INTERNATIONAL MARITIME ORGANIZATION

IMO

E

MARITIME SAFETY COMMITTEE
83rd session
Agenda item 28

MSC 83/28/Add.2
2 November 2007
Original: ENGLISH

REPORT OF THE MARITIME SAFETY COMMITTEE ON ITS EIGHTY-THIRD SESSION

Attached are annexes 1 to 16 to the report of the Maritime Safety Committee on its eighty-third session (MSC 83/28).

LIST OF ANNEXES

(See document MSC 83/28/Add.1 for annexes 17, 32 and 35 and document MSC 83/28/Add.3 for annexes 18 to 31, 33, 34 and 36 to 44)

ANNEX 1

RESOLUTION MSC.239(83)
(adopted on 12 October 2007)

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

THE MARITIME SAFETY COMMITTEE,

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

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

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

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

2. DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the said amendments shall be deemed to have been accepted on 1 January 2009, unless, prior to that date, more than one third of the Contracting Governments to the Convention or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet, have notified their objections to the amendments;

3. INVITES SOLAS Contracting Governments to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 July 2009 upon their acceptance in accordance with paragraph 2 above;

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

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

ANNEX

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

CHAPTER IV
RADIOCOMMUNICATIONS

PART A
GENERAL

1 The following new regulation 4-1 is added after the existing regulation 4:

"**Regulation 4-1**
GMDSS satellite providers

The Maritime Safety Committee shall determine the criteria, procedures and arrangements for the evaluation, recognition, review and oversight of the provision of mobile satellite communication services in the Global Maritime Distress and Safety System (GMDSS) pursuant to the provisions of this chapter."

CHAPTER VI
CARRIAGE OF CARGOES

2 The following new regulation 5-1 is added after the existing regulation 5:

"**Regulation 5-1**
Material safety data sheets

Ships carrying MARPOL Annex I cargoes, as defined in Appendix I to Annex I of the Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973, and marine fuel oils shall be provided with a material safety data sheet prior to the loading of such cargoes based on the recommendations developed by the Organization.*

---

* Refer to the Recommendation for material safety data sheets (MSDS) for MARPOL Annex I cargoes and marine fuel oils, adopted by the Organization by resolution MSC.150(77), as may be amended."

APPENDIX
CERTIFICATES

Form of Safety Certificate for Passenger Ships

3 In the table of paragraph 2.1.3 in the section commencing with the words "THIS IS TO CERTIFY:", the reference to "regulation II-1/13" is replaced by the reference to "regulation II-1/18[4]", the words "C.1, C.2, C.3" are replaced by "P.1, P.2, P.3" and the following footnote is added:

"[4] For ships constructed before 1 January 2009, the applicable subdivision notation "C.1, C.2 and C.3" should be used."

Form of Nuclear Passenger Ship Safety Certificate

4 In the table of paragraph 2.1.3 in the section commencing with the words "THIS IS TO CERTIFY:" of the Form of Nuclear Passenger Ship Safety Certificate, the reference to "regulation II-1/13" is replaced by "regulation II-1/18[3]", the words "C.1, C.2, C.3" are replaced by "P.1, P.2, P.3" and the following footnote is added:

"[3] For ships constructed before 1 January 2009, the applicable subdivision notation "C.1, C.2 and C.3" should be used."

5 After the existing paragraph 2.10 in the section commencing with the words "THIS IS TO CERTIFY:", the following new paragraphs 2.11 and 2.12 are added:

"2.11. the ship was/was not/[1] subjected to an alternative design and arrangements in pursuance of regulation II-2/17 of the Convention;

2.12 a Document of approval of alternative design and arrangements for fire safety is/is not/[1] appended to this Certificate.

[1] Delete as appropriate."

Form of Nuclear Cargo Ship Safety Certificate

6 After the existing paragraph 2.9 in the section commencing with the words "THIS IS TO CERTIFY:", the following new paragraphs 2.10 and 2.11 are added:

"2.10 the ship was/was not/[3] subjected to an alternative design and arrangements in pursuance of regulation II-2/17 of the Convention;

2.11 a Document of approval of alternative design and arrangements for fire safety is/is not/[3] appended to this Certificate.

[3] Delete as appropriate."

***

ANNEX 2

RESOLUTION MSC.240(83)
(adopted on 12 October 2007)

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

THE MARITIME SAFETY COMMITTEE,

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

RECALLING FURTHER article VIII(b) of the International Convention for the Safety of Life at Sea (SOLAS), 1974 (hereinafter referred to as "the Convention") and article VI of the Protocol of 1988 relating to the Convention (hereinafter referred to as "the 1988 SOLAS Protocol") concerning the procedure for amending the 1988 SOLAS Protocol,

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

1. ADOPTS, in accordance with article VIII(b)(iv) of the Convention and article VI of the 1988 SOLAS Protocol, amendments to the appendix to the Annex to the 1988 SOLAS Protocol, the text of which is set out in the Annex to the present resolution;

2. DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention and article VI of the 1988 SOLAS Protocol, that the said amendments shall be deemed to have been accepted on 1 January 2009, unless, prior to that date, more than one third of the Parties to the 1988 SOLAS Protocol or Parties the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet, have notified their objections to the amendments;

3. INVITES the Parties concerned to note that, in accordance with article VIII(b)(vii)(2) of the Convention and article VI of the 1988 SOLAS Protocol, the amendments shall enter into force on 1 July 2009, upon their acceptance in accordance with paragraph 2 above;

4. RECOMMENDS the Parties concerned to issue certificates complying with the annexed amendments at the first renewal survey after 1 July 2009;

5. REQUESTS the Secretary-General, in conformity with article VIII(b)(v) of the Convention and article VI of the 1988 SOLAS Protocol, to transmit certified copies of the present resolution and the text of the amendments contained in the Annex to all Parties to the 1988 SOLAS Protocol;

6. FURTHER REQUESTS the Secretary-General to transmit copies of this resolution and its Annex to Members of the Organization, which are not Parties to the 1988 SOLAS Protocol.

ANNEX

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

APPENDIX

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

Form of Safety Certificate for Passenger Ships

1 The following new paragraphs 2.10 and 2.11 are added after the existing paragraph 2.9 in the section commencing with the words "THIS IS TO CERTIFY":

"2.10 the ship was/was not/[1] subjected to an alternative design and arrangements in pursuance of regulation II-2/17 of the Convention;

2.11 a Document of approval of alternative design and arrangements for fire safety is/is not/[1] appended to this Certificate.

[1] Delete as appropriate."

2 In the table of paragraph 2.1.3 in the section commencing with the words "THIS IS TO CERTIFY", the reference to "regulation II-1/13" is replaced by the reference to "regulation II-1/18[4]", the words "C.1, C.2, C.3" are replaced by "P.1, P.2, P.3" and the following footnote is added:

"[4] For ships constructed before 1 January 2009, the applicable subdivision notation "C.1, C.2 and C.3" should be used."

Form of Safety Construction Certificate for Cargo Ships

3 The following new paragraphs 5 and 6 are added after the existing paragraph 4 in the section commencing with the words "THIS IS TO CERTIFY":

"5 the ship was/was not/[4] subjected to an alternative design and arrangements in pursuance of regulation II-2/17 of the Convention;

6 a Document of approval of alternative design and arrangements for fire safety is/is not/[4] appended to this Certificate.

[4] Delete as appropriate."

Form of Safety Equipment Certificate for Cargo Ships

4 The following new paragraphs 2.7 and 2.8 are added after the existing paragraph 2.6 in the section commencing with the words "THIS IS TO CERTIFY":

"2.7 the ship was/was not/[4] subjected to an alternative design and arrangements in pursuance of regulation II-2/17 of the Convention;

2.8 a Document of approval of alternative design and arrangements for fire safety is/is not/[4] appended to this Certificate.

[4] Delete as appropriate."

Form of Safety Certificate for Cargo Ships

5 The following new paragraphs 2.11 and 2.12 are added after the existing paragraph 2.10 in the section commencing with the words "THIS IS TO CERTIFY":

"2.11 the ship was/was not/[4] subjected to an alternative design and arrangements in pursuance of regulation II-2/17 of the Convention;

2.12 a Document of approval of alternative design and arrangements for fire safety is/is not/[4] appended to this Certificate.

[4] Delete as appropriate."

***

ANNEX 3

RESOLUTION MSC.241(83)
(adopted on 12 October 2007)

ADOPTION OF AMENDMENTS TO THE INTERNATIONAL CODE FOR THE SAFE CARRIAGE OF PACKAGED IRRADIATED NUCLEAR FUEL, PLUTONIUM AND HIGH-LEVEL RADIOACTIVE WASTES ON BOARD SHIPS (INF CODE)

THE MARITIME SAFETY COMMITTEE,

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

NOTING resolution MSC.88(71) by which it adopted the International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships (hereinafter referred to as "the INF Code"), which has become mandatory under chapter VII of the International Convention for the Safety of Life at Sea, 1974 (hereinafter referred to as "the Convention"),

NOTING ALSO article VIII(b) and regulation VII/14.1 of the Convention concerning the procedure for amending the INF Code,

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

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

2. DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the amendments shall be deemed to have been accepted on 1 January 2009, unless, prior to that date, more than one third of the Contracting Governments to the Convention or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet, have notified their objections to the amendments;

3. INVITES Contracting Governments to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 July 2009 upon their acceptance in accordance with paragraph 2 above;

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

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

ANNEX

AMENDMENTS TO THE INTERNATIONAL CODE FOR THE SAFE CARRIAGE OF PACKAGED IRRADIATED NUCLEAR FUEL, PLUTONIUM AND HIGH-LEVEL RADIOACTIVE WASTES ON BOARD SHIPS (INF CODE)

CHAPTER 2
DAMAGE STABILITY

1 In paragraph 2.2.1, the words “Part B” are replaced by the words “Part B-1”.

2 In paragraphs 2.2.2 and 2.3.2, the following new sentence is added at the end of the paragraphs:

“For ships less than 80 m in length, the subdivision index R at 80 m shall be used.”

***

ANNEX 4

DRAFT AMENDMENTS TO SOLAS CHAPTERS II-1 AND II-2

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

Regulation 35-1 – Bilge pumping arrangements

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

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

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

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

2 The existing paragraph 6.1.4 is replaced by the following:

"6.1.4 When fixed pressure water-spraying systems are provided, in view of the serious loss of stability which could arise due to large quantities of water accumulating on the deck or decks during the operation of the fixed pressure water-spraying system, the following arrangements shall be provided:

.1 in passenger ships:

.1.1 in the spaces above the bulkhead deck, scuppers shall be fitted so as to ensure that such water is rapidly discharged directly overboard, [to the satisfaction of the Administration,] taking into account the guidelines developed by the Organization*;

.1.2.1 in ro-ro passenger ships discharge valves for scuppers, fitted with positive means of closing operable from a position above the bulkhead deck in accordance with the requirements of the International Convention on Load Lines in force, shall be kept open while the ships are at sea;

.1.2.2 any operation of valves referred to in paragraph 6.1.4.1.2.1 shall be recorded in the log-book;

.1.3 in the spaces below the bulkhead deck, the Administration may require pumping and drainage facilities to be provided additional to the requirements of regulation II-1/35-1. In such case, the drainage system shall be sized to remove no less than 125% of the combined capacity of

both the water spraying system pumps and the required number of fire hose nozzles, [to the satisfaction of the Administration,] taking into account the guidelines developed by the Organization*. The drainage system valves shall be operable from outside the protected space at a position in the vicinity of the extinguishing system controls. Bilge wells shall be of sufficient holding capacity and shall be arranged at the side shell of the ship at a distance from each other of not more than 40 m in each watertight compartment;

.2 in cargo ships, the drainage and pumping arrangements shall be such as to prevent the build-up of free surfaces. In such case, the drainage system shall be sized to remove no less than 125% of the combined capacity of both the water spraying system pumps and the required number of fire hose nozzles, [to the satisfaction of the Administration,] taking into account the guidelines developed by the Organization*. The drainage system valves shall be operable from outside the protected space at a position in the vicinity of the extinguishing system controls. Bilge wells shall be of sufficient holding capacity and shall be arranged at the side shell of the ship at a distance from each other of not more than 40 m in each watertight compartment. If this is not possible the adverse effect upon stability of the added weight and free surface of water shall be taken into account to the extent deemed necessary by the Administration in its approval of the stability information.** Such information shall be included in the stability information supplied to the master as required by regulation II-1/5-1.

The requirement of this paragraph shall apply to ships constructed on or after [date of entry into force]. Ships constructed on or after 1 July 2002 and before [date of entry into force] shall comply with the previously applicable requirements of paragraph 6.1.4, as amended by resolution MSC.91(72).

6.1.5 In addition to provisions in paragraph 6.1.4 for closed vehicles and ro-ro spaces and special category spaces [measures shall be taken] to prevent the blockage of drainage arrangements, [to the satisfaction of the Administration,] taking into account the guidelines developed by the Organization*. Ships constructed before [date of entry into force] shall comply with the requirements of this paragraph by the first survey after [date of entry into force].

---

* Refer to the Guidelines for drainage systems in closed vehicle and ro-ro spaces and special category spaces (to be developed).

** Refer to the Recommendation on fixed fire-extinguishing systems for special category spaces adopted by the Organization by resolution A.123(V).

***

ANNEX 5

PROJECT PLAN FOR A SECOND TRIAL APPLICATION OF THE GUIDELINES FOR THE VERIFICATION OF COMPLIANCE WITH GBS USING THE IACS CSR FOR OIL TANKERS

A. Project objectives

The objective of the project is to conduct a second trial application of Tier III of the GBS for oil tankers and bulk carriers with the intention of validating the Tier III verification framework, identifying shortcomings and making proposals for improvement and implementation.

B. Terms of reference

The terms of reference for the project are as follows:

.1 further develop the Draft Guidelines for the verification of compliance with GBS, parts A and B, based on the report of the GBS Working Group (MSC 83/WP.5) and taking into account documents MSC 83/5/13, MSC 83/5/14 and MSC 83/5/15, along with detailed feedback provided by individual delegations (MSC 84/5), with a view towards:

.1 ensuring functional requirements are included in Tier II only;

.2 ensuring evaluation criteria allow for the consideration of alternatives and facilitate the development of new technology and concepts;

.3 ensuring consistency between the information and documentation requirements, evaluation criteria and functional requirements;

.4 utilizing periodic reporting of rule performance as appropriate; and

.5 ensuring the evaluation criteria provide the Group of Experts with sufficient flexibility to exercise judgment during the verification within the bounds of the functional requirements;

.2 conduct a trial of the refined GBS Tier III evaluation process using the IACS Common Structural Rules (CSR) for oil tankers;

.3 examine and evaluate:

.1 the verification framework of Tier III;

.2 the resources needed to conduct an appropriate verification; and

.3 the efficiency and effectiveness of the verification process;

.4 prepare and submit to MSC 84 an interim report of the Pilot Panel documenting the progress made; and

.5 prepare the final report of the Pilot Panel for MSC 85, including:

.1 draft Guidelines for the verification of compliance with GBS, parts A and B;

.2 if identified, potential modifications of Tiers I and II;

.3 an assessment of the resource implications of the verification process, considering both initial verification and the maintenance of verification; and

.4 recommendations to enhance the efficiency of the verification process, considering any possible flexibility between self-assessment combined with audit and in depth evaluation.

C. Project organization

1 Project Co-ordinator (PC): leads the pilot project; executes project plan; facilitates necessary meetings; assembles reports of the pilot project for submission to MSC.

2 Pilot Panel (PP): consists of no more than 15 members; refines draft Guidelines for the verification of compliance with GBS, reviews information provided by IACS to the Pilot Panel and evaluates the submitted information according to the terms of reference.

3 IACS: demonstrates, using CSR for oil tankers, how a classification society rule set could be verified as meeting Tiers I and II, considering the draft Guidelines for the verification of compliance with GBS (Tier III); responds to inquiries from the Pilot Panel; submits lessons learned and resource implications of the verification process for inclusion in the report to MSC 85.

D. Pilot Panel membership

1 The Pilot Panel, as established after MSC 82, will be reconvened for the second trial application. IMO Member States or international organization who nominated individual Pilot Panel members should notify the IMO Secretariat of the ability of their nominee to participate in Phase II by 15 November 2007.

2 In the event that individual Panel members are not able to participate in this Phase II effort, replacement members of the Pilot Panel (PP) will be determined as follows:

.1 IMO members and international organizations may nominate* suitable experts by 15 November 2007 and include a statement on individuals' qualifications and ability to meet project milestones (see timetable in section E).

.2 The MSC Chairman, in consultation with the Secretariat, will select the PP members and inform the selected members and the PC.

* Nominations should be sent to the attention of Mr. K. Sekimizu, Director Maritime Safety Division, and copied by e-mail to hhoppe@imo.org.

3 Nominated individuals should have adequate knowledge of rules and rule development and be able to correctly interpret the rules for correlation with relevant regulatory requirements and at least one of the following:

.1 ship design and construction;

.2 safety requirements;

.3 environmental protection requirements;

.4 ship operational efficiency; and

.5 survey, inspection and maintenance regimes.

E. Provisional schedule for the pilot project

Date	Who	Action
15 November 2007	Pilot Panel Members	Confirm availability for Phase II with Secretariat.
15 November 2007	Member States, NGOs, IGOs	Nominate replacement members for Pilot Panel.
1 December 2007	MSC Chairman, IMO Secretariat	Inform PC and PP of membership of PP.
1 December 2007	PC, PP	Begin refinement of Tier III based on working group report and documents submitted to MSC 83.
February 2008	PC, PP	Meeting to complete initial revision of Tier III.
Mid-February 2008	PC	Commence trial application. Provide revised Tier III to IACS.
March 2008	PC	Submit interim progress report to MSC 84.
April 2008	PC, PP, IACS	IACS presentation meeting, evaluation discussion and additional questions.
June 2008	PP, PC	Meeting to finalize trial application and prepare report to MSC 85.
Mid-August 2008	PC	Submit report to MSC 85.

F. Meetings

The meeting venues will be advised by the Project Co-ordinator. Each attendee of the meetings shall pay their individual costs. The IMO Secretariat is invited to attend the meetings.

***

ANNEX 6

RESOLUTION MSC.242(83)
(adopted on 12 October 2007)

USE OF THE LONG-RANGE IDENTIFICATION AND TRACKING INFORMATION FOR MARITIME SAFETY AND MARINE ENVIRONMENT PROTECTION PURPOSES

THE MARITIME SAFETY COMMITTEE,

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

RECALLING ALSO the provisions of regulation V/19-1 (the regulation) of the International Convention for the Safety of Life at Sea, 1974, as amended (the Convention) on the Long-range identification and tracking (LRIT) of ships and, in particular, that, as from 31 December 2008, ships shall transmit and Contracting Governments to the Convention (Contracting Governments) shall be able to receive, pursuant to the provisions of the regulation, LRIT information transmitted by ships,

RECALLING FURTHER that, at its seventy-ninth session, it had agreed that the purpose and scope of long-range identification and tracking should be extended to include safety and environmental protection applications,

ALSO RECALLING that regulation V/19-1.8.1 states that, subject to the provisions of regulations V/19-1.8.2 to V/19-1.11.2, Contracting Governments shall be able to receive LRIT information about ships, for security and other purposes as agreed by the Organization,

NOTING that the use of LRIT information for safety and marine environment protection purposes would provide significant added value through an improvement of the knowledge of ships positions and identity,

BEARING IN MIND that the conditions for the entry into force of regulation V/19-1 have been met and the regulation will enter into force on 1 January 2008,

HAVING CONSIDERED, at its eighty-third session, a proposal to allow the use of LRIT information for safety and marine environment protection purposes stating that the LRIT information specified in regulation V/19-1.5 was adequate in that respect and provided a significant added value for these objectives,

1. AGREES that Contracting Governments may request, receive and use, LRIT information for safety and marine environment protection purposes;

2. AGREES ALSO to reaffirm the present decisions within the framework of regulation V/19-1.8.1 once regulation V/19-1 had entered into force;

3. INVITES the Marine Environment Protection Committee to note this decision.

***

ANNEX 7

RESOLUTION MSC.243(83)
(adopted on 12 October 2007)

ESTABLISHMENT OF INTERNATIONAL LRIT DATA EXCHANGE ON AN INTERIM BASIS

THE MARITIME SAFETY COMMITTEE,

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

RECALLING ALSO the provisions of regulation V/19-1 (the regulation) of the International Convention for the Safety of Life at Sea, 1974, as amended (the Convention) on the Long-range identification and tracking (LRIT) of ships and, in particular, that, as from 31 December 2008, ships shall transmit and Contracting Governments to the Convention (Contracting Governments) shall be able to receive, pursuant to the provisions of the regulation, LRIT information transmitted by ships,

BEARING IN MIND that the conditions for the entry into force of regulation V/19-1 have been met and the regulation will enter into force on 1 January 2008,

RECALLING FURTHER the Performance standards and functional requirements on long-range identification and tracking of ships (the Performance standards) adopted by resolution MSC.210(81), in particular, section 10 on the International LRIT Data Exchange,

ALSO RECALLING the Arrangements for the timely establishment of the LRIT system adopted by resolution MSC.211(81) and, in particular, that the International LRIT Data Centre and the International LRIT Data Exchange should commence trials and testing of the LRIT system not later than 1 July 2008,

MINDFUL of the key and pivotal role of the International LRIT Data Exchange in the LRIT system architecture,

DESIRING to put the necessary arrangements in place so as to ensure that the LRIT system becomes fully operational, as planned, on 31 December 2008,

NOTING that the proposal for the establishment of the International LRIT Data Centre and the International LRIT Data Exchange which was presented for consideration did not find, during its eighty-third session, favour amongst the Contracting Governments,

HAVING CONSIDERED, at its eighty-third session, as a result of the developments, a contingency offer from the United States in relation to the establishment and operation of the International LRIT Data Exchange on an interim basis and until such time the Committee would be able to make the necessary permanent arrangements,

1. RECOGNIZES (in view of the fact that the Contracting Governments have accepted the offer of the United States to host, build and operate, on an interim and temporary basis the International LRIT Data Exchange) pursuant to paragraph 10.1 of the Performance standards the aforesaid exchange as the International LRIT Data Exchange referred to in the Performance standards subject to the terms and conditions set out in the Annex to the present resolution;

2. AGREES that, bearing in mind that the contingency offer from the United States is only an interim arrangement and a permanent solution should be found for the International LRIT Data Exchange as soon as possible (within two years as from 1 January 2008 subject to a further review by the Committee), it will start, no later than at its eighty-fourth session, arrangements for seeking a solution for the establishment and operation of the International LRIT Data Exchange on a permanent basis;

3. REQUESTS the Secretariat to prepare, following any necessary consultations with the United States, a draft resolution on the establishment of an International LRIT Data Exchange on an interim basis, within the framework of regulation V/19-1.14, for consideration and adoption by the Committee at its eighty-fourth session.

ANNEX

ESTABLISHMENT OF INTERNATIONAL LRIT DATA EXCHANGE ON AN INTERIM BASIS

The International LRIT Data Exchange should be established and operated by the United States under the following conditions:

1 The International LRIT Data Exchange should comply with the salient aspects of:

(1) regulation V/19-1;

(2) the Performance standards;

(3) the technical standards and specifications approved by the Committee;

(4) the criteria for the location of the International LRIT Data Centre and the International LRIT Data Exchange; and

(5) any guidance in relation to financial and operational matters issued by the Committee.

2 The International LRIT Data Exchange would be provided by the United States at their own expense and, in this respect, the United States has clarified that its present intention was that consistent with their domestic laws and procurement regulations, the capital, operating and maintenance costs for the interim International LRIT Data Exchange would be borne by the United States. Their intention was that none of the LRIT Data Centres and none of the Contracting Governments would be required to make any payment to the United States for the services provided by the International LRIT Data Exchange.

3 The United States, while not withdrawing their reservation, during the eighty-second session of the Committee, with respect to the decision of Committee in relation to the appointment of the International Mobile Satellite Organization as the LRIT Co-ordinator, will co-operate fully and will meet all its obligations vis-à-vis IMSO as LRIT Co-ordinator in respect of participation of IMSO in the initial developmental testing and in connection with the audit of the performance of the International LRIT Data Exchange within the framework established by regulation V/19-1 and section 14 of the Performance standards.

4 The Contracting Governments agree that the United States does not assume any form of liability in case of any technical failure of the International LRIT Data Exchange. However, the LRIT information should be secured and not be accessible.

***

ANNEX 8

DRAFT AMENDMENTS TO SOLAS REGULATIONS II-2/10 AND II-2/19.4

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

Regulation 10 – Fire fighting

1 The following new paragraph 4.1.5 is added after the existing paragraph 4.1.4:

"4.1.5 By the first scheduled dry-docking after [1 July 2009], fixed carbon dioxide fire-extinguishing systems for the protection of machinery spaces and cargo pump-rooms on all ships shall comply with the provisions of paragraph 2.2.2 of chapter 5 of the Fire Safety Systems Code."

Regulation 19 – Carriage of dangerous goods

2 In paragraph 4, the words ", as defined in regulation VII/2," are deleted.

***

ANNEX 9

DRAFT AMENDMENTS TO THE GUIDELINES ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF BULK CARRIERS AND OIL TANKERS (RESOLUTION A.744(18), AS AMENDED)

Contents

1 After the existing title of "ANNEX A" the following new title is inserted:

"**Part A**

GUIDELINES ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF BULK CARRIERS HAVING SINGLE-SIDE SKIN CONSTRUCTION"

2 After the existing list of contents for "ANNEX A", the following is inserted:

"**Part B**

GUIDELINES ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF BULK CARRIERS HAVING DOUBLE-SIDE SKIN CONSTRUCTION

Annex 7 Condition evaluation report

Annex 8 Recommended procedures for thickness measurements

Annex 9 Guidelines for technical assessment in conjunction with planning for enhanced surveys of bulk carriers relevant survey

Annex 10 Requirements for extent of thickness measurements at those areas of substantial corrosion of bulk carriers with double-side skin construction within the cargo length area

Annex 11 Strength of cargo hatch cover securing arrangements for bulk carriers

Annex 12 Procedural requirements for thickness measurements"

ANNEX A

GUIDELINES ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF BULK CARRIERS

3 After the above title, the following is inserted:

"**Part A**

GUIDELINES ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF BULK CARRIERS HAVING SINGLE-SIDE SKIN CONSTRUCTION"

1.1 Application

4 The existing text of paragraph 1.1.1 is replaced by the following:

"1.1.1 The Guidelines should apply to all self-propelled bulk carriers of 500 gross tonnage and above having single-side skin construction. Where a bulk carrier has a combination of single- and double-side skin construction, the relevant requirements of parts A and B should apply to that construction, as applicable."

5 The following new part B is inserted after part A:

"**Part B**

GUIDELINES ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF BULK CARRIERS HAVING DOUBLE-SIDE SKIN CONSTRUCTION

1 General

1.1 Application*

1.1.1 The Guidelines should apply to all self-propelled bulk carriers of 500 gross tonnage and above having double-side skin construction. Where a bulk carrier has a combination of single- and double-side skin construction, the relevant requirements of parts A and B should apply to that construction, as applicable.

1.1.2 The Guidelines should apply to surveys of hull structure and piping systems in way of cargo holds, cofferdams, pipe tunnels, void spaces within the cargo length area and all ballast tanks. The surveys should be carried out during the surveys prescribed by regulation I/10 of the Convention.

1.1.3 The Guidelines contain the extent of examination, thickness measurements and tank testing. The survey should be extended when substantial corrosion and/or structural defects are found and include additional close-up survey when necessary.

1.2 Definitions

1.2.1 *Bulk carrier* is a ship which is constructed generally with single deck, topside tanks and hopper side tanks in cargo spaces, and is intended primarily to carry dry cargo in bulk and includes such types as ore carriers and combination carriers.**

1.2.2 *Ballast tank* is a tank which is used for water ballast and includes side ballast tanks, ballast double bottom spaces, topside tanks, hopper side tanks and peak tanks. A double-side tank should be considered, for survey purposes, as a separate tank even if it is in connection to either the topside tank or the hopper side tank.

1.2.3 *Spaces* are separate compartments including holds and tanks.

1.2.4 *Overall survey* is a survey intended to report on the overall condition of the hull structure and determine the extent of additional close-up surveys.

1.2.5 *Close-up survey* is a survey where the details of structural components are within the close visual inspection range of the surveyor, i.e., preferably within reach of hand.

---

* The intention of these Guidelines is to ensure that an appropriate level of review of plans and documents is conducted and consistency in application is attained. Such evaluation of survey reports, survey programmes, planning documents, etc., should be carried out at the managerial level of the Administration or organization recognized by the Administration.

** For combination carriers, additional requirements are specified in the Guidelines on the enhanced programme of inspections during surveys for oil tankers, set out in Annex B.

1.2.6 *Transverse section* includes all longitudinal members such as plating, longitudinals and girders at the deck, sides, bottom, inner bottom, hopper sides, inner sides, top wing inner sides and longitudinal bulkheads.

1.2.7 *Representative spaces* are those which are expected to reflect the condition of other spaces of similar type and service and with similar corrosion prevention systems. When selecting representative spaces, account should be taken of the service and repair history on board and identifiable critical and/or suspect areas.

1.2.8 *Suspect areas* are locations showing substantial corrosion and/or are considered by the surveyor to be prone to rapid wastage.

1.2.9 *Substantial corrosion* is an extent of corrosion such that assessment of corrosion pattern indicates a wastage in excess of 75% of allowable margins, but within acceptable limits.

1.2.10 A *corrosion prevention system* is normally considered a full hard coating.

Protective coating should usually be epoxy coating or equivalent. Other coating systems may be considered acceptable as alternatives provided that they are applied and maintained in compliance with the manufacturer's specifications.

Where soft coatings have been applied, safe access should be provided for the surveyor to verify the effectiveness of the coating and to carry out an assessment of the conditions of internal structures which may include spot removal of the coating. When safe access cannot be provided, the soft coating should be removed.

1.2.11 *Coating condition* is defined as follows:

GOOD condition with only minor spot rusting;

FAIR condition with local breakdown of coating at edges of stiffeners and weld connections and/or light rusting over 20% or more of areas under consideration, but less than as defined for POOR condition;

POOR condition with general breakdown of coating over 20% or more of areas or hard scale at 10% or more of areas under consideration.

1.2.12 *Critical structural areas* are locations which have been identified from calculations to require monitoring or from the service history of the subject ship or from similar or sister ships to be sensitive to cracking, buckling or corrosion which would impair the structural integrity of the ship.

1.2.13 *Cargo length area* is that part of the ship which includes all cargo holds and adjacent areas including fuel tanks, cofferdams, ballast tanks and void spaces.

1.2.14 *Intermediate survey* is a survey carried out either at the second or third annual survey or between these surveys.

1.2.15 A *prompt and thorough repair* is a permanent repair completed at the time of survey to the satisfaction of the surveyor, therein removing the need for the imposition of any associated condition of classification or recommendation.

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

1.2.17 *Specially considered* means sufficient close-up inspection and thickness measurements are taken to confirm the actual average condition of the structure under coating.

1.3 Repairs

1.3.1 Any damage in association with wastage over the allowable limits (including buckling, grooving, detachment or fracture), or extensive areas of wastage over the allowable limits, which affects or, in the opinion of the Administration, will affect the ship's structural, watertight or weathertight integrity, should be promptly and thoroughly repaired. Areas which should be considered include:

.1 side shell frames, their end attachments or adjacent shell plating;

.2 deck structure and deck plating;

.3 bottom structure and bottom plating;

.4 watertight or oiltight bulkheads; and

.5 hatch covers or hatch coamings.

Where adequate repair facilities are not available, the Administration may allow the ship to proceed directly to a repair facility. This may require discharging the cargo and/or temporary repairs for the intended voyage.

1.3.2 Additionally, when a survey results in the identification of corrosion or structural defects, either of which, in the opinion of the Administration, will impair the ship's fitness for continued service, remedial measures should be implemented before the ship continues in service.

1.4 Surveyors

For bulk carriers of 20,000 tons deadweight and above, two surveyors should jointly carry out the first scheduled renewal survey after the bulk carrier passes 10 years of age, and all subsequent renewal surveys and intermediate surveys. If the surveys are carried out by a recognized organization, the surveyors should be exclusively employed by such recognized organizations.

2 Renewal survey

2.1 General

2.1.1 The renewal survey may be commenced at the fourth annual survey and be progressed during the succeeding year with a view to completion by the fifth anniversary date.

2.1.2 As part of the preparation for the renewal survey, the survey programme should be dealt with in advance of the survey. The thickness measurement should not be held before the fourth annual survey.

2.1.3 The survey should include, in addition to the requirements of the annual survey, examination, tests and checks of sufficient extent to ensure that the hull and related piping is in a satisfactory condition and is fit for its intended purpose for the new period of validity of the Cargo Ship Safety Construction Certificate, subject to proper maintenance and operation and to renewal surveys being carried out.

2.1.4 All cargo holds, ballast tanks, including double bottom and double-side tanks, pipe tunnels, cofferdams and void spaces bounding cargo holds, decks and outer hull should be examined, and this examination should be supplemented by thickness measurement and testing, as required by 2.6 and 2.7, to ensure that the structural integrity remains effective. The examination should be sufficient to discover substantial corrosion, significant deformation, fractures, damages or other structural deterioration.

2.1.5 All piping systems within the above spaces should be examined and operationally tested under working conditions to ensure that the condition remains satisfactory.

2.1.6 The survey extent of ballast tanks converted to void spaces should be specially considered in relation to the requirements for ballast tanks.

2.2 Dry-dock survey

2.2.1 A survey in dry dock should be a part of the renewal survey. There should be a minimum of two inspections of the outside of the ship's bottom during the five-year period of the certificate. In all cases, the maximum interval between bottom inspections should not exceed 36 months.

2.2.2 For ships of 15 years of age and over, inspection of the outside of the ship's bottom should be carried out with the ship in dry dock. For ships of less than 15 years of age, alternate inspections of the ship's bottom not conducted in conjunction with the renewal survey may be carried out with the ship afloat. Inspection of the ship afloat should only be carried out when the conditions are satisfactory and the proper equipment and suitably qualified staff are available.

2.2.3 If a survey in dry-dock is not completed in conjunction with the enhanced survey during renewal survey or if the 36 month maximum interval referred to in 2.2.1 is not complied with, the Cargo Ship Safety Construction Certificate should cease to be valid until a survey in dry-dock is completed.

2.3 Space protection

Where provided, the condition of the corrosion prevention system of ballast tanks should be examined. For ballast tanks, excluding double bottom tanks, where a coating is found in POOR condition as defined in 1.2.11, and it is not renewed, or where a soft coating has been applied, or where a coating has not been applied, the tanks in question should be examined at annual intervals. When such breakdown of coating is found in ballast double bottom tanks, or where a soft coating has been applied or where a coating has not been applied, the tanks in question may be examined at annual intervals. When considered necessary by the surveyor, or where extensive corrosion exists, thickness measurement should be carried out. Where a protective coating is provided in cargo holds and is found in good condition, the extent of close-up surveys and thickness measurements may be specially considered.

2.4 Hatch covers and coamings

2.4.1 A thorough inspection of the items listed in 3.3 should be carried out.

2.4.2 Checking of the satisfactory operation of all mechanically operated hatch covers should be made, including:

.1 stowage and securing in open condition;

.2 proper fit and efficiency of sealing in closed condition;

.3 operational testing of hydraulic and power components, wires, chains and link drives.

2.4.3 The effectiveness of sealing arrangements of all hatch covers by hose testing or equivalent should be checked.

2.4.4 Thickness measurement of the hatch cover and coaming plating and stiffeners should be carried out as given in annex 2.

2.5 Extent of overall and close-up surveys

2.5.1 An overall survey of all spaces excluding fuel oil tanks should be carried out at the renewal survey. Fuel oil tanks in way of cargo holds should be sufficiently examined to ensure that their condition is satisfactory.

2.5.2 Each renewal survey should include a close-up examination of sufficient extent to establish the condition of the cargo holds and ballast tanks as indicated in annex 1.

2.6 Extent of thickness measurements

2.6.1 The requirements for thickness measurements at the renewal survey are given in annex 2.

2.6.2 Representative thickness measurements to determine both general and local levels of corrosion in the transverse web frames in all water ballast tanks should be carried out. Thickness measurements should also be carried out to determine the corrosion levels on

the transverse bulkhead plating. The thickness measurements may be dispensed with provided the surveyor is satisfied by the close-up examination that there is no structural diminution, and the coating where applied remains efficient.

2.6.3 The surveyor may extend the thickness measurements as deemed necessary. Provisions for extended measurements for areas with substantial corrosion as defined in 1.2.9 are given in annex 10.

2.6.4 For areas in spaces where coatings are found to be in GOOD condition as defined in 1.2.11, the extent of thickness measurements according to annex 2 may be specially considered by the Administration. Where a protective coating is provided in cargo holds and is found in good condition, the extent of close-up surveys and thickness measurements may be specially considered.

2.6.5 Transverse sections should be chosen where the largest reductions are suspected to occur or are revealed from deck plating measurements.

2.7 Extent of tank pressure testing

2.7.1 All boundaries of ballast tanks, deep tanks and cargo holds used for ballast within the cargo hold length should be pressure tested. Representative tanks for fresh water, fuel oil and lubrication oil should also be pressure tested.

2.7.2 Generally, the hydrostatic pressure should correspond to a water level to the top of hatches for ballast/cargo holds, or top of air pipes for ballast tanks or fuel tanks.

3 Annual survey

3.1 General

The annual survey should consist of an examination for the purpose of ensuring, as far as practicable, that the hull hatch covers, coamings and piping are maintained in a satisfactory condition and should take into account the service history, condition and extent of the corrosion prevention system of ballast tanks and areas identified in the survey report file.

3.2 Examination of the hull

3.2.1 Examination of the hull plating and its closing appliances should be carried out as far as can be seen.

3.2.2 Examination of watertight penetrations should be carried out as far as practicable.

3.3 Examination of hatch covers and coamings

3.3.1 It should be confirmed that no unapproved changes have been made to the hatch covers, hatch coamings and their securing and sealing devices since the last survey.

3.3.2 A thorough survey of cargo hatch covers and coamings is only possible by examination in the open as well as closed positions and should include verification of proper opening and closing operation. As a result, at least the hatch covers sets within the

forward 25% of the ship's length and at least one additional set, such that all the sets on the ship are assessed at least once in every 5-year period, should be surveyed open, closed and in operation to the full extent in each direction at each annual survey, including:

.1 stowage and securing in open condition;

.2 proper fit and efficiency of sealing in closed condition; and

.3 operational testing of hydraulic and power components, wires, chains and link drives.

The closing of the covers should include the fastening of all peripheral, and cross joint cleats or other securing devices. Particular attention should be paid to the condition of hatch covers in the forward 25% of the ship's length, where sea loads are normally greatest.

3.3.3 If there are indications of difficulty in operating and securing hatch covers, additional sets above those required by 3.3.2, at the discretion of the surveyor, should be tested in operation.

3.3.4 Where the cargo hatch securing system does not function properly, repairs should be carried out under the supervision of the Administration. Where hatch covers or coamings undergo substantial repairs, the strength of securing devices should be upgraded to comply with annex 13.

3.3.5 For each cargo hatch cover set, at each annual survey, the following items should be surveyed:

.1 cover panels, including side plates, and stiffener attachments that may be accessible in the open position by close-up survey (for corrosion, cracks, deformation);

.2 sealing arrangements of perimeter and cross joints (gaskets for condition and permanent deformation, flexible seals on combination carriers, gasket lips, compression bars, drainage channels and non-return valves);

.3 clamping devices, retaining bars, cleating (for wastage, adjustment, and condition of rubber components);

.4 closed cover locating devices (for distortion and attachment);

.5 chain or rope pulleys;

.6 guides;

.7 guide rails and track wheels;

.8 stoppers;

.9 wires, chains, tensioners and gypsies;

.10 hydraulic system, electrical safety devices and interlocks; and

.11 end and interpanel hinges, pins and stools where fitted.

