available before departure to the person or organization designated by the port State authority.	SOLAS 1974, regulations VII/4.5 and VII/7-2; MARPOL Annex III, regulation 4
10	**In addition to the certificates listed in sections 1, and 2 or 3 above, where applicable, any ship carrying INF cargo shall carry:**	
	International Certificate of Fitness for the Carriage of INF Cargo A ship carrying INF cargo shall comply with the requirements of the International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships (INF Code) in addition to any other applicable requirements of the SOLAS regulations and shall be surveyed and be provided with the International Certificate of Fitness for the Carriage of INF Cargo.	SOLAS 1974, regulation VII/16; INF Code (resolution MSC.88(71)), paragraph 1.3
11	**In addition to the certificates listed in sections 1, and 2 or 3 above, where applicable, any Nuclear Ship shall carry:**	
	A Nuclear Cargo Ship Safety Certificate or Nuclear Passenger Ship Safety Certificate, in place of the Cargo Ship Safety Certificate or Passenger Ship Safety Certificate, as appropriate. Every Nuclear powered ship shall be issued with the certificate required by SOLAS chapter VIII.	SOLAS 1974, regulation VIII/10

No.	Contents	Reference
Other certificates and documents which are not mandatory		
	Special purpose ships	
	Special Purpose Ship Safety Certificate In addition to SOLAS certificates as specified in paragraph 7 of the Preamble of the Code of Safety for Special Purpose Ships, a Special Purpose Ship Safety Certificate should be issued after survey in accordance with the provisions of paragraph 1.6 of the Code for Special Purpose Ships. The duration and validity of the certificate should be governed by the respective provisions for cargo ships in SOLAS 1974. If a certificate is issued for a special purpose ship of less than 500 gross tonnage, this certificate should indicate to what extent relaxations in accordance with 1.2 were accepted.	Resolution A.534(13), as amended by MSC/Circ.739; 2008 SPS Code (resolution MSC.266(84)), SOLAS 1974, regulation I/12; 1988 SOLAS Protocol, regulation I/12
	Offshore support vessels	
	Offshore Supply Vessel Document of Compliance The Document of Compliance should be issued after satisfied that the vessel complies with the provisions of the Guidelines for the design and construction of Offshore Supply Vessels, 2006.	Resolution MSC.235(82)
	Certificate of Fitness for Offshore Support Vessels When carrying such cargoes, offshore support vessels should carry a Certificate of Fitness issued under the "Guidelines for the Transport and Handling of Limited Amounts of Hazardous and Noxious Liquid Substances in Bulk on Offshore Support Vessels". If an offshore support vessel carries only noxious liquid substances, a suitably endorsed International Pollution Prevention Certificate for the Carriage of Noxious Liquid Substances in Bulk may be issued instead of the above Certificate of Fitness.	Resolution A.673(16); MARPOL Annex II, regulation 13(4)
	Diving systems	
	Diving System Safety Certificate A certificate should be issued either by the Administration or any person or organization duly authorized by it after survey or inspection to a diving system which complies with the requirements of the Code of Safety for Diving Systems. In every case, the Administration should assume full responsibility for the certificate.	Resolution A.536(13), section 1.6

No.	Contents	Reference
	Passenger submersible craft	
	Safety Compliance Certificate for Passenger Submersible Craft Applicable to submersible craft adapted to accommodate passengers and intended for underwater excursions with the pressure in the passenger compartment at or near one atmosphere. A Design and Construction Document issued by the Administration should be attached to the Safety Compliance Certificate.	MSC/Circ.981, as amended by MSC/Circ.1125
	Dynamically supported craft	
	Dynamically Supported Craft Construction and Equipment Certificate To be issued after survey carried out in accordance with paragraph 1.5.1(a) of the Code of Safety for Dynamically Supported Craft.	Resolution A.373(X), section 1.6
	Mobile offshore drilling units	
	Mobile Offshore Drilling Unit Safety Certificate To be issued after survey carried out in accordance with the provisions of the Code for the Construction and Equipment of Mobile Offshore Drilling Units, 1979, or, for units constructed on or after 1 May 1991, the Code for the Construction and Equipment of Drilling Units, 1989.	Resolution A.414(XI), section 1.6; resolution A.649(16), section 1.6; resolution A.649(16), as modified by resolution MSC.38(63), section 1.6; 2009 MODU Code (resolution A.1023(26))
	Wing-In-Ground (WIG) Craft	
	Wing–in–ground Craft Safety Certificate A certificate called a WIG Craft Safety Certificate should be issued after completion of an initial or renewal survey to a craft, which complies with the provisions of the Interim Guidelines for WIG craft.	MSC/Circ.1054, section 9

No.	Contents	Reference
	Permit to Operate WIG Craft A permit to operate should be issued by the Administration to certify compliance with the provisions of the Interim Guidelines for WIG craft.	MSC/Circ.1054, section 10
	Noise levels	
	Noise Survey Report Applicable to existing ships to which SOLAS II-1/3-12 does not apply. A noise survey report should be made for each ship in accordance with the Code on Noise Levels on Board Ships.	Resolution A.468(XII), section 4.3

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MSC.1/Circ.1463
1 July 2013

APPLICATION OF SOLAS REGULATIONS XII/3, XII/7 AND XII/11

1 The Maritime Safety Committee, at its ninety-second session (12 to 21 June 2013), approved the meaning of the term “periodical survey” prepared by the Sub-Committee on Flag State Implementation, in relation to the application of SOLAS regulations XII/3, XII/7 and XII/11, as set out in the annex, with a view to providing more specific guidance for application of the relevant requirements of the SOLAS Convention.

2 Member Governments are invited to use the annexed guidance when applying the relevant provisions of the SOLAS Convention and to bring it to the attention of all parties concerned.

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ANNEX

APPLICATION OF SOLAS REGULATIONS XII/3, XII/7 and XII/11

Meaning of the term "Periodical Survey"

1 In SOLAS regulations XII/3, XII/7 and XII/11, the term "periodical survey" has been used to refer to the dates by which the requirements under these regulations are to be complied with. Since the requirements under SOLAS chapter XII mainly deal with the hull structure, it is necessary that the above-mentioned threshold dates are associated with the examination of the outside of the ship's bottom. Therefore, the term "periodical survey" referred to in SOLAS chapter XII is linked to the surveys which are associated with an examination of the outside of the ship's bottom i.e. the intermediate surveys and renewal surveys for the Cargo Ship Safety Construction Certificate, or the Cargo Ship Safety Certificate, as mentioned in SOLAS regulations I/10 and I/12, as modified by the 1988 SOLAS Protocol.

2 Considering that the terms "intermediate survey" or "renewal survey" have been used in all IMO instruments, instead of the term "periodical survey", after the 1988 SOLAS Protocol entered into force, Administrations may note that the meaning of the term "periodical survey" in the context of SOLAS regulations XII/3, XII/7 and XII/11 is the same as "renewal survey" or "intermediate survey" of a ship, as referred to in SOLAS regulation I/10, as modified by the 1988 SOLAS Protocol.