3.3.6 At each hatchway, at each annual survey, the coamings, with plating, stiffeners and brackets should be checked for corrosion, cracks and deformation, especially of the coaming tops.

3.3.7 Where considered necessary, the effectiveness of sealing arrangements may be proved by hose or chalk testing supplemented by dimensional measurements of seal compressing components.

3.3.8 Where portable covers, wooden or steel pontoons are fitted, the satisfactory condition of the following should be confirmed:

.1 wooden covers and portable beams, carriers or sockets for the portable beam, and their securing devices;

.2 steel pontoons, including close-up survey of hatch cover plating;

.3 tarpaulins;

.4 cleats, battens and wedges;

.5 hatch securing bars and their securing devices;

.6 loading pads/bars and the side plate edge;

.7 guide plates and chocks;

.8 compression bars, drainage channels and drain pipes (if any).

3.4 Examination of cargo holds

3.4.1 For bulk carriers over 10 years of age, the following should be carried out:

.1 overall survey of two selected cargo holds. Where a protective coating is provided in cargo holds and is found in GOOD condition, the extent of close-up surveys and thickness measurements may be specially considered; and

.2 when considered necessary by the surveyor, thickness measurement should be carried out. If the results of these thickness measurements indicate that substantial corrosion is found, the extent of thickness measurements should be increased in accordance with annex 10.

3.4.2 For bulk carriers over 15 years of age, the following should be carried out:

.1 overall survey of all cargo holds. Where a protective coating is provided in cargo holds and is found in GOOD condition, the extent of close-up surveys and thickness measurements may be specially considered; and

.2 when considered necessary by the surveyor, thickness measurement should be carried out. If the results of these thickness measurements indicate that substantial corrosion is found, the extent of thickness measurements should be increased in accordance with annex 10.

3.4.3 All piping and penetrations in cargo holds, including overboard piping, should be examined for bulk carriers over 10 years of age.

3.5 Examination of ballast tanks

Examination of ballast tanks should be carried out when required as a consequence of the results of the renewal survey and intermediate survey. When considered necessary by the surveyor, thickness measurement should be carried out. If the results of these thickness measurements indicate that substantial corrosion is found, the extent of thickness measurements should be increased in accordance with annex 10.

4 Intermediate survey

4.1 General

4.1.1 Notwithstanding the provisions of 1.1.2, items that are additional to the requirements of the annual survey may be surveyed either at the second or third annual survey or between these surveys.

4.1.2 The extent of survey is dependent upon the age of the ship as specified in 4.2, 4.3 and 4.4.

4.2 Bulk carriers 5 to 10 years of age

4.2.1 Ballast tanks

4.2.1.1 For spaces used for salt water ballast, an overall survey of representative spaces selected by the surveyor should be carried out. If such inspections reveal no visible structural defects, the examination may be limited to a verification that the protective coating remains efficient.

4.2.1.2 Where POOR coating condition, corrosion or other defects are found in salt water ballast spaces or where protective coating was not applied from the time of construction, the examination should be extended to other ballast spaces of the same type.

4.2.1.3 In salt water ballast spaces other than double bottom tanks, where a protective coating is found in POOR condition and it is not renewed, or where soft coating has been applied, or where a protective coating was not applied from the time of construction, the tanks in question should be examined and thickness measurements carried out as considered necessary at annual intervals. When such breakdown of coating is found in salt water ballast double bottom tanks, where a soft coating has been applied, or where a coating has not been applied, the tanks in question should be examined at annual intervals. When considered necessary by the surveyor, or where extensive corrosion exists, thickness measurements should be carried out.

4.2.1.4 In addition to the above requirements, areas found to be suspect areas at the previous renewal survey should be overall and close-up surveyed.

4.2.2 Cargo holds

4.2.2.1 An overall survey of all cargo holds should be carried out.

4.2.2.2 Where considered necessary by the surveyor as a result of the overall survey of any one cargo hold as described in 4.2.2.1, the survey should be extended to include a close-up survey of that cargo hold as well as a close-up survey of sufficient extent of those areas of the structure as deemed necessary.

4.2.3 Extent of thickness measurement

4.2.3.1 Thickness measurement should be carried out to an extent sufficient to determine both general and local corrosion levels at areas subject to close-up survey as described in 4.2.2.1. The minimum requirement for thickness measurements at the intermediate survey are areas found to be suspect areas at the previous renewal survey.

4.2.3.2 Where substantial corrosion is found, the extent of thickness measurements should be increased in accordance with the requirements of annex 10.

4.2.3.3 The thickness measurement may be dispensed with provided the surveyor is satisfied by the close-up survey, that there is no structural diminution and the protective coating, where applied, remains effective.

4.3 Bulk carriers 10 to 15 years of age

4.3.1 Ballast tanks

4.3.1.1 For bulk carriers:

All salt water ballast tanks should be examined. If such inspections reveal no visible structural defects, the examination may be limited to a verification that the protective coating remains efficient.

4.3.1.2 For ore carriers:

.1 all web frame rings – in one ballast wing tank;

.2 one deck transverse – in each of the remaining ballast wing tanks;

.3 both transverse bulkheads – in one ballast wing tank; and

.4 one transverse bulkhead – in each remaining ballast wing tank.

4.3.1.3 In addition, the requirements described in 4.2.1.2 to 4.2.1.4 apply.

4.3.2 Cargo holds

4.3.2.1 An overall survey of all cargo holds should be carried out.

4.3.2.2 Where considered necessary by the surveyor as a result of the overall survey of any one cargo hold as described in 4.3.2.1, the survey should be extended to include a close-up survey of that cargo hold as well as a close-up survey of sufficient extent of those areas of the structure as deemed necessary.

4.3.3 Extent of thickness measurement

4.3.3.1 Thickness measurement should be carried out to an extent sufficient to determine both general and local corrosion levels at areas subject to close-up survey as described in 4.3.2.1. The minimum requirement for thickness measurements at the intermediate survey are areas found to be suspect areas at the previous renewal survey.

4.3.3.2 In addition, the requirements described in 4.2.3.2 and 4.2.3.3 apply.

4.4 Bulk carriers exceeding 15 years of age

4.4.1 The requirements of the intermediate survey should be to the same extent as the previous renewal survey required in 2 and 5.1. However, pressure testing of tanks and cargo holds used for ballast is not required unless deemed necessary by the attending surveyor.

4.4.2 In application of 4.4.1, the intermediate survey may be commenced at the second annual survey and be progressed during the succeeding year with a view to completion at the third annual survey in lieu of the application of 2.1.1.

5 Preparations for survey

5.1 Survey programme

5.1.1 A specific survey programme should be worked out in advance of the renewal survey by the owner in co-operation with the Administration. The survey programme should be in a written format based on the information in annex 4A. The survey should not commence until the survey programme has been agreed.

5.1.2 Prior to the development of the survey programme, the survey planning questionnaire should be completed by the owner based on the information set out in annex 4B, and forwarded to the Administration.

5.1.3 In developing the survey programme, the following documentation should be collected and consulted with a view to selecting tanks, holds, areas and structural elements to be examined:

.1 survey status and basic ship information;

.2 documentation on board, as described in 7.2 and 7.3;

.3 main structural plans (scantlings drawings), including information regarding use of high-tensile steels (HTS);

.4 relevant previous survey and inspection reports from both the classification society and the owner;

.5 information regarding the use of ship's holds and tanks, typical cargoes and other relevant data;

.6 information regarding corrosion protection level on the new building; and

.7 information regarding the relevant maintenance level during operation.

5.1.4 The submitted survey programme should account for, and comply, as a minimum, with the provisions of annexes 1 and 2 and paragraph 2.7 for close-up survey, thickness measurement and tank testing, respectively, and should include relevant information, including at least:

.1 basic ship information and particulars;

.2 main structural plans (scantling drawings), including information regarding use of high-tensile steels (HTS);

.3 plan of holds and tanks;

.4 list of holds and tanks with information on use, protection and condition of coating;

.5 conditions for survey (e.g., information regarding tank cleaning, gas-freeing, ventilation, lighting, etc.);

.6 provisions and methods for access to structures;

.7 equipment for surveys;

.8 nomination of holds and tanks and areas for close-up survey (per annex 1);

.9 nomination of sections for thickness measurement (per annex 2);

.10 nomination of tanks for testing (per 2.7); and

.11 damage experience related to ship in question.

5.1.5 The Administration should advise the owner of the maximum acceptable structural corrosion diminution levels applicable to the ship.

5.1.6 Use may also be made of the Guidelines for technical assessment in conjunction with the planning of enhanced surveys for bulk carriers, contained in annex 9. These Guidelines are a recommended tool which may be invoked at the discretion of the Administration, when considered necessary and appropriate, in conjunction with the preparation of the required survey programme.

5.2 Conditions for survey

5.2.1 The owner should provide the necessary facilities for a safe execution of the survey.

5.2.2 In order to enable the attending surveyors to carry out the survey, provisions for proper and safe access, should be agreed between the owner and the Administration.

5.2.3 Details of the means of access should be provided in the survey planning questionnaire.

5.2.4 In cases where the provisions of safety and required access are judged by the attending surveyors not to be adequate, the survey of the spaces involved should not proceed.

5.2.5 Cargo holds, tanks and spaces should be safe for access. Cargo holds, tanks and spaces should be gas free and properly ventilated. Prior to entering a tank, void or enclosed space, it should be verified that the atmosphere in the tank is free from hazardous gas and contains sufficient oxygen.

5.2.6 Cargo holds, tanks and spaces should be sufficiently clean and free from water, scale, dirt, oil residues, sediments, etc., to reveal corrosion, deformation, fractures, damages or other structural deterioration as well as the condition of the coating. In particular, this applies to areas which are subject to thickness measurement.

5.2.7 Sufficient illumination should be provided to reveal corrosion, deformation, fractures, damages or other structural deterioration as well as the condition of the coating.

5.2.8 The surveyor(s) should always be accompanied by, at least, one responsible person, assigned by the owner, experienced in tank and enclosed spaces inspection. In addition, a back-up team of at least two experienced persons should be stationed at the hatch opening of the tank or space that is being surveyed. The back-up team should continuously observe the work in the tank or space and should keep life-saving and evacuation equipment ready for use.

5.2.9 A communication system should be arranged between the survey party in the cargo hold, tank or space being examined, the responsible officer on deck and, as the case may be, the navigation bridge. The communication arrangements should be maintained throughout the survey.

5.3 Access to structures*

5.3.1 For overall survey, means should be provided to enable the surveyor to examine the structure in a safe and practical way.

5.3.2 For close-up survey, one or more of the following means for access, acceptable to the surveyor, should be provided:

* Refer to the Guidelines on the means of access to structures for inspection and maintenance of oil tankers and bulk carriers (MSC/Circ.686).

.1 permanent staging and passages through structures;

.2 temporary staging and passages through structures;

.3 lifts and moveable platforms;

.4 portable ladders;

.5 other equivalent means.

5.4 Equipment for survey

5.4.1 Thickness measurements should normally be carried out by means of ultrasonic test equipment. The accuracy of the equipment should be proven to the surveyor as required.

5.4.2 One or more of the following fracture detection procedures may be required if deemed necessary by the surveyor:

.1 radiographic equipment;

.2 ultrasonic equipment;

.3 magnetic particle equipment;

.4 dye penetrant;

.5 other equivalent means.

5.4.3 Explosimeter, oxygen-meter, breathing apparatus, lifelines, riding belts with rope and hook and whistles together with instructions and guidance on their use should be made available during the survey. A safety check-list should be provided.

5.4.4 Adequate and safe lighting should be provided for the safe and efficient conduct of the survey.

5.4.5 Adequate protective clothing should be made available and used (e.g., safety helmet, gloves, safety shoes, etc.) during the survey.

5.5 Survey at sea or at anchorage

5.5.1 Survey at sea or at anchorage may be accepted provided the surveyor is given the necessary assistance from the personnel on board. Necessary precautions and procedures for carrying out the survey should be in accordance with 5.1, 5.2, 5.3 and 5.4.

5.5.2 A communication system should be arranged between the survey party in the spaces and the responsible officer on deck.

5.5.3 When rafts or boats will be used for close-up survey, the following conditions should be observed:

.1 only rough duty, inflatable rafts or boats, having satisfactory residual buoyancy and stability even if one chamber is ruptured, should be used;

.2 the boat or raft should be tethered to the access ladder and an additional person should be stationed down the access ladder with a clear view of the boat or raft;

.3 appropriate lifejackets should be available for all participants;

.4 the surface of water in the tank or hold should be calm (under all foreseeable conditions the expected rise of water within the tank should not exceed 0.25 m) and the water level either stationary or falling. On no account should the level of the water be rising while the boat or raft is in use;

.5 the tank, hold or space should contain clean ballast water only. Even a thin sheen of oil on the water is not acceptable; and

.6 at no time should the water level be allowed to be within 1 m of the deepest under deck web face flat so that the survey team is not isolated from a direct escape route to the tank hatch. Filling to levels above the deck transverses should only be contemplated if a deck access manhole is fitted and open in the bay being examined, so that an escape route for the survey party is available at all times. Other effective means of escape to the deck may be considered.

5.5.4 Rafts or boats alone may be allowed for inspection of the under deck areas for tanks or spaces, if the depth of the webs is 1.5 m or less.

5.5.5 If the depth of the webs is more than 1.5 m, rafts or boats alone may be allowed only:

.1 when the coating of the under deck structure is in GOOD condition and there is no evidence of wastage; or

.2 if a permanent means of access is provided in each bay to allow safe entry and exit. This means of access should be direct from the deck via a vertical ladder with a small platform fitted approximately 2 m below the deck. Other effective means of escape to the deck may be considered.

If neither of the above conditions are met, then staging or other equivalent means should be provided for the survey of the under deck areas.

5.5.6 The use of rafts or boats alone in 5.5.4 and 5.5.5 does not preclude the use of boats or rafts to move about within a tank during a survey.

5.6 Survey planning meeting

5.6.1 The establishment of proper preparation and the close co-operation between the attending surveyor(s) and the owner's representatives onboard prior to and during the survey are an essential part in the safe and efficient conduct of the survey. During the survey on board safety meetings should be held regularly.

5.6.2 Prior to commencement of any part of the renewal and intermediate survey, a survey planning meeting should be held between the attending surveyor(s), the owner's representative in attendance, the thickness measurement company operator (as applicable) and the master of the ship for the purpose to ascertain that all the arrangements envisaged in the survey programme are in place, so as to ensure the safe and efficient conduct of the survey work to be carried out.

5.6.3 The following is an indicative list of items that should be addressed in the meeting:

.1 schedule of the ship (i.e., the voyage, docking and undocking manoeuvres, periods alongside, cargo and ballast operations, etc.);

.2 provisions and arrangements for thickness measurements (i.e., access, cleaning/de-scaling, illumination, ventilation, personal safety);

.3 extent of the thickness measurements;

.4 acceptance criteria (refer to the list of minimum thicknesses);

.5 extent of close-up survey and thickness measurement considering the coating condition and suspect areas/areas of substantial corrosion;

.6 execution of thickness measurements;

.7 taking representative readings in general and where uneven corrosion/pitting is found;

.8 mapping of areas of substantial corrosion; and

.9 communication between attending surveyor(s) the thickness measurement company operator(s) and owner's representative(s) concerning findings.

6 Documentation on board

6.1 General

6.1.1 The owner should obtain, supply and maintain on board the ship documentation as specified in 6.2 and 6.3, which should be readily available for the surveyor. The condition evaluation report referred to in 6.2 should include a translation into English.

6.1.2 The documentation should be kept on board for the lifetime of the ship.

6.2 Survey report file

6.2.1 A survey report file should be a part of the documentation on board consisting of:

.1 reports of structural surveys (annex 6);

.2 condition evaluation report (annex 7); and

.3 thickness measurement reports (annex 8).

6.2.2 The survey report file should be available also in the owner's and the Administration offices.

6.3 Supporting documents

6.3.1 The following additional documentation should be available on board:

.1 main structural plans of holds and ballast tanks;

.2 previous repair history;

.3 cargo and ballast history;

.4 inspections by ship's personnel with reference to:

.4.1 structural deterioration in general;

.4.2 leakages in bulkheads and piping;

.4.3 condition of coating or corrosion prevention system, if any. A guidance for reporting is shown in annex 3;

.5 survey programme as required by 5.1 until such time as the renewal survey has been completed,

and any other information that would help to identify critical structural areas and/or suspect areas requiring inspection.

6.4 Review of documentation on board

Prior to survey, the surveyor should examine the completeness of the documentation on board, and its contents as a basis for the survey.

7 Procedures for thickness measurements

7.1 General

7.1.1 The required thickness measurements, if not carried out by the recognized organization acting on behalf of the Administration, should be witnessed by a surveyor of the recognized organization. The surveyor should be on board to the extent necessary to control the process.

7.1.2 The thickness measurement company should be part of the survey planning meeting to be held prior to commencing the survey.

7.1.3 In all cases the extent of the thickness measurements should be sufficient as to represent the actual average condition.

7.1.4 Procedural requirements for thickness measurements are set out in annex 12.

7.2 Certification of thickness measurement company

The thickness measurements should be carried out by a qualified company certified by an organization recognized by the Administration according to principles stated in annex 5.

7.3 Reporting

7.3.1 A thickness measurement report should be prepared and submitted to the Administration. The report should give the location of measurements, the thickness measured as well as corresponding original thickness. Furthermore, the report should give the date when the measurements were carried out, type of measuring equipment, names of personnel and their qualifications and be signed by the operator. The thickness measurement report should follow the principles as specified in the recommended procedures for thickness measurements set out in annex 8.

7.3.2 The surveyor should verify and countersign the thickness measurement reports.

8 Reporting and evaluation of survey

8.1 Evaluation of survey report

8.1.1 The data and information on the structural condition of the ship collected during the survey should be evaluated for acceptability and continued structural integrity of the ship.

8.1.2 The analysis of data should be carried out and endorsed by the Administration and the conclusions of the analysis should form a part of the condition evaluation report.

8.2 Reporting

8.2.1 Principles for survey reporting are shown in annex 6.

8.2.2 When a survey is split between different survey stations, a report should be made for each portion of the survey. A list of items examined and/or tested (pressure testing, thickness measurements, etc.) and an indication of whether the item has been credited, should be made available to the next attending surveyor(s), prior to continuing or completing the survey.

8.2.3 A condition evaluation report of the survey and results should be issued to the owner as shown in annex 7 and placed on board the ship for reference at future surveys. The condition evaluation report should be endorsed by the Administration.

ANNEX 1

REQUIREMENTS FOR CLOSE-UP SURVEY AT RENEWAL SURVEYS

AGE ≤ 5 years	**5 < AGE ≤ 10 years**	**10 < AGE ≤ 15 years**	**AGE > 15 years**
1	**2**	**3**	**4**
One transverse web with associated plating and longitudinals in two representative water ballast tanks of each type. This is to include the foremost topside and double-side water ballast tanks on either side. (A) Two selected cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted. (C) All cargo hold hatch covers and coaming. (D)	One transverse web with associated plating and longitudinals as applicable in each water ballast tank. (A) Forward and aft transverse bulkhead including stiffening system in a transverse section including topside, hopper side and double-side ballast tanks. (A) 25% of ordinary transverse frames in the foremost double-side tanks. (B) One transverse bulkhead in each cargo hold, including internal structure of upper and lower stools, where fitted. (C) All cargo hold hatch covers and coamings. (D) All deck plating and under deck structures inside line of hatch openings between cargo hold hatches. (E)	All transverse webs with associated plating and longitudinals as applicable in each water ballast tank. (A) All transverse bulkheads including stiffening system in each water ballast tank. (A) 25% of ordinary transverse frames in the foremost double-side tanks. (B) All cargo hold transverse bulkheads including internal structure of upper and lower stools, where fitted. (C) All cargo hold hatch covers and coamings. (D) All deck plating and under deck structures inside line of hatch openings between cargo hold hatches. (E)	All transverse webs with associated plating and longitudinals as applicable in each water ballast tank. (A) All transverse bulkheads including stiffening system in each water ballast tank. (A) All ordinary transverse frames in all double-side tanks. (B) Areas (C) – (E) as for column 3

(A) Transverse web or watertight transverse bulkhead in topside, hopper side and double-side ballast tanks. In fore and aft peak tanks transverse web means a complete transverse web frame ring including adjacent structural members.
(B) Ordinary transverse frame in double-side tanks.
(C) Cargo hold transverse bulkheads, platings, stiffeners and girders.
(D) Cargo hold hatch covers and coamings.
(E) Deck plating and under deck structure inside line of hatch openings between cargo hold hatches.

***Note*:** Close-up survey of transverse bulkheads to be carried out at four levels:

Level (a) Immediately above the inner bottom and immediately above the line of gussets (if fitted) and shedders for ships without lower stool.

Level (b) Immediately above and below the lower stool shelf plate (for those ships fitted with lower stools), and immediately above the line of the shedder plates.

Level (c) About mid-height of the bulkhead.

Level (d) Immediately below the upper deck plating and immediately adjacent to the upper wing tank, and immediately below the upper stool shelf plate for those ships fitted with upper stools, or immediately below the topside tanks.

ANNEX 2

REQUIREMENTS FOR THICKNESS MEASUREMENTS AT RENEWAL SURVEYS

AGE ≤ 5 years	**5 < AGE ≤ 10 years**	**10 < AGE ≤ 15 years**	**AGE > 15 years**
1	**2**	**3**	**4**
1 Suspect areas	**1** Suspect areas **2** Within the cargo length area: two transverse sections of deck plating outside line of cargo hatch openings **3** Measurement, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to annex 1 **4** All cargo holds hatch covers and coamings (plating and stiffeners) **5** All deck plating inside line of openings between cargo hold hatches **6** Wind and water strakes in way of transverse sections considered under point 2 above	**1** Suspect areas **2** Within the cargo length area: .1 each deck plate outside line of cargo hatch openings .2 two transverse sections, one of which should be in the amidship area, outside line of cargo hatch openings **3** Measurement, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to annex 1 **4** All cargo hold hatch covers and coamings (plating and stiffeners) **5** All deck plating inside line of openings between cargo hold hatches **6** All wind and water strakes within the cargo length area **7** Selected wind and water strakes outside the cargo length area	**1** Suspect areas **2** Within the cargo length area: .1 each deck plate outside line of cargo hatch openings .2 three transverse sections, one of which should be in the amidship area, outside line of cargo hatch openings .3 each bottom plate **3** Points 3 to 7 referred to in column 3

ANNEX 3

OWNER'S INSPECTION REPORT

Structural condition

Ship's name: .....

OWNER'S INSPECTION REPORT - Structural condition

For tank/hold no.: .....

Grade of steel: deck: .....……..... side: .....
bottom: .....….. ..... longitudinal bulkhead: .....

Elements	Cracks	Buckles	Corrosion	Coating condition	Pitting	Modification/ Other repair
Deck:						
Bottom:						
Side:						
Side framing:						
Longitudinal bulkheads:						
Transverse bulkheads:						

Repairs carried out due to:

Thickness measurements carried out (dates):

Results in general:

Overdue surveys:

Outstanding conditions of class:

Comments:

Date of inspection: .....
Inspected by: .....
Signature: .....

ANNEX 4A

SURVEY PROGRAMME

Basic information and particulars

Name of ship:
IMO number:
Flag State:
Port of registry:
Gross tonnage:
Deadweight (metric tonnes):
Length between perpendiculars (m):
Shipbuilder:
Hull number:
Recognized organization (RO):
RO ship identity:
Date of delivery of the ship:
Owner:
Thickness measurement company:

1 Preamble

1.1 Scope

1.1.1 The present survey programme covers the minimum extent of overall surveys, close-up surveys, thickness measurements and pressure testing within the cargo length area, cargo holds, ballast tanks, including fore and aft peak tanks, required by the Guidelines.

1.1.2 The arrangements and safety aspects of the survey should be acceptable to the attending surveyor(s).

1.2 Documentation

All documents used in the development of the survey programme should be available onboard during the survey as required by section 6.

2 Arrangement of cargo holds, tanks and spaces

This section of the survey programme should provide information (either in the form of plans or text) on the arrangement of cargo holds, tanks and spaces that fall within the scope of the survey.

3 List of cargo holds, tanks and spaces with information on their use, extent of coatings and corrosion protection system

This section of the survey programme should indicate any changes relating to (and should update) the information on the use of the holds and tanks of the ship, the extent of coatings and the corrosion protective system provided in the Survey Planning Questionnaire.

4 Conditions for survey

This section of the survey programme should provide information on the conditions for survey, e.g., information regarding cargo hold and tank cleaning, gas freeing, ventilation, lighting, etc.

5 Provisions and method of access to structures

This section of the survey programme should indicate any changes relating to (and should update) the information on the provisions and methods of access to structures provided in the Survey Planning Questionnaire.

6 List of equipment for survey

This section of the survey programme should identify and list the equipment that will be made available for carrying out the survey and the required thickness measurements.

7 Survey requirements

7.1 Overall survey

This section of the survey programme should identify and list the spaces that should undergo an overall survey for this ship in accordance with 2.4.1 and 2.5.1.

7.2 Close-up survey

This section of the survey programme should identify and list the hull structures that should undergo a close-up survey for this ship in accordance with 2.5.2.

8 Identification of tanks for tank testing

This section of the survey programme should identify and list the cargo holds and tanks that should undergo tank testing for this ship in accordance with 2.7.

9 Identification of areas and sections for thickness measurements

This section of the survey programme should identify and list the areas and sections where thickness measurements should be taken in accordance with 2.6.1.

10 Minimum thickness of hull structures

This section of the survey programme should specify the minimum thickness for hull structures of this ship that are subject to survey, according to .1 or .2:

.1 ☐ Determined from the attached wastage allowance table and the original thickness to the hull structure plans of the ship;

.2 ☐ Given in the following table(s):

Area or location	**Original as-built thickness (mm)**	**Minimum thickness (mm)**	**Substantial corrosion thickness (mm)**
Deck			
Plating			
Longitudinals			
Longitudinal girders			
Cross deck plating			
Cross deck stiffeners			
Bottom			
Plating			
Longitudinals			
Longitudinal girders			
Inner bottom			
Plating			
Longitudinals			
Longitudinal girders			
Floors			
Ship side in way of topside tanks			
Plating			
Longitudinals			
Ship side in way of hopper side tanks			
Plating			
Longitudinals			
Ship side in way of double-side tanks (if applicable)			
Plating			
Longitudinals or ordinary transverse frames			
Longitudinal stringers			
Longitudinal bulkhead (if applicable)			
Plating			
Longitudinals (if applicable)			
Longitudinal girders (if applicable)			
Transverse bulkheads			
Plating			
Stiffeners (if applicable)			
Upper stool plating			
Upper stool stiffeners			
Lower stool plating			
Lower stool stiffeners			
Transverse web in topside tanks			
Plating			
Flanges			
Stiffeners			

Transverse web in hopper tanks			
Plating			
Flanges			
Stiffeners			
Transverse web in double-side tanks			
Plating			
Flanges			
Stiffeners			
Hatch covers			
Plating			
Stiffeners			
Hatch coamings			
Plating			
Stiffeners			

Note: The wastage allowance tables should be attached to the survey programme.

11 Thickness measurement company

This section of the survey programme should identify changes, if any, relating to the information on the thickness measurement company provided in the Survey Planning Questionnaire.

12 Damage experience related to the ship

This section of the survey programme should, using the tables provided below, provide details of the hull damages for at least the last three years in way of the cargo holds, ballast tanks and void spaces within the cargo length area. These damages are subject to survey.

Hull damages sorted by location for this ship

Cargo hold, tank or space number or area	**Possible cause, if known**	**Description of the damages**	**Location**	**Repair**	**Date of repair**

Hull damages for sister or similar ships (if available) in the case of design related damage

Cargo hold, tank or space number or area	Possible cause, if known	Description of the damages	Location	Repair	Date of repair

13 Areas identified with substantial corrosion from previous surveys

This section of the survey programme should identify and list the areas of substantial corrosion from previous surveys.

14 Critical structural areas and suspect areas

This section of the survey programme should identify and list the critical structural areas and the suspect areas, when such information is available.

15 Other relevant comments and information

This section of the survey programme should provide any other comments and information relevant to the survey.

Appendices

Appendix 1 – List of plans

The provisions of 5.1.4.2 require that the main structural plans of cargo holds and ballast tanks (scantling drawings), including information regarding the use of high-tensile steel (HTS), should be available. This appendix of the survey programme should identify and list the main structural plans which form part of the survey programme.

Appendix 2 – Survey Planning Questionnaire

The Survey Planning Questionnaire (annex 4B), which has been submitted by the owner, should be appended to the survey programme.

Appendix 3 – Other documentation

This part of the survey programme should identify and list any other documentation that forms part of the plan.

Prepared by the owner in co-operation with the Administration for compliance with 5.1.4.

Date: .... (name and signature of authorized owner's representative)

Date: .... (name and signature of authorized representative of the Administration)

ANNEX 4B

SURVEY PLANNING QUESTIONNAIRE

1 The following information will enable the owner, in co-operation with the Administration, to develop a Survey Plan complying with the requirements of the Guidelines. It is essential that the owner provides, when completing the present questionnaire, up-to-date information. The present questionnaire, when completed, should provide all information and material required by the Guidelines.

Particulars

Ship's name:
IMO number:
Flag State:
Port of registry:
Owner:
Recognized organization:
Gross tonnage:
Deadweight (metric tonnes):
Date of delivery:

Information on access provision for close-up surveys and thickness measurement

2 The owner should indicate, in the table below, the means of access to the structures subject to close-up survey and thickness measurement. A close-up survey is an examination where the details of structural components are within the close visual inspection range of the attending surveyor, i.e., preferably within reach of hand.

Hold/Tank No.	Structure	Temporary staging	Rafts	Ladders	Direct access	Other means (please specify)
F.P.	Fore peak					
A.P.	Aft peak					
Cargo holds	Hatch side coamings					
	Topside sloping plate					
	Upper stool plating					
	Cross deck					
	Double-side tank plating					
	Transverse bulkhead					
	Hopper tank platting					
	Lower stool					
	Tank top					
Topside tanks	Under deck structure					
	Side shell and structure					
	Sloping plate and structure					
	Webs and bulkheads					
Hopper tanks	Hopper sloping plate and structure					
	Side shell and structure					
	Bottom structure					
	Webs and bulkheads					
Double-side tanks	Side shell and structure					
	Inner skin and structure					
	Webs and bulkheads					
	Double bottom structure					
	Upper stool internal structure					
	Lower stool internal structure					
Wing tanks of double ore carriers	Under deck and structure					
	Side shell and structure					
	Side shell vertical web and structure					
	Longitudinal bulkhead and structure					
	Longitudinal bulkhead web and structure					
	Bottom plating and structure					
	Cross ties/stringers					

History of bulk cargoes of a corrosive nature (e.g., high-sulphur content)

Owner's inspections

3 Using a format similar to that of the table below (which is given as an example), the owner should provide details of the results of their inspections, for the last 3 years – in accordance with the Guidelines – on all CARGO holds and BALLAST tanks and VOID spaces within the cargo area.

Tank/Hold No.	**Corrosion protection (1)**	**Coating extent (2)**	**Coating condition (3)**	**Structural deterioration (4)**	**Hold and tank history (5)**
Cargo holds					
Topside tanks					
Hopper tanks					
Double-side skin tanks					
Double bottom tanks					
Upper stools					
Lower stools					
Wing tanks (ore carriers)					
Fore peak					
Aft peak					
Miscellaneous other spaces:					

***Note*:** Indicate tanks which are used for oil/ballast.

1) HC = hard coating; SC = soft coating; A = anodes; NP = no protection
2) U = upper part; M = middle part; L = lower part; C = complete
3) G = good; F = fair; P = poor; RC = recoated (during the last 3 years)
4) N = no findings recorded; Y = findings recorded, description of findings should be attached to this questionnaire
5) DR = damage and repair; L = leakages; CV = conversion (description to be attached to this questionnaire)

Name of owner's representative:

Signature: ---

Date: ---

Reports of port State control inspections

List the reports of port State control inspections containing hull structural related deficiencies, relevant information on rectification of the deficiencies:

Safety management system

List non-conformities related to hull maintenance, including the associated corrective actions:

Name and address of the approved thickness measurement company:

ANNEX 5

PROCEDURES FOR CERTIFICATION OF A COMPANY ENGAGED IN THICKNESS MEASUREMENT OF HULL STRUCTURES

1 Application

This guidance applies for certification of the company which intends to engage in the thickness measurement of hull structures of ships.

2 Procedures for certification

Submission of documents

2.1 The following documents should be submitted to an organization recognized by the Administration for approval:

.1 outline of the company, e.g., organization and management structure;

.2 experience of the company on thickness measurement of hull structures of ships;

.3 technicians' careers, i.e., experience of technicians as thickness measurement operators, technical knowledge and experience of hull structure, etc. Operators should be qualified according to a recognized industrial NDT Standard;

.4 equipment used for thickness measurement such as ultrasonic testing machines and their maintenance/calibration procedures;

.5 a guide for thickness measurement operators;

.6 training programmes for technicians for thickness measurement;

.7 measurement record format in accordance with recommended procedures for thickness measurements (see annex 8).

Auditing of the company

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

2.3 Certification is conditional upon an on-board demonstration of thickness measurement as well as satisfactory reporting.

3 Certification

3.1 Upon satisfactory results of both the audit of the company referred to in 2.2 and the demonstration tests referred to in 2.3, the Administration or organization recognized by the Administration should issue a certificate of approval as well as a notice to the effect that the thickness measurement operation system of the company has been certified.

3.2 Renewal/endorsement of the certificate should be made at intervals not exceeding three years by verification that original conditions are maintained.

4 Report of any alteration to the certified thickness measurement operation system

In cases where any alteration to the certified thickness measurement operation system of the company is made, such an alteration should be immediately reported to the organization recognized by the Administration. Re-audit should be made where deemed necessary by the organization recognized by the Administration.

5 Withdrawal of the certification

The certification may be withdrawn in the following cases:

.1 where the measurements were improperly carried out or the results were improperly reported;

.2 where the surveyor found any deficiencies in the approved thickness measurement operation systems of the company; and

.3 where the company failed to report any alteration referred to in 4 to the organization recognized by the Administration as required.

ANNEX 6

SURVEY REPORTING PRINCIPLES

As a principle, for bulk carriers subject to the Guidelines, the surveyor should include the following contents in his report for survey of hull structure and piping systems, as relevant for the survey.

1 General

1.1 A survey report should be generated in the following cases:

.1 in connection with commencement, continuation and/or completion of periodical hull surveys, i.e., annual, intermediate and renewal surveys, as relevant;

.2 when structural damages/defects have been found;

.3 when repairs, renewals or modifications have been carried out; and

.4 when condition of class (recommendation) has been imposed or has been deleted.

1.2 The reporting should provide:

.1 evidence that prescribed surveys have been carried out in accordance with applicable requirements;

.2 documentation of surveys carried out with findings, repairs carried out and condition of class (recommendation) imposed or deleted;

.3 survey records, including actions taken, which should form an auditable documentary trail. Survey reports should be kept in the survey report file required to be on board;

.4 information for planning of future surveys; and

.5 information which may be used as input for maintenance of classification rules and instructions.

1.3 When a survey is split between different survey stations, a report should be made for each portion of the survey. A list of items surveyed, relevant findings and an indication of whether the item has been credited, are to be made available to the next attending surveyor, prior to continuing or completing the survey. Thickness measurement and tank testing carried out is also to be listed for the next surveyor.

2 Extent of the survey

2.1 Identification of compartments where an overall survey has been carried out.

2.2 Identification of locations, in each ballast tank and cargo hold including hatch covers and coamings, where a close-up survey has been carried out, together with information on the means of access used.

2.3 Identification of locations, in each ballast tank and cargo hold including hatch covers and coamings, where thickness measurement has been carried out.

Note: As a minimum, the identification of location of close-up survey and thickness measurement should include a confirmation with description of individual structural members corresponding to the extent of requirements stipulated in Annex A based on type of periodical survey and the ship's age.

Where only partial survey is required, e.g., one transverse web, two selected cargo hold transverse bulkheads, the identification should include location within each ballast tank and cargo hold by reference to frame numbers.

2.4 For areas in ballast tanks and cargo holds where protective coating is found to be in good condition and the extent of close-up survey and/or thickness measurement has been specially considered, structures subject to special consideration should be identified.

2.5 Identification of tanks subject to tank testing.

2.6 Identification of piping systems on deck and within cargo holds, ballast tanks, pipe tunnels, cofferdams and void spaces where:

.1 examination including internal examination of piping with valves and fittings and thickness measurement, as relevant, has been carried out; and

.2 operational test to working pressure has been carried out.

3 Result of the survey

3.1 Type, extent and condition of protective coating in each tank, as relevant (rated GOOD, FAIR or POOR) including identification of tanks fitted with anodes.

3.2 Structural condition of each compartment with information on the following, as relevant:

.1 identification of findings, such as:

.1.1 corrosion with description of location, type and extent;

.1.2 areas with substantial corrosion;

.1.3 cracks/fractures with description of location and extent;

.1.4 buckling with description of location and extent; and

.1.5 indents with description of location and extent;

.2 identification of compartments where no structural damages/defects are found. The report may be supplemented by sketches/photos; and

.3 thickness measurement report should be verified and signed by the surveyor controlling the measurements on board.

4 Actions taken with respect to findings

4.1 Whenever the attending surveyor is of the opinion that repairs are required, each item to be repaired should be identified in a numbered list. Whenever repairs are carried out, details of the repairs effected should be reported by making specific reference to relevant items in the numbered list.

4.2 Repairs carried out should be reported with identification of:

.1 compartment;

.2 structural member;

.3 repair method (i.e., renewal or modification), including:

.3.1 steel grades and scantlings (if different from the original); and

.3.2 sketches/photos, as appropriate;

.4 repair extent; and

.5 non-destructive test (NDT)/tests.

4.3 For repairs not completed at the time of survey, condition of class/recommendation should be imposed with a specific time limit for the repairs. In order to provide correct and proper information to the surveyor attending for survey of the repairs, condition of class/recommendation should be sufficiently detailed with identification of each item to be repaired. For identification of extensive repairs, reference may be made to the survey report.

ANNEX 7

CONDITION EVALUATION REPORT
Issued upon completion of renewal survey

General particulars

Ship's name:	Class/Administration identity number: Previous class/Administration identity number(s): IMO number:
Port of registry:	National flag: Previous national flag(s):
Deadweight (metric tonnes):	Gross tonnage: National: ITC (1969):
Date of build:	Classification notation:
Date of major conversion:	
Type of conversion:	Owner: Previous owner(s)

---

1 The survey reports and documents listed below have been reviewed by the undersigned and found to be satisfactory

2 The renewal survey has been completed in accordance with the present Guidelines on (date) ……

Condition evaluation report completed by	Name Signature	Title
Office	Date	
Condition evaluation report verified by	Name Signature	Title
Office	Date	

Attached reports and documents:

1)
2)
3)
4)
5)
6)

Contents of condition evaluation report

Part 1 –	General particulars:	– *See front page*
Part 2 –	Report review:	– Where and how survey was done
Part 3 –	Close-up survey:	– Extent (which tanks/holds)
Part 4 –	Thickness measurements:	– Reference to thickness measurement report – Summary of where measured – Separate form indicating the spaces with substantial corrosion, and corresponding: – thickness diminution – corrosion pattern
Part 5 –	Tank corrosion prevention system:	– Separate form indicating: – location of coating/anodes – condition of coating (if applicable)
Part 6 –	Repairs:	– Identification of spaces/areas
Part 7 –	Condition of class/flag State requirements:	
Part 8 –	Memoranda:	– Acceptable defects – Any points of attention for future surveys, e.g., for suspect areas – Extended annual/intermediate survey due to coating breakdown
Part 9 –	Conclusion:	– Statement on evaluation/verification of survey report

Extract of thickness measurements

Reference is made to the thickness measurement report:

Position of substantially corroded tanks/areas[1] or areas with deep pitting[3]	**Thickness diminution [%]**	**Corrosion pattern[2]**	**Remarks: e.g. (e.g., ref. attached sketches)**

Notes:

1 Substantial corrosion, i.e., 75% – 100% of acceptable margins wasted.

2 P = Pitting
C = Corrosion in general

3 Any bottom plating with a pitting intensity of 20% or more, with wastage in the substantial corrosion range or having an average depth of pitting of 1/3 or more of actual plate thickness should be noted.

Tank/hold corrosion prevention system

Tank/hold Nos.[1]	**Tank/hold corrosion prevention system[2]**	**Coating condition[3]**	**Remarks**

Notes:

1 All ballast tanks and cargo holds should be listed.

2 C = Coating A = Anodes NP = No protection

3 Coating condition according to the following standard:

GOOD condition with only minor spot rusting.

FAIR condition with local breakdown of coating at edges of stiffeners and weld connections and/or light rusting over 20% or more of areas under consideration, but less than as defined for POOR condition.

POOR condition with general breakdown of coating over 20% or more of areas or hard scale at 10% or more of areas under consideration.

If coating condition POOR is given, extended annual surveys should be introduced. This should be noted in part 7 of the Contents of condition evaluation report.

ANNEX 8

RECOMMENDED PROCEDURES FOR THICKNESS MEASUREMENTS

1 This annex should be used for recording thickness measurements as required by part B of Annex A.

2 Thickness measurement sheet forms TM1-DSBC, TM2-DSBC, TM3-DSBC, TM4-DSBC, TM5-DSBC and TM6-DSBC (appendices 2 to 5) should be used, as appropriate, for recording thickness measurements and these sheets should be bound with the cover sheet of the report of GENERAL PARTICULARS in appendix 1. The maximum allowable diminution should be stated. The maximum allowable diminution could be stated in an attached document.

3 Appendices 3 to 5 are guidance diagrams and notes relating to the reporting forms and the procedure for the thickness measurements.

APPENDIX 1

THICKNESS MEASUREMENT REPORT

GENERAL PARTICULARS

Ship's name:

IMO Number:

Administration Identification Number:

Port of registry:

Gross tonnage:

Deadweight:

Date of build:

Classification society:

Name of Company performing the thickness measurement:

Thickness measurement company certified by:

Certificate No.:

Certificate valid from: ..... to .....

Place of measurement:

First date of measurement:

Last date of measurement:

Renewal survey/intermediate survey* due:

Details of measurement equipment:

Qualification of operator:

Report Number:
Consisting of ……..... Forms

Name of operator: ..... Name of surveyor: .....

Signature of operator: ..... Signature of surveyor: .....

Company official stamp: ..... Administration official stamp: .....

* Delete as appropriate.

APPENDIX 2

TM1-DSBC **Report on THICKNESS MEASUREMENT OF ALL DECK PLATING, ALL BOTTOM SHEEL PLATING AND SIDE SHELL PLATING***

(* – delete as appropriate)

Ship's name ………………………… Class Identity No. ………………………… Report No. . ………………………… IMO No. …………………………

STRAKE POSITION																	
PLATE POSITION	No. or Letter	Org. Thk.	Forward Reading						Aft Reading						Mean Diminution %		
			Gauged		Diminution P		Diminution S		Gauged		Diminution P		Diminution S				
		mm	P	S	mm	%	mm	%	P	S	mm	%	mm	%	P	S	mm
12th forward																	
11th																	
10th																	
9th																	
8th																	
7th																	
6th																	
5th																	
4th																	
3rd																	
2nd																	
1st																	
Amidships																	
1st aft																	
2nd																	
3rd																	
4th																	
5th																	
6th																	
7th																	
8th																	
9th																	
10th																	
11th																	
12th																	

Operator's Signature …………………………………… NOTES – See Reverse

NOTES TO REPORT TM1–DSBC

1 This report should be used for recording the thickness measurement of:

.1 all strength deck plating within cargo length area;

.2 all keel, bottom shell plating and bilge plating within the cargo length area;

.3 side shell plating including selected wind and water strakes outside cargo length area; and

.4 all wind and water strakes within cargo length area.

2 The strake position should be cleared as follows:

.1 for strength deck indicate the number of the strake of plating inboard from the stringer plate;

.2 for bottom plating indicate the number of the strake of plating outboard from the keel plate; and

.3 for side shell plating give number of the strake of plating sheerstrake and letter as shown on shell expansion.

3 Only the deck plating strakes outside line of openings are to be recorded.

4 Measurements should be taken at the forward and aft areas of all plates and where plates cross ballast/cargo tank boundaries separate measurements for the area of plating in way of each type of tank should be recorded.

5 The single measurements recorded are to represent the average of multiple measurements.

6 The maximum allowable diminution could be stated in an attached document.

TM2-DSBC(i) **Report on THICKNESS MEASUREMENT OF SHELL AND DECK PLATING at transverse sections (one, two or three transverse sections)**

Ship's name ..... Class Identity No. ..... Report No. . ..... IMO No. .....

STRENGTH DECK AND SHEERSTRAKE PLATING																													
	FIRST TRANSVERSE SECTION AT FRAME NUMBER									SECOND TRANSVERSE SECTION AT FRAME NUMBER									THIRD TRANSVERSE SECTION AT FRAME NUMBER										
STRAKE POSITION	No. or Letter	Org. Thk.	Max. Alwb. Dim.	Gauged		Diminution P		Diminution S		No. or Letter	Org. Thk.	Max. Alwb. Dim.	Gauged		Diminution P		Diminution S		No. or Letter	Org. Thk.	Max. Alwb. Dim.	Gauged		Diminution P		Diminution S			
		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%		
Stringer Plate																													
1st strake inboard																													
2nd																													
3rd																													
4th																													
5th																													
6th																													
7th																													
8th																													
9th																													
10th																													
11th																													
12th																													
13th																													
14th																													
centre strake																													
sheer strake																													
TOPSIDE TOTAL																													

Operator's Signature .....

NOTES – See Reverse

NOTES TO REPORT TM2-DSBC(i)

1 This report should be used for recording the thickness measurement of:

Strength deck plating and sheerstrake plating transverse sections:

One, two or three sections within the cargo length area, comprising the structural items (0), (1) and (2) as shown on the diagrams of typical transverse sections (Appendices 3 and 4).

2 Only the deck plating strakes outside line of hatch openings should be recorded.

3 The top side area comprises deck plating, stringer plate and sheerstrake (including rounded gunwales).

4 The exact frame station of measurement should be stated.

5 The single measurements recorded should represent the average of multiple measurements.

6 The maximum allowable diminution could be stated in an attached document.

TM2-DSBC(ii) **Report on THICKNESS MEASUREMENT OF SHELL AND DECK PLATING at transverse sections (one, two or three transverse sections)**

Ship's name ..... Class Identity No. ..... Report No. ..... IMO No. .....

SHELL PLATING																													
	FIRST TRANSVERSE SECTION AT FRAME NUMBER									SECOND TRANSVERSE SECTION AT FRAME NUMBER									THIRD TRANSVERSE SECTION AT FRAME NUMBER										
STRAKE POSITION	No. or Letter	Org. Thk.	Max. Alwb. Dim.	Gauged		Diminution P		Diminution S		No. or Letter	Org. Thk.	Max. Alwb. Dim.	Gauged		Diminution P		Diminution S		No. or Letter	Org. Thk.	Max. Alwb. Dim.	Gauged		Diminution P		Diminution S			
		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%		
1st below sheer strake																													
2nd																													
3rd																													
4th																													
5th																													
6th																													
7th																													
8th																													
9th																													
10th																													
11th																													
12th																													
13th																													
14th																													
15th																													
16th																													
17th																													
18th																													
19th																													
20th																													
keel strake																													
BOTTOM TOTAL																													

Operator's Signature .....

NOTES – See Reverse

NOTES TO REPORT TM2-DSBC(ii)

1 This report should be used for recording the thickness measurement of:

Shell plating at transverse sections:

One, two or three sections within the cargo length area, comprising the structural items (3), (4), (5) and (6) as shown on the diagrams of typical transverse sections in appendices 3 and 4.

2 The bottom area comprises keel, bottom and bilge plating.

3 The exact frame station of measurement should be stated.

4 The single measurements recorded should represent the average of multiple measurements.

5 The maximum allowable diminution could be stated in an attached document.

TM3-DSBC **Report on THICKNESS MEASUREMENT OF LONGITUDINAL MEMBERS at transverse sections (one, two or three transverse sections)**

Ship's name ..... Class Identity No. ..... Report No. ..... IMO No. .....

STRUCTURAL MEMBER	FIRST TRANSVERSE SECTION AT FRAME NUMBER									SECOND TRANSVERSE SECTION AT FRAME NUMBER									THIRD TRANSVERSE SECTION AT FRAME NUMBER								
	Item No.	Org. Thk.	Max. Alwb. Dim.	Gauged		Diminution P		Diminution S		Item No.	Org. Thk.	Max. Alwb. Dim.	Gauged		Diminution P		Diminution S		Item No.	Org. Thk.	Max. Alwb. Dim.	Gauged		Diminution P		Diminution S	
		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%

Operator's Signature .....

NOTES – See Reverse

NOTES TO REPORT TM3-DSBC

1 This report should be used for recording the thickness measurement of:

Longitudinal members at transverse sections:

Two, or three sections within the cargo length area comprising the appropriate structural items (10) to (25) as shown on diagrams of typical transverse sections in appendices 3 and 4.

2 The exact frame station of measurement should be stated.

3 The single measurements recorded should represent the average of multiple measurements.

4 The maximum allowable diminution could be stated in an attached document.

TM4-DSBC **Report on THICKNESS MEASUREMENT OF TRANSVERSE STRUCTURAL MEMBERS**
In the double bottom, hopper side and topside water ballast tanks

Ship's name ..... Class Identity No. ..... Report No. . ..... IMO No. .....

TANK DESCRIPTION:									
LOCATION OF STRUCTURE:									
STRUCTURAL MEMBER	ITEM	Original Thickness	Max. Alwb. Dim.	Gauged		Diminution P		Diminution S	
		mm	mm	P	S	mm	%	mm	%

Operator's Signature .....

NOTES – See Reverse

NOTES TO REPORT TM4-DSBC

1 This report should be used for recording the thickness measurement:

Transverse structural members, comprising the appropriate structural items (30) to (34) as shown on diagrams of typical transverse sections illustrated in appendices 3 and 4.

2 Guidance for areas of measurements is indicated in appendix 5.

3 The single measurements recorded should represent the average of multiple measurements.

4 The maximum allowable diminution could be stated in an attached document.

TM5-DSBC **Report on THICKNESS OF WATERTIGHT TRANSVERSE BULKHEADS IN CARGO HOLDS**

Ship's name ..... Class Identity No. ..... Report No. . ..... IMO No. .....

LOCATION OF STRUCTURE:					FRAME NO.:			
STRUCTURAL COMPONENT (PLATING/STIFFENER)								
	Original Thickness	Max. Alwb. Dim.	Gauged		Diminution P		Diminution S	
	mm	mm	Port	Starboard	mm	%	mm	%

Operator's Signature .....

NOTES – See Reverse

NOTES TO REPORT TM5-DSBC

1 This report should be used for recording the thickness measurement of:

Watertight transverse bulkheads in cargo holds.

2 Guidance for areas of measurements is indicated in appendix 3.

3 The single measurements recorded should represent the average of multiple measurements.

4 The maximum allowable diminution could be stated in an attached document.

TM6-DSBC **Report on THICKNESS MEASUREMENT OF MISCELLANEOUS STRUCTURAL MEMBERS**

Ship's name ..... Class Identity No. ..... Report No. . ..... IMO No. .....

STRUCTURAL MEMBER:									SKETCH
LOCATION OF STRUCTURE:									
Description	Org. Thk.	Max. Alwb. Dim.	Gauged		Diminution P		Diminution S		
	mm	mm	P	S	mm	%	mm	%	

Operator's Signature .....

NOTES – See Reverse

NOTES TO REPORT TM6-DSBC

1 This report should be used for recording the thickness measurement of:

Miscellaneous structural members including the structural items (40), (41) and (42) as shown on diagrams of typical transverse sections illustrated in Appendix 3.

2 Guidance for areas of measurements is indicated in appendix 5.

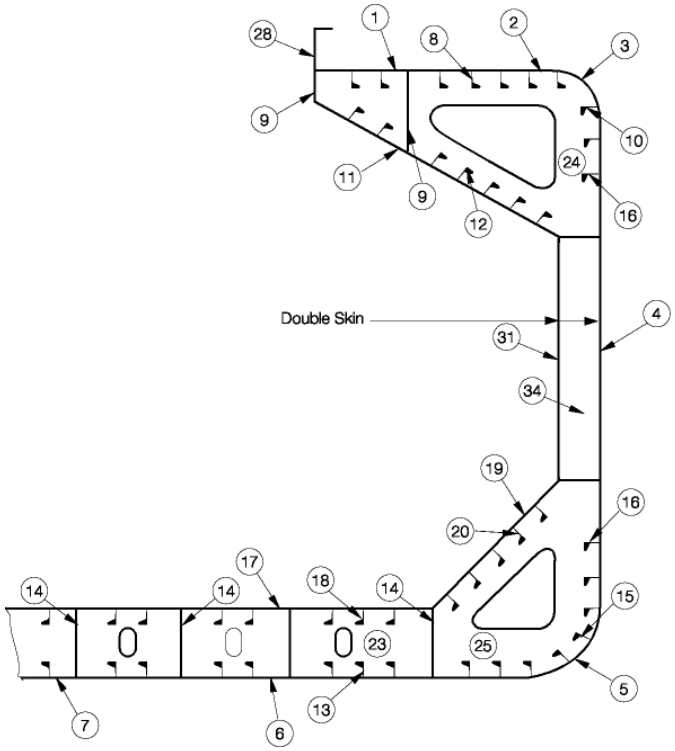
3 The single measurements recorded should represent the average of multiple measurements.

4 The maximum allowable diminution could be stated in an attached document.

APPENDIX 3

THICKNESS MEASUREMENT – DOUBLE-SIDE SKIN CONSTRUCTION

Typical transverse section of a double skin bulk carrier with indication of longitudinal and transverse members.



Report on TM2-DSBC(i) and (ii)
1 Strength deck plating
2 Stringer plate
3 Sheerstrake
4 Side shell plating
5 Bilge plating
6 Bottom shell plating
7 Keel plate

Report on TM3-DSBC	
8 Deck longitudinals	17 Inner bottom plating
9 Deck girders	18 Inner bottom longitudinals
10 Sheerstrake longitudinals	19 Hopper plating
11 Topside tank sloping plating	20 Hopper longitudinals
12 Topside tank sloping plating longitudinals	31 Inner side plating - Inner side longitudinals, if any
13 Bottom longitudinals	- Horizontal girders in wing ballast tanks
14 Bottom girders	
15 Bilge longitudinals	
16 Side shell longitudinals, if any	

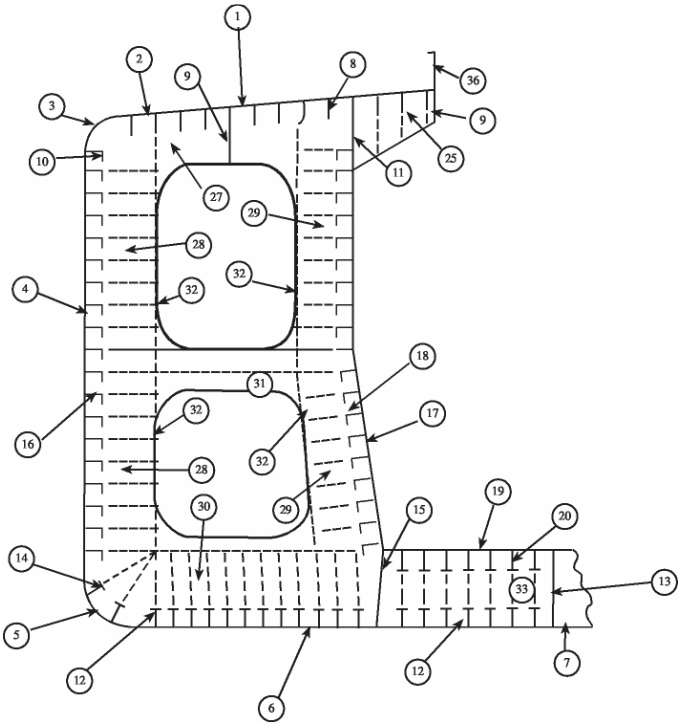
Report on TM4-DSBC
23 Double bottom tank floors
25 Hopper side tank transverses
34 Transverse web frame
- Topside tank transverses

Report on TM6-DSBC
28 Hatch coamings
- Deck plating between hatches
- Hatch covers

APPENDIX 4

THICKNESS MEASUREMENT - ORE CARRIERS

Typical transverse section of an ore carrier with indication of longitudinal and transverse members.



Report on TM2-DSBC(i) and (ii)
1 Strength deck plating
2 Stringer plate
3 Sheerstrake
4 Side shell plating
5 Bilge plating
6 Bottom shell plating
7 Keel plate

Report on TM3-DSBC
8 Deck longitudinals
9 Deck girders
10 Sheerstrake longitudinals
11 Longitudinal bulkhead top strake
12 Bottom longitudinals
13 Bottom girders
14 Bilge longitudinals
15 Longitudinal bulkhead lower strake
16 Side shell longitudinals
17 Longitudinal bulkhead plating (remainder)
18 Longitudinal bulkhead longitudinals
19 Inner bottom plating
20 Inner bottom longitudinals
21
22
23
24

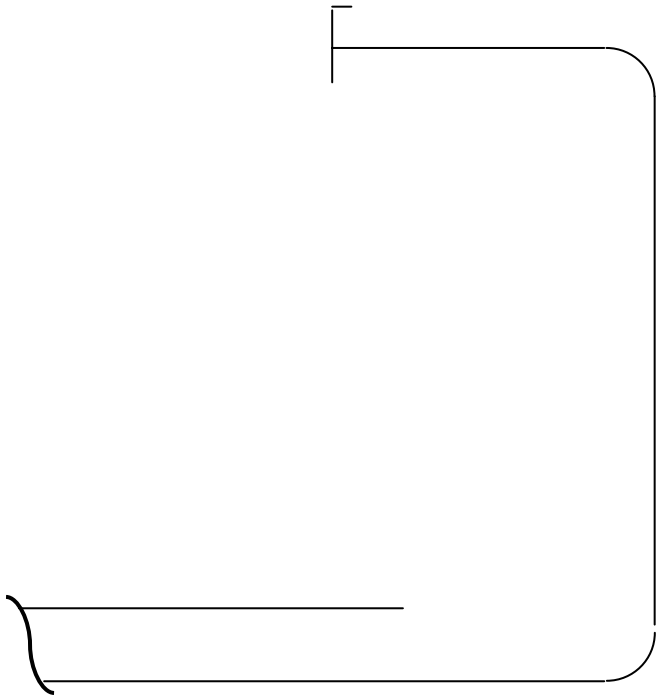
Report on TM4-DSBC
25 Deck transverse centre tank
26 Bottom transverse centre tank
27 Deck transverse wing tank
28 Side shell vertical web
29 Longitudinal bulkhead vertical web
30 Bottom transverse wing tank
31 Struts
32 Transverse web face plate
33 Double bottom floors
34
35

Report on TM6-DSBC
36 Hatch coamings
37 Deck plating between hatches
38 Hatch covers
39
40

APPENDIX 5

THICKNESS MEASUREMENT – DOUBLE-SIDE SKIN CONSTRUCTION

Transverse section outline: the diagram may be used for those ships where the diagrams given in appendices 3 and 4 are not suitable.



Report on TM2-DSBC(i) and (ii)
1 Strength deck plating
2 Stringer plate
3 Sheerstrake
4 Side shell plating
5 Bilge plating
6 Bottom shell plating
7 Keel plate

Report on TM3-DSBC	
8 Deck longitudinals	17 Inner bottom plating
9 Deck girders	18 Inner bottom longitudinals
10 Sheerstrake longitudinals	19 Hopper plating
11 Topside tank sloping plating	20 Hopper longitudinals
12 Topside tank sloping plating longitudinals	31 Inner side plating - Inner side longitudinals, if any
13 Bottom longitudinals	- Horizontal girders in wing ballast tanks
14 Bottom girders	
15 Bilge longitudinals	
16 Side shell longitudinals, if any	

Report on TM4-DSBC
23 Double bottom tank floors
25 Hopper side tank transverses
34 Transverse web frame
- Topside tank transverses

Report on TM6-DSBC
28 Hatch coamings
- Deck plating between hatches
- Hatch covers

ANNEX 9

GUIDELINES FOR TECHNICAL ASSESSMENT IN CONJUNCTION WITH PLANNING FOR ENHANCED SURVEYS OF BULK CARRIERS*

1 INTRODUCTION

These guidelines contain information and suggestions concerning technical assessments, which may be of use in conjunction with the planning of enhanced surveys of double skin bulk carriers. As indicated in 5.1.6, the guidelines are a recommended tool which may be invoked at the discretion of the Administration, when considered necessary and appropriate, in conjunction with the preparation of the required survey programme.

2 PURPOSE AND PRINCIPLES

2.1 Purpose

2.1.1 The purpose of the technical assessments described in these guidelines is to assist in identifying critical structural areas, nominating suspect areas and in focusing attention on structural elements or areas of structural elements which may be particularly susceptible to, or evidence a history of, wastage or damage. This information may be useful in nominating locations, areas holds and tanks for thickness measurement, close-up survey and tank testing.

2.1.2 Critical structural areas are locations which have been identified from calculations to require monitoring or from the service history of the subject ship or from similar or sister ships (if available) to be sensitive to cracking, buckling or corrosion which would impair the structural integrity of the ship.

2.2 Minimum requirements

However, these guidelines may not be used to reduce the requirements pertaining to thickness measurement, close-up survey and tank testing contained in annexes 1 and 2 of part B and in paragraph 2.7, respectively, which, in all cases, should be complied with as a minimum.

2.3 Timing

As with other aspects of survey planning, the technical assessments described in these guidelines should be worked out by the owner or operator in co-operation with the Administration well in advance of the commencement of the renewal survey, i.e., prior to commencing the survey and normally at least 12 to 15 months before the survey's completion due date.

---

* References:

1 IACS, "Unified Requirement Z10.5, "Hull Surveys of Double Skin Bulk Carriers""
2 IACS, "Bulk Carriers: Guidelines for Surveys, Assessment and Repair of Hull Structures, January 2002"
3 TSCF, "Guidelines for the Inspection and Maintenance of Double Hull Tanker Structures, 1995"
4 TSCF, "Guidance Manual for Tanker Structures, 1997"

2.4 Aspects to be considered

2.4.1 Technical assessments, which may include quantitative or qualitative evaluation of relative risks of possible deterioration, of the following aspects of a particular ship may be used as a basis for the nomination of holds, tanks and areas for survey:

.1 design features such as stress levels on various structural elements, design details and extent of use of high-tensile steel;

.2 former history with respect to corrosion, cracking, buckling, indents and repairs for the particular ship as well as similar vessels, where available; and

.3 information with respect to types of cargo carried, use of different holds/tanks for cargo/ballast, protection of holds and tanks and condition of coating, if any.

2.4.2 Technical assessments of the relative risks of susceptibility to damage or deterioration of various structural elements and areas are to be judged and decided on the basis of recognized principles and practices, such as may be found in references 2, 3 and 4.

3 TECHNICAL ASSESSMENT

3.1 General

3.1.1 There are three basic types of possible failure, which may be the subject of technical assessment in connection with planning of surveys; corrosion, cracks and buckling. Contact damages are not normally covered by the survey planning since indents are usually noted in memoranda and assumed to be dealt with as a normal routine by surveyors.

3.1.2 Technical assessments performed in conjunction with the survey planning process should, in principle, be as shown schematically in figure 1. The approach is basically an evaluation of the risk in the following aspects based on the knowledge and experience related to:

.1 design; and

.2 corrosion.

3.1.3 The design should be considered with respect to structural details, which may be susceptible to buckling or cracking as a result of vibration, high stress levels or fatigue.

3.1.4 Corrosion is related to the ageing process, and is closely connected with the quality of corrosion prevention systems fitted at new building, and subsequent maintenance during the service life. Corrosion may also lead to cracking and/or buckling.

3.2 Methods

3.2.1 Design details

3.2.1.1 Damage experience related to the ship in question and sister and/or similar ships, where available, is the main source of information to be used in the process of planning. In addition, a selection of structural details from the design drawings is to be included.

3.2.1.2 Typical damage experience to be considered will consist of:

.1 number, extent, location and frequency of cracks; and

.2 location of buckles.

3.2.1.3 This information may be found in the survey reports and/or the owner's files, including the results of the owner's own inspections. The defects should be analyzed, noted and marked on sketches.

3.2.1.4 In addition, general experience should be utilized. Also, reference should be made to reference 2, which contains a catalogue of typical damages and proposed repair methods for various structural details on single skin bulk carriers. Reference should also be made to reference 3, which contains catalogues of typical damages and proposed repair methods for double hull oil tanker structural details which may to some extent be similar to structural details in double skin bulk carriers. Such figures should be used together with a review of the main drawings, in order to compare with the actual structure and search for similar details that may be susceptible to damage. In particular, chapter 3 of reference 3 deals with various aspects specific to double hull tankers, such as stress concentration locations, misalignment during construction, corrosion trends, fatigue considerations and areas requiring special attention, while chapter 4 of reference 3 addresses experience gained on structural defects in double hulls (chemical tankers, OBO carriers, ore/oil carriers, gas carriers), which should also be considered in working out the survey planning.

3.2.1.5 The review of the main structural drawings, in addition to using the above-mentioned figures, should include checking for typical design details where cracking has been experienced. The factors contributing to damage should be carefully considered.

3.2.1.6 The use of high-tensile steel (HTS) is an important factor. Details showing good service experience where ordinary, mild steel has been used may be more susceptible to damage when HTS, and its higher associated stresses, are utilized. There is extensive and, in general, good experience, with the use of HTS for longitudinal material in deck and bottom structures. Experience in other locations, where the dynamic stresses may be higher, is less favourable, e.g., side structures.

3.2.1.7 In this respect, stress calculations of typical and important components and details, in accordance with relevant methods, may prove useful and should be considered.

3.2.1.8 The selected areas of the structure identified during this process should be recorded and marked on the structural drawings to be included in the Survey Programme.

3.2.2 Corrosion

3.2.2.1 In order to evaluate relative corrosion risks, the following information should generally be considered:

.1 usage of tanks, holds and spaces;

.2 condition of coatings;

.3 cleaning procedures;

.4 previous corrosion damage;

.5 ballast use and time for cargo holds;

.6 risk of corrosion in cargo holds and ballast tanks; and

.7 location of ballast tanks adjacent to heated fuel oil tanks.

3.2.2.2 Reference 4 gives definitive examples which can be used for judging and describing coating condition, using typical pictures of conditions.

3.2.2.3 The evaluation of corrosion risks should be based on information in both reference 2 and reference 4, as far as applicable to double-side skin construction, together with relevant information on the anticipated condition of the ship as derived from the information collected in order to prepare the Survey Programme and the age of the ship. The various holds, tanks and spaces should be listed with the corrosion risks nominated accordingly.

3.2.3 Locations for close-up survey and thickness measurement

3.2.3.1 On the basis of the table of corrosion risks and the evaluation of design experience, the locations for initial close-up survey and thickness measurement (areas and sections) may be nominated.

3.2.3.2 The sections subject to thickness measurement should normally be nominated in tanks, holds and spaces where corrosion risk is judged to be the highest.

3.2.3.3 The nomination of tanks, holds and spaces for close-up survey should initially be based on highest corrosion risk, and should always include ballast tanks. The principle for the selection should that the extent is increased by age or where information is insufficient or unreliable.

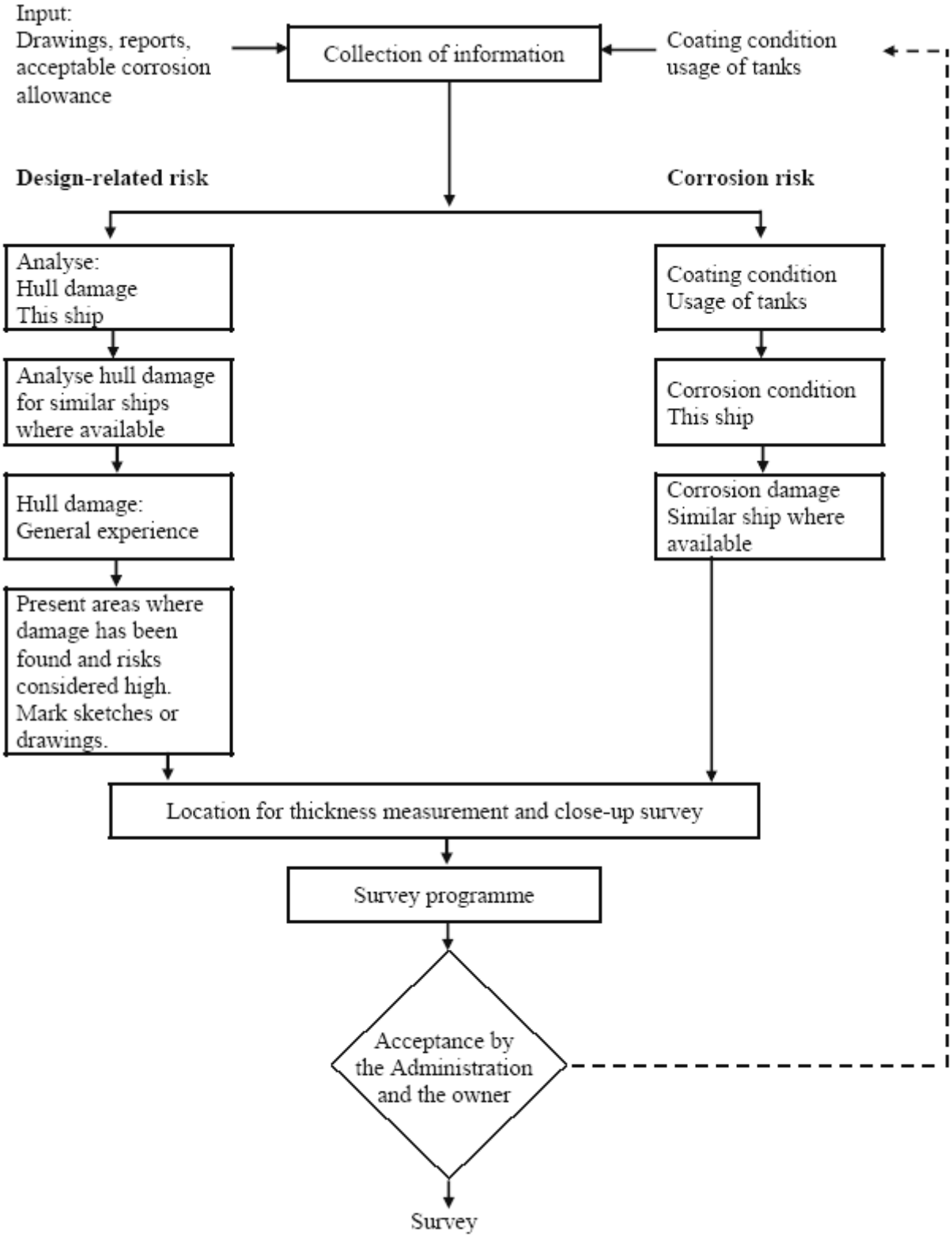


Figure 1 – Technical assessment and the survey planning process

ANNEX 10

REQUIREMENTS FOR EXTENT OF THICKNESS MEASUREMENTS AT THOSE AREAS OF SUBSTANTIAL CORROSION OF BULK CARRIERS WITH DOUBLE-SIDE SKIN CONSTRUCTION WITHIN THE CARGO LENGTH AREA

TABLE 1 – BOTTOM, INNER BOTTOM AND HOPPER STRUCTURE		
Structural member	**Extent of measurement**	**Pattern of measurement**
Bottom, inner bottom and hopper structure plating	Minimum of three bays across double bottom tank, including aft bay Measurements around and under all suction bell mouths	Five-point pattern for each panel between longitudinals and floors
Bottom, inner bottom and hopper structure longitudinals	Minimum of three longitudinals in each bay where bottom plating measured	Three measurements in line across flange and three measurements on the vertical web
Bottom girders, including the watertight ones	At fore and aft watertight floors and in centre of tanks	Vertical line of single measurements on girder plating with one measurement between each panel stiffener, or a minimum of three measurements
Bottom floors, including the watertight ones	Three floors in the bays where bottom plating measured, with measurements at both ends and middle	Five-point pattern over two square metre area
Hopper structure web frame ring	Three floors in bays where bottom plating measured	Five-point pattern over one square metre of plating Single measurements on flange
Hopper structure transverse watertight bulkhead or swash bulkhead	– lower 1/3 of bulkhead	– five-point pattern over one square metre of plating
	– upper 2/3 of bulkhead	– five-point pattern over two square metre of plating
	– stiffeners (minimum of three)	– For web, five-point pattern over span (two measurements across web at each end and one at centre of span). For flange, single measurements at each end and centre of span
Panel stiffening	Where applicable	Single measurements

TABLE 2 – DECK STRUCTURE INCLUDING CROSS STRIPS, MAIN CARGO HATCHWAYS, HATCH COVERS, COAMINGS AND TOPSIDE TANKS		
Structural member	**Extent of measurement**	**Pattern of measurement**
Cross deck strip plating	Suspect cross deck strip plating	Five-point pattern between under deck stiffeners over 1 metre length
Under deck stiffeners	Transverse members Longitudinal member	Five-point pattern at each end and mid span Five-point pattern on both web and flange
Hatch covers	Side and end skirts, each three locations Three longitudinal bands, outboard strakes (2) and centreline strake (1)	Five-point pattern at each location Five-point measurement each band
Hatch coamings	Each side and end of coaming, one band lower 1/3, one band upper 2/3 of coaming	Five-point measurement each band i.e., end or side coaming
Topside ballast tanks	a) watertight transverse bulkheads: - Lower 1/3 of bulkhead - Upper 2/3 of bulkhead - Stiffeners	Five-point pattern over 1 sq. metre of plating Five-point pattern over 1 sq. metre of plating Five-point pattern over 1 metre length
Topside ballast tanks	b) two representative swash transverse bulkheads: - Lower 1/3 of bulkhead - Upper 2/3 of bulkhead - Stiffeners	Five-point pattern over 1 sq. metre of plating Five-point pattern over 1 sq. metre of plating Five-point pattern over 1 metre length
Topside ballast tanks	c) three representative bays of slope plating: - Lower 1/3 of tank - Upper 2/3 of tank	Five-point pattern over 1 sq. metre of plating Five point pattern over 1 sq. metre of plating
Topside ballast tanks	d) Longitudinals, suspect and adjacent	Five point pattern on both web and flange over 1 metre length
Main deck plating	Suspect plates and adjacent (4)	Five-point pattern over 1 sq. metre of plating
Main deck longitudinals	Suspect plates	Five point pattern on both web and flange over 1 metre length
Web frames/transverses	Suspect plates	Five-point pattern over 1 sq. metre

TABLE 3 – STRUCTURE IN DOUBLE-SIDE BALLAST TANKS		
Structural member	**Extent of measurement**	**Pattern of measurement**
Side shell and inner plating: – Upper strake and strakes in way of horizontal girders – All other strakes	 – Plating between each pair of transverse frames / longitudinals in a minimum of three bays (along the tank) – Plating between every third pair of longitudinals in same three bays	 – Single measurement – Single measurement
Side shell and inner side transverse frames / longitudinals on: – upper strake – all other strakes	 – Each transverse frame / longitudinal in same three bays – Every third transverse frame / longitudinal in same three bays	 – Three measurements across web and 1 measurement on flange – Three measurements across web and 1 measurement on flange
Transverse frames / longitudinals: – brackets	Minimum of three at top, middle and bottom of tank in same three bays	Five-point pattern over area of bracket
Vertical web and transverse bulkheads: – strakes in a way of horizontal girders – other strakes	 – Minimum of two webs and both transverse bulkheads – Minimum of two webs and both transverse bulkheads	 – Five-point pattern over approx. two square metre area – Two measurements between each pair of vertical stiffeners
Horizontal girders	Plating on each girder in a minimum of three bays	Two measurements between each pair of longitudinal girder stiffeners
Panel stiffening	Where applicable	Single measurements

TABLE 4 – TRANSVERSE BULKHEADS IN CARGO HOLDS		
Structural member	**Extent of measurement**	**Pattern of measurement**
Lower stool, where fitted	– Transverse band within 25 mm of welded connection to inner bottom – Transverse bands within 25 mm of welded connection to shelf plate	– Five-point pattern between stiffeners over one metre length – Five-point pattern between stiffeners over one metre length
Transverse bulkheads	– Transverse band at approximately mid height – Transverse band at part of bulkhead adjacent to upper deck or below upper stool shelf plate (for those ships fitted with upper stools)	– Five-point pattern over one square metre of plating – Five-point pattern over one square metre of plating

ANNEX 11

STRENGTH OF CARGO HATCH COVER SECURING ARRANGEMENTS FOR BULK CARRIERS

1 Securing devices

The strength of securing devices should comply with the following requirements:

.1 Panel hatch covers should be secured by appropriate devices (bolts, wedges or similar) suitably spaced alongside the coamings and between cover elements. Arrangement and spacing should be determined with due attention to the effectiveness for weather-tightness, depending upon the type and the size of the hatch cover, as well as on the stiffness of the cover edges between the securing devices.

.2 The net sectional area of each securing device is not to be less than:

$$A = 1.4\ a / f\ (cm^2)$$

where:

a = spacing between securing devices not to be taken less than 2 metres
f = $(\sigma_Y / 235)^e$
σ_Y = specified minimum upper yield stress in N/mm^2 of the steel used for fabrication, not to be taken greater than 70% of the ultimate tensile strength
e = 0.75 for $\sigma_Y > 235$
= 1.0 for $\sigma_Y \leq 235$

Rods or bolts should have a net diameter not less than 19 mm for hatchways exceeding 5 m^2 in area.

.3 Between cover and coaming and at cross-joints, a packing line pressure sufficient to obtain weathertightness should be maintained by the securing devices. For packing line pressures exceeding 5 N/mm, the cross section area should be increased in direct proportion. The packing line pressure should be specified.

.4 The cover edge stiffness should be sufficient to maintain adequate sealing pressure between securing devices. The moment of inertia, I, of edge elements be less than:

$$I = 6\ p\ a^4\ (cm^4)$$

where:

p = packing line pressure in N/mm, minimum 5 N/mm
a = spacing in m of securing devices

.5 Securing devices should be of reliable construction and securely attached to the hatchway coamings, decks or covers. Individual securing devices on each cover are to have approximately the same stiffness characteristics.

.6 Where rod cleats are fitted, resilient washers or cushions should be incorporated.

.7 Where hydraulic cleating is adopted, a positive means should be provided to ensure that it remains mechanically locked in the closed position in the event of failure of the hydraulic system.

2 Stoppers

2.1 Nos.1 and 2 hatch covers should be effectively secured, by means of stoppers, against the transverse forces arising from a pressure of 175 kN/m^2.

2.2 No.2 hatch covers should be effectively secured, by means of stoppers, against the longitudinal forces acting on the forward end arising from a pressure of 175 kN/m^2.

2.3 No.1 hatch cover should be effectively secured, by means of stoppers, against the longitudinal forces acting on the forward end arising from a pressure of 230 kN/m^2. This pressure may be reduced to 175 kN/m^2 if a forecastle is fitted.

2.4 The equivalent stress in stoppers and their supporting structures and calculated in the throat of the stopper welds is not to exceed the allowable value of 0.8 σ_Y.

3 Materials and welding

Where stoppers or securing devices are fitted to comply with this annex, they should be manufactured of materials, including welding electrodes, to the satisfaction of the Administration.

ANNEX 12

PROCEDURAL REQUIREMENTS FOR THICKNESS MEASUREMENTS

1 General

Thickness measurements required in the context of hull structural surveys, if not carried out by the society itself should be witnessed by a surveyor. The attendance of the surveyor should be recorded. This also applies to thickness measurements taken during voyages.

2 Survey meeting

2.1 Prior to commencement of the renewal or intermediate survey, a meeting should be held between the attending surveyor(s), the owner's representative(s) in attendance and the thickness measurement firm's representative(s) so as to ensure the safe and efficient execution of the surveys and thickness measurements to be carried out on board.

2.2 Communication with the thickness measurement operator(s) and owner's representative(s) should be agreed during the meeting, with respect to the following:

.1 reporting of thickness measurements on regular basis;

.2 prompt notification to the surveyor in case of findings such as:

.2.1 excessive and/or extensive corrosion or pitting/grooving of any significance;

.2.2 structural defects like buckling, fractures and deformed structures;

.2.3 detached and/or holed structure; and

.2.4 corrosion of welds.

2.3 The survey report should indicate where and when the meeting took place and who attended (the name of the surveyor(s), the owner's representative(s) and the thickness measurement firm's representative(s)).

3 Monitoring of the thickness measurement process on board

3.1 The surveyor should decide final extent and location of thickness measurements after overall survey of representative spaces onboard.

3.2 In case the owner prefers to commence the thickness measurements prior to the overall survey, then the surveyor should advise that the planned extent and locations of thickness measurements are subject to confirmation during the overall survey. Based on findings, the surveyor may require additional thickness measurements to be taken.

3.3 The surveyor should direct the gauging operation by selecting locations such that readings taken represent, on average, the condition of the structure for that area.

3.4 Thickness measurements taken mainly to evaluate the extent of corrosion, which may affect the hull girder strength, should be carried out in a systematic manner such that all longitudinal structural members are gauged, as required.

3.5 Where thickness measurements indicate substantial corrosion or wastage in excess of allowable diminution, the surveyor should direct locations for additional thickness measurements in order to delineate areas of substantial corrosion and to identify structural members for repairs/renewals.

3.6 Thickness measurements of structures in areas where close-up surveys are required should be carried out simultaneously with close-up survey.

4 Review and verification

4.1 Upon completion of the thickness measurements, the surveyor should confirm that no further gaugings are needed, or specify additional gaugings.

4.2 Where these guidelines allow the extent of thickness measurements to be reduced after special considerations by the surveyor, these special considerations should be reported, where appropriate.

4.3 In case thickness measurements are partly carried out, the extent of remaining thickness measurements should be reported for the use of the next surveyor."

***

ANNEX 10

RESOLUTION MSC.244(83)
(adopted on 5 October 2007)

ADOPTION OF PERFORMANCE STANDARD FOR PROTECTIVE COATINGS FOR VOID SPACES ON BULK CARRIERS AND OIL TANKERS

THE MARITIME SAFETY COMMITTEE,

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

HAVING ADOPTED, by resolution MSC.215(82), the Performance standard for protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers and, by resolution MSC.216(82), amended SOLAS regulation II-1/3-2 to make the performance standard mandatory;

RECOGNIZING the need to also develop a performance standard for protective coatings for void spaces on bulk carriers and oil tankers,

HAVING CONSIDERED, at its eighty-third session, the proposed Performance standard for protective coatings for void spaces on bulk carriers and oil tankers,

1. ADOPTS the Performance standard for protective coatings for void spaces on bulk carriers and oil tankers, the text of which is set out in the Annex to the present resolution;

2. INVITES Member Governments to utilize the Performance standard when applying protective coatings to void spaces on bulk carriers and oil tankers.

ANNEX

PERFORMANCE STANDARD FOR PROTECTIVE COATINGS FOR VOID SPACES ON BULK CARRIERS AND OIL TANKERS

1 PURPOSE

This Standard provides technical requirements for protective coatings for void spaces constructed of steel in bulk carriers and oil tankers.

2 DEFINITIONS

For the purpose of this Standard, the following definitions apply:

2.1 *Dew point* is the temperature at which air is saturated with moisture.

2.2 *DFT* is dry film thickness.

2.3 *Dust* is loose particle matter present on a surface prepared for painting, arising from blast-cleaning or other surface preparation processes, or resulting from the action of the environment.

2.4 *Edge grinding* is the treatment of edge before secondary surface preparation.

2.5 "*GOOD*" *condition* is the condition with minor spot rusting as defined in the Guidelines on the enhanced programme of inspections during surveys of bulk carriers and oil tankers (resolution A.744(18)).

2.6 *Hard coating* is a coating that chemically converts during its curing process or a non-convertible air drying coating which may be used for maintenance purposes. It can be either inorganic or organic.

2.7 *NDFT* is the nominal dry film thickness. 90/10 practice means that 90% of all thickness measurements should be greater than or equal to NDFT and none of the remaining 10% measurements should be below 0.9 x NDFT.

2.8 *Primer coat* is the first coat of the coating system applied in the shipyard after shop primer application.

2.9 *Shop primer* is the prefabrication primer coating applied to steel plates, often in automatic plants (and before the first coat of a coating system).

2.10 *Stripe coating* is painting of edges, welds, hard to reach areas, etc., to ensure good paint adhesion and proper paint thickness in critical areas.

2.11 *Target useful life* is the target value, in years, of the durability for which the coating system is designed.

2.12 *Technical Data Sheet* is paint manufacturers' Product Data Sheet which contains detailed technical instruction and information relevant to the coating and its application.

2.13 *Totally enclosed space* is a space which has no means of access and no ventilation.

2.14 *Void space* is an enclosed space below the bulkhead deck, within and forward of, the cargo area of oil tankers or the cargo length area of bulk carriers, excluding:

.1 a dedicated seawater ballast tank;

.2 a space for the carriage of cargo;

.3 a space for the storage of any substance (e.g., oil fuel, fresh water, provisions);

.4 a space for the installation of any machinery (e.g., cargo pump, ballast pump, bow thruster);

.5 any space in normal use by personnel; and

.6 a double-side skin space of bulk carriers of 150 m in length and upwards which shall comply with the Performance standard for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers adopted by resolution MSC.215(82).

For the purpose of this regulation, "cargo area" and "cargo length area" are as defined in resolution A.744(18).

3 GENERAL PRINCIPLES

3.1 The ability of the coating system to reach its target useful life depends on the type of coating system, steel preparation, application and coating inspection and maintenance. All these aspects contribute to the good performance of the coating system.

3.2 Inspection of surface preparation and coating processes should be agreed upon between the shipowner, the shipyard and the coating manufacturer and presented to the Administration for review. Clear evidence of these inspections should be reported and be included in the Coating Technical File (CTF) (see paragraph 3.4).

3.3 When considering the standard provided in section 4, the following should be taken into account:

.1 it is essential that specifications, procedures and the various different steps in the coating application process (including, but not limited to, surface preparation) are strictly applied by the shipbuilder in order to prevent premature decay and/or deterioration of the coating system;

.2 the coating performance can be improved by adopting measures at the ship design stage such as reducing scallops, using rolled profiles, avoiding complex geometric configurations and ensuring that the structural configuration permits easy access for tools and to facilitate cleaning, drainage and drying of the space to be coated; and

.3 the coating performance standard provided in this resolution is based on the experience of manufacturers, shipyards and ship operators; it is not intended to exclude suitable alternative coating systems, providing a performance at least equivalent to that specified in this Standard is demonstrated. Acceptance criteria for alternative systems are provided in section 8.

3.4 Coating Technical File

3.4.1 Specification of the coating system applied to void spaces in bulk carriers and oil tankers, records of the shipyard's and shipowner's coating work, detailed criteria for coating selection, job specifications, inspection, maintenance and repair should be documented in the Coating Technical File (CTF), which should be reviewed by the Administration or an organization recognized by the Administration.

3.4.2 New construction stage

The Coating Technical File should contain at least the following items relating to this Standard and should be delivered by the shipyard at the new ship construction stage:

.1 copy of Statement of Compliance or Type Approval Certificate;

.2 copy of Technical Data Sheet, including:

.1 product name and identification mark and/or number;
.2 materials, components and composition of the coating system, colours;
.3 minimum and maximum dry film thickness;
.4 application methods, tools and/or machines;
.5 condition of surface to be coated (de-rusting grade, cleanness, profile, etc.); and
.6 environmental limitations (temperature and humidity);

.3 shipyard work records of coating application, including:

.1 applied actual space and area (in square metres) of each void space;
.2 applied coating system;
.3 time of coating, thickness, number of layers, etc.;
.4 ambient condition during coating; and
.5 method of surface preparation;

.4 procedures for inspection and repair of coating system during ship construction;

.5 coating log issued by the coating inspector, stating that the coating was applied in accordance with the specifications to the satisfaction of the coating supplier representative and specifying deviations from the specifications (example of daily log and non-conformity report, see annex 2);

.6 shipyard's verified inspection report, including:

.1 completion date of inspection;
.2 result of inspection;
.3 remarks (if given);
.4 inspector signature; and

.7 procedures for in-service maintenance and repair of coating system.

3.4.3 Maintenance, repair and partial re-coating

Maintenance, repair and partial re-coating activities should be recorded in the Coating Technical File in accordance with the relevant section of the guidelines for coating maintenance and repair[1].

3.4.4 Re-coating

If full re-coating is carried out, the items specified in paragraph 3.4.2 should be recorded in the Coating Technical File.

3.4.5 The Coating Technical File should be kept on board and maintained throughout the life of the ship.

3.5 Health and safety

The shipyard is responsible for the implementation of national regulations to ensure the health and safety of individuals and to minimize the risk of fire and explosion.

4 COATING STANDARD

4.1 Performance standard

This Standard is based on specifications and requirements which intend to provide a target useful coating life of 15 years, which is considered to be the time period, from initial application, over which the coating system is intended to remain in "GOOD" condition. The actual useful life will vary, depending on numerous variables including actual conditions encountered in service.

4.2 Standard application

4.2.1 Protective coatings for the following void spaces should comply with the requirements in this Standard:

.1 in bulk carriers:

.1 double bottom pipe passages / pipe tunnels;

.2 small void spaces located behind gusset or shedder plates at the bottom of corrugation bulkheads with the exception of totally enclosed spaces;

.3 other small void spaces in cargo spaces, with the exception of totally enclosed spaces;

.4 lower transverse stool of transverse bulkheads, with the exception of totally enclosed spaces[2]; and

.5 upper transverse stool of transverse bulkheads, with the exception of totally enclosed spaces[2]; and

---

[1] To be developed by the Organization.

[2] Noting, *inter alia*, the mandatory provisions of resolution A.744(18), as amended, regarding the requirement to undertake close-up surveys of the internal structure of upper and lower stools, where fitted.

.2 in oil tankers:

.1 forward cofferdam/cofferdam separating cargo from forepeak;

.2 cofferdam in cargo area/cofferdam separating incompatible cargoes;

.3 aft cofferdam;

.4 duct keel/pipe tunnels;

.5 lower bulkhead stools; and

.6 upper bulkhead stools.

4.2.2 Protective coatings for the following void spaces should comply with the requirements in the 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)):

.1 in bulk carriers:

.1 double-side skin spaces in ships of less than 150 m in length; and

.2 upper and lower side void spaces and double bottoms void spaces in cargo area; and

.2 in oil tankers:

double-side skin (DSS) voids including sides, bottoms/double hull voids spaces protecting cargo oil tanks.

4.2.3 No requirements are contained in this Standard for protective coatings for the following void spaces in bulk carriers and oil tankers:

.1 totally enclosed spaces located behind gusset or shedder plates at the bottom of corrugation bulkheads and other small totally enclosed spaces in cargo tanks;

.2 lower transverse stool of transverse bulkheads that are totally enclosed spaces;

.3 upper transverse stool of transverse bulkheads that are totally enclosed spaces;

.4 transducer voids; and

.5 any spaces not specifically mentioned in paragraphs 4.2.1 and 4.2.2.

4.3 Special application

4.3.1 This Standard covers protective coating requirements for the ship steel structure. It is noted that other independent items are fitted within the tanks to which coatings are applied to provide protection against corrosion.

4.3.2 It is recommended that this Standard be applied, to the extent possible, to those portions of permanent means of access provided for inspection, not integral to the ship structure, such as rails, independent platforms, ladders, etc. Other equivalent methods of providing corrosion protection for non-integral items may also be used, provided they do not impair the performance of the coatings of the surrounding structure. Access arrangements that are integral to the ship structure, such as increased stiffener depths for walkways, stringers, etc., should fully comply with this Standard.

4.3.3 It is also recommended that supports for piping, measuring devices, etc., be coated in accordance with the provisions for non-integral items indicated in paragraph 4.3.2.

4.4 Basic coating requirements

4.4.1 The requirements for protective coating systems, which should be applied at ship construction to void spaces in bulk carriers and oil tankers meeting the standard specified in paragraph 4.1, are listed in table 1.

4.4.2 Coating manufacturers should provide a specification of the protective coating system to satisfy the requirements of table 1.

4.4.3 The Administration or an organization recognized by the Administration should verify the Technical Data Sheet and Statement of Compliance or Type Approval Certificate for the protective coating system.

4.4.4 The shipyard should apply the protective coating in accordance with the verified Technical Data Sheet and its own verified application procedures.

Table 1 - Basic coating system requirements for void spaces in bulk carriers and oil tankers

	Characteristic	Requirement
1 Design of coating system		
.1	Selection of the coating system	The selection of the coating system should be considered by the parties involved with respect to the service conditions and planned maintenance. The following aspects, among other things should be considered: .1 location of space relative to heated surfaces; .2 required surface conditions; .3 required surface cleanliness and dryness; .4 relative humidity; .5 access and maintenance; and .6 mechanical ventilation. Coating manufacturers should have products with documented satisfactory performance records and technical data sheets. The manufacturers should also be capable of rendering adequate technical assistance. Performance records, Technical Data Sheet and technical assistance (if given) should be recorded in the Coating Technical File. Coatings for application underneath sun-heated decks or on bulkheads forming boundaries of heated spaces should be able to withstand repeated heating and/or cooling without becoming brittle.
.2	Coating type	Epoxy-based systems. Other coating systems with performance according to the test procedure in annex 1. When a multi-coat system is applied, contrasting colour is recommended for each coat. The top coat should be of a light colour in order to facilitate in-service inspection.

	Characteristic	Requirement
.3	Coating pre-qualification test	Epoxy-based systems tested prior to the date of adoption of this standard in a laboratory by a method corresponding to the test procedure in annex 1 or equivalent, which, as a minimum, meets the requirements for rusting and blistering may be accepted; or any coating system which meets the requirements in table 1.1.3 of the Performance standard for protective coating for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers (resolution MSC.215(82)), is accepted and may be applied in accordance with this Standard; or which have documented field exposure for 5 years with a final coating condition of not less than "GOOD" may also be accepted. For other systems, including epoxy-based systems tested after the adoption of this Standard, testing according to the procedure in annex 1 to this Standard should be required.
.4	Job specification	There should be a minimum of one stripe coat and one spray coat. The stripe coat should be applied on thermally cut free edges and small holes only. Surface contaminants such as rust, grease, dust, salt, oil, etc., should be removed prior to painting with proper methods according to the paint manufacturer's recommendation. Abrasive inclusions embedded in the coating should be removed. Job specifications should include the dry-to-recoat times and walk-on time given by the manufacturer.
.5	NDFT (nominal total dry film thickness)[3]	NDFT 200 µm with a 90/10 rule for epoxy based coatings, other systems to coating manufacturer's specifications. Maximum total dry film thickness according to manufacturer's detailed specifications. Care should be taken to avoid increasing the thickness in an exaggerated way. Wet film thickness should be regularly checked during application. Thinner should be limited to those types and quantities recommended by the manufacturer.

[3] Type of gauge and calibration in accordance with SSPC-PA2:2004. Paint Application Specification No.2.

	Characteristic	Requirement
2	**PSP (Primary surface preparation)**	
.1	Blasting and profile[4,5]	Sa 2½; with profiles between 30-75 μm. Blasting should not be carried out when: .1 the relative humidity is above 85%; or .2 the surface temperature of steel is less than 3°C above the dew point. Checking of the steel surface cleanliness and roughness profile should be carried out at the end of the surface preparation and before the application of the primer, in accordance with the manufacturer's recommendations.
.2	Water soluble salt limit equivalent to NaCl[6]	≤ 50 mg/m^2 of sodium chloride.
.3	Shop primer	Zinc containing inhibitor free zinc silicate based or equivalent. Compatibility with main coating system should be confirmed by the coating manufacturer.
3	**SSP (Secondary surface preparation)**	
.1	Steel condition	The steel surface should be prepared so that the coating selected can achieve an even distribution at the required NDFT and have an adequate adhesion by removing sharp edges, grinding weld beads and removing weld spatter and any other surface contaminant[7]. Edges to be smooth, subject to one pass grinding or at least equivalent process before painting[8].

[4] Reference standard: ISO 8501-1:1988/Suppl:1994. Preparation of steel substrate before application of paints and related products – Visual assessment of surface cleanliness.

[5] Reference standard: ISO 8503-1/2:1988. Preparation of steel substrate before application of paints and related products – Surface roughness characteristics of blast-cleaned steel substrates.

[6] Conductivity measured in accordance with ISO 8502-9:1998. Preparation of steel substrate before application of paints and related products – Test for the assessment of surface cleanliness.

[7] Reference standard: ISO 8501-3:2001 (grade P1). Preparation of steel substrate before application of paints and related products – Visual assessment of surface cleanliness.

[8] Reference standard: ISO 8501-3:2001 (grade P2). Preparation of steel substrate before application of paints and related products – Visual assessment of surface cleanliness.

	Characteristic	Requirement
.2	Surface treatment[4]	For damaged shop primer: Sa 2 or St 3 on damaged shop primer and welds; For intact shop primer: Sa 2 removing at least 70% of intact shop primer, which has not passed a pre-qualification certified by test procedures in table 1.1.3. If the complete coating system comprising epoxy-based main coating and shop primer has passed a pre-qualification certified by test procedures in table 1.1.3 intact shop primer may be retained provided the same epoxy coating system is used. The retained shop primer should be cleaned by sweep blasting, high pressure water washing or other methods in accordance with the manufacturer's recommendation. If a zinc silicate shop primer has passed the pre-qualification test of table 1.1.3 as part of an epoxy coating system, it may be used in combination with other epoxy coatings certified under table 1.1.3, provided that the compatibility has been confirmed by the manufacturer by the test in accordance with paragraph 1.7 of appendix 1 to annex 1 of the Performance standard for protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers, without wave movement.
.3	Surface treatment after erection[4]	St 3 or better or Sa 2 where practicable on butts and damages. Coating in overlap to be feathered.
.4	Profile requirements[5]	In case of full or partial blasting 30-75 μm, otherwise as recommended by the coating manufacturer.
.5	Dust[9]	Dust quantity rating "2" for dust size class "3", "4" and "5".
.6	Water soluble salts limit equivalent to NaCl after blasting/ grinding[6]	≤ 100 mg/m^2 of sodium chloride.
.7	Oil contamination	No oil contamination.

[9] Reference standard: ISO 8502-3:1993. Preparation of steel substrate before application of paints and related products – Test for the assessment of surface cleanliness.

	Characteristic	Requirement
4	**Miscellaneous**	
.1	Ventilation	Adequate ventilation is necessary for the proper drying and curing of coating. Ventilation should be maintained throughout the application process and for a period after application is completed, as recommended by the coating manufacturer.
.2	Environmental conditions	Coating should be applied under controlled humidity and surface conditions, in accordance with the manufacturer's specifications. In addition, coating should not be applied when: .1 the relative humidity is above 85%; or .2 the surface temperature is less than 3°C above the dew point.
.3	Testing of coating[3]	Destructive testing should be avoided. Dry film thickness should be measured after each coat for quality control purposes and the total dry film thickness should be confirmed after completion of final coat, using appropriate thickness gauges.
.4	Repair	Any defective areas, e.g. pin-holes, bubbles, voids, etc. should be marked up and appropriate repairs effected. All such repairs should be re-checked and documented.

5 COATING SYSTEM APPROVAL

Results from prequalification tests (table 1.1.3) of the coating system should be documented, and a Statement of Compliance or Type Approval Certificate should be issued if found satisfactory by a third party, independent of the coating manufacturer.

6 COATING INSPECTION REQUIREMENTS

6.1 General

6.1.1 To ensure compliance with this Standard, the following should be carried out by qualified coating inspectors certified to NACE Coating Inspector Level 2, FROSIO Inspector level III or equivalent as verified by the Administration[10].

6.1.2 Coating inspectors should inspect surface preparation and coating application during the coating process by carrying out, as a minimum, those inspection items identified in section 6.2 to ensure compliance with this Standard. Emphasis should be placed on initiation of each stage of surface preparation and coatings application, as improper work is extremely difficult to correct later in the coating progress. Representative structural members should be non-destructively

[10] In accordance with SOLAS regulation I/6, for the purposes of this Standard, the Administration may entrust a recognized organization acting on its behalf to determine compliance with the provisions of this Standard.

examined for coating thickness. The inspector should verify that appropriate collective measures have been carried out.

6.1.3 Results from the inspection should be recorded by the inspector and should be included in the CTF (refer to annex 2, Example of Daily Log and Non-conformity Report).

6.2 Inspection items

Construction stage		**Inspection items**
Primary surface preparation	1	The surface temperature of steel, the relative humidity and the dew point should be measured and recorded before the blasting process starts and at times of sudden changes in weather.
	2	The surface of steel plates should be tested for soluble salt checked for oil, grease and other contamination.
	3	The cleanliness of the steel surface should be monitored in the shop primer application process.
	4	The shop primer material should be confirmed to meet the requirements of 2.3 of table 1.
Thickness		If compatibility with the main coating system has been declared, then the thickness and curing of the zinc silicate shop primer should be confirmed to conform to the specified values.
Block assembly	1	After completing construction of the block and before secondary surface preparation starts, a visual inspection for steel surface treatment including edge treatment should be carried out. Any oil, grease or other visible contamination should be removed.
	2	After blasting/grinding/cleaning and prior to coating, a visual inspection of the prepared surface should be carried out. On completion of blasting and cleaning and prior to the application of the first coat of the system, the steel surface should be tested for levels of remaining soluble salts in at least one location per block.
	3	The surface temperature, the relative humidity and the dew point should be monitored and recorded during the coating application and curing.
	4	Inspection should be performed of the steps in the coating application process mentioned in table 1.
	5	DFT measurements should be taken to prove that the coating has been applied to the thickness as specified and outlined in annex 3.

Construction stage		Inspection items
Erection	1	Visual inspection for steel surface condition, surface preparation and verification of conformance to other requirements in table 1, and the agreed specification should be performed.
	2	The surface temperature, the relative humidity and the dew point should be measured and recorded before coating starts and regularly during the coating process.
	3	Inspection should be performed of the steps in the coating application process mentioned in table 1.

7 VERIFICATION REQUIREMENTS

The following should be carried out by the Administration prior to reviewing the Coating Technical File for the ship subject to this Standard:

.1 check that the Technical Data Sheet and Statement of Compliance or Type Approval Certificate comply with the Standard;

.2 check that the coating identification on representative containers is consistent with the coating identified in the Technical Data Sheet and Statement of Compliance or Type Approval Certificate;

.3 check that the inspector is qualified in accordance with the qualification standards in paragraph 6.1.1;

.4 check that the inspector's reports of surface preparation and the coating's application indicate compliance with the manufacturer's Technical Data Sheet and Statement of Compliance or Type Approval Certificate; and

.5 monitor implementation of the coating inspection requirements.

8 ALTERNATIVE SYSTEMS

8.1 All systems that are not an epoxy-based system applied according to table 1 of this Standard are defined as alternative systems.

8.2 This Standard is based on recognized and commonly used coating systems. It is not meant to exclude other, alternative, systems with proven equivalent performance, for example non epoxy-based systems.

8.3 Acceptance of alternative systems should be subject to documented evidence that they ensure a corrosion prevention performance at least equivalent to that indicated in this Standard.

8.4 As a minimum, the documented evidence should consist of satisfactory performance corresponding to that of a coating system which conforms to the Standard as described in section 4, a target useful life of 15 years in either actual field exposure for five years with final coating condition not less than "GOOD" or laboratory testing. Laboratory tests should be conducted in accordance with the test procedure given in annex 1 of this Standard.

ANNEX 1

TEST PROCEDURE FOR COATING QUALIFICATION FOR VOID SPACES OF BULK CARRIERS AND OIL TANKERS

1 Scope

This procedure provides details of the test procedure referred to in section 4, table 1, items .1.2 and .1.3 and paragraph 8.3 of this Standard.

2 Definition

Coating specification means the specification of coating systems which includes the type of coating system, steel preparation, surface preparation, surface cleanliness, environmental conditions, application procedure, acceptance criteria and inspection.

3 Test

Coating specification should be verified by a condensation chamber test in accordance with the procedures specified in this section.

3.1 Test condition

Condensation chamber tests should be conducted in accordance with ISO 6270.

.1 The exposure time should be 30 days.

.2 There should be 3 test panels.

.3 The size of each test panel should be 150 mm x 150 mm x 3 mm. All of the panels should be treated according to the Performance standard, tables 1, 2 and 3, and coating system applied according to table 1.1.4 and 1.1.5. At the primer stage, two of the panels should be weathered for at least 2 months and cleaned by low pressure washing or other mild method. Blast sweep or high pressure washing, or other primer removal methods should not be used. The third plate should have the primer removed to St 3 before the top coat is applied. Weathering method and extent should take into consideration that the primer should be the foundation for a 15 year target life system. To facilitate innovation, alternative preparation, coating systems and dry film thicknesses may be used when clearly defined.

.4 The reverse side of the test piece should be painted appropriately, in order not to affect the test results.

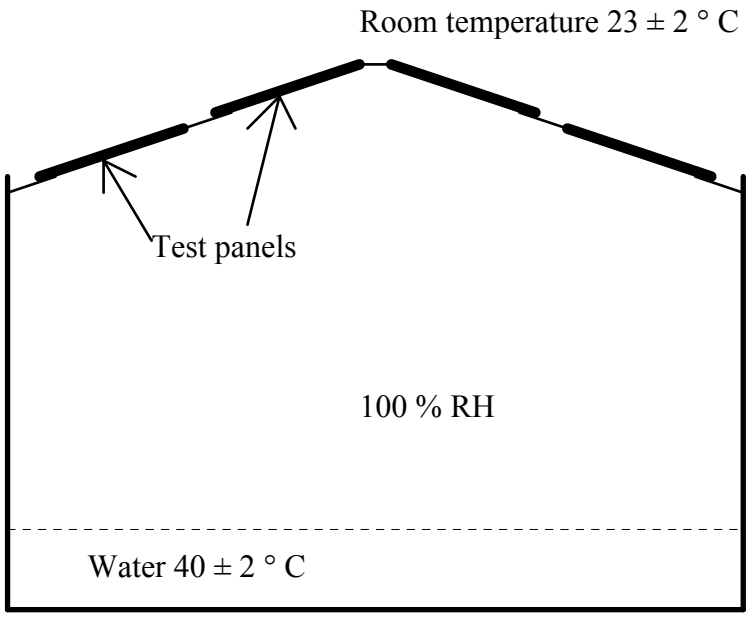


Figure 1: Condensation chamber

3.2 Test results

3.2.1 Prior to the testing, the following measured data of the coating system should be reported:

.1 infrared (IR) identification of the base and hardener components of the coating;

.2 specific gravity[11], of the base and hardener components of the paint; and

.3 number of pinholes, low voltage detector at 90 V.

3.2.2 After the testing, the following measured data should be reported:

.1 blisters and rust[12];

.2 dry film thickness (DFT) (use of a template);

.3 adhesion value[13]; and

.4 flexibility[14] modified according to panel thickness (3 mm steel, 300 μm coating, 150 mm cylindrical mandrel gives 2% elongation) for information only.

[11] According to ISO 2811-74.
[12] According to ISO 4628/2 and ISO 4628/3.
[13] According to ISO 4624.
[14] According to ASTM D4145.

3.3 Acceptance criteria

3.3.1 The test results based on section 2 should satisfy the following criteria:

Item	**Acceptance criteria for epoxy-based systems applied according to table 1 of this standard**	**Acceptance criteria for alternative systems**
Blisters on panel	No blisters	No blisters
Rust on panel	Ri 0 (0%)	Ri 0 (0%)
Number of pinholes	0	0
Adhesive failure	> 3.5 MPa Adhesive failure between substrate and coating or between coats for 60% or more of the areas	> 5 MPa Adhesive failure between substrate and coating or between coats for 60% or more of the areas
Cohesive failure	> 3 MPa Cohesive failure in coating for 40% or more of the area	> 5 MPa Cohesive failure in coating for 40% or more of the area

3.3.2 Epoxy-based systems tested prior to the date of adoption of this Standard should satisfy only the criteria for blistering and rust in the table above.

3.3.3 Epoxy-based systems tested when applied according to table 1 of this Standard should satisfy the criteria for epoxy-based systems as indicated in the table above.

3.3.4 Alternative systems not necessarily epoxy-based and/or not necessarily applied according to table 1 of this Standard should satisfy the criteria for alternative systems as indicated in the table above.

3.4 Test report

The test report should include the following information:

.1 name of the manufacturer;

.2 date of tests;

.3 product name/identification of both paint and primer;

.4 batch number;

.5 data of surface preparation on steel panels, including the following:

.1 surface treatment;
.2 water soluble salts limit;
.3 dust; and
.4 abrasive inclusions;

.6 application data of coating system, including the following:

.1 shop primed;
.2 number of coats;
.3 recoat interval[15];
.4 dry film thickness (DFT) prior to testing[15];
.5 thinner[15];
.6 humidity[15];
.7 air temperature[15]; and
.8 steel temperature;

.7 test results according to section 2; and

.8 judgment according to section 3.

[15] Both of actual specimen data and manufacturer's requirement/recommendation.

ANNEX 2

EXAMPLE OF DAILY LOG AND NON-CONFORMITY REPORT

DAILY LOG **Sheet No:**

Ship:	**Void No:**	**Database:**
Part of structure:		
SURFACE PREPARATION		
Method:	**Area (m^2):**	
Abrasive:	**Grain size:**	
Surface temperature:	**Air temperature:**	
Relative humidity (max):	**Dew point:**	
Standard achieved:		
Rounding of edges:		
Comments:		
Job No.:	**Date:**	**Signature:**

COATING APPLICATION:

Method:

Coat No.	System	Batch No.	Date	Air temp.	Surf temp.	RH%	Dew point	DFT* Meas.*	Specified

* **Measured minimum and maximum DFT. DFT readings to be attached to daily log**

Comments:

Job No: **Date:** **Signature:**

NON-CONFORMITY REPORT **Sheet No:**

Ship:	**Void No:**	**Database:**
Part of structure:		
DESCRIPTION OF THE INSPECTION FINDINGS TO BE CORRECTED		
Description of findings:		
Reference document (daily log):		
Action taken:		
Job No.:	**Date:**	**Signature:**

ANNEX 3

DRY FILM THICKNESS MEASUREMENTS

The following verification check points of DFT should be taken:

.1 one gauge reading per 5 m^2 of flat surface areas;

.2 one gauge reading at 2 to 3 m intervals and as close as possible to tank boundaries, but not further than 15 mm from edges of tank boundaries;

.3 longitudinal and transverse stiffener members:

One set of gauge readings as shown below, taken at 2 to 3 m run and not less than two sets between primary support members;

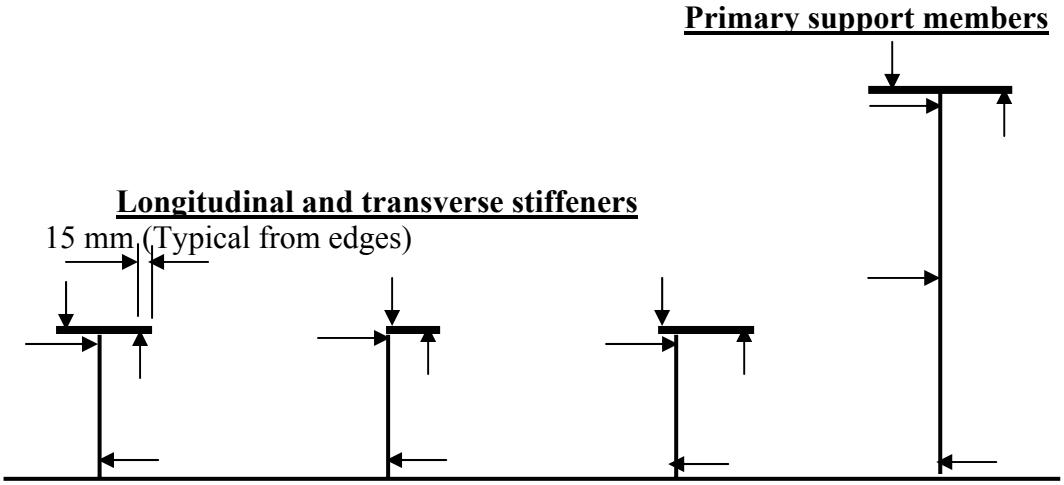


Figure 2

Note: Arrows of diagram indicate critical areas and should be understood to mean indication for both sides.

.4 three gauge readings for each set of primary support members and two gauge readings for each set of other members as indicated by the arrows in the diagram;

.5 for primary support members (girders and transverses) one set of gauge readings for 2 to 3 m run as shown in figure 3 above but not less than three sets;

.6 around openings one gauge reading from each side of the opening;

.7 five gauge readings per square metre (m^2) but not less than three gauge readings taken at complex areas (i.e. large brackets of primary support members); and

.8 additional spot checks should be taken to verify coating thickness for any area considered necessary by the coating inspector.

***

ANNEX 11

DRAFT SOLAS REGULATION II-1/3-9 (MEANS OF EMBARKATION ON, AND DISEMBARKATION FROM, SHIPS)

CHAPTER II-1

CONSTRUCTION – STRUCTURE, SUBDIVISION AND STABILITY, MACHINERY AND ELECTRICAL INSTALLATIONS

1 The following new regulation 3-9 is added after the existing regulation II-1/3-8:

"**Regulation 3-9**

Means of embarkation on and disembarkation from ships

1 Ships constructed on or after [date of entry into force] shall be provided with means of embarkation on and disembarkation from ships for use in port and in port-related or pilotage operations, such as gangways and accommodation ladders, in accordance with paragraph 2, unless the Administration deems that compliance with a particular provision is unreasonable or impractical*.

2 The means of embarkation and disembarkation required in paragraph 1 shall be constructed and installed based on the guidelines developed by the Organization.**

3 For all ships the means of embarkation and disembarkation shall be inspected and maintained** in suitable condition for their intended purpose, taking into account any restrictions related to safe loading. All wires used to support the means of embarkation and disembarkation shall be maintained as specified in regulation III/20.4."

***

* Circumstances where compliance may be deemed unreasonable or impractical may include where the ship:
.1 has small freeboards and is provided with boarding ramps; or
.2 is engaged in voyages between designated ports where appropriate shore accommodation/embarkation ladders (platforms) are provided.

** Refer to the Guidelines for construction, maintenance and inspection of accommodation ladders and gangways (MSC.1/Circ....).

ANNEX 12

DRAFT AMENDMENTS TO SOLAS REGULATION II-1/3-4 (EMERGENCY TOWING ARRANGEMENTS ON TANKERS)

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

Regulation 3-4 – Emergency towing arrangements on tankers

1 The existing title of the regulation is replaced by the following:

"**Emergency towing arrangements and procedures**"

2 The existing paragraphs 1 to 3 are replaced by the following:

"**1 Emergency towing arrangements on tankers**

1.1 Emergency towing arrangements shall be fitted at both ends on board every tanker of not less than 20,000 tonnes deadweight.

1.2 For tankers constructed on or after 1 July 2002:

.1 the arrangements shall, at all times, be capable of rapid deployment in the absence of main power on the ship to be towed and easy connection to the towing ship. At least one of the emergency towing arrangements shall be pre-rigged ready for rapid deployment; and

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

1.3 For tankers constructed before 1 July 2002, the design and construction of emergency towing arrangements shall be approved by the Administration, based on the Guidelines developed by the Organization*.

2 Emergency towing procedures on ships

2.1 This paragraph applies to:

.1 all passenger ships not later than 1 January 2010;

* Refer to the Guidelines on emergency towing arrangements for tankers, adopted by the Maritime Safety Committee by resolution MSC.35(63), as may be amended.

.2 cargo ships constructed on or after 1 January 2010; and

.3 cargo ships constructed before 1 January 2010 not later than 1 January 2012.

2.2 Ships shall be provided with a ship-specific emergency towing procedure. Such a procedure shall be carried aboard the ship for use in emergency situations and shall be based on existing arrangements and equipment available on board the ship.

2.3 The procedure* shall include:

.1 drawings of fore and aft deck showing possible emergency towing arrangements;

.2 inventory of equipment on board that can be used for emergency towing;

.3 means and methods of communication; and

.4 sample procedures to facilitate the preparation for and conducting of emergency towing operations."

***

* Refer to the Guidelines for owners/operators on preparing for emergency towing procedures (MSC.1/Circ....).

ANNEX 13

DRAFT MSC RESOLUTION

ADOPTION OF THE INTERNATIONAL CODE ON INTACT STABILITY, 2008 (2008 IS CODE)

THE MARITIME SAFETY COMMITTEE,

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

RECALLING ALSO resolution A.749(18) entitled "Code on Intact Stability for All Types of Ships Covered by IMO Instruments", as amended by resolution MSC.75(69),

RECOGNIZING the need to update the aforementioned Code and the importance of establishing mandatory international intact stability requirements,

NOTING resolution MSC…[(85)], by which it adopted, *inter alia*, amendments to the International Convention for the Safety of Life at Sea, 1974, as amended (1974 SOLAS Convention) and to the Protocol of 1988 relating to the International Convention on Load Lines, 1966, (1988 LL Protocol) to make the introduction and the provisions of part A of the International Code on Intact Stability, 2008 mandatory under the Convention and the Protocol,

HAVING CONSIDERED, at its [eighty-fifth] session, the text of the proposed International Code on Intact Stability, 2008,

1. ADOPTS the International Code on Intact Stability, 2008 (2008 IS Code), the text of which is set out in the Annex to the present resolution;

2. INVITES Contracting Governments to the 1974 SOLAS Convention and Parties to the 1988 LL Protocol to note that the 2008 IS Code will take effect on [1 July 2010] upon the entry into force of the respective amendments to the 1974 SOLAS Convention and 1988 LL Protocol;

3. REQUESTS the Secretary-General to transmit certified copies of the present resolution and the text of the 2008 IS Code contained in the Annex to all Contracting Governments to the 1974 SOLAS Convention and Parties to the 1988 LL Protocol;

4. FURTHER REQUESTS the Secretary-General to transmit copies of this resolution and the Annex to all Members of the Organization which are not Contracting Governments to the 1974 SOLAS Convention and Parties to the 1988 LL Protocol;

5. RECOMMENDS Governments concerned to use the recommendatory provisions contained in part B of the 2008 IS Code as a basis for relevant safety standards, unless their national stability requirements provide at least an equivalent degree of safety.

ANNEX

INTERNATIONAL CODE ON INTACT STABILITY, 2008 (2008 IS CODE)

CONTENTS

PREAMBLE

1 This Code has been assembled to provide, in a single document, mandatory requirements in the introduction and in part A and recommended provisions in part B relating to intact stability, based primarily on existing IMO instruments. Where recommendations in this Code appear to differ from other IMO Codes, the other Codes should be taken as the prevailing instrument. For the sake of completeness and for the convenience of the user, this Code also contains relevant provisions from mandatory IMO instruments.

2 Criteria included in the Code are based on the best "state-of-the-art" concepts, available at the time they were developed, taking into account sound design and engineering principles and experience gained from operating ships. Furthermore, design technology for modern ships is rapidly evolving and the Code should not remain static but should be re-evaluated and revised, as necessary. To this end, the Organization will periodically review the Code taking into consideration both experience and further development.

3 A number of influences such as the dead ship condition, wind on ships with large windage area, rolling characteristics, severe seas, etc., were taken into account based on the state-of-the-art technology and knowledge at the time of the development of the Code.

4 It was recognized that in view of a wide variety of types, sizes of ships and their operating and environmental conditions, problems of safety against accidents related to stability have generally not yet been solved. In particular, the safety of a ship in a seaway involves complex hydrodynamic phenomena which up to now have not been fully investigated and understood. Motion of ships in a seaway should be treated as a dynamical system and relationships between ship and environmental conditions like wave and wind excitations are recognized as extremely important elements. Based on hydrodynamic aspects and stability analysis of a ship in a seaway, stability criteria development poses complex problems that require further research.

INTRODUCTION

1 Purpose

1.1 The purpose of the Code is to present mandatory and recommendatory stability criteria and other measures for ensuring the safe operation of ships, to minimize the risk to such ships, to the personnel on board and to the environment. This introduction and part A of the Code address the mandatory criteria and part B contains recommendations and additional guidelines.

1.2 This Code contains intact stability criteria for the following types of ships and other marine vehicles of 24 m in length and above unless otherwise stated:

.1 cargo ships;

.2 cargo ships carrying timber deck cargoes;

.3 passenger ships;

.4 fishing vessels;

.5 special purpose ships;

.6 offshore supply vessels;

.7 mobile offshore drilling units;

.8 pontoons; and

.9 cargo ships carrying containers on deck and containerships.

1.3 Administrations may impose additional requirements regarding the design aspects of ships of novel design or ships not otherwise covered by the Code.

2 Definitions

For the purpose of this Code the definitions given hereunder shall apply. For terms used, but not defined in this Code, the definitions as given in the 1974 SOLAS Convention as amended shall apply.

2.1 *Administration* means the Government of the State whose flag the ship is entitled to fly.

2.2 *Passenger ship* is a ship which carries more than twelve passengers as defined in regulation I/2 of the 1974 SOLAS Convention, as amended.

2.3 *Cargo ship* is any ship which is not a passenger ship, a ship of war and troopship, a ship which is not propelled by mechanical means, a wooden ship of primitive build, a fishing vessel and a mobile offshore drilling unit.

2.4 *Oil tanker* means a ship constructed or adapted primarily to carry oil in bulk in its cargo spaces and includes combination carriers and any chemical tanker as defined in Annex II of the MARPOL Convention when it is carrying a cargo or part cargo of oil in bulk.

2.4.1 *Combination carrier* means a ship designed to carry either oil or solid cargoes in bulk.

2.4.2 *Crude oil tanker* means an oil tanker engaged in the trade of carrying crude oil.

2.4.3 *Product carrier* means an oil tanker engaged in the trade of carrying oil other than crude oil.

2.5 *Fishing vessel* is a vessel used for catching fish, whales, seals, walrus or other living resources of the sea.

2.6 *Special purpose ship* means a mechanically self-propelled ship which, by reason of its function, carries on board more than 12 special personnel as defined in paragraph 1.3.3 of the Code of Safety for Special Purpose Ships (resolution A.534(13)), including passengers (ships engaged in research, expeditions and survey; ships for training of marine personnel; whale and fish factory ships not engaged in catching; ships processing other living resources of the sea, not engaged in catching or other ships with design features and modes of operation similar to ships mentioned above which, in the opinion of the Administration may be referred to this group).

2.7 *Offshore supply vessel* means a vessel which is engaged primarily in the transport of stores, materials and equipment to offshore installations and designed with accommodation and bridge erections in the forward part of the vessel and an exposed cargo deck in the after part for the handling of cargo at sea.

2.8 *Mobile offshore drilling unit* (MODU or unit) is a ship capable of engaging in drilling operations for the exploration or exploitation of resources beneath the sea-bed such as liquid or gaseous hydrocarbons, sulphur or salt.

2.8.1 *Column-stabilized unit* is a unit with the main deck connected to the underwater hull or footings by columns or caissons.

2.8.2 *Surface unit* is a unit with a ship- or barge-type displacement hull of single or multiple hull construction intended for operation in the floating condition.

2.8.3 *Self-elevating unit* is a unit with moveable legs capable of raising its hull above the surface of the sea.

2.8.4 *Coastal State* means the Government of the State exercising administrative control over the drilling operations of the unit.

2.8.5 *Mode of operation* means a condition or manner in which a unit may operate or function while on location or in transit. The modes of operation of a unit include the following:

.1 *operating conditions* means conditions wherein a unit is on location for the purpose of conducting drilling operations, and combined environmental and operational loadings are within the appropriate design limits established for such operations. The unit may be either afloat or supported on the sea-bed, as applicable;

.2 *severe storm conditions* means conditions wherein a unit may be subjected to the most severe environmental loadings for which the unit is designed. Drilling

operations are assumed to have been discontinued due to the severity of the environmental loadings, the unit may be either afloat or supported on the sea-bed, as applicable; and

.3 *transit conditions* means conditions wherein a unit is moving from one geographical location to another.

2.9 *High-speed craft* (HSC)[1] is a craft capable of a maximum speed, in metres per second (m/s), equal to or exceeding:

$$3.7 * \nabla^{0.1667}$$

where: ∇ = displacement corresponding to the design waterline (m^3).

2.10 *Containership* means a ship which is used primarily for the transport of marine containers.

2.11 *Freeboard* is the distance between the assigned load line and freeboard deck[2].

2.12 *Length of ship*. The length should be taken as 96% of the total length on a waterline at 85% of the least moulded depth measured from the top of the keel, or as the length from the fore side of the stem to the axis of the rudder stock on the waterline, if that be greater. In ships designed with a rake of keel the waterline on which this length is measured should be parallel to the designed waterline.

2.13 *Moulded breadth* is the maximum breadth of the ship measured amidships to the moulded line of the frame in a ship with a metal shell and to the outer surface of the hull in a ship with a shell of any other material.

2.14 *Moulded depth* is the vertical distance measured from the top of the keel to the top of the freeboard deck beam at side. In wood and composite ships, the distance is measured from the lower edge of the keel rabbet. Where the form at the lower part of the midship section is of a hollow character, or where thick garboards are fitted, the distance is measured from the point where the line of the flat of the bottom continued inwards cuts the side of the keel. In ships having rounded gunwales, the moulded depth should be measured to the point of intersection of the moulded lines of the deck and side shell plating, the lines extending as though the gunwale were of angular design. Where the freeboard deck is stepped and the raised part of the deck extends over the point at which the moulded depth is to be determined, the moulded depth should be measured to a line of reference extending from the lower part of the deck along a line parallel with the raised part.

---

[1] The Code of Safety for High-Speed Craft, 2000 (2000 HSC Code) has been developed following a thorough revision of the Code of Safety for High-Speed Craft, 1994 (1994 HSC Code) which was derived from the previous Code of Safety for Dynamically Supported Craft (DSC Code) adopted by IMO in 1977, recognizing that safety levels can be significantly enhanced by the infrastructure associated with regular service on a particular route, whereas the conventional ship safety philosophy relies on the ship being self-sustaining with all necessary emergency equipment being carried on board.

[2] For the purposes of application of chapters I and II of Annex I of the International Convention on Load Lines, 1966 or the Protocol of 1988 as amended, as applicable to open-top containerships, "freeboard deck" is the freeboard deck according to the International Convention on Load Lines, 1966 or the Protocol of 1988 as amended, as applicable as if hatch covers are fitted on top of the hatch cargo coamings.

2.15 *Near-coastal voyage* means a voyage in the vicinity of the coast of a State as defined by the Administration of that State.

2.16 *Pontoon* is considered to be normally:

.1 non self-propelled;

.2 unmanned;

.3 carrying only deck cargo;

.4 having a block coefficient of 0.9 or greater;

.5 having a breadth/depth ratio of greater than 3; and

.6 having no hatchways in the deck except small manholes closed with gasketed covers.

2.17 *Timber* means sawn wood or lumber, cants, logs, poles, pulpwood and all other types of timber in loose or packaged forms. The term does not include wood pulp or similar cargo.

2.18 *Timber deck cargo* means a cargo of timber carried on an uncovered part of a freeboard or superstructure deck. The term does not include wood pulp or similar cargo.[3]

2.19 *Timber load line* means a special load line assigned to ships complying with certain conditions related to their construction set out in the International Convention on Load Lines and used when the cargo complies with the stowage and securing conditions of the Code of Safe Practice for Ships Carrying Timber Deck Cargoes, 1991 (resolution A.715(17)).

2.20 *Certification of the inclining test weights* is the verification of the weight marked on a test weight. Test weights should be certified using a certificated scale. The weighing should be performed close enough in time to the inclining test to ensure the measured weight is accurate.

2.21 *Draught* is the vertical distance from the moulded baseline to the waterline.

2.22 The *inclining test* involves moving a series of known weights, normally in the transverse direction, and then measuring the resulting change in the equilibrium heel angle of the ship. By using this information and applying basic naval architecture principles, the ship's vertical centre of gravity (VCG) is determined.

2.23 *Lightship condition* is a ship complete in all respects, but without consumables, stores, cargo, crew and effects, and without any liquids on board except that machinery and piping fluids, such as lubricants and hydraulics, are at operating levels.

2.24 A *lightweight survey* involves taking an audit of all items which should be added, deducted or relocated on the ship at the time of the inclining test so that the observed condition of

[3] Refer to regulation 42(1) of the International Convention on Load Lines, 1966 or the Protocol of 1988 as amended, as applicable.

the ship can be adjusted to the lightship condition. The mass, longitudinal, transverse and vertical location of each item should be accurately determined and recorded. Using this information, the static waterline of the ship at the time of the inclining test as determined from measuring the freeboard or verified draught marks of the ship, the ship's hydrostatic data, and the sea water density, the lightship displacement and longitudinal centre of gravity (LCG) can be obtained. The transverse centre of gravity (TCG) may also be determined for mobile offshore drilling units (MODUs) and other ships which are asymmetrical about the centreline or whose internal arrangement or outfitting is such that an inherent list may develop from off-centre mass.

2.25 An *in-service inclining test* means an inclining test which is performed in order to verify the pre-calculated GM_C and the deadweight's centre of gravity of an actual loading condition.

2.26 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 Stability Booklet are met in any operational loading condition. A Stability Instrument comprises hardware and software.

PART A
MANDATORY CRITERIA

CHAPTER 1 – GENERAL

1.1 Application

1.1.1 The criteria stated under chapter 2 of this part present a set of minimum requirements that shall apply to cargo[4] and passenger ships of 24 m in length and over.

1.1.2 The criteria stated under chapter 3 are special criteria for certain types of ships. For the purpose of part A the definitions given in the Introduction apply.

1.2 Dynamic stability phenomena in waves

Administrations shall be aware that some ships are more at risk of encountering critical stability situations in waves. Necessary precautionary provisions may need to be taken in the design to address the severity of such phenomena. The phenomena in seaways which may cause large roll angles and/or accelerations have been identified hereunder.

Having regard to the phenomena described in this section, the Administration may for a particular ship or group of ships apply criteria demonstrating that the safety of the ship is sufficient. Any Administration which applies such criteria should communicate to the Organization particulars thereof. It is recognized by the Organization that performance oriented criteria for the identified phenomena listed in this section need to be developed and implemented to ensure a uniform international level of safety.

1.2.1 *Righting lever variation*

Any ship exhibiting large righting lever variations between wave trough and wave crest condition may experience parametric roll or pure loss of stability or combinations thereof.

1.2.2 *Resonant roll in dead ship condition*

Ships without propulsion or steering ability may be endangered by resonant roll while drifting freely.

1.2.3 *Broaching and other manoeuvring related phenomena*

Ships in following and quartering seas may not be able to keep constant course despite maximum steering efforts which may lead to extreme angles of heel.

---

[4] For containerships of 100 m in length and over, provisions of chapter 2.3 of part B may be applied as an alternative to the application of chapter 2.2 of this part. Offshore supply vessels and special purpose ships are not required to comply with provisions of chapter 2.3 of part A. For offshore supply vessels, provisions of chapter 2.4 of part B may be applied as an alternative to the application of chapter 2.2 of this part. For special purpose ships, provisions of chapter 2.5 of part B may be applied as an alternative to the application of chapter 2.2 of this part.

CHAPTER 2 – GENERAL CRITERIA

2.1 General

2.1.1 All criteria shall be applied for all conditions of loading as set out in part B, 3.3 and 3.4.

2.1.2 Free surface effects (part B, 3.1) shall be accounted for in all conditions of loading as set out in part B, 3.3 and 3.4.

2.1.3 Where anti-rolling devices are installed in a ship, the Administration shall be satisfied that the criteria can be maintained when the devices are in operation and that failure of power supply or the failure of the device(s) will not result in the vessel being unable to meet the relevant provisions of this Code.

2.1.4 A number of influences such as icing of topsides, water trapped on deck, etc., adversely affect stability and the Administration is advised to take these into account, so far as is deemed necessary.

2.1.5 Provisions shall be made for a safe margin of stability at all stages of the voyage, regard being given to additions of weight, such as those due to absorption of water and icing (details regarding ice accretion are given in part B, chapter 6 – Icing considerations) and to losses of weight such as those due to consumption of fuel and stores.

2.1.6 Each ship shall be provided with a stability booklet, approved by the Administration, which contains sufficient information (see part B, 3.6) to enable the master to operate the ship in compliance with the applicable requirements contained in the Code. If a stability instrument is used as a supplement to the stability booklet for the purpose of determining compliance with the relevant stability criteria such instrument shall be subject to the approval by the Administration (see part B, chapter 4 – Stability calculations performed by stability instruments).

2.1.7 If curves or tables of minimum operational metacentric height (GM) or maximum centre of gravity (VCG) are used to ensure compliance with the relevant intact stability criteria those limiting curves shall extend over the full range of operational trims, unless the Administration agrees that trim effects are not significant. When curves or tables of minimum operational metacentric height (GM) or maximum centre of gravity (VCG) versus draught covering the operational trims are not available, the master must verify that the operating condition does not deviate from a studied loading condition, or verify by calculation that the stability criteria are satisfied for this loading condition taking into account trim effects.

2.2 Criteria regarding righting lever curve properties

2.2.1 The area under the righting lever curve (GZ curve) shall not be less than 0.055 metre-radians up to $\varphi = 30°$ angle of heel and not less than 0.09 metre-radians up to $\varphi = 40°$ or the angle of down-flooding φ_f[5] if this angle is less than 40°. Additionally, the area under the righting lever curve (GZ curve) between the angles of heel of 30° and 40° or between 30° and φ_f, if this angle is less than 40°, shall not be less than 0.03 metre-radians.

[5] φ_f is an angle of heel at which openings in the hull, superstructures or deckhouses which cannot be closed weathertight immerse. In applying this criterion, small openings through which progressive flooding cannot take place need not be considered as open.

2.2.2 The righting lever GZ shall be at least 0.2 m at an angle of heel equal to or greater than 30°.

2.2.3 The maximum righting lever shall occur at an angle of heel not less than 25°. If this is not practicable, alternative criteria, based on an equivalent level of safety[6], may be applied subject to the approval of the Administration.

2.2.4 The initial metacentric height GM_0 shall not be less than 0.15 m.

2.3 Severe wind and rolling criterion (weather criterion)

2.3.1 The ability of a ship to withstand the combined effects of beam wind and rolling shall be demonstrated, with reference to the figure 2.3.1 as follows:

.1 the ship is subjected to a steady wind pressure acting perpendicular to the ship's centreline which results in a steady wind heeling lever (l_{w1});

.2 from the resultant angle of equilibrium (φ_0), the ship is assumed to roll owing to wave action to an angle of roll (φ_1) to windward. The angle of heel under action of steady wind (φ_0) should not exceed 16° or 80% of the angle of deck edge immersion, whichever is less;

.3 the ship is then subjected to a gust wind pressure which results in a gust wind heeling lever (l_{w2}); and

.4 under these circumstances, area *b* shall be equal to or greater than area *a*, as indicated in figure 2.3.1 below:

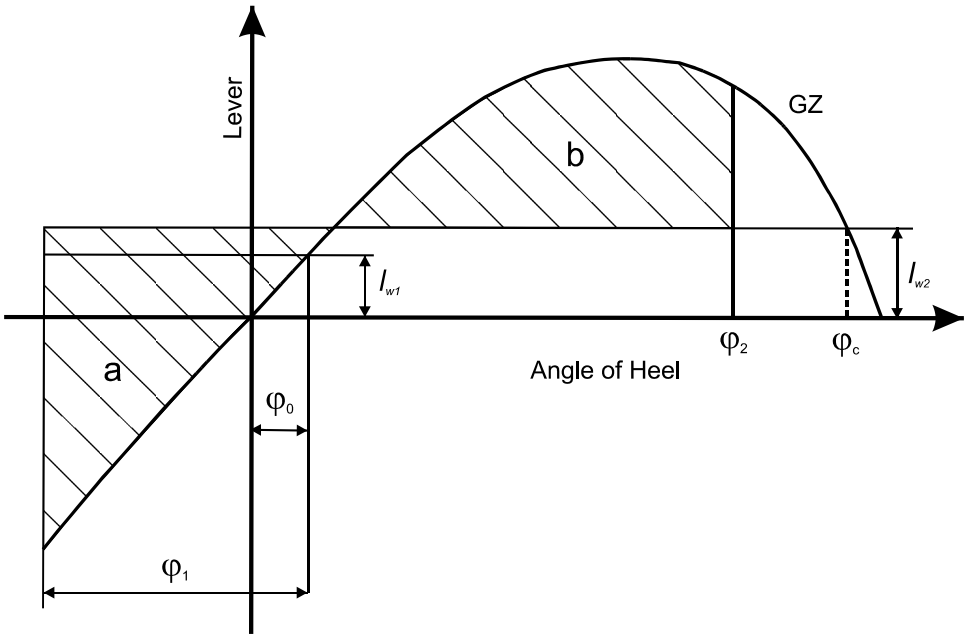


Figure 2.3.1 – Severe wind and rolling

[6] Refer to the Explanatory Notes to the International Code on Intact Stability, 2008 (MSC.1/Circ.[...]).

where the angles in figure 2.3.1 are defined as follows:

φ_0 = angle of heel under action of steady wind

φ_1 = angle of roll to windward due to wave action (see 2.3.1.2, 2.3.4 and footnote 6)

φ_2 = angle of down-flooding (φ_f) or 50° or φ_c, whichever is less,

where:

φ_f = angle of heel at which openings in the hull, superstructures or deckhouses which cannot be closed weathertight immerse. In applying this criterion, small openings through which progressive flooding cannot take place need not be considered as open.

φ_c = angle of second intercept between wind heeling lever l_{w2} and GZ curves.

2.3.2 The wind heeling levers l_{w1} and l_{w2} referred to in 2.3.1.1 and 2.3.1.3 are constant values at all angles of inclination and shall be calculated as follows:

$$l_{w_1} = \frac{P * A * Z}{1000 * g * \Delta} \quad (m) \quad \text{and}$$

$$l_{w_2} = 1.5 * l_{w_1} \quad (m)$$

where:

P = wind pressure of 504 Pa. The value of P used for ships in restricted service may be reduced subject to the approval of the Administration

A = projected lateral area of the portion of the ship and deck cargo above the waterline (m^2)

Z = vertical distance from the centre of A to the centre of the underwater lateral area or approximately to a point at one half the mean draught (m)

Δ = displacement (t)

g = gravitational acceleration of 9.81 m/s^2

2.3.3 Alternative means for determining the wind heeling lever (l_{w1}) may be accepted, to the satisfaction of the Administration, as an equivalent to calculation in 2.3.2. When such alternative tests are carried out, reference shall be made based on the Guidelines developed by the Organization[7]. The wind velocity used in the tests shall be 26 m/s in full scale with uniform velocity profile. The value of wind velocity used for ships in restricted services may be reduced to the satisfaction of the Administration.

[7] Refer to the Interim Guidelines for alternative assessment of the weather criterion (MSC.1/Circ.1200).

2.3.4 The angle of roll (φ_1)[8] referred to in 2.3.1.2 shall be calculated as follows:

$$\varphi_1 = 109 * k * X_1 * X_2 * \sqrt{r * s} \quad (degrees)$$

where:

X_1 = factor as shown in table 2.3.4-1

X_2 = factor as shown in table 2.3.4-2

k = factor as follows:

k = 1.0 for round-bilged ship having no bilge or bar keels

k = 0.7 for a ship having sharp bilges

k = as shown in table 2.3.4-3 for a ship having bilge keels, a bar keel or both

r = $0.73 + 0.6\ OG/d$

with:

OG = KG – d

d = mean moulded draught of the ship (m)

s = factor as shown in table 2.3.4-4, where T is the ship roll natural period. In absence of sufficient information, the following approximate formula can be used:

Rolling period $$T = \frac{2 * C * B}{\sqrt{GM}} (s)$$

where:

C = $0.373 + 0.023(B/d) - 0.043(L_{wl}/100)$.

The symbols in tables 2.3.4-1, 2.3.4-2, 2.3.4-3 and 2.3.4-4 and the formula for the rolling period are defined as follows:

L_{wl} = length of the ship at waterline (m)

B = moulded breadth of the ship (m)

[8] The angle of roll for ships with anti-rolling devices should be determined without taking into account the operation of these devices unless the Administration is satisfied with the proof that the devices are effective even with sudden shutdown of their supplied power.

d = mean moulded draught of the ship (m)

C_B = block coefficient (-)

A_k = total overall area of bilge keels, or area of the lateral projection of the bar keel, or sum of these areas (m²)

GM = metacentric height corrected for free surface effect (m).

Table 2.3.4-1 – Values of factor X_1

B/d	X_1
≤ 2.4	1.0
2.5	0.98
2.6	0.96
2.7	0.95
2.8	0.93
2.9	0.91
3.0	0.90
3.1	0.88
3.2	0.86
3.4	0.82
≥ 3.5	0.80

Table 2.3.4-2 – Values of factor X_2

C_B	X_2
≤ 0.45	0.75
0.50	0.82
0.55	0.89
0.60	0.95
0.65	0.97
≥ 0.70	1.00

Table 2.3.4-3 – Values of factor k

$\frac{A_k \times 100}{L_{WL} \times B}$	k
0	1.0
1.0	0.98
1.5	0.95
2.0	0.88
2.5	0.79
3.0	0.74
3.5	0.72
≥ 4.0	0.70

Table 2.3.4-4 – Values of factor *s*

T	*s*
≤ 6	0.100
7	0.098
8	0.093
12	0.065
14	0.053
16	0.044
18	0.038
≥ 20	0.035

(Intermediate values in these tables shall be obtained by linear interpolation)

2.3.5 The tables and formulae described in 2.3.4 are based on data from ships having:

.1 *B/d* smaller than 3.5;

.2 *(KG/d-1)* between -0.3 and 0.5;

.3 *T* smaller than 20 s.

For ships with parameters outside of the above limits the angle of roll (φ_1) may be determined with model experiments of a subject ship with the procedure described in MSC.1/Circ.1200 as the alternative. In addition, the Administration may accept such alternative determinations for any ship, if deemed appropriate.

CHAPTER 3 – SPECIAL CRITERIA FOR CERTAIN TYPES OF SHIPS

3.1 Passenger ships

Passenger ships shall comply with the requirements of 2.2 and 2.3.

3.1.1 In addition, the angle of heel on account of crowding of passengers to one side as defined below shall not exceed 10°.

3.1.1.1 A minimum weight of 75 kg shall be assumed for each passenger except that this value may be increased subject to the approval of the Administration. In addition, the mass and distribution of the luggage shall be approved by the Administration.

3.1.1.2 The height of the centre of gravity for passengers shall be assumed equal to:

.1 1 m above deck level for passengers standing upright. Account may be taken, if necessary, of camber and sheer of deck; and

.2 0.3 m above the seat in respect of seated passengers.

3.1.1.3 Passengers and luggage shall be considered to be in the spaces normally at their disposal, when assessing compliance with the criteria given in 2.2.1 to 2.2.4.

3.1.1.4 Passengers without luggage shall be considered as distributed to produce the most unfavourable combination of passenger heeling moment and/or initial metacentric height, which may be obtained in practice, when assessing compliance with the criteria given in 3.1.1 and 3.1.2, respectively. In this connection, a value higher than four persons per square metre is not necessary.

3.1.2 In addition, the angle of heel on account of turning shall not exceed 10° when calculated using the following formula:

$$M_R = 0.200 * \frac{v_0^2}{L_{WL}} * \Delta * \left(KG - \frac{d}{2} \right)$$

where:

M_R = heeling moment (kNm)

v_o = service speed (m/s)

L_{WL} = length of ship at waterline (m)

Δ = displacement (t)

d = mean draught (m)

KG = height of centre of gravity above baseline (m)

3.2 Oil tankers of 5,000 dwt and above

Oil tankers, as defined in the section Definitions, shall comply with regulation 27 of Annex I to MARPOL 73/78.

3.3 Cargo ships carrying timber deck cargoes

Cargo ships carrying timber deck cargoes shall comply with the requirements of 2.2 and 2.3 unless the Administration is satisfied with the application of alternative provision 3.3.2.

3.3.1 *Scope*

The provisions given hereunder apply to all ships of 24 m in length and over engaged in the carriage of timber deck cargoes. Ships that are provided with, and make use of, their timber load line shall also comply with the requirements of regulations 41 to 45 of the 1966 Load Line Convention.

3.3.2 *Alternative stability criteria*

For ships loaded with timber deck cargoes and provided that the cargo extends longitudinally between superstructures (where there is no limiting superstructure at the after end, the timber deck cargo shall extend at least to the after end of the aftermost hatchway)[9] transversely for the full beam of ship, after due allowance for a rounded gunwale, not exceeding 4% of the breadth of the ship and/or securing the supporting uprights and which remains securely fixed at large angles of heel may be:

3.3.2.1 The area under the righting lever curve (GZ curve) shall not be less than 0.08 metre-radians up to $\varphi = 40°$ or the angle of flooding if this angle is less than 40°.

3.3.2.2 The maximum value of the righting lever (GZ) shall be at least 0.25 m.

3.3.2.3 At all times during a voyage, the metacentric height GM_0 shall not be less than 0.1 m, taking into account the absorption of water by the deck cargo and/or ice accretion on the exposed surfaces (details regarding ice accretion are given in part B, chapter 6 (Icing considerations)).

3.3.2.4 When determining the ability of the ship to withstand the combined effects of beam wind and rolling according to 2.3, the 16° limiting angle of heel under action of steady wind shall be complied with, but the additional criterion of 80% of the angle of deck edge immersion may be ignored.

3.4 Cargo ships carrying grain in bulk

The intact stability of ships engaged in the carriage of grain shall comply with the requirements of the International Code for the Safe Carriage of Grain in Bulk adopted by resolution MSC.23(59).[10]

---

[9] Refer to regulation 44(2) of the International Convention on Load Lines, 1966 or the Protocol of 1988 relating thereto as amended, as applicable.

[10] Refer to part C of chapter VI of the 1974 SOLAS Convention as amended by resolution MSC.23(59).

3.5 High-speed craft

High-speed craft, as defined in paragraph 2 of the Introduction (Definitions), constructed on or after 1 January 1996, to which chapter X of the 1974 SOLAS Convention applies, shall comply with stability requirements of the 1994 HSC Code (resolution MSC.36(63)). Any high-speed craft to which chapter X of the 1974 SOLAS Convention applies, irrespective of its date of construction, which has undergone repairs, alterations or modifications of major character; and a high-speed craft constructed on or after 1 July 2002, shall comply with stability requirements of the 2000 HSC Code (resolution MSC.97(73)).

PART B
RECOMMENDATIONS FOR CERTAIN TYPES OF SHIPS AND ADDITIONAL GUIDELINES

CHAPTER 1 – GENERAL

1.1 Purpose

The purpose of this part of the Code is to:

.1 recommend stability criteria and other measures for ensuring the safe operation of certain types of ships to minimize the risk to such ships, to the personnel on board and to the environment; and

.2 provide guideline for stability information, operational provisions against capsizing, icing considerations, considerations for watertight integrity and the determination of lightship parameters.

1.2 Application

1.2.1 This part of the Code contains recommended intact stability criteria for certain types of ships and other marine vehicles not included in part A or intended to supplement those of part A in particular cases regarding size or operation.

1.2.2 Administrations may impose additional requirements regarding the design aspects of ships of novel design or ships not otherwise covered by the Code.

1.2.3 The criteria stated in this part should give guidance to Administrations if no national requirements are applied.

CHAPTER 2 – RECOMMENDED DESIGN CRITERIA FOR CERTAIN TYPES OF SHIPS

2.1 Fishing vessels

2.1.1 *Scope*

The provisions given hereunder apply to decked seagoing fishing vessels as defined in Definitions. The stability criteria given in 2.1.3 and 2.1.4 below should be complied with for all conditions of loading as specified in 3.4.1.6, unless the Administration is satisfied that operating experience justifies departures therefrom.

2.1.2 *General precautions against capsizing*

Apart from general precautions referred to in part B, 5.1, 5.2 and 5.3, the following measures should be considered as preliminary guidance on matters influencing safety as related to stability:

.1 all fishing gear and other heavy material should be properly stowed and placed as low in the vessel as possible;

.2 particular care should be taken when pull from fishing gear might have a negative effect on stability, e.g., when nets are hauled by power-block or the trawl catches obstructions on the sea-bed. The pull of the fishing gear should be from as low a point on the vessel, above the waterline, as possible;

.3 gear for releasing the deck load in fishing vessels which carry the catch on deck, e.g., herring, should be kept in good working condition;

.4 when the main deck is prepared for carrying deck load by dividing it with pound boards, there should be slots between them of suitable size to allow easy flow of water to freeing ports, thus preventing trapping of water;

.5 to prevent a shift of the fish load carried in bulk, portable divisions in the holds should be properly installed;

.6 reliance on automatic steering may be dangerous as this prevents changes to course which may be needed in bad weather;

.7 necessary care should be taken to maintain adequate freeboard in all loading conditions, and where load line regulations are applicable they should be strictly adhered to at all times; and

.8 particular care should be taken when the pull from fishing gear results in dangerous heel angles. This may occur when fishing gear fastens onto an underwater obstacle or when handling fishing gear, particularly on purse seiners, or when one of the trawl wires tears off. The heel angles caused by the fishing gear in these situations may be eliminated by employing devices which can relieve or remove excessive forces applied through the fishing gear. Such devices should not impose a danger to the vessel through operating in circumstances other than those for which they were intended.

2.1.3 *Recommended general criteria*[11]

2.1.3.1 The general intact stability criteria given in part A, 2.2.1 to 2.2.3 should apply to fishing vessels having a length of 24 m and over, with the exception of requirements on the initial metacentric height GM, (part A, 2.2.4), which, for fishing vessels, should not be less than 0.35 m for single-deck vessels. In vessels with complete superstructure or vessels of 70 m in length and over the metacentric height may be reduced to the satisfaction of the Administration but in no case should be less than 0.15 m.

2.1.3.2 The adoption by individual countries of simplified criteria which apply such basic stability values to their own types and classes of vessels is recognized as a practical and valuable method of economically judging the stability.

2.1.3.3 Where arrangements other than bilge keels are provided to limit the angle of roll, the Administration should be satisfied that the stability criteria referred to in 2.1.3.1 are maintained in all operating conditions.

2.1.4 *Severe wind and rolling criterion (weather criterion) for fishing vessels*

2.1.4.1 The Administration may apply the provisions of part A, 2.3 to fishing vessels of 45 m length and over.

2.1.4.2 For fishing vessels in the length range between 24 m and 45 m, the Administration may apply the provisions of part A, 2.3. Alternatively the values of wind pressure (see part A, 2.3.2) may be taken from the following table:

h (m)	1	2	3	4	5	6 and over
P (Pa)	316	386	429	460	485	504

where h is the vertical distance from the centre of the projected vertical area of the vessel above the waterline, to the waterline.

2.1.5 *Recommendation for an interim simplified stability criterion for decked fishing vessels under 30 m in length*

2.1.5.1 For decked vessels with a length less than 30 m, the following approximate formula for the minimum metacentric height GM_{min} (in metres) for all operating conditions should be used as the criterion:

$$GM_{\min} = 0.53 + 2B\left[0.075 - 0.37\left(\frac{f}{B}\right) + 0.82\left(\frac{f}{B}\right)^2 - 0.014\left(\frac{B}{D}\right) - 0.032\left(\frac{l_S}{L}\right)\right]$$

where:

L is the length of the vessel on the waterline in maximum load condition (m)

l_s is the actual length of enclosed superstructure extending from side to side of the vessel (m)

[11] Refer to regulation III/2 of the 1993 Torremolinos Protocol.

B is the extreme breadth of the vessel on the waterline in maximum load condition (m)

D is the depth of the vessel measured vertically amidships from the base line to the top of the upper deck at side (m)

f is the smallest freeboard measured vertically from the top of the upper deck at side to the actual waterline (m).

The formula is applicable for vessels having:

.1 *f/B* between 0.02 and 0.20;

.2 l_s/L smaller than 0.60;

.3 *B/D* between 1.75 and 2.15;

.4 sheer fore and aft at least equal to or exceeding the standard sheer prescribed in regulation 38(8) of the International Convention on Load Lines, 1966 or the Protocol of 1988 as amended, as applicable; and

.5 height of superstructure included in the calculation is not less than 1.8 m.

For ships with parameters outside the above limits the formula should be applied with special care.

2.1.5.2 The above formula is not intended as a replacement for the basic criteria given in 2.1.3 and 2.1.4 but is to be used only if circumstances are such that cross curves of stability, KM curve and subsequent GZ curves are not and cannot be made available for judging a particular vessel's stability.

2.1.5.3 The calculated value of GM, should be compared with actual GM values of the vessel in all loading conditions. If an inclining experiment based on estimated displacement, or another approximate method of determining the actual GM is used, a safety margin should be added to the calculated GM_{min}.

2.2 Pontoons

2.2.1 *Application*

The provisions given hereunder apply to seagoing pontoons. A pontoon is considered to be normally:

.1 non self-propelled;

.2 unmanned;

.3 carrying only deck cargo;

.4 having a block coefficient of 0.9 or greater;

.5 having a breadth/depth ratio of greater than 3.0; and

.6 having no hatchways in the deck except small manholes closed with gasketed covers.

2.2.2 ***Stability drawings and calculations***

The following information is typical of that required to be submitted to the Administration for approval:

.1 lines drawing;

.2 hydrostatic curves;

.3 cross curves of stability;

.4 report of draught and density readings and calculation of lightship displacement and longitudinal centre of gravity;

.5 statement of justification of assumed vertical centre of gravity;

.6 simplified stability guidance such as a loading diagram, so that the pontoon may be loaded in compliance with the stability criteria.

2.2.3 ***Concerning the performance of calculations***

The following guidance is suggested:

.1 no account should be taken of the buoyancy of deck cargo (except buoyancy credit for adequately secured timber);

.2 consideration should be given to such factors as water absorption (e.g. timber), trapped water in cargo (e.g. pipes) and ice accretion;

.3 in performing wind heel calculations:

.3.1 the wind pressure should be constant and for general operations be considered to act on a solid mass extending over the length of the cargo deck and to an assumed height above the deck;

.3.2 the centre of gravity of the cargo should be assumed at a point mid-height of the cargo; and

.3.3 the wind lever should be taken from the centre of the deck cargo to a point at one half the mean draught;

.4 calculations should be performed covering the full range of operating draughts; and

.5 the down-flooding angle should be taken as the angle at which an opening through which progressive flooding may take place is immersed. This would not be an opening closed by a watertight manhole cover or a vent fitted with an automatic closure.

2.2.4 *Intact stability criteria*

2.2.4.1 The area under the righting lever curve up to the angle of maximum righting lever should not be less than 0.08 metre-radians.

2.2.4.2 The static angle of heel due to a uniformly distributed wind load of 540Pa (wind speed 30 m/s) should not exceed an angle corresponding to half the freeboard for the relevant loading condition, where the lever of wind heeling moment is measured from the centroid of the windage area to half the draught.

2.2.4.3 The minimum range of stability should be:

For $L \leq 100$ m	20°
For $L \geq 150$ m	15°
For intermediate length	by interpolation.

2.3 Containerships greater than 100 m

2.3.1 *Application*[12]

These requirements apply to containerships greater than 100 m in length as defined in paragraph 2 of the Introduction (Definitions). They may also be applied to other cargo ships in this length range with considerable flare or large water plane areas. The Administration may apply the following criteria instead of those in part A, 2.2.

2.3.2 *Intact stability*

2.3.2.1 The area under the righting lever curve (GZ curve) should not be less than $0.009/C$ metre-radians up to $\varphi = 30°$ angle of heel, and not less than $0.016/C$ metre-radians up to $\varphi = 40°$ or the angle of flooding φ_f (as defined in part A, 2.2) if this angle is less than 40°.

2.3.2.2 Additionally, the area under the righting lever curve (GZ curve) between the angles of heel of 30° and 40° or between 30° and φ_f, if this angle is less than 40°, should not be less than $0.006/C$ metre-radians.

2.3.2.3 The righting lever GZ should be at least $0.033/C$ m at an angle of heel equal or greater than 30°.

2.3.2.4 The maximum righting lever GZ should be at least $0.042/C$ m.

2.3.2.5 The total area under the righting lever curve (GZ curve) up to the angle of flooding φ_f should not be less than $0.029/C$ metre-radians.

---

[12] Since the criteria in this section were empirically developed with the data of containerships less than 200 m in length, they should be applied to ships beyond such limits with special care.

2.3.2.6 In the above criteria the form factor C should be calculated using the formula and figure 2.3-1:

$$C = \frac{d\,D'}{B_m^2}\sqrt{\frac{d}{KG}}\left(\frac{C_B}{C_W}\right)^2\sqrt{\frac{100}{L}}$$

where:

d = mean draught (m)

D' = moulded depth of the ship, corrected for defined parts of volumes within the hatch coamings according to the formula:

$D' = D + h\left(\frac{2b - B_D}{B_D}\right)\left(\frac{2\Sigma l_H}{L}\right)$, as defined in figure 2.3-1;

D = moulded depth of the ship (m);

B_D = moulded breadth of the ship (m);

KG = height of the centre of mass above base, corrected for free surface effect, not be taken as less than d (m);

C_B = block coefficient;

C_W = water plane coefficient;

l_H = length of each hatch coaming within L/4 forward and aft from amidships (m) (see figure 2.3-1);

b = mean width of hatch coamings within L/4 forward and aft from amidships (m) (see figure 2.3-1);

h = mean height of hatch coamings within L/4 forward and aft from amidships (m) (see figure 2.3-1);

L = length of the ship (m);

B = breadth of the ship on the waterline (m);

B_m = breadth of the ship on the waterline at half mean draught (m).

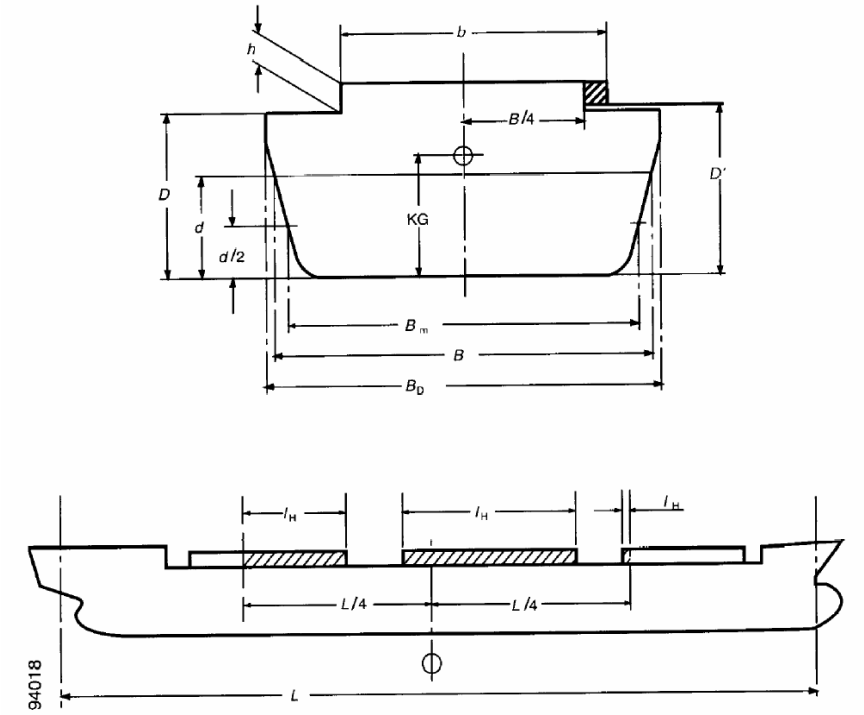


Figure 2.3-1

The shaded areas in figure 2.3-1 represent partial volumes within the hatch coamings considered contributing to resistance against capsizing at large heeling angles when the ship is on a wave crest.

2.3.2.7 The use of electronic loading and stability instrument is encouraged in determining the ship's trim and stability during different operational conditions.

2.4 Offshore supply vessels

2.4.1 *Application*

2.4.1.1 The provisions given hereunder apply to offshore supply vessels, as defined in paragraph 2 of the Introduction (Definitions), of 24 m in length and over. The alternative stability criteria contained in 2.4.5 apply to vessels of not more than 100 m in length.

2.4.1.2 For a vessel engaged in near-coastal voyages, as defined in Definitions, the principles given in 2.4.2 should guide the Administration in the development of its national standards. Relaxations from the requirements of the Code may be permitted by an Administration for vessels engaged in near-coastal voyages off its own coasts provided the operating conditions are, in the opinion of that Administration, such as to render compliance with the provisions of the Code unreasonable or unnecessary.

2.4.1.3 Where a ship other than an offshore supply vessel, as defined in Definitions, is employed on a similar service, the Administration should determine the extent to which compliance with the provisions of the Code is required.

2.4.2 *Principles governing near-coastal voyages*

2.4.2.1 The Administration defining near-coastal voyages for the purpose of the present Code should not impose design and construction standards for a vessel entitled to fly the flag of another State and engaged in such voyages in a manner resulting in a more stringent standard for such a vessel than for a vessel entitled to fly its own flag. In no case should the Administration impose, in respect of a vessel entitled to fly the flag of another State, standards in excess of the Code for a vessel not engaged in near-coastal voyages.

2.4.2.2 With respect to a vessel regularly engaged in near-coastal voyages off the coast of another State the Administration should prescribe design and construction standards for such a vessel at least equal to those prescribed by the Government of the State off whose coast the vessel is engaged, provided such standards do not exceed the Code in respect of a vessel not engaged in near-coastal voyages.

2.4.2.3 A vessel which extends its voyages beyond a near-coastal voyage should comply with the present Code.

2.4.3 *Constructional precautions against capsizing*

2.4.3.1 Access to the machinery space should, if possible, be arranged within the forecastle. Any access to the machinery space from the exposed cargo deck should be provided with two weathertight closures. Access to spaces below the exposed cargo deck should preferably be from a position within or above the superstructure deck.

2.4.3.2 The area of freeing ports in the side bulwarks of the cargo deck should at least meet the requirements of regulation 24 of the International Convention on Load Lines, 1966 or the Protocol of 1988 relating thereto, as amended, as applicable. The disposition of the freeing ports should be carefully considered to ensure the most effective drainage of water trapped in pipe deck cargoes or in recesses at the after end of the forecastle. In vessels operating in areas where icing is likely to occur, no shutters should be fitted in the freeing ports.

2.4.3.3 The Administration should give special attention to adequate drainage of pipe stowage positions having regard to the individual characteristics of the vessel. However, the area provided for drainage of the pipe stowage positions should be in excess of the required freeing port area in the cargo deck bulwarks and should not be fitted with shutters.

2.4.3.4 A vessel engaged in towing operations should be provided with means for quick release of the towing hawser.

2.4.4 *Operational procedures against capsizing*

2.4.4.1 The arrangement of cargo stowed on deck should be such as to avoid any obstruction of the freeing ports or of the areas necessary for the drainage of pipe stowage positions to the freeing ports.

2.4.4.2 A minimum freeboard at the stern of at least 0.005 L should be maintained in all operating conditions.

2.4.5 *Stability criteria*

2.4.5.1 The stability criteria given in part A, 2.2 should apply to all offshore supply vessels except those having characteristics which render compliance with part A, 2.2 impracticable.

2.4.5.2 The following equivalent criteria should be applied where a vessel's characteristics render compliance with part A, 2.2 impracticable:

.1 the area under the curve of righting levers (GZ curve) should not be less than 0.070 metre-radians up to an angle of 15° when the maximum righting lever (GZ) occurs at 15° and 0.055 metre-radians up to an angle of 30° when the maximum righting lever (GZ) occurs at 30° or above. Where the maximum righting lever (GZ) occurs at angles of between 15° and 30°, the corresponding area under the righting lever curve should be:

$$0.055 + 0.001\ (30° - \varphi_{max})\ \text{metre-radians}^{13};$$

.2 the area under the righting lever curve (GZ curve) between the angles of heel of 30° and 40°, or between 30° and φ_f if this angle is less than 40°, should be not less than 0.03 metre-radians;

.3 the righting lever (GZ) should be at least 0.20 m at an angle of heel equal to or greater than 30°;

.4 the maximum righting lever (GZ) should occur at an angle of heel not less than 15°;

.5 the initial transverse metacentric height (GM_o) should not be less than 0.15 m; and

.6 reference is made also to part A, 2.1.3 to 2.1.5 and part B, 5.1.

2.5 Special purpose ships

2.5.1 *Application*

The provisions given hereunder apply to special purpose ships, as defined in Definitions, of not less than 500 gross tonnage. The Administration may also apply these provisions as far as reasonable and practicable to special purpose ships of less than 500 gross tonnage.

2.5.2 *Stability criteria*

The intact stability of special purpose ships should comply with the provisions given in part A, 2.2 except that the alternative criteria given in part B, 2.4.5 which apply to offshore supply vessels may be used for special purpose ships of less than 100 m in length of similar design and characteristics.

[13] φ_{max} is the angle of heel in degrees at which the righting lever curve reaches its maximum.

2.6 Mobile offshore drilling units (MODUs)

2.6.1 *Application*

2.6.1.1 The provisions given hereunder apply to mobile offshore drilling units as defined in Definitions, the keels of which are laid or which are at a similar stage of construction on or after 1 May 1991. For MODUs constructed before that date, the corresponding provisions of chapter 3 of resolution A.414(XI) should apply.

2.6.1.2 The coastal State may permit any unit designed to a lesser standard than that of this chapter to engage in operations, having taken account of the local environmental conditions. Any such unit should, however, comply with safety requirements which in the opinion of the coastal State are adequate for the intended operation and ensure the overall safety of the unit and the personnel on board.

2.6.2 *Righting moment and wind heeling moment curves*

2.6.2.1 Curves of righting moments and of wind heeling moments similar to figure 2.6-1 with supporting calculations should be prepared covering the full range of operating draughts, including those in transit conditions, taking into account the maximum deck cargo and equipment in the most unfavourable position applicable. The righting moment curves and wind heeling moment curves should be related to the most critical axes. Account should be taken of the free surface of liquids in tanks.

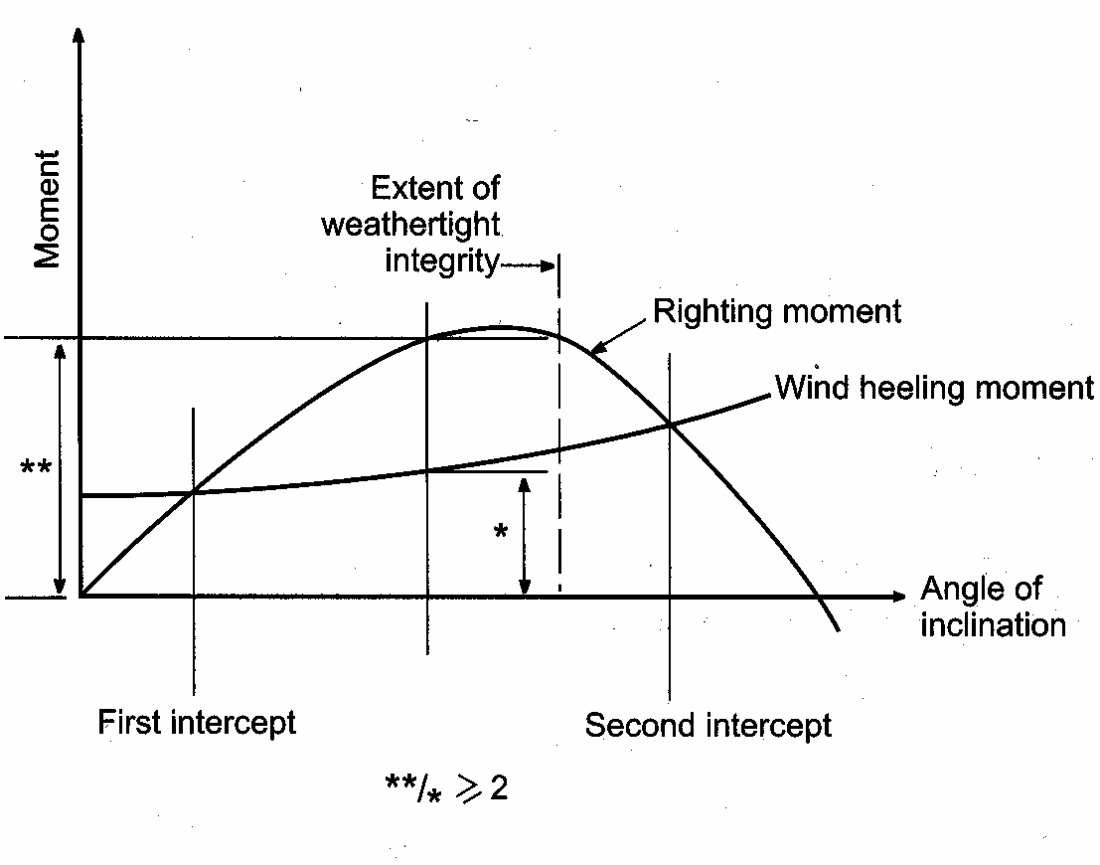


Figure 2.6-1 – Righting moment and wind heeling moment curves

2.6.2.2 Where equipment is of such a nature that it can be lowered and stowed, additional wind heeling moment curves may be required and such data should clearly indicate the position of such equipment.

2.6.2.3 The curves of wind heeling moment should be drawn for wind forces calculated by the following formula:

$$F = 0.5 * C_S * C_H * \rho * V^2 * A$$

where:

F is the wind force (N)

C_S is the shape coefficient depending on the shape of the structural member exposed to the wind (see table 2.6.2.3-1)

C_H is the height coefficient depending on the height above sea level of the structural member exposed to wind (see table 2.6.2.3-2)

ρ is the air mass density (1.222 kg/m³)

V is the wind velocity (m/s)

A is the projected area of all exposed surfaces in either the upright or the heeled condition (m²).

Table 2.6.2.3-1 – Values of the coefficient C_S

Shape	C_S
Spherical	0.40
Cylindrical	0.50
Large flat surface (hull, deck-house, smooth under-deck areas)	1.00
Drilling derrick	1.25
Wires	1.20
Exposed beams and girders under deck	1.30
Small parts	1.40
Isolated shapes (crane, beam, etc.)	1.50
Clustered deck-houses or similar structures	1.10

Table 2.6.2.3-2 – Values of the coefficient C_H

Height above sea level (m)	C_H
0 – 15.3	1.00
15.3 – 30.5	1.10
30.5 – 46.0	1.20
46.0 – 61.0	1.30
61.0 – 76.0	1.37
76.0 – 91.5	1.43
91.5 – 106.5	1.48
106.5 – 122.0	1.52
122.0 – 137.0	1.56
137.0 – 152.5	1.60
152.5 – 167.5	1.63
167.5 – 183.0	1.67
183.0 – 198.0	1.70
198.0 – 213.5	1.72
213.5 – 228.5	1.75
228.5 – 244.0	1.77
244.0 – 256.0	1.79
Above 256	1.80

2.6.2.4 Wind forces should be considered from any direction relative to the unit and the value of the wind velocity should be as follows:

.1 in general, a minimum wind velocity of 36 m/s (70 knots) for offshore service should be used for normal operating conditions and a minimum wind velocity of 51.5 m/s (100 knots) should be used for the severe storm conditions; and

.2 where a unit is to be limited in operation to sheltered locations (protected inland waters such as lakes, bays, swamps, rivers, etc.), consideration should be given to a reduced wind velocity of not less than 25.8 m/s (50 knots) for normal operating conditions.

2.6.2.5 In calculating the projected areas to the vertical plane, the area of surfaces exposed to wind due to heel or trim, such as under decks, etc., should be included, using the appropriate shape factor. Open truss work may be approximated by taking 30% of the projected block area of both the front and back section, i.e. 60% of the projected area of one side.

2.6.2.6 In calculating the wind heeling moments, the lever of the wind overturning force should be taken vertically from the centre of pressure of all surfaces exposed to the wind to the centre of lateral resistance of the underwater body of the unit. The unit is to be assumed floating free of mooring restraint.

2.6.2.7 The wind heeling moment curve should be calculated for a sufficient number of heel angles to define the curve. For ship-shaped hulls the curve may be assumed to vary as the cosine function of ship heel.

2.6.2.8 Wind heeling moments derived from wind-tunnel tests on a representative model of the unit may be considered as alternatives to the method given in 2.6.2.3 to 2.6.2.7. Such heeling moment determination should include lift and drag effects at various applicable heel angles.

2.6.3 *Intact stability criteria*

2.6.3.1 The stability of a unit in each mode of operation should meet the following criteria (see also figure 2.6-2):

.1 for surface and self-elevating units the area under the righting moment curve to the second intercept or down-flooding angle, whichever is less, should be not less than 40% in excess of the area under the wind heeling moment curve to the same limiting angle;

.2 for column-stabilized units the area under the righting moment curve to the angle of down-flooding should be not less than 30% in excess of the area under the wind heeling moment curve to the same limiting angle; and

.3 the righting moment curve should be positive over the entire range of angles from upright to the second intercept.

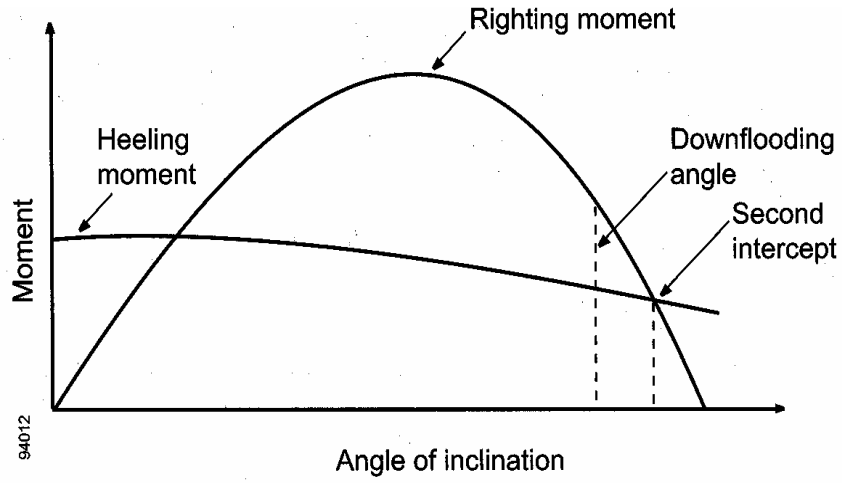


Figure 2.6-2 – Righting moment and heeling moment curves

2.6.3.2 Each unit should be capable of attaining a severe storm condition in a period of time consistent with the meteorological conditions. The procedures recommended and the approximate length of time required, considering both operating conditions and transit conditions, should be contained in the operating manual, as referred to in 3.6.2. It should be possible to achieve the severe storm condition without the removal or relocation of solid consumables or other variable load. However, the Administration may permit loading a unit past the point at which solid consumables would have to be removed or relocated to go to severe storm condition under the following conditions, provided the allowable KG requirement is not exceeded:

.1 in a geographic location where weather conditions annually or seasonally do not become sufficiently severe to require a unit to go to severe storm condition; or

.2 where a unit is required to support extra deckload for a short period of time that is well within the bounds of a favourable weather forecast.

The geographic locations and weather conditions and loading conditions when this is permitted should be identified in the operating manual.

2.6.3.3 Alternative stability criteria may be considered by the Administration provided an equivalent level of safety is maintained and if they are demonstrated to afford adequate positive initial stability. In determining the acceptability of such criteria, the Administration should consider at least the following and take into account as appropriate:

.1 environmental conditions representing realistic winds (including gusts) and waves appropriate for world-wide service in various modes of operation;

.2 dynamic response of a unit. Analysis should include the results of wind-tunnel tests, wave tank model tests, and non-linear simulation, where appropriate. Any wind and wave spectra used should cover sufficient frequency ranges to ensure that critical motion responses are obtained;

.3 potential for flooding taking into account dynamic responses in a seaway;

.4 susceptibility to capsizing considering the unit's restoration energy and the static inclination due to the mean wind speed and the maximum dynamic response; and

.5 an adequate safety margin to account for uncertainties.

An example of alternative criteria for twin-pontoon column-stabilized semi-submersible units is given in section 2.6.4.

2.6.4 *An example of alternative intact stability criteria for twin-pontoon column-stabilized semi-submersible units*

2.6.4.1 The criteria given below apply only to twin-pontoon column-stabilized semi-submersible units in severe storm conditions which fall within the following ranges of parameters:

V_p/V_t is between 0.48 and 0.58

$A_{wp}/(V_c)^{2/3}$ is between 0.72 and 1.00

$L_{wp}/[V_c * (L_{ptn}/2)]$ is between 0.40 and 0.70

The parameters used in the above equations are defined in paragraph 2.6.4.3.

2.6.4.2 Intact stability criteria

The stability of a unit in the survival mode of operation should meet the following criteria.

2.6.4.2.1 Capsize criteria

These criteria are based on the wind heeling moment and righting moment curves calculated as shown in section 2.6.2 of the Code at the survival draught. The reserve energy area 'B' must be equal to or greater than 10% of the dynamic response area 'A' as shown in figure 2.6-3.

Area 'B'/Area 'A' $\geq$ 0.10

where:

Area 'A' is the area under the righting moment curve measured from φ_1 to (φ_1 + 1.15 * φ_{dyn})

Area 'B' is the area under the righting moment curve measured from (φ_1 + 1.15 * φ_{dyn}) to φ_2

φ_1 is the first intercept with the 100 knot wind moment curve

φ_2 is the second intercept with the 100 knot wind moment curve

φ_{dyn} is the dynamic response angle due to waves and fluctuating wind

$$\varphi_{dyn} = (10.3 + 17.8 * C)/(1 + GM/(1.46 + 0.28 * BM))$$

$$C = (L_{ptn}^{5/3} * VCP_{w1} * A_w * V_p * V_c^{1/3})/(L_{wp}^{5/3} * V_t)$$

Parameters used in the above equations are defined in paragraph 2.6.4.3.

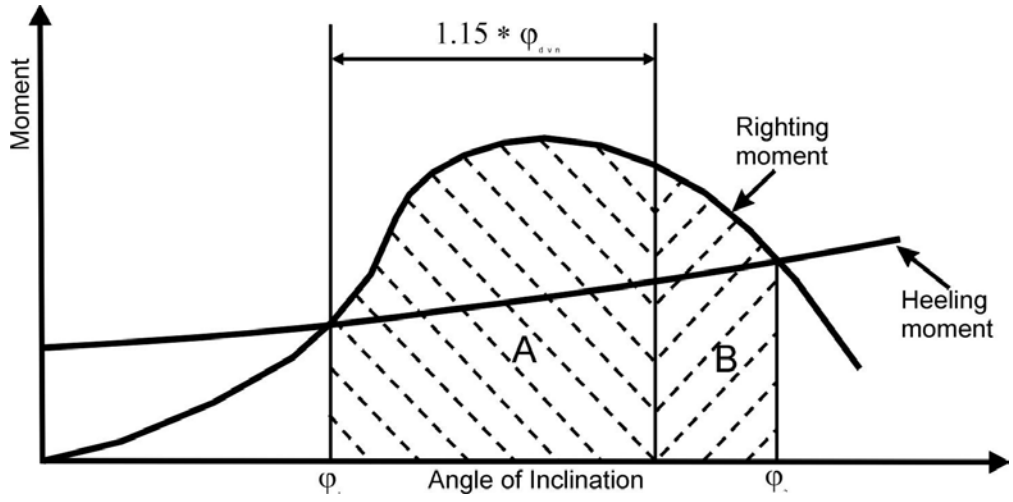


Figure 2.6-3 – Righting moment and heeling moment curves

2.6.4.2.2 Down-flooding criteria

These criteria are based on the physical dimensions of the unit and the relative motion of the unit about a static inclination due to a 75 knot wind measured at the survival draught. The initial down-flooding distance (DFD_0) should be greater than the reduction in down-flooding distance at the survival draught as shown in figure 2.6-4.

DFD_0 - RDFD > 0.0

where:

DFD_0 is the initial down-flooding distance to D_m (m)

RDFD is the reduction in down-flooding distance (m) equal to SF (k * QSD_1 + RMW)

SF is equal to 1.10, which is a safety factor to account for uncertainties in the analysis, such as non-linear effects

k (correlation factor) is equal to 0.55 + 0.08 * (a - 4.0) + 0.056 * (1.52 - GM);
(GM cannot be taken to be greater than 2.44 m)

a is equal to $(FBD_0/D_m)*(S_{ptn} * L_{cc})/A_{wp}$
(a cannot be taken to be less than 4.0)

QSD_1 is equal to DFD_0 minus quasi-static down-flooding distance at φ_1 (m), but not to be taken less than 3.0 m

RMW is the relative motion due to waves about φ_1 (m), equal to 9.3 + 0.11 * (X - 12.19)

X is equal to $D_m *(V_t/V_p)*(A_{wp}^2/I_{wp})*(L_{ccc}/L_{ptn})$
(X cannot be taken to be less than 12.19 m).

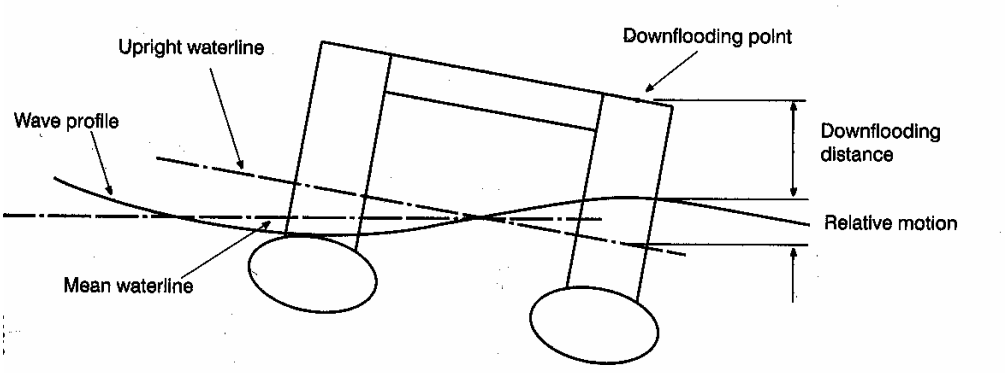


Figure 2.6-4 – Definition of down-flooding distance and relative motion

The parameters used in the above equations are defined in paragraph 2.6.4.3.

2.6.4.3 Geometric parameters

A_{wp} is the waterplane area at the survival draught, including the effects of bracing members as applicable (m^2).

A_w is the effective wind area with the unit in the upright position (i.e. the product of projected area, shape coefficient and height coefficient) (m^2).

BM is the vertical distance from the metacentre to the centre of buoyancy with the unit in the upright position (m).

D_m is the initial survival draught (m).

FBD_0 is the vertical distance from D_m, to the top of the upper exposed weathertight deck at the side (m).

GM for paragraph 2.6.4.2.1, GM is the metacentric height measured about the roll or diagonal axis, whichever gives the minimum reserve energy ratio, 'B'/'A'. This axis is usually the diagonal axis as it possesses a characteristically larger projected wind area which influences the three characteristic angles mentioned above (m).

GM for paragraph 2.6.4.2.2, GM is the metacentric height measured about the axis which gives the minimum down-flooding distance margin (i.e. generally the direction that gives the largest QSD_1) (m).

I_{wp} is the water plane second moment of inertia at the survival draught, including the effects of bracing members as applicable (m^4).

L_{ccc} is the longitudinal distance between centres of the corner columns (m).

L_{ptn} is the length of each pontoon (m).

S_{ptn} is the transverse distance between the centrelines of the pontoons (m).

V_c is the total volume of all columns from the top of the pontoons to the top of the column structure, except for any volume included in the upper deck (m^3).

V_p is the total combined volume of both pontoons (m^3).

V_t is the total volume of the structures (pontoons, columns and bracings) contributing to the buoyancy of the unit, from its baseline to the top of the column structure, except for any volume included in the upper deck (m^3).

VCP_{w1} is the vertical centre of wind pressure above D_m (m).

2.6.4.4 Capsize criteria assessment form

Input data

GM	.....	=	m
BM	.....	=	m
VCP_{w1}	.....	=	m
A_w	.....	=	m^2
V_t	.....	=	m^3

V_c ..... = m^3

V_p ..... = m^3

I_{wp} ..... = m^4

L_{ptn} ..... = m

Determine

φ_1 ..... = ... deg

φ_2 ..... = ... deg

C = $(L_{ptn}^{5/3} * VCP_{w1} * A_w * V_p * V_c^{1/3})/(I_{wp}^{5/3} * V_t)$ ... = ... m^{-1}

φ_{dyn} = $(10.3 + 17.8C)/(1.0 + GM/(1.46 + 0.28BM))$ ..... = ... deg

Area 'A' ..... = ... m-deg

Area 'B' ..... = ... m-deg

Results Reserve energy ratio:

'B'/'A' = ... (minimum = 0.10)

GM = ... m (KG = ... m)

Note: The minimum GM is that which produces a 'B'/'A' ratio = 0.10

2.6.4.5 Down-flooding criteria assessment form

Input data

DFD_0 ..... = ... m

FBD_0 ..... = ... m

GM ..... = ... m

D_m ..... = ... m

V_t ..... = ... m^3

V_p ..... = ... m^3

A_{wp} ..... = ... m^2

I_{wp} ..... = ... m^4

L_{ccc} ..... = ... m

L_{ptn} ..... = ... m

S_{ptn} ..... = ... m

SF ..... = 1.10

Determine

φ_1 ..... = ... deg

DFD_1 ..... = ... m

$QSD_1 = DFD_0 - DFD_1$ ..... = ... m

$a = (FBD_0/D_m)*(S_{ptn} * L_{ccc})/A_{wp}$ ..... = ... (a_{min} = 4.0)

$k = 0.55 + 0.08*(a - 4.0) + 0.056*(1.52 - GM)$ .. = ... m (GM_{max} = 2.44 m)

$X = D_m*(V_t/V_p)*(A_{wp}^2 /I_{wp}))(L_{ccc}/L_{ptn})$ ..... = ... m (X_{min} = 12.19 m)

$RMW = 9.3 + 0.11*(X - 12.19)$ ..... = ... m

$RDFD = SF*(k * QSD_1 + RMW)$ ..... = ... m

Results Down-flooding margin:

DFD0 - RDFD = ... (minimum = 0.0 m)

GM = ... m (KG = ... m)

Note: The minimum GM is that which produces a down-flooding margin = 0.0 m.

CHAPTER 3 – GUIDANCE IN PREPARING STABILITY INFORMATION

3.1 Effect of free surfaces of liquids in tanks

3.1.1 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.

3.1.2 Free surface effects should be considered whenever the filling level in a tank is less than 98% of full condition. Free surface effects need not be considered where a tank is nominally full, i.e. filling level is 98% or above. Free surface effects for small tanks may be ignored under condition specified in 3.1.12.[14]

But nominally full cargo tanks should be corrected for free surface effects at 98% filling level. In doing so, the correction to initial metacentric height should be based on the inertia moment of liquid surface at 5° of heeling angle divided by displacement, and the correction to righting lever is suggested to be on the basis of real shifting moment of cargo liquids.

3.1.3 Tanks which are taken into consideration when determining the free surface correction may be in one of two categories:

.1 tanks with filling levels fixed (e.g. liquid cargo, water ballast). The free surface correction should be defined for the actual filling level to be used in each tank; or

.2 tanks with filling levels variable (e.g. consumable liquids such as fuel oil, diesel oil and fresh water, and also liquid cargo and water ballast during liquid transfer operations). Except as permitted in 3.1.5 and 3.1.6, the free surface correction should be the maximum value attainable between the filling limits envisaged for each tank, consistent with any operating instructions.

3.1.4 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.

3.1.5 Where water ballast tanks, including anti-rolling tanks and anti-heeling tanks, are to be filled or discharged during the course of a voyage, the free surface effects should be calculated to take account of the most onerous transitory stage relating to such operations.

3.1.6 For ships engaged in liquid transfer operations, the free surface corrections at any stage[15] of the liquid transfer operations may be determined in accordance with the filling level in each tank at that stage of the transfer operation.

3.1.7 The corrections to the initial metacentric height and to the righting lever curve should be addressed separately as follows.

---

[14] Refer to the intact stability design criteria, contained in MARPOL regulation I/27, together with the associated Unified Interpretation 45.

[15] A sufficient number of loading conditions representing the initial, intermediate and final stages of the filling or discharge operation using the free surface correction at the filling level in each tank at the considered stage may be evaluated to fulfil this recommendation.

3.1.8 In determining the correction to initial metacentric height, the transverse moments of inertia of the tanks should be calculated at 0° angle of heel according to the categories indicated in 3.1.3.

3.1.9 The righting lever curve may be corrected by any of the following methods subject to the agreement of the Administration:

.1 correction based on the actual moment of fluid transfer for each angle of heel calculated; or

.2 correction based on the moment of inertia, calculated at 0° angle of heel, modified at each angle of heel calculated.

3.1.10 Corrections may be calculated according to the categories indicated in 3.1.2.

3.1.11 Whichever method is selected for correcting the righting lever curve, only that method should be presented in the ship's stability booklet. However, where an alternative method is described for use in manually calculated loading conditions, an explanation of the differences which may be found in the results, as well as an example correction for each alternative, should be included.

3.1.12 Small tanks which satisfy the following condition corresponding to an angle of inclination of 30°, need not be included in the correction:

$M_{fs} / \Delta_{min} < 0.01$ m

where:

M_{fs} free surface moment (mt)

Δ_{min} is the minimum ship displacement calculated at d_{min} (t)

d_{min} is the minimum mean service draught of the ship without cargo, with 10% stores and minimum water ballast, if required (m).

3.1.13 The usual remainder of liquids in empty tanks need not be taken into account in calculating the corrections, provided that the total of such residual liquids does not constitute a significant free surface effect.

3.2 Permanent ballast

If used, permanent ballast should be located in accordance with a plan approved by the Administration and in a manner that prevents shifting of position. Permanent ballast should not be removed from the ship or relocated within the ship without the approval of the Administration. Permanent ballast particulars should be noted in the ship's stability booklet.

3.3 Assessment of compliance with stability criteria[16]

3.3.1 Except as otherwise required by this Code, for the purpose of assessing in general whether the stability criteria are met, stability curves using the assumptions given in this Code should be drawn for the loading conditions intended by the owner in respect of the ship's operations.

3.3.2 If the owner of the ship does not supply sufficiently detailed information regarding such loading conditions, calculations should be made for the standard loading conditions.

3.4 Standard conditions of loading to be examined

3.4.1 *Loading conditions*

The standard loading conditions referred to in the text of the present Code are as follows.

3.4.1.1 *For a passenger ship:*

.1 ship in the fully loaded departure condition with cargo, full stores and fuel and with the full number of passengers with their luggage;

.2 ship in the fully loaded arrival condition, with cargo, the full number of passengers and their luggage but with only 10% stores and fuel remaining;

.3 ship without cargo, but with full stores and fuel and the full number of passengers and their luggage; and

.4 ship in the same condition as at 0 above with only 10% stores and fuel remaining.

3.4.1.2 *For a cargo ship:*

.1 ship in the fully loaded departure condition, with cargo homogeneously distributed throughout all cargo spaces and with full stores and fuel;

.2 ship in the fully loaded arrival condition with cargo homogeneously distributed throughout all cargo spaces and with 10% stores and fuel remaining;

.3 ship in ballast in the departure condition, without cargo but with full stores and fuel; and

.4 ship in ballast in the arrival condition, without cargo and with 10% stores and fuel remaining.

[16] Care should be taken in the assessment of compliance with stability criteria, especially conditions in which liquid transfer operations might be expected or anticipated, to insure that the stability criteria is met at all stages of the voyage.

3.4.1.3 *For a cargo ship intended to carry deck cargoes:*

.1 ship in the fully loaded departure condition with cargo homogeneously distributed in the holds and with cargo specified in extension and mass on deck, with full stores and fuel; and

.2 ship in the fully loaded arrival condition with cargo homogeneously distributed in holds and with a cargo specified in extension and mass on deck, with 10% stores and fuel.

3.4.1.4 *For a ship intended to carry timber deck cargoes:*

The loading conditions which should be considered for ships carrying timber deck cargoes are specified in 3.4.1.3. The stowage of timber deck cargoes should comply with the provisions of chapter 3 of the Code of Safe Practice for Ships Carrying Timber Deck Cargoes, 1991 (resolution A.715(17)).[17]

3.4.1.5 *For an offshore supply vessel the standard loading conditions should be as follows:*

.1 vessel in fully loaded departure condition with cargo distributed below deck and with cargo specified by position and weight on deck, with full stores and fuel, corresponding to the worst service condition in which all the relevant stability criteria are met;

.2 vessel in fully loaded arrival condition with cargo as specified in 3.4.1.5.1, but with 10% stores and fuel;

.3 vessel in ballast departure condition, without cargo but with full stores and fuel;

.4 vessel in ballast arrival condition, without cargo and with 10% stores and fuel remaining; and

.5 vessel in the worst anticipated operating condition.

3.4.1.6 *For fishing vessels the standard loading conditions referred to in 2.1.1 are as follows*[18]*:*

.1 departure conditions for the fishing grounds with full fuel, stores, ice, fishing gear, etc.;

.2 departure from the fishing grounds with full catch and a percentage of stores, fuel, etc., as agreed by the Administration;

.3 arrival at home port with 10% stores, fuel, etc. remaining and full catch; and

.4 arrival at home port with 10% stores, fuel, etc. and a minimum catch, which should normally be 20% of full catch but may be up to 40% provided the Administration is satisfied that operating patterns justify such a value.

---

[17] Refer to chapter VI of the 1974 SOLAS Convention and to part C of chapter VI of the 1974 SOLAS Convention as amended by resolution MSC.22(59).

[18] Refer to regulation III/7 of the 1993 Torremolinos Protocol.

3.4.2 ***Assumptions for calculating loading conditions***

3.4.2.1 For the fully loaded conditions mentioned in 3.4.1.2.1, 3.4.1.2.2, 3.4.1.3.1 and 3.4.1.3.2 if a dry cargo ship has tanks for liquid cargo, the effective deadweight in the loading conditions therein described should be distributed according to two assumptions, i.e. with cargo tanks full, and with cargo tanks empty.

3.4.2.2 In the conditions mentioned in 3.4.1.1.1, 3.4.1.2.1 and 3.4.1.3.1 it should be assumed that the ship is loaded to its subdivision load line or summer load line or if intended to carry a timber deck cargo, to the summer timber load line with water ballast tanks empty.

3.4.2.3 If in any loading condition water ballast is necessary, additional diagrams should be calculated taking into account the water ballast. Its quantity and disposition should be stated.

3.4.2.4 In all cases, the cargo in holds is assumed to be fully homogeneous unless this condition is inconsistent with the practical service of the ship.

3.4.2.5 In all cases, when deck cargo is carried, a realistic stowage mass should be assumed and stated, including the height of the cargo.

3.4.2.6 Considering timber deck cargo the following assumptions are to be made for calculating the loading conditions referred to in 3.4.1.4:

.1 the amount of cargo and ballast should correspond to the worst service condition in which all the relevant stability criteria of part A 2.2 or the optional criteria given in part A 3.3.2, are met. In the arrival condition, it should be assumed that the weight of the deck cargo has increased by 10% due to water absorption.

3.4.2.7 For offshore supply vessels the assumptions for calculating loading conditions should be as follows:

.1 if a vessel is fitted with cargo tanks, the fully loaded conditions of 3.4.1.5.1 and 3.4.1.5.2 should be modified, assuming first the cargo tanks full and then the cargo tanks empty;

.2 if in any loading condition water ballast is necessary, additional diagrams should be calculated, taking into account the water ballast, the quantity and disposition of which should be stated in the stability information;

.3 in all cases when deck cargo is carried a realistic stowage weight should be assumed and stated in the stability information, including the height of the cargo and its centre of gravity;

.4 where pipes are carried on deck, a quantity of trapped water equal to a certain percentage of the net volume of the pipe deck cargo should be assumed in and around the pipes. The net volume should be taken as the internal volume of the pipes, plus the volume between the pipes. This percentage should be 30 if the freeboard amidships is equal to or less than 0.015 L and 10 if the freeboard amidships is equal to or greater than 0.03 L. For intermediate values of the freeboard amidships the percentage may be obtained by linear interpolation.

In assessing the quantity of trapped water, the Administration may take into account positive or negative sheer aft, actual trim and area of operation; or

.5 if a vessel operates in zones where ice accretion is likely to occur, allowance for icing should be made in accordance with the provisions of chapter 6 (Icing considerations).

3.4.2.8 For fishing vessels the assumptions for calculating loading conditions should be as follows:

.1 allowance should be made for the weight of the wet fishing nets and tackle, etc. on deck;

.2 allowance for icing, where this is anticipated to occur, should be made in accordance with the provisions of 6.3;

.3 in all cases the cargo should be assumed to be homogeneous unless this is inconsistent with practice;

.4 in conditions referred to in 3.4.1.6.2 and 3.4.1.6.3 deck cargo should be included if such a practice is anticipated;

.5 water ballast should normally only be included if carried in tanks which are specially provided for this purpose.

3.5 Calculation of stability curves

3.5.1 *General*

Hydrostatic and stability curves should be prepared for the trim range of operating loading conditions taking into account the change in trim due to heel (free trim hydrostatic calculation). The calculations should take into account the volume to the upper surface of the deck sheathing. Furthermore, appendages and sea chests need to be considered when calculating hydrostatics and cross curves of stability. In the presence of port-starboard asymmetry, the most unfavourable righting lever curve should be used.

3.5.2 *Superstructures, deckhouses, etc., which may be taken into account*

3.5.2.1 Enclosed superstructures complying with regulation 3(10)(b) of the 1966 Load Line Convention and 1988 Protocol as amended may be taken into account.

3.5.2.2 Additional tiers of similarly enclosed superstructures may also be taken into account. As guidance windows (pane and frame) that are considered without deadlights in additional tiers above the second tier if considered buoyant should be designed with strength to sustain a safety margin[19] with regard to the required strength of the surrounding structure.[20]

[19] As a guidance for Administrations a safety margin of 30% should be applied.
[20] IMO guidance for testing these windows is to be developed.

3.5.2.3 Deckhouses on the freeboard deck may be taken into account, provided that they comply with the conditions for enclosed superstructures laid down in regulation 3(10)(b) of the 1966 Load Line Convention and 1988 Protocol relating thereto, as amended.

3.5.2.4 Where deckhouses comply with the above conditions, except that no additional exit is provided to a deck above, such deckhouses should not be taken into account; however, any deck openings inside such deckhouses should be considered as closed even where no means of closure are provided.

3.5.2.5 Deckhouses, the doors of which do not comply with the requirements of regulation 12 of the 1966 Load Line Convention and 1988 Protocol as amended should not be taken into account; however, any deck openings inside the deckhouse are regarded as closed where their means of closure comply with the requirements of regulations 15, 17 or 18 of the 1966 Load Line Convention and 1988 Protocol as amended.

3.5.2.6 Deckhouses on decks above the freeboard deck should not be taken into account, but openings within them may be regarded as closed.

3.5.2.7 Superstructures and deckhouses not regarded as enclosed can, however, be taken into account in stability calculations up to the angle at which their openings are flooded (at this angle, the static stability curve should show one or more steps, and in subsequent computations the flooded space should be considered non-existent).

3.5.2.8 In cases where the ship would sink due to flooding through any openings, the stability curve should be cut short at the corresponding angle of flooding and the ship should be considered to have entirely lost its stability.

3.5.2.9 Small openings such as those for passing wires or chains, tackle and anchors, and also holes of scuppers, discharge and sanitary pipes should not be considered as open if they submerge at an angle of inclination more than 30°. If they submerge at an angle of 30° or less, these openings should be assumed open if the Administration considers this to be a source of significant flooding.

3.5.2.10 Trunks may be taken into account. Hatchways may also be taken into account having regard to the effectiveness of their closures.

3.5.3 *Calculation of stability curves for ships carrying timber deck cargoes*

In addition to the provisions given above, the Administration may allow account to be taken of the buoyancy of the deck cargo assuming that such cargo has a permeability of 25% of the volume occupied by the cargo. Additional curves of stability may be required if the Administration considers it necessary to investigate the influence of different permeabilities and/or assumed effective height of the deck cargo.

3.6 Stability booklet

3.6.1 Stability data and associated plans should be drawn up in the working language of the ship and any other language the Administration may require. Reference is also made to the International Safety Management (ISM) Code, adopted by the Organization by resolution A.741(18). All translations of the stability booklet should be approved.

3.6.2 Each ship should be provided with a stability booklet, approved by the Administration, which contains sufficient information to enable the master to operate the ship in compliance with the applicable requirements contained in the Code. The Administration may have additional requirements. On a mobile offshore drilling unit, the stability booklet may be referred to as an operating manual. The stability booklet may include information on longitudinal strength. This Code addresses only the stability-related contents of the booklet.[21]

3.6.3 For ships carrying timber deck cargoes:

.1 comprehensive stability information should be supplied which takes into account timber deck cargo. Such information should enable the master, rapidly and simply, to obtain accurate guidance as to the stability of the ship under varying conditions of service. Comprehensive rolling period tables or diagrams have proved to be very useful aids in verifying the actual stability conditions;[22]

.2 the Administration may deem it necessary that the master be given information setting out the changes in deck cargo from that shown in the loading conditions, when the permeability of the deck cargo is significantly different from 25% (refer to 3.5.3); and

.3 conditions should be shown indicating the maximum permissible amount of deck cargo having regard to the lightest stowage rate likely to be met in service.

3.6.4 The format of the stability booklet and the information included will vary dependent on the ship type and operation. In developing the stability booklet, consideration should be given to including the following information[23]:

.1 a general description of the ship;

.2 instructions on the use of the booklet;

.3 general arrangement plans showing watertight compartments, closures, vents, downflooding angles, permanent ballast, allowable deck loadings and freeboard diagrams;

.4 hydrostatic curves or tables and cross curves of stability calculated on a free-trimming basis, for the ranges of displacement and trim anticipated in normal operating conditions;

.5 capacity plan or tables showing capacities and centres of gravity for each cargo stowage space;

.6 tank sounding tables showing capacities, centres of gravity, and free surface data for each tank;

---

[21] Refer to regulation II-1/22 of the 1974 SOLAS Convention, as amended, regulation 10 of the International Convention on Load Lines, 1966 or the Protocol of 1988 as amended, as applicable and regulation III/10 of the 1993 Torremolinos Protocol.

[22] Refer to regulation II-1/22 of the 1974 SOLAS Convention, as amended, and regulation 10(2) of the International Convention on Load Lines, 1966 or the Protocol of 1988 as amended, as applicable.

[23] Refer to Model Loading and Stability Manual (MSC/Circ.920).

.7 information on loading restrictions, such as maximum KG or minimum GM curve or table that can be used to determine compliance with the applicable stability criteria;

.8 standard operating conditions and examples for developing other acceptable loading conditions using the information contained in the stability booklet;

.9 a brief description of the stability calculations done including assumptions;

.10 general precautions for preventing unintentional flooding;

.11 information concerning the use of any special cross-flooding fittings with descriptions of damage conditions which may require cross-flooding;

.12 any other necessary guidance for the safe operation of the ship under normal and emergency conditions;

.13 a table of contents and index for each booklet;

.14 inclining test report for the ship, or:

.14.1 where the stability data is based on a sister ship, the inclining test report of that sister ship along with the lightship measurement report for the ship in question; or

.14.2 where lightship particulars are determined by other methods than from inclining of the ship or its sister, a summary of the method used to determine those particulars;

.15 recommendation for determination of ship's stability by means of an in-service inclining test.

3.6.5 As an alternative to the stability booklet mentioned in 3.6.1, a simplified booklet in an approved form containing sufficient information to enable the master to operate the ship in compliance with the applicable provisions of the Code as may be provided at the discretion of the Administration concerned.

3.7 Operational measures for ships carrying timber deck cargoes

3.7.1 The stability of the ship at all times, including during the process of loading and unloading timber deck cargo, should be positive and to a standard acceptable to the Administration. It should be calculated having regard to:

.1 the increased weight of the timber deck cargo due to:

.1.1 absorption of water in dried or seasoned timber, and

.1.2 ice accretion, if applicable (chapter 6 (Icing considerations));

.2 variations in consumables;

.3 the free surface effect of liquid in tanks; and

.4 weight of water trapped in broken spaces within the timber deck cargo and especially logs.

3.7.2 The master should:

.1 cease all loading operations if a list develops for which there is no satisfactory explanation and it would be imprudent to continue loading;

.2 before proceeding to sea, ensure that:

.2.1 the ship is upright;

.2.2 the ship has an adequate metacentric height; and

.2.3 the ship meets the required stability criteria.

3.7.3 The masters of ships having a length less than 100 m should also:

.1 exercise good judgement to ensure that a ship which carries stowed logs on deck has sufficient additional buoyancy so as to avoid overloading and loss of stability at sea;

.2 be aware that the calculated GM_0 in the departure condition may decrease continuously owing to water absorption by the deck cargo of logs, consumption of fuel, water and stores and ensure that the ship has adequate GM_0 throughout the voyage; and

.3 be aware that ballasting after departure may cause the ship's operating draught to exceed the timber load line. Ballasting and deballasting should be carried out in accordance with the guidance provided in the Code of Safe Practice for Ships Carrying Timber Deck Cargoes, 1991 (resolution A.715(17)).

3.7.4 Ships carrying timber deck cargoes should operate, as far as possible, with a safe margin of stability and with a metacentric height which is consistent with safety requirements but such metacentric height should not be allowed to fall below the recommended minimum, as specified in part A, 3.3.2.

3.7.5 However, excessive initial stability should be avoided as it will result in rapid and violent motion in heavy seas which will impose large sliding and racking forces on the cargo causing high stresses on the lashings. Operational experience indicates that metacentric height should preferably not exceed 3% of the breadth in order to prevent excessive accelerations in rolling provided that the relevant stability criteria given in part A, 3.3.2 are satisfied. This recommendation may not apply to all ships and the master should take into consideration the stability information obtained from the ship's stability booklet.

3.8 Operating booklets for certain ships

3.8.1 Special purpose ships and novel craft, should be provided with additional information in the stability booklet such as design limitations, maximum speed, worst intended weather conditions or other information regarding the handling of the craft that the master needs to operate the ship safely.

3.8.2 For double hull oil tankers of single cargo tank across design, an operation manual for loading and unloading cargo oil should be provided, including operational procedures of loading and unloading cargo oil and detailed data of the initial metacentric height of the oil tanker and that of free surface correction of liquids in cargo oil tanks and ballast tanks during loading and unloading cargo oil (including ballasting and discharging) and cargo oil washing of tanks.[24]

3.8.3 The stability booklet of ro-ro passenger ships should contain information concerning the importance of securing and maintaining all closures watertight due to the rapid loss of stability which may result when water enters the vehicle deck and the fact that capsize can rapidly follow.

[24] Refer to the Guidance on intact stability of existing tankers during liquid transfer operations (MSC/Circ.706 – MEPC/Circ.304).

CHAPTER 4 – STABILITY CALCULATIONS PERFORMED BY STABILITY INSTRUMENTS

4.1 Stability instruments[25]

A stability instrument installed onboard should cover all stability requirements applicable to the ship. The software is subject to approval by the Administration. Active and passive systems are defined in 4.1.2. These requirements cover passive systems and the off-line operation mode of active systems only.

4.1.1 *General*

4.1.1.1 The scope of stability calculation software should be in accordance with the approved stability booklet and should at least include all information and perform all calculations or checks as necessary to ensure compliance with the applicable stability requirements.

4.1.1.2 An approved stability instrument is not a substitute for the approved stability booklet, and is used as a supplement to the approved stability booklet to facilitate stability calculations.

4.1.1.3 The input/output information should be easily comparable with the approved stability booklet so as to avoid confusion and possible misinterpretation by the operator.

4.1.1.4 An operation manual is to be provided for the stability instrument.

4.1.1.5 The language in which the stability calculation results are displayed and printed out as well as the operation manual is written should be the same as used in the ship's approved stability booklet. A translation into a language considered appropriate may be required.

4.1.1.6 The stability instrument is ship specific equipment and the results of the calculations are only applicable to the ship for which it has been approved.

4.1.1.7 In case of modifications of the ship which cause alterations in the stability booklet, the specific approval of any original stability calculation software is no longer valid. The software is to be modified accordingly and re-approved.

4.1.1.8 Any change in software version related to the stability calculation should be reported to and be approved by the Administration.

4.1.2 *Data entry system*

4.1.2.1 A passive system requires manual data entry.

4.1.2.2 An active system replaces partly the manual entry with sensors reading and entering the contents of tanks, etc.

4.1.2.3 Any integrated system which controls or initiates actions based on the sensor-supplied inputs is not within the scope of this Code except the part calculating the stability.

[25] Refer to the Guidelines for the approval of stability instruments (MSC.1/Circ.1229).

4.1.3 *Types of stability software*

Three types of calculations performed by stability software are acceptable depending upon a vessel's stability requirements:

Type 1

Software calculating intact stability only (for vessels not required to meet a damage stability criterion).

Type 2

Software calculating intact stability and checking damage stability on basis of a limit curve (e.g. for vessels applicable to SOLAS part B-1 damage stability calculations, etc.) or previously approved loading conditions.

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.). The results of the direct calculations performed by the stability instrument could be accepted by the Administration even if they differ from the required minimum GM or maximum VCG stated in the approved stability booklet.

Such deviations could be accepted under the condition that all relevant stability requirements will be complied with by the results of the direct calculations.

4.1.4 *Functional requirements*

4.1.4.1 The stability instrument should present relevant parameters of each loading condition in order to assist the master in his judgement on whether the ship is loaded within the approved limits. The following parameters should be presented for a given loading condition:

.1 detailed deadweight data items including centre of gravity and free surfaces, if applicable;

.2 trim; list;

.3 draught at the draught marks and perpendiculars;

.4 summary of loading condition displacement; VCG; LCG, TCG; VCB, LCB, TCB, LCF, GM and GM_L;

.5 table showing the righting lever versus heeling angle including trim and draught;

.6 down-flooding angle and corresponding down-flooding opening; and

.7 compliance with stability criteria: Listings of all calculated stability criteria, the limit values, the obtained values and the conclusions (criteria fulfilled or not fulfilled).

4.1.4.2 If direct damage stability calculations are performed, the relevant damage cases according to the applicable rules should be pre-defined for automatic check of a given loading condition.

4.1.4.3 A clear warning should be given on screen and in hard copy printout if any of the limitations are not complied with.

4.1.4.4 The data are to be presented on screen and in hard copy printout in a clear unambiguous manner.

4.1.4.5 The date and time of a saved calculation should be part of the screen display and hard copy printout.

4.1.4.6 Each hard copy printout should contain identification of the calculation program including version number.

4.1.4.7 Units of measurement are to be clearly identified and used consistently within a loading calculation.

4.1.5 ***Acceptable tolerances***

Depending on the type and scope of programs, the acceptable tolerances are to be determined differently, according to 4.1.5.1 or 4.1.5.2. Deviation from these tolerances should not be accepted unless the Administration considers that there is a satisfactory explanation for the difference and that there will be no adverse effect on the safety of the ship.

The accuracy of the results should be determined using an independent program or the approved stability booklet with identical input.

4.1.5.1 Programs which use only pre-programmed data from the approved stability booklet as the basis for stability calculations should have zero tolerances for the printouts of input data.

Output data tolerances are to be close to zero, however, small differences associated with calculation rounding or abridged input data are acceptable. Additionally differences associated with the use of hydrostatic and stability data for trims and the method calculating free surface moments that differ from those in the approved stability booklet are acceptable subject to review by the Administration.

4.1.5.2 Programs which use hull form models as their basis for stability calculations should have tolerances for the printouts of basic calculated data established against either data from the approved stability booklet or data obtained using the Administration's approval model.

4.1.6 ***Approval procedure***

4.1.6.1 *Conditions of approval of the stability instrument*

The software approval includes:

.1 verification of type approval, if any;

.2 verification that the data used is consistent with the current condition of the ship (refer to paragraph 4.1.6.2);

.3 verification and approval of the test conditions; and

.4 verification that the software is appropriate for the type of ship and stability calculations required.

The satisfactory operation of the stability instrument is to be verified by testing upon installation (refer to paragraph 4.1.8). A copy of the approved test conditions and the operation manual for the stability instrument are to be available on board.

4.1.6.2 *Specific approval*

4.1.6.2.1 The accuracy of the computational results and actual ship data used by the calculation program for the particular ship on which the program will be installed should be to the satisfaction of the Administration.

4.1.6.2.2 Upon application for data verification, minimum of four loading conditions should be taken from the ship's approved stability booklet, which are to be used as the test conditions. For ships carrying liquids in bulk, at least one of the conditions should include partially filled tanks. For ships carrying grain in bulk, one of the grain loading conditions should include a partially filled grain compartment. Within the test conditions each compartment should be loaded at least once. The test conditions normally are to cover the range of load draughts from the deepest envisaged loaded condition to the light ballast condition and should include at least one departure and one arrival condition.

4.1.6.2.3 The following data, submitted by the applicant, should be consistent with arrangements and most recently approved lightship characteristics of the ship according to current plans and documentation on file, subject to possible further verification on board:

.1 identification of the calculation program including version number. Main dimensions, hydrostatic particulars and, if applicable, the ship's profile;

.2 the position of the forward and aft perpendiculars, and if appropriate, the calculation method to derive the forward and aft draughts at the actual position of the ship's draught marks;

.3 ship's lightweight and centre of gravity derived from the most recently approved inclining experiment or light weight survey;

.4 lines plan, offset tables or other suitable presentation of hull form data including all relevant appendages, if necessary to model the ship;

.5 compartment definitions, including frame spacing, and centres of volume, together with capacity tables (sounding/ullage tables), free surface corrections, if appropriate; and

.6 cargo and consumables distribution for each loading condition.

Verification by the Administration does not absolve the shipowner of responsibility for ensuring that the information programmed into the stability instrument is consistent with the current condition of the ship and approved stability booklet.

4.1.7 *User manual*

A simple and straightforward user manual written in the same language as the stability booklet is to be provided, containing descriptions and instructions, as appropriate, for at least the following:

.1 installation;

.2 function keys;

.3 menu displays;

.4 input and output data;

.5 required minimum hardware to operate the software;

.6 use of the test loading conditions;

.7 computer-guided dialogue steps; and

.8 list of warnings.

A user manual in electronic format may be provided in addition to the written manual.

4.1.8 *Installation testing*

4.1.8.1 To ensure correct working of the stability instrument after the final or updated software has been installed, it is the responsibility of the ship's master to have test calculations carried out according to the following pattern in the presence of an Administration's surveyor. From the approved test conditions at least one load case (other than light ship) should be calculated.

Note: Actual loading condition results are not suitable for checking the correct working of the stability instrument.

4.1.8.2 Normally, the test conditions are permanently stored in the stability instrument. Steps to be performed:

.1 retrieve the test load case and start a calculation run; compare the stability results with those in the documentation;

.2 change several items of deadweight (tank weights and the cargo weight) sufficiently to change the draught or displacement by at least 10%. The results are to be reviewed to ensure that they differ in a logical way from those of the approved test condition;

.3 revise the above modified load condition to restore the initial test condition and compare the results. The relevant input and output data of the approved test condition are to be replicated; and

.4 alternatively, one or more test conditions should be selected and the test calculations performed by entering all deadweight data for each selected test condition into the program as if it were a proposed loading. The results should be verified as identical to the results in the approved copy of the test conditions.

4.1.9 ***Periodical testing***

4.1.9.1 It is the responsibility of the ship's master to check the accuracy of the stability instrument at each annual survey by applying at least one approved test condition. If an Administration's representative is not present for the stability instrument check, a copy of the test condition results obtained by this check is to be retained on board as documentation of satisfactory testing for the Administration's representative's verification.

4.1.9.2 At each renewal survey this checking for all approved test loading conditions is to be done in the presence of the Administration's representative.

4.1.9.3 The testing procedure should be carried out in accordance with paragraph 4.1.8.

4.1.10 ***Other requirements***

4.1.10.1 Protection against unintentional or unauthorized modification of programs and data should be provided.

4.1.10.2 The program should monitor operation and activate an alarm when the program is incorrectly or abnormally used.

4.1.10.3 The program and any data stored in the system should be protected from corruption by loss of power.

4.1.10.4 Error messages with regard to limitations such as filling a compartment beyond capacity or more than once, or exceeding the assigned load line, etc., should be included.

4.1.10.5 If any software related to stability measures such as sea keeping abilities of the vessel, evaluation of in-service inclining experiments and processing the results for further calculation, as well as the evaluation of roll period measurements is installed on board, such software should be reported to the Administration for consideration.

4.1.10.6 Program functionalities should include mass and moment calculations with numerical and graphical presentation of the results, such as initial stability values, righting lever curve, areas under the righting lever curve and range of stability.

4.1.10.7 All input data from automatically measuring sensors, such as gauging devices or draught reading systems should be presented to the user for verification. The user should have the possibility to override faulty readings manually.

CHAPTER 5 – OPERATIONAL PROVISIONS AGAINST CAPSIZING

5.1 General precautions against capsizing

5.1.1 Compliance with the stability criteria does not ensure immunity against capsizing, regardless of the circumstances, or absolve the master from his responsibilities. Masters should therefore exercise prudence and good seamanship having regard to the season of the year, weather forecasts and the navigational zone and should take the appropriate action as to speed and course warranted by the prevailing circumstances.[26]

5.1.2 Care should be taken that the cargo allocated to the ship is capable of being stowed so that compliance with the criteria can be achieved. If necessary, the amount should be limited to the extent that ballast weight may be required.

5.1.3 Before a voyage commences, care should be taken to ensure that the cargo, cargo handling cranes and sizeable pieces of equipment have been properly stowed or lashed so as to minimize the possibility of both longitudinal and lateral shifting, while at sea, under the effect of acceleration caused by rolling and pitching.[27]

5.1.4 A ship, when engaged in towing operations, should possess an adequate reserve of stability to withstand the anticipated heeling moment arising from the tow line without endangering the towing ship. Deck cargo on board the towing ship should be so positioned as not to endanger the safe working of the crew on deck or impede the proper functioning of the towing equipment and be properly secured. Tow line arrangements should include towing springs and a method of quick release of the tow.

5.1.5 The number of partially filled or slack tanks should be kept to a minimum because of their adverse effect on stability. The negative effect on stability of filled pool tanks should be taken into consideration.

5.1.6 The stability criteria contained in part A chapter 2 set minimum values, but no maximum values are recommended. It is advisable to avoid excessive values of metacentric height, since these might lead to acceleration forces which could be prejudicial to the ship, its complement, its equipment and to safe carriage of the cargo. Slack tanks may, in exceptional cases, be used as a means of reducing excessive values of metacentric height. In such cases, due consideration should be given to sloshing effects.

5.1.7 Regard should be paid to the possible adverse effects on stability where certain bulk cargoes are carried. In this connection, attention should be paid to the IMO Code of Safe Practice for Solid Bulk Cargoes.

5.2 Operational precautions in heavy weather

5.2.1 All doorways and other openings, through which water can enter into the hull or deckhouses, forecastle, etc., should be suitably closed in adverse weather conditions and accordingly all appliances for this purpose should be maintained on board and in good condition.

---

[26] Refer to the Revised Guidance to the master for avoiding dangerous situations in adverse weather and sea conditions (MSC.1/Circ.1228).

[27] Refer to the Guidelines for the preparation of the Cargo Securing Manual (MSC/Circ.745).

5.2.2 Weathertight and watertight hatches, doors, etc., should be kept closed during navigation, except when necessarily opened for the working of the ship and should always be ready for immediate closure and be clearly marked to indicate that these fittings are to be kept closed except for access. Hatch covers and flush deck scuttles in fishing vessels should be kept properly secured when not in use during fishing operations. All portable deadlights should be maintained in good condition and securely closed in bad weather.

5.2.3 Any closing devices provided for vent pipes to fuel tanks should be secured in bad weather.

5.2.4 Fish should never be carried in bulk without first being sure that the portable divisions in the holds are properly installed.

5.3 Ship handling in heavy weather

5.3.1 In all conditions of loading necessary care should be taken to maintain a seaworthy freeboard.

5.3.2 In severe weather, the speed of the ship should be reduced if propeller emergence, shipping of water on deck or heavy slamming occurs.

5.3.3 Special attention should be paid when a ship is sailing in following, quartering or head seas because dangerous phenomena such as parametric resonance, broaching to, reduction of stability on the wave crest, and excessive rolling may occur singularly, in sequence or simultaneously in a multiple combination, creating a threat of capsize. A ship's speed and/or course should be altered appropriately to avoid the above-mentioned phenomena.[28]

5.3.4 Reliance on automatic steering may be dangerous as this prevents ready changes to course which may be needed in bad weather.

5.3.5 Water trapping in deck wells should be avoided. If freeing ports are not sufficient for the drainage of the well, the speed of the ship should be reduced or the course changed, or both. Freeing ports provided with closing appliances should always be capable of functioning and are not to be locked.

5.3.6 Masters should be aware that steep or breaking waves may occur in certain areas, or in certain wind and current combinations (river estuaries, shallow water areas, funnel shaped bays, etc.). These waves are particularly dangerous, especially for small ships.

5.3.7 In severe weather, the lateral wind pressure may cause a considerable angle of heel. If anti-heeling measures (e.g. ballasting, use of anti-heeling devices, etc.) are used to compensate for heeling due to wind, changes of the ship's course relative to the wind direction may lead to dangerous angles of heel or capsizing. Therefore, heeling caused by the wind should not be compensated with anti-heeling measures, unless, subject to the approval by the Administration, the vessel has been proven by calculation to have sufficient stability in worst case conditions (i.e. improper or incorrect use, mechanism failure, unintended course change, etc.). Guidance on the use of anti-heeling measures should be provided in the stability booklet.

[28] Refer to the Revised Guidance to the master for avoiding dangerous situations in adverse weather and sea conditions (MSC.1/Circ.1228).

5.3.8 Use of operational guidelines for avoiding dangerous situations in severe weather conditions or an on-board computer based system is recommended. The method should be simple to use.

5.3.9 High-speed craft should not be intentionally operated outside the worst intended conditions and limitations specified in the relevant certificates, or in documents referred to therein.

CHAPTER 6 – ICING CONSIDERATIONS

6.1 General

6.1.1 For any ship operating in areas where ice accretion is likely to occur, adversely affecting a ship's stability, icing allowances should be included in the analysis of conditions of loading.

6.1.2 Administrations are advised to take icing into account and are permitted to apply national standards where environmental conditions are considered to warrant a higher standard than those recommended in the following sections.

6.2 Cargo ships carrying timber deck cargoes

6.2.1 The master should establish or verify the stability of his ship for the worst service condition, having regard to the increased weight of deck cargo due to water absorption and/or ice accretion and to variations in consumables.[29]

6.2.2 When timber deck cargoes are carried and it is anticipated that some formation of ice will take place, an allowance should be made in the arrival condition for the additional weight.

6.3 Fishing vessels

The calculations of loading conditions for fishing vessels (refer to 3.4.2.8) should, where appropriate, include allowance for ice accretion, in accordance with the following provisions.

6.3.1 *Allowance for ice accretion*[30]

For vessels operating in areas where ice accretion is likely to occur, the following icing allowance should be made in the stability calculations:

.1 30 kg per square metre on exposed weather decks and gangways;

.2 7.5 kg per square metre for projected lateral area of each side of the vessel above the water plane;

.3 the projected lateral area of discontinuous surfaces of rail, sundry booms, spars (except masts) and rigging of vessels having no sails and the projected lateral area of other small objects should be computed by increasing the total projected area of continuous surfaces by 5% and the static moments of this area by 10%.

Vessels intended for operation in areas where ice is known to occur should be:

.4 designed to minimize the accretion of ice; and

.5 equipped with such means for removing ice as the Administration may require; for example, electrical and pneumatic devices, and/or special tools such as axes or wooden clubs for removing ice from bulwarks, rails and erections.

---

[29] Refer to regulation 44(10) of the 1966 Load Line Convention and regulation 44(7) of the 1988 Load Line Protocol as amended.

[30] Refer to regulation III/8 of the 1993 Torremolinos Protocol.

6.3.2 *Guidance relating to ice accretion*

In the application of the above standards the following icing areas should apply:

.1 the area north of latitude 65° 30′ N, between longitude 28° W and the west coast of Iceland; north of the north coast of Iceland; north of the rhumb line running from latitude 66° N, longitude 15° W to latitude 73° 30′ N, longitude 15° E, north of latitude 73° 30′ N between longitude 15° E and 35° E, and east of longitude 35° E, as well as north of latitude 56° N in the Baltic Sea;

.2 the area north of latitude 43° N bounded in the west by the North American coast and the east by the rhumb line running from latitude 43° N, longitude 48° W to latitude 63° N, longitude 28° W and thence along longitude 28° W;

.3 all sea areas north of the North American Continent, west of the areas defined in 6.3.2.1 and 6.3.2.2;

.4 the Bering and Okhotsk Seas and the Tartary Strait during the icing season; and

.5 south of latitude 60° S.

A chart to illustrate the areas is attached at the end of this chapter.

For vessels operating in areas where ice accretion may be expected:

.6 within the areas defined in 6.3.2.1, 6.3.2.3, 6.3.2.4 and 6.3.2.5 known to having icing conditions significantly different from those described in 6.3.1, ice accretion requirements of one half to twice the required allowance may be applied; and

.7 within the area defined in 6.3.2.2, where ice accretion in excess of twice the allowance required by 6.3.1 may be expected, more severe requirements than those given in 6.3.1 may be applied.

6.3.3 *Brief survey of the causes of ice formation and its influence upon the seaworthiness of the vessel*

6.3.3.1 The skipper of a fishing vessel should bear in mind that ice formation is a complicated process which depends upon meteorological conditions, condition of loading and behaviour of the vessel in stormy weather as well as on the size and location of superstructures and rigging. The most common cause of ice formation is the deposit of water droplets on the vessel's structure. These droplets come from spray driven from wave crests and from ship-generated spray.

6.3.3.2 Ice formation may also occur in conditions of snowfall, sea fog (including arctic sea smoke), a drastic fall in ambient temperature, as well as from the freezing of drops of rain on impact with the vessel's structure.

6.3.3.3 Ice formation may sometimes be caused or accentuated by water shipped on board and retained on deck.

6.3.3.4 Intensive ice formation generally occurs on stem, bulwark and bulwark rail, front walls of superstructures and deck-houses, hawse holes, anchors, deck gear, forecastle deck and upper deck, freeing ports, aerials, stays, shrouds, masts and spars.

6.3.3.5 It should be borne in mind that the most dangerous areas as far as ice formation is concerned are the sub-Arctic regions.

6.3.3.6 The most intensive ice formation takes place when wind and sea come from ahead. In beam and quartering winds, ice accumulates quicker on the windward side of the vessel, thus leading to a constant list which is extremely dangerous.

6.3.3.7 Listed below are meteorological conditions causing the most common type of ice formation due to spraying of a vessel. Examples of the weight of ice formation on a typical fishing vessel of displacement in the range 100 t to 500 t are also given. For larger vessels the weight will be correspondingly greater.

6.3.3.8 Slow accumulations of ice take place:

.1 at ambient temperature from -1°C to -3°C and any wind force;

.2 at ambient temperature -4°C and lower and wind force from 0 to 9 m/s; and

.3 under the conditions of precipitation, fog or sea mist followed by a drastic fall of the ambient temperature.

Under all these conditions the intensity of ice accumulation may not exceed 1.5 t/h.

6.3.3.9 At ambient temperature of -4°C to -8°C and wind force 10 to 15 m/s, rapid accumulation of ice takes place. Under these conditions the intensity of ice accumulation can lie within the range 1.5 to 4 t/h.

6.3.3.10 Very fast accumulation of ice takes place:

.1 at ambient temperature of -4°C and lower and wind forces of 16 m/s and over; and

.2 at ambient temperature -9°C and lower and wind force 10 to 15 m/s.

Under these conditions the intensity of ice accumulation can exceed 4 t/h.

6.3.3.11 The skipper should bear in mind that ice formation adversely affects the seaworthiness of the vessel as ice formation leads to:

.1 an increase in the weight of the vessel due to accumulation of ice on the vessel's surfaces which causes the reduction of freeboard and buoyancy;

.2 a rise of the vessel's centre of gravity due to the high location of ice on the vessel's structures with corresponding reduction in the level of stability;

.3 an increase of windage area due to ice formation on the upper parts of the vessel and hence an increase in the heeling moment due to the action of the wind;

.4 a change of trim due to uneven distribution of ice along the vessel's length;

.5 the development of a constant list due to uneven distribution of ice across the breadth of the vessel; and

.6 impairment of the manoeuvrability and reduction of the speed of the vessel.

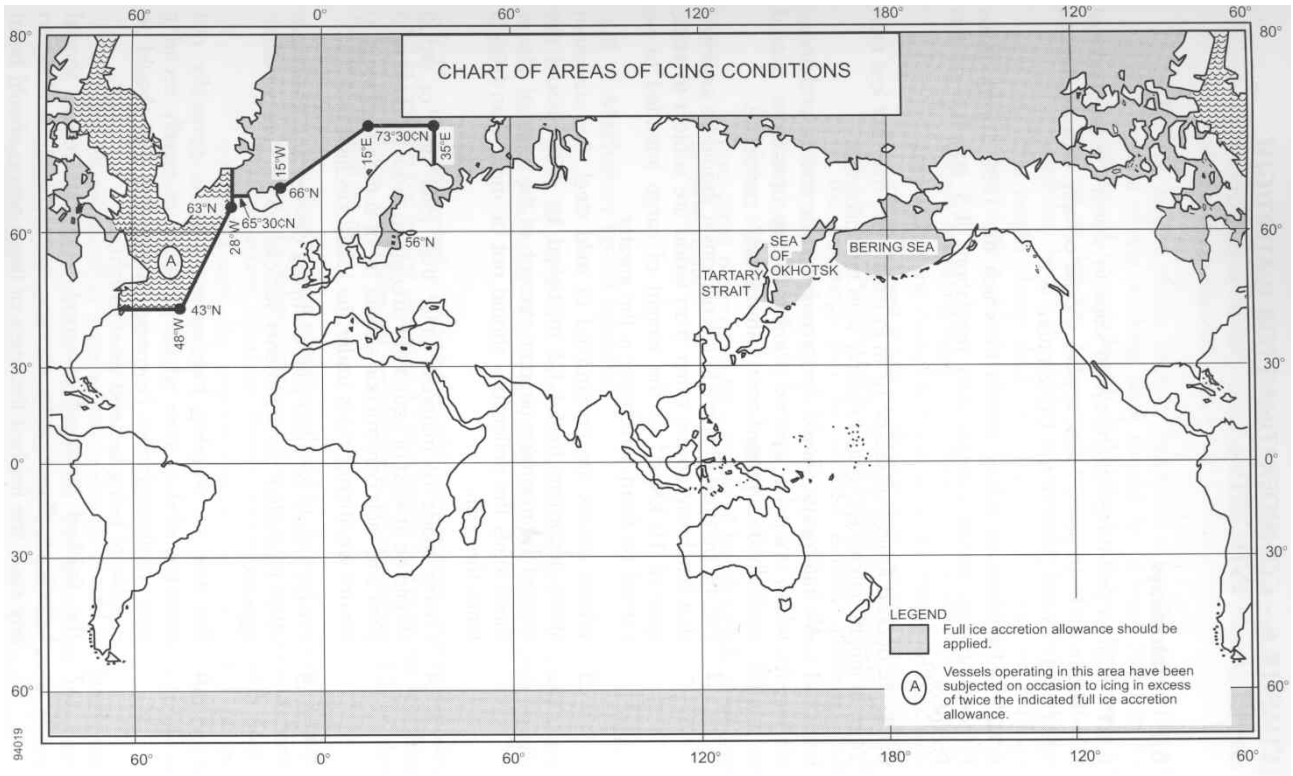
6.3.4 Operational procedures related to ensuring a fishing vessel's endurance in conditions of ice formation are given in annex 2 (Recommendations for skippers of fishing vessels on ensuring a vessel's endurance in conditions of ice formation).

6.4 Offshore supply vessels 24 m to 100 m in length

For vessels operating in areas where ice accretion is likely to occur:

.1 no shutters should be fitted in the freeing ports; and

.2 with regard to operational precautions against capsizing, reference is made to the recommendations for skippers of fishing vessels on ensuring a vessel's endurance in conditions of ice formation, as given in paragraph 6.3.3 and in annex 2 (Recommendations for skippers of fishing vessels on ensuring a vessel's endurance in conditions of ice formation).



CHAPTER 7 – CONSIDERATIONS FOR WATERTIGHT AND WEATHERTIGHT INTEGRITY

7.1 Hatchways

7.1.1 Cargo and other hatchways in ships to which the International Convention on Load Lines, 1966, applies should comply with regulations 13, 14, 15, 16 and 26(5) of this Convention.

7.1.2 Hatchways in fishing vessels to which the 1993 Torremolinos Protocol applies should comply with regulations II/5 and II/6 of this Protocol.

7.1.3 In decked fishing vessels of 12 m in length and over but less than 24 m in length hatchways should comply with the following:

7.1.3.1 All hatchways should be provided with covers and those which may be opened during fishing operations should normally be arranged near to the vessel's centreline.

7.1.3.2 For the purpose of strength calculations it should be assumed that hatchway covers other than wood are subject to static load of 10 kN/m^2 or the weight of cargo intended to be carried on them, whichever is the greater.

7.1.3.3 Where covers are constructed of mild steel, the maximum stress according to 7.1.3.2 multiplied by 4.25 should not exceed the minimum ultimate strength of the material. Under these loads the deflections should not be more than 0.0028 times the span.

7.1.3.4 Covers made of materials other than mild steel or wood should be at least of equivalent strength to those made of mild steel and their construction should be of sufficient stiffness to ensure weathertightness under the loads specified in 7.1.3.2.

7.1.3.5 Covers should be fitted with clamping devices and gaskets or other equivalent arrangements sufficient to ensure weathertightness.

7.1.3.6 The use of wooden hatchway covers is generally not recommended in view of the difficulty of rapidly securing their weathertightness. However, where fitted they should be capable of being secured weathertight.

7.1.3.7 The finished thickness of wood hatchway covers should include an allowance for abrasion due to rough handling. In any case, the finished thickness of these covers should be at least 4 mm for each 100 mm of unsupported span subject to a minimum of 40 mm and the width of their bearing surfaces should be at least 65 mm.

7.1.3.8 The height above deck of hatchway coamings on exposed parts of the working deck should be at least 300 mm for vessels of 12 m in length and at least 600 mm for vessels of 24 m in length. For vessels of intermediate length the minimum height should be obtained by linear interpolation. The height above deck of hatchway coamings on exposed parts of the superstructure deck should be at least 300 mm.

7.1.3.9 Where operating experience has shown justification and on approval of the competent authority the height of hatchway coamings, except those which give direct access to machinery spaces may be reduced from the height as specified in 7.1.3.8 or the coamings may be omitted entirely, provided that efficient watertight hatch covers other than wood are fitted. Such

hatchways should be kept as small as practicable and the covers should be permanently attached by hinges or equivalent means and be capable of being rapidly closed or battened down.

7.2 Machinery space openings

7.2.1 In ships to which the International Convention on Load Lines, 1966 or the Protocol of 1988 as amended, as applicable, applies machinery space openings should comply with regulation 17.

7.2.2 In fishing vessels to which the 1993 Torremolinos Protocol applies and in new decked fishing vessels of 12 m in length and over, but less than 24 m in length, the following requirements of regulation II/7 of this Protocol should be met:

.1 machinery space openings should be framed and enclosed by casings of a strength equivalent to the adjacent superstructure. External access openings therein should be fitted with doors complying with the requirements of regulation II/4 of the Protocol or, in vessels less than 24 m in length, with hatch covers other than wood complying with the requirements of 7.1.3 of this chapter; and

.2 openings other than access openings should be fitted with covers of equivalent strength to the unpierced structure, permanently attached thereto and capable of being closed weathertight.

7.2.3 In offshore supply vessels, access to the machinery space should, if possible, be arranged within the forecastle. Any access to the machinery space from the exposed cargo deck should be provided with two weathertight closures. Access to spaces below the exposed cargo deck should preferably be from a position within or above the superstructure deck.

7.3 Doors

7.3.1 In passenger ships to which the International Convention for the Safety of Life at Sea, 1974, applies, doors should comply with regulations II-l/13 and 16 of this Convention.

7.3.2 In ships to which the International Convention on Load Lines, 1966 or the Protocol of 1988 relating thereto, as amended, as applicable, applies, doors should comply with regulation 12 of this Convention.

7.3.3 In fishing vessels to which the 1993 Torremolinos Protocol applies, doors should comply with regulation II/2 and regulation II/4 of this Protocol.

7.3.4 In decked fishing vessels of 12 m in length and over but less than 24 m in length:

.1 Watertight doors may be of the hinged type and should be capable of being operated locally from each side of the door. A notice should be attached to the door on each side stating that the door should be kept closed at sea.

.2 All access openings in bulkheads of enclosed deck erections, through which water could enter and endanger the vessel, should be fitted with doors permanently attached to the bulkhead, framed and stiffened so that the whole structure is of equivalent strength to the unpierced structure, and weathertight when closed, and

means should be provided so that they can be operated from each side of the bulkhead.

.3 The height above deck of sills in those doorways, companionways, deck erections and machinery casings situated on the working deck and on superstructure decks which give direct access to parts of that deck exposed to the weather and sea should be at least equal to the height of hatchway coamings as specified in 7.1.3.8.

.4 Where operating experience has shown justification and on approval of the competent authority, the height above deck of sills in the doorways specified in 7.3.4.3 except those giving direct access to machinery spaces, may be reduced to not less than 150 mm on superstructure decks and not less than 380 mm on the working deck for vessels 24 m in length, or not less than 150 mm on the working deck for vessels of 12 m in length. For vessels of intermediate length the minimum acceptable reduced height for sills in doorways on the working deck should be obtained by linear interpolation.

7.4 Cargo ports and other similar openings

7.4.1 Cargo ports and other similar openings in ships to which the International Convention on Load Lines, 1966 or the Protocol of 1988 relating thereto, as amended, as applicable, applies should comply with regulation 21 of this Convention.

7.4.2 Openings through which water can enter the vessel and fish flaps on stern trawlers in fishing vessels to which the 1993 Torremolinos Protocol applies should comply with regulation II/3 of this Protocol.

7.4.3 Cargo port and other similar openings in passenger ships to which the International Convention for the Safety of Life at Sea, 1974 applies should comply with regulations II-1/15, 17 and 22 of this Convention. In addition, such openings in ro-ro passenger ships to which this Convention applies, should comply with regulation II-1/17-1 of this Convention.

7.4.4 Cargo port and other similar openings in cargo ships to which the International Convention for the Safety of Life at Sea, 1974 applies should comply with regulation II-1/15-10 of this Convention.

7.5 Sidescuttles, window scuppers, inlets and discharges

7.5.1 In passenger ships to which the International Convention for the Safety of Life at Sea, 1974 applies, openings in shell plating below the bulkhead deck should comply with regulation II-1/15 of this Convention.

Watertight integrity above the bulkhead deck should comply with regulation II-1/17 of this Convention.

In addition, in ro-ro passenger ships, watertight integrity below the bulkhead deck should comply with regulation II-1/23 and integrity of the hull and superstructure should comply with regulation II-1/17-1 of this Convention.

7.5.2 In ships to which the International Convention on Load Lines, 1966 or the Protocol of 1988 relating thereto, as amended, as applicable, applies, scuppers, inlets and discharges

should comply with regulation 22 and sidescuttles should comply with regulation 23 of this Convention.

7.5.3 In fishing vessels to which the 1993 Torremolinos Protocol applies, sidescuttles and windows should comply with regulation II/12 and inlets and discharges should comply with regulation II/13 of this Protocol.

7.5.4 In decked fishing vessels of 12 m in length and over but less than 24 m in length, sidescuttles, windows and other openings and inlets and discharges should comply with the following:

.1 sidescuttles to spaces below the working deck and to enclosed spaces on the working deck should be fitted with hinged deadlights capable of being closed watertight;

.2 sidescuttles should be fitted in a position such that their sills are above a line drawn parallel to the working deck at side having its lowest point 500 mm above the deepest operating waterline;

.3 sidescuttles, together with their glasses and deadlights, should be of substantial construction to the satisfaction of the competent authority;

.4 skylights leading to spaces below the working deck should be of substantial construction and capable of being closed and secured weathertight, and with provision for adequate means of closing in the event of damage to the inserts. Skylights leading to machinery spaces should be avoided as far as practicable;

.5 toughened safety glass or suitable permanently transparent material of equivalent strength should be fitted in all wheelhouse windows exposed to the weather. The means of securing windows and the width of the bearing surfaces should be adequate, having regard to the window material used. Openings leading to spaces below deck from a wheelhouse whose windows are not provided with the protection required by 0 should be fitted with a weathertight closing appliance;

.6 deadlights or a suitable number of storm shutters should be provided where there is no other method of preventing water from entering the hull through a broken window or sidescuttle;

.7 the competent authority may accept sidescuttles and windows without deadlights in side or aft bulkheads of deck erections located on or above the working deck if satisfied that the safety of the vessel will not be impaired;

.8 the number of openings in the sides of the vessel below the working deck should be the minimum compatible with the design and proper working of the vessel and such openings should be provided with closing arrangements of adequate strength to ensure watertightness and the structural integrity of the surrounding structure;

.9 discharges led through the shell either from spaces below the working deck or from spaces within deck erections should be fitted with efficient and accessible means for preventing water from passing inboard. Normally each separate discharge should have an automatic non-return valve with a positive means of

closing it from a readily accessible position. Such a valve is not required if the competent authority considers that the entry of water into the vessel through the opening is not likely to lead to dangerous flooding and that the thickness of the pipe is sufficient. The means for operating the valve with a positive means of closing should be provided with an indicator showing whether the valve is open or closed. The open inboard end of any discharge system should be above the deepest operating waterline at an angle of heel satisfactory to the competent authority;

.10 in machinery spaces main and auxiliary sea inlets and discharges essential for the operation of machinery should be controlled locally. Controls should be readily accessible and should be provided with indicators showing whether the valves are open or closed. Suitable warning devices should be incorporated to indicate leakage of water into the space; and

.11 fittings attached to the shell and all valves should be of steel, bronze or other ductile material. All pipes between the shell and valves should be of steel, except that in vessels constructed of material other than steel, other suitable materials may be used.

7.5.5 In cargo ships to which the International Convention for the Safety of Life at Sea, 1974 applies, external openings should comply with regulation II-1/15-2 of this Convention.

7.6 Other deck openings

7.6.1 Miscellaneous openings in freeboard and superstructure decks in ships to which the International Convention on Load Lines, 1966 or the Protocol of 1988 relating thereto, as amended, as applicable, applies should comply with regulation 18 of this Convention.

7.6.2 In decked fishing vessels of 12 m and over where it is essential for fishing operations, flush deck scuttles of the screw, bayonet or equivalent type and manholes may be fitted provided these are capable of being closed watertight and such devices should be permanently attached to the adjacent structure. Having regard to the size and disposition of the openings and the design of the closing devices, metal-to-metal closures may be fitted if they are effectively watertight. Openings other than hatchways, machinery space openings, manholes and flush scuttles in the working or superstructure deck should be protected by enclosed structures fitted with weathertight doors or their equivalent. Companionways should be situated as close as practicable to the centreline of the vessel.[31]

7.7 Ventilators, air pipes and sounding devices

7.7.1 Ventilators in ships to which the International Convention on Load Lines, 1966 or the Protocol of 1988 relating thereto, as amended, as applicable, applies should comply with regulation 19 and air pipes should comply with regulation 20 of this Convention.

7.7.2 Ventilators in fishing vessels to which the 1993 Torremolinos Protocol applies should comply with regulation II/9 and air pipes should comply with regulation II/10 of this Protocol. Sounding devices should comply with regulation II/11 of this Protocol.

[31] Refer to regulation II/8 of the 1993 Torremolinos Protocol.

7.7.3 Ventilators and air pipes in fishing vessels of 12 m in length and over but less than 24 m in length should comply with the following:

.1 ventilators should have coamings of substantial construction and should be capable of being closed weathertight by devices permanently attached to the ventilator or adjacent structure. Ventilators should be arranged as close to the vessel's centreline as possible and, where practicable, should extend through the top of a deck erection or companionway;

.2 the coamings of ventilators should be as high as practicable. On the working deck the height above deck of coamings of ventilators, other than machinery space ventilators, should be not less than 760 mm and on superstructure decks not less than 450 mm. When the height of such ventilators may interfere with the working of the vessel their coaming heights may be reduced to the satisfaction of the competent authority. The height above deck of machinery space ventilator openings should be to the satisfaction of the competent authority;

.3 closing appliances need not be fitted to ventilators the coamings of which extend more than 2.5 m above the working deck or more than 1.0 m above a deck-house top or superstructure deck;

.4 where air pipes to tanks or other spaces below deck extend above the working or superstructure decks the exposed parts of the pipes should be of substantial construction and, as far as is practicable, located close to the vessel's centreline and protected from damage by fishing or lifting gear. Openings of such pipes should be protected by efficient means of closing, permanently attached to the pipe or adjacent structure, except that where the competent authority is satisfied that they are protected against water trapped on deck, these means of closing may be omitted; and

.5 where air pipes are situated near the side of the vessel their height above deck to the point where water may have access below should be at least 760 mm on the working deck and at least 450 mm on the superstructure deck. The competent authority may accept reduction of the height of an air pipe to avoid interference with the fishing operations.

7.7.4 In offshore supply vessels air pipes and ventilators should comply with the following:

.1 air pipes and ventilators should be fitted in protected positions in order to avoid damage by cargo during operations and to minimize the possibility of flooding. Air pipes on the exposed cargo and forecastle decks should be fitted with automatic closing devices; and

.2 due regard should be given to the position of machinery space ventilators. Preferably they should be fitted in a position above the superstructure deck, or above an equivalent level if no superstructure deck is fitted.

7.8 Freeing ports

7.8.1 Where bulwarks on the weather portion of the freeboard or superstructure decks or, in fishing vessels, the working decks form wells, freeing ports should be arranged along the length of the bulwark as to ensure that the deck is freed of water most rapidly and effectively. Lower edges of freeing ports should be as near the deck as practicable.[32]

7.8.2 In ships to which the International Convention on Load Lines, 1966 or the Protocol of 1988 as amended, as applicable, applies freeing ports should comply with regulation 24 of this Convention.

7.8.3 In decked fishing vessels of 12 m in length and over, freeing ports should comply with the following:[33]

7.8.3.1 The minimum freeing port area A in m², on each side of the vessel for each well on the working deck, should be determined in relation to the length l and height of bulwark in the well as follows:

.1 $A = K * l$

where:

K = 0.07 for vessels of 24 m in length and over

K = 0.035 for vessels of 12 m in length;
for intermediate lengths the value of K should be obtained by linear interpolation (l need not be taken as greater than 70% of the vessel's length);

.2 where the bulwark is more than 1.2 m in average height, the required area should be increased by 0.004 m² per metre of length of well for each 0.1 m difference in height; and

.3 where the bulwark is less than 0.9 m in average height, the required area may be decreased by 0.004 m² per metre of length of well for each 0.1 m difference in height.

7.8.3.2 The freeing port area calculated according to 7.8.3.1 should be increased where the Administration or competent authority considers that the vessel's sheer is not sufficient to ensure rapid and effective freeing of the deck of water.

7.8.3.3 Subject to the approval of the Administration or competent authority, the minimum freeing port area for each well on the superstructure deck should be not less than one-half the area A given in 7.8.3.1 except that where the superstructure deck forms a working deck for fishing operations the minimum area on each side should be not less than 75% of the area A.

---

[32] Refer to regulation 24(5) of the International Convention on Load Lines, 1966 or the Protocol of 1988 as amended, as applicable and regulation 11/14(4) of the 1993 Torremolinos Protocol.

[33] Refer to regulation II/l 4 of the 1993 Torremolinos Protocol.

7.8.3.4 Freeing ports should be so arranged along the length of bulwarks as to provide the most rapid and effective freeing of the deck from water. Lower edges of freeing ports should be as near the deck as practicable.

7.8.3.5 Pound boards and means for stowage and working the fishing gear should be arranged so that the effectiveness of the freeing ports will not be impaired or water trapped on deck and prevented from easily reaching the freeing ports. Pound boards should be so constructed that they can be locked in position when in use and will not hamper the discharge of shipped water.

7.8.3.6 Freeing ports over 0.3 m in depth should be fitted with bars spaced not more than 0.23 m nor less than 0.15 m apart or provided with other suitable protective arrangements. Freeing port covers, if fitted, should be of approved construction. If devices are considered necessary for locking freeing port covers during fishing operations they should be to the satisfaction of the competent authority and easily operable from a readily accessible position.

7.8.3.7 In vessels intended to operate in areas subject to icing, covers and protective arrangements for freeing ports should be capable of being easily removed to restrict ice accumulation. Size of opening and means provided for removal of these protective arrangements should be to the satisfaction of the competent authority.

7.8.3.8 In addition, in fishing vessels of 12 m in length and above but less than 24 m in length where wells or cockpits are fitted in the working deck or superstructure deck with their bottoms above the deepest operating waterline, efficient non-return means of drainage overboard should be provided. Where bottoms of such wells or cockpits are below the deepest operating waterline, drainage to the bilges should be provided.

7.8.4 In offshore supply vessels the Administration should give special attention to adequate drainage of pipe stowage positions, having regard to the individual characteristics of the vessel. However, the area provided for drainage of the pipe stowage positions should be in excess of the required freeing port area in the cargo deck bulwark and should not be fitted with shutters.

7.9 Miscellaneous

7.9.1 Ships engaged in towing operations should be provided with means for quick release of the towing hawser.

CHAPTER 8 – DETERMINATION OF LIGHTSHIP PARAMETERS

8.1 Application

8.1.1 Every passenger ship regardless of size and every cargo ship having a length, as defined in the International Convention on Load Lines, 1966 or the Protocol of 1988 relating thereto, as amended, as applicable, of 24 m and upwards, should be inclined upon its completion and the elements of its stability determined.[34]

8.1.2 The Administration may allow the inclining test of an individual ship as required by paragraph 8.1.1 to be dispensed with provided basic stability data are available from the inclining test of a sister ship and it is shown to the satisfaction of the Administration that reliable stability information for the exempted ship can be obtained from such basic data.

To be dispensed from an inclining test, the deviation of lightship mass is not to exceed,

for L[35] < 50 m: 2% of the lightship mass of the lead ship or as given in the information on stability;

for L > 160 m: 1% of the lightship mass of the lead ship or as given in the information on stability;

for intermediate L: by linear interpolation,

and the deviation of the lightship's longitudinal centre of gravity (LCG) referred to L should not be greater than 0.5% of the lightship's LCG of the lead ship or as given in the information on stability regardless of the ship's length.

8.1.3 The Administration may allow the inclining test of an individual ship or class of ships especially designed for the carriage of liquids or ore in bulk to be dispensed with when reference to existing data for similar ships clearly indicates that due to the ship's proportions and arrangements more than sufficient metacentric height will be available in all probable loading conditions.

8.1.4 Where any alterations are made to a ship so as to materially affect the stability, the ship should be re-inclined.

8.1.5 At periodic intervals not exceeding five years, a lightweight survey should be carried out on all passenger ships to verify any changes in lightship displacement and longitudinal centre of gravity. The ship should be re-inclined whenever, in comparison with the approved stability information, a deviation from the lightship displacement exceeding 2% or a deviation of the longitudinal centre of gravity exceeding 1% of L is found, or anticipated.

8.1.6 The inclining test prescribed is adaptable for ships with a length below 24 m if special precautions are taken to ensure the accuracy of the test procedure.

---

[34] Refer to regulation II-1/5 of the 1974 SOLAS Convention, as amended.

[35] For the purpose of paragraphs 8.1.2 and 8.1.5 the length (L) means the subdivision length (L_S) as defined in regulation II-1/2.1 of the 1974 SOLAS Convention, as amended. For ships to which the Convention applies, and for other ships the length (L) means the length of ship as defined in 2.12 of the Purpose and Definitions of this Code.

8.2 Preparations for the inclining test

8.2.1 *Notification of the Administration*

Written notification of the inclining test should be sent to the Administration as it requires or in due time before the test. An Administration representative should be present to witness the inclining test and the test results be submitted for review.

The responsibility for making preparations, conducting the inclining test and lightweight survey, recording the data, and calculating the results rests with the shipyard, owner or naval architect. While compliance with the procedures outlined herein will facilitate an expeditious and accurate inclining test, it is recognized that alternative procedures or - arrangements may be equally efficient. However, to minimize risk of delay, it is recommended that all such variances be submitted to the Administration for review prior to the inclining test.

8.2.1.1 *Details of notification*

Written notification should provide the following information as the Administration may require:

.1 identification of the ship by name and shipyard hull number, if applicable;

.2 date, time, and location of the test;

.3 inclining weight data:

.1 type;

.2 amount (number of units and weight of each);

.3 certification;

.4 method of handling (i.e. sliding rail or crane);

.5 anticipated maximum angle of heel to each side;

.4 measuring devices:

.1 pendulums – approximate location and length;

.2 U-tubes – approximate location and length;

.3 inclinometers – location and details of approvals and calibrations;

.5 approximate trim;

.6 condition of tanks;

.7 estimated weights to deduct, to complete, and to relocate in order to place the ship in its true lightship condition;

.8 detailed description of any computer software to be used to aid in calculations during the inclining test; and

.9 name and telephone number of the person responsible for conducting the inclining test.

8.2.2 ***General condition of the ship***

8.2.2.1 A ship should be as complete as possible at the time of the inclining test. The test should be scheduled to minimize the disruption in the ship's delivery date or its operational commitments.

8.2.2.2 The amount and type of work left to be completed (mass to be added) affect the accuracy of the lightship characteristics, so good judgement should be used. If the mass or centre of gravity of an item to be added cannot be determined with confidence, it is best to conduct the inclining test after the item is added.

8.2.2.3 Temporary material, tool boxes, staging, sand, debris, etc., on board should be reduced to absolute minimum before the inclining test. Excess crew or personnel not directly involved in the inclining test should be removed from on board the ship before the test.

8.2.2.4 Decks should be free of water. Water trapped on deck may shift and pocket in a fashion similar to liquids in a tank. Any rain, snow or ice accumulated on the ship should be removed prior to the test.

8.2.2.5 The anticipated liquid loading for the test should be included in the planning for the test. Preferably, all tanks should be empty and clean, or completely full. The number of slack tanks should be kept to an absolute minimum. The viscosity of the fluid, the depth of the fluid and the shape of the tank should be such that the free surface effect can be accurately determined.

8.2.2.6 The ship should be moored in a quiet, sheltered area free from extraneous forces such as propeller wash from passing vessels, or sudden discharges from shore side pumps. The tide conditions and the trim of the ship during the test should be considered. Prior to the test, the depth of water should be measured and recorded in as many locations as are necessary to ensure that the ship will not contact the bottom. The specific gravity of water should be accurately recorded. The ship should be moored in a manner to allow unrestricted heeling. The access ramps should be removed. Power lines, hoses, etc., connected to shore should be at a minimum, and kept slack at all times.

8.2.2.7 The ship should be as upright as possible; with inclining weights in the initial position, up to one-half degree of list is acceptable. The actual trim and deflection of keel, if practical, should be considered in the hydrostatic data. In order to avoid excessive errors caused by significant changes in the water plane area during heeling, hydrostatic data for the actual trim and the maximum anticipated heeling angles should be checked beforehand.

8.2.2.8 The total weight used should be sufficient to provide a minimum inclination of one degree and a maximum of four degrees of heel to each side. The Administration may, however, accept a smaller inclination angle for large ships provided that the requirements on pendulum deflection or U-tube difference in height in 8.2.2.9 are complied with. Test weights should be compact and of such a configuration that the vertical centre of gravity of the weights can be accurately determined. Each weight should be marked with an identification number and its

mass. Re-certification of the test weights should be carried out prior to the incline. A crane of sufficient capacity and reach, or some other means, should be available during the inclining test to shift weights on the decking in an expeditious and safe manner. Water ballast transfer may be carried out, when it is impractical to incline using solid weights if acceptable to the Administration.

8.2.2.9 The use of three pendulums is recommended but a minimum of two should be used to allow identification of bad readings at any one pendulum station. They should each be located in an area protected from the wind. One or more pendulums may be substituted by other measuring devices (U-tubes or inclinometers) at the discretion of the Administration. Alternative measuring devices should not be used to reduce the minimum inclining angles recommended in 8.2.2.8.

The use of an inclinometer or U-tube should be considered in each separate case. It is recommended that inclinometers or other measuring devices only be used in conjunction with at least one pendulum.

8.2.2.10 Efficient two-way communications should be provided between central control and the weight handlers and between central control and each pendulum station. One person at a central control station should have complete control over all personnel involved in the test.

8.3 Plans required

The person in charge of the inclining test should have available a copy of the following plans at the time of the inclining test:

.1 lines plan;

.2 hydrostatic curves or hydrostatic data;

.3 general arrangement plan of decks, holds, inner bottoms, etc.;

.4 capacity plan showing capacities and vertical and longitudinal centres of gravity of cargo spaces, tanks, etc. When ballast water is used as inclining weight, the transverse and vertical centres of gravity for the applicable tanks for each angle of inclination, must be available;

.5 tank sounding tables;

.6 draught mark locations; and

.7 docking drawing with keel profile and draught mark corrections (if available).

8.4 Test procedure

8.4.1 Procedures followed in conducting the inclining test and lightweight survey should be in accordance with the recommendations laid out in annex 1 (Detailed guidance for the conduct of an inclining test to this Code).

8.4.1.1 Freeboard/draught readings should be taken to establish the position of the waterline in order to determine the displacement of the ship at the time of the inclining test. It is recommended that at least five freeboard readings, approximately equally spaced, be taken on

each side of the ship or that all draught marks (forward, midship and aft) be read on each side of the ship. Draught/freeboard readings should be read immediately before or immediately after the inclining test.

8.4.1.2 The standard test employs eight distinct weight movements. Movement No.8, a recheck of the zero point, may be omitted if a straight line plot is achieved after movement No.7. If a straight line plot is achieved after the initial zero and six weight movements, the inclining test is complete and the second check at zero may be omitted. If a straight line plot is not achieved, those weight movements that did not yield acceptable plotted points should be repeated or explained.

8.4.2 A copy of the inclining data should be forwarded to the Administration along with the calculated results of the inclining test in an acceptable report format, if required.

8.4.3 All calculations performed during the inclining test and in preparation of an inclining test report may be carried out by a suitable computer program. Output generated by such a program may be used for presentation of all or partial data and calculations included in the test report if it is clear, concise, well documented, and generally consistent in form and content with Administration requirements.

8.5 Inclining test for MODUs

8.5.1 An inclining test should be required for the first unit of a design, when as near to completion as possible, to determine accurately the lightship data (weight and position of centre of gravity).

8.5.2 For successive units which are identical by design, the lightship data of the first unit of the series may be accepted by the Administration in lieu of an inclining test, provided the difference in lightship displacement or position of centre of gravity due to weight changes for minor differences in machinery, outfitting or equipment, confirmed by the results of a deadweight survey, are less than 1% of the values of the lightship displacement and principal horizontal dimensions as determined for the first of the series. Extra care should be given to the detailed weight calculation and comparison with the original unit of a series of column-stabilized, semi-submersible types as these, even though identical by design, are recognized as being unlikely to attain an acceptable similarity of weight or centre of gravity to warrant a waiver of the inclining test.

8.5.3 The results of the inclining test, or deadweight survey and inclining experiment adjusted for weight differences, should be indicated in the Operating Manual.

8.5.4 A record of all changes to machinery, structure, outfit and equipment that affect the lightship data, should be maintained in the Operating Manual or a lightship data alterations log and be taken into account in daily operations.

8.5.5 For column-stabilized units, a deadweight survey should be conducted at intervals not exceeding five years. Where the deadweight survey indicates a change from the calculated lightship displacement in excess of 1% of the operating displacement, an inclining test should be conducted.

8.5.6 An inclining test or a deadweight survey should be carried out in the presence of an officer of the Administration, or a duly authorized person or representative of an approved organization.

8.6 Stability test for pontoons

An inclining experiment is not normally required for a pontoon, provided a conservative value of the lightship vertical centre of gravity (KG) is assumed for the stability calculations. The KG can be assumed at the level of the main deck although it is recognized that a lesser value could be acceptable if fully documented. The lightship displacement and longitudinal centre of gravity should be determined by calculation based on draught and density readings.

ANNEX 1

DETAILED GUIDANCE FOR THE CONDUCT OF AN INCLINING TEST

1 INTRODUCTION

This annex supplements the inclining standards put forth in part B, chapter 8 (Determination of lightship parameters) of this Code. This annex contains important detailed procedures for conducting an inclining test in order to ensure that valid results are obtained with maximum precision at a minimal cost to owners, shipyards and the Administration. A complete understanding of the correct procedures used to perform an inclining test is imperative in order to ensure that the test is conducted properly and so that results can be examined for accuracy as the inclining experiment is conducted.

2 PREPARATIONS FOR THE INCLINING TEST

2.1 Free surface and tankage

2.1.1 If there are liquids on board the ship when it is inclined, whether in the bilges or in the tanks, they will shift to the low side when the ship heels. This shift of liquids will exaggerate the heel of the ship. Unless the exact weight and distance of liquid shifted can be precisely calculated, the metacentric height (GM) calculated from the inclining test will be in error. Free surface should be minimized by emptying the tanks completely and making sure all bilges are dry; or by completely filling the tanks so that no shift of liquid is possible. The latter method is not the optimum because air pockets are difficult to remove from between structural members of a tank, and the weight and centre of the liquid in a full tank should be accurately determined in order to adjust the lightship values accordingly. When tanks must be left slack, it is desirable that the sides of the tanks be parallel vertical planes and the tanks be regular in shape (i.e. rectangular, trapezoidal, etc.) when viewed from above, so that the free surface moment of the liquid can be accurately determined. For example, the free surface moment of the liquid in a tank with parallel vertical sides can be readily calculated by the formula:

$M_{fs} = l*b^3*\rho_t/12$ (mt)

where:

l = length of tank (m)

b = breadth of tank (m)

ρ_t = specific gravity of liquid in tank (t/m³)

$$Free\ surface\ correction = \frac{\sum_x M_{fs}(1) + M_{fs}(2) + ... + M_{fs}(x)}{\Delta} \quad \text{(m)}$$

where:

M_{fs} = free surface moment (mt)

Δ = displacement (t)

Free surface correction is independent of the height of the tank in the ship, location of the tank, and direction of heel. As the width of the tank increases, the value of free surface moment increases by the third power. The distance available for the liquid to shift is the predominant factor. This is why even the smallest amount of liquid in the bottom of a wide tank or bilge is normally unacceptable and should be removed prior to the inclining experiment. Insignificant amounts of liquids in V-shaped tanks or voids (e.g. a chain locker in the bow), where the potential shift is negligible, may remain if removal of the liquid would be difficult or would cause extensive delays.

When ballast water is used as inclining weight, the actual transverse and vertical movements of the liquid should be calculated taking into account the change of heel of the ship. Free surface corrections as defined in this paragraph should not apply to the inclining tanks.

2.1.2 ***Free surface and slack tanks***: The number of slack tanks should normally be limited to one port/starboard pair or one centreline tank of the following:

.1 fresh water reserve feed tanks;

.2 fuel/diesel oil storage tanks;

.3 fuel/diesel oil day tanks;

.4 lube oil tanks;

.5 sanitary tanks; or

.6 potable water tanks.

To avoid pocketing, slack tanks should normally be of regular (i.e. rectangular, trapezoidal, etc.) cross section and be 20% to 80% full if they are deep tanks and 40% to 60% full if they are double-bottom tanks. These levels ensure that the rate of shifting of liquid remains constant throughout the heel angles of the inclining test. If the trim changes as the ship is inclined, then consideration should also be given to longitudinal pocketing. Slack tanks containing liquids of sufficient viscosity to prevent free movement of the liquids, as the ship is inclined (such as bunker at low temperature), should be avoided since the free surface cannot be calculated accurately. A free surface correction for such tanks should not be used unless the tanks are heated to reduce viscosity. Communication between tanks should never be allowed. Cross-connections, including those via manifolds, should be closed. Equal liquid levels in slack tank pairs can be a warning sign of open cross connections. A bilge, ballast, and fuel oil piping plan can be referred to, when checking for cross connection closures.

2.1.3 ***Pressed-up tanks***: “Pressed up” means completely full with no voids caused by trim or inadequate venting. Anything less than 100% full, for example the 98% condition regarded as full for operational purposes, is not acceptable. Preferably, the ship should be rolled from side to side to eliminate entrapped air before taking the final sounding. Special care should be taken when pressing fuel oil tanks to prevent accidental pollution. An example of a tank that would appear “pressed up”, but actually contains entrapped air, is shown in figure A1-2.1.3.

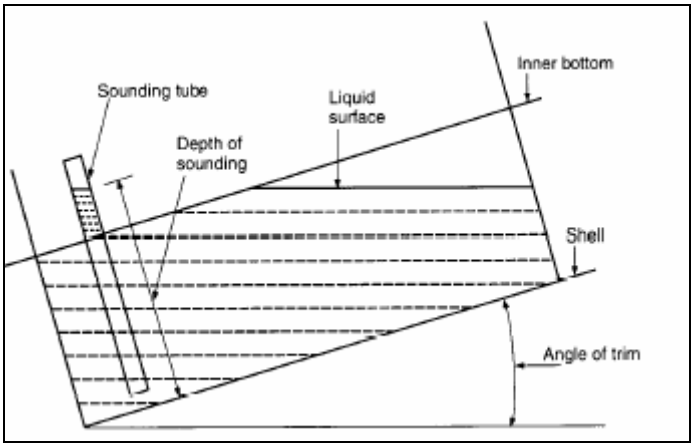


Figure A1-2.1.3

2.1.4 ***Empty tanks***: It is generally not sufficient to simply pump tanks until suction is lost. Enter the tank after pumping to determine if final stripping with portable pumps or by hand is necessary. The exceptions are very narrow tanks or tanks where there is a sharp deadrise, since free surface would be negligible. Since all empty tanks should be inspected, all manholes should be open and the tanks well ventilated and certified as safe for entry. A safe testing device should be on hand to test for sufficient oxygen and minimum toxic levels. A certified marine chemist's certificate certifying that all fuel oil and chemical tanks are safe for human entry should be available, if necessary.

2.2 Mooring arrangements

The importance of good mooring arrangements cannot be overemphasized. The arrangement selections will be dependent upon many factors. Among the most important are depth of water, wind and current effects. Whenever possible, the ship should be moored in a quiet, sheltered area free from extraneous forces such as propeller wash from passing ships, or sudden discharges from shore side pumps. The depth of water under the hull should be sufficient to ensure that the hull will be entirely free of the bottom. The tide conditions and the trim of the ship during the test should be considered. Prior to the test, the depth of water should be measured and recorded in as many locations as necessary to ensure the ship will not contact the bottom. If marginal, the test should be conducted during high tide or the ship moved to deeper water.

2.2.1 The mooring arrangement should ensure that the ship will be free to list without restraint for a sufficient period of time to allow a satisfactory reading of the heeling angle, due to each weight shift, to be recorded.

2.2.2 The ship should be held by lines at the bow and the stern, attached to bollards and/or cleats on the deck. If suitable restraint of the ship cannot be achieved using deck fittings, then temporary padeyes should be attached as close as possible to the centreline of the ship and as near the waterline as practical. Where the ship can be moored to one side only, it is good practice to supplement the bow and stern lines with two spring lines in order to maintain positive control of the ship, as shown in figure A1-2.2.2. The leads of the spring lines should be as long as practicable. Cylindrical camels should be provided between the ship and the dock. All lines should be slack, with the ship free of the pier and camels, when taking readings.

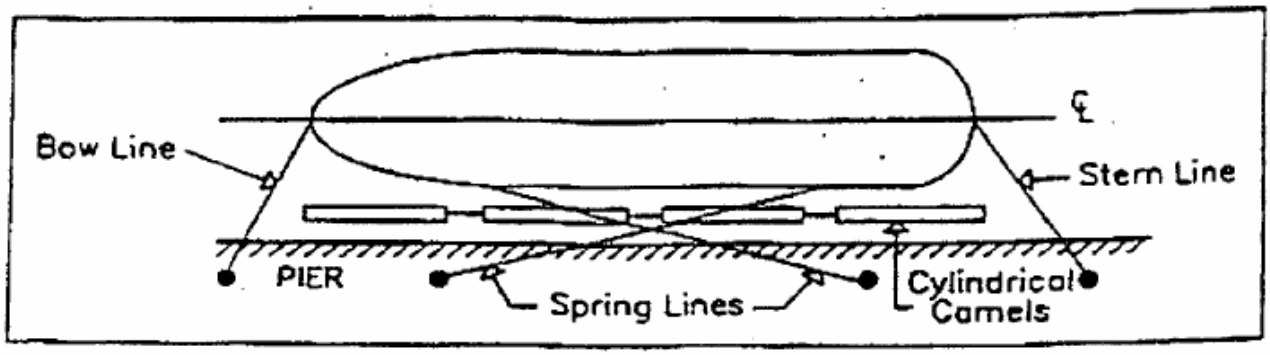


Figure A1-2.2.2

2.2.2.1 If the ship is held off the pier by the combined effect of the wind and current, a superimposed heeling moment will act on the ship throughout the test. For steady conditions this will not affect the results. Gusty winds or uniformly varying wind and/or current will cause these superimposed heeling moments to change, which may require additional test points to obtain a valid test. The need for additional test points can be determined by plotting test points as they are obtained.

2.2.2.2 If the ship is pressed against the fenders by wind and/or current, all lines should be slack. The cylindrical camels will prevent binding but there will be an additional superimposed heeling moment due to the ship bearing against the camels. This condition should be avoided where possible but, when used, consideration should be given to pulling the ship free of the dock and camels and letting the ship drift as readings are taken.

2.2.2.3 Another acceptable arrangement is where the combined wind and current are such that the ship may be controlled by only one line at either the bow or the stern. In this case, the control line should be led from on or near the centreline of the ship with all lines but the control line slack, the ship is free to veer with the wind and/or current as readings are taken. This can sometimes be troublesome because varying wind and/or current can cause distortion of the plot.

2.2.3 The mooring arrangement should be submitted to the approval authority for review prior to the test.

2.2.4 If a floating crane is used for handling inclining weights, it should not be moored to the ship.

2.3 Test weights

2.3.1 Weights, such as porous concrete, that can absorb significant amounts of moisture should only be used if they are weighed just prior to the inclining test or if recent weight certificates are presented. Each weight should be marked with an identification number and its weight. For small ships, drums completely filled with water may be used. Drums should normally be full and capped to allow accurate weight control. In such cases, the weight of the drums should be verified in the presence of the Administration representative using a recently calibrated scale.

2.3.2 Precautions should be taken to ensure that the decks are not overloaded during weight movements. If deck strength is questionable then a structural analysis should be performed to determine if existing framing can support the weight.

2.3.3 Generally, the test weights should be positioned as far outboard as possible on the upper deck. The test weights should be on board and in place prior to the scheduled time of the inclining test.

2.3.4 Where the use of solid weights to produce the inclining moment is demonstrated to be impracticable, the movement of ballast water may be permitted as an alternative method. This acceptance would be granted for a specific test only, and approval of the test procedure by the Administration is required. As a minimal prerequisite for acceptability, the following conditions should be required:

.1 inclining tanks should be wall-sided and free of large stringers or other internal members that create air pockets. Other tank geometries may be accepted at the discretion of the Administration;

.2 tanks should be directly opposite to maintain ship's trim;

.3 specific gravity of ballast water should be measured and recorded;

.4 pipelines to inclining tanks should be full. If the ship's piping layout is unsuitable for internal transfer, portable pumps and pipes/hoses may be used;

.5 blanks must be inserted in transfer manifolds to prevent the possibility of liquids being "leaked" during transfer. Continuous valve control must be maintained during the test;

.6 all inclining tanks must be manually sounded before and after each shift;

.7 vertical, longitudinal and transverse centres should be calculated for each movement;

.8 accurate sounding/ullage tables must be provided. The ship's initial heel angle should be established prior to the incline in order to produce accurate values for volumes and transverse and vertical centres of gravity for the inclining tanks at every angle of heel. The draught marks amidships (port and starboard) should be used when establishing the initial heel angle;

.9 verification of the quantity shifted may be achieved by a flow meter or similar device; and

.10 the time to conduct the inclining must be evaluated. If time requirements for transfer of liquids are considered too long, water may be unacceptable because of the possibility of wind shifts over long periods of time.

2.4 Pendulums

2.4.1 The pendulums should be long enough to give a measured deflection, to each side of upright, of at least 15 cm. Generally, this will require a pendulum length of at least 3 m. It is recommended that pendulum lengths of 4 to 6 m be used. Usually, the longer the pendulum the greater the accuracy of the test; however, if excessively long pendulums are used on a tender ship the pendulums may not settle down and the accuracy of the pendulums would then be questionable. On large ships with high GM, pendulum lengths in excess of the length recommended above may be required to obtain the minimum deflection. In such cases, the

trough, as shown in figure A1-2.4.6, should be filled with high-viscosity oil. If the pendulums are of different lengths, the possibility of collusion between station recorders is avoided.

2.4.2 On smaller ships, where there is insufficient headroom to hang long pendulums, the 15 cm deflection should be obtained by increasing the test weight so as to increase the heel. On most ships the typical inclination is between one and four degrees.

2.4.3 The pendulum wire should be piano wire or other monofilament material. The top connection of the pendulum should afford unrestricted rotation of the pivot point. An example is that of a washer with the pendulum wire attached suspended from a nail.

2.4.4 A trough filled with a liquid should be provided to dampen oscillations of the pendulum after each weight movement. It should be deep enough to prevent the pendulum weight from touching the bottom. The use of a winged plumb bob at the end of the pendulum wire can also help to dampen the pendulum oscillations in the liquid.

2.4.5 The battens should be smooth, light-coloured wood, 1 to 2 cm thick, and should be securely fixed in position so that an inadvertent contact will not cause them to shift. The batten should be aligned close to the pendulum wire but not in contact with it.

2.4.6 A typical satisfactory arrangement is shown in figure A1-2.4.6. The pendulums may be placed in any location on the ship, longitudinally and transversely. The pendulums should be in place prior to the scheduled time of the inclining test.

2.4.7 It is recommended that inclinometers or other measuring devices only be used in conjunction with at least one pendulum. The Administration may approve an alternative arrangement when this is found impractical.

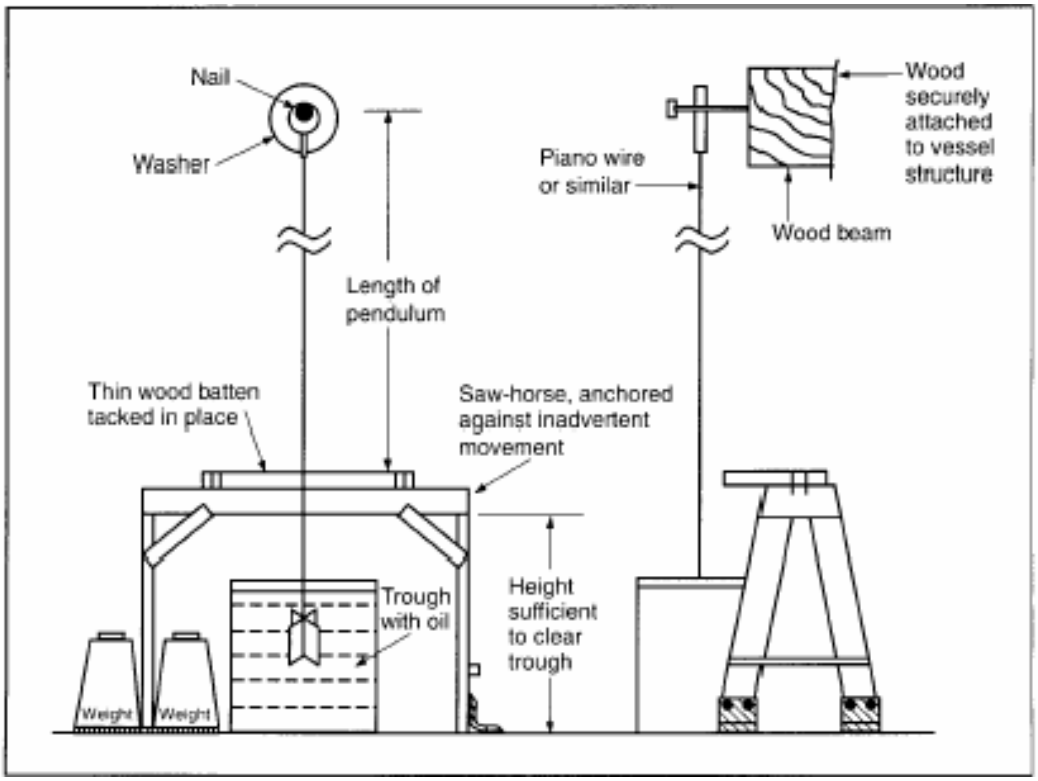


Figure A1-2.4.6

2.5 U-tubes

2.5.1 The legs of the device should be securely positioned as far as outboard as possible and should be parallel to the centreline plane of the ship. The distance between the legs should be measured perpendicular to the centreline plane. The legs should be vertical, as far as practical.

2.5.2 Arrangements should be made for recording all readings at both legs. For easy reading and checking for air pockets, clear plastic tube or hose should be used throughout. The U-tube should be pressure-tested prior to the inclining test to ensure watertightness.

2.5.3 The horizontal distance between the legs of the U-tube should be sufficient to obtain a level difference of at least 15 cm between the upright and the maximum inclination to each side.

2.5.4 Normally, water would be used as the liquid in the U-tube. Other low-viscosity liquids may also be considered.

2.5.5 The tube should be free of air pockets. Arrangements should be made to ensure that the free flow of the liquid in the tube is not obstructed.

2.5.6 Where a U-tube is used as a measuring device, due consideration should be given to the prevailing weather conditions (see 4.1.1.3):

.1 if the U-tube is exposed to direct sunlight, arrangements should be made to avoid temperature differences along the length of the tube;

.2 if temperatures below 0°C are expected, the liquid should be a mixture of water and an anti-freeze additive; and

.3 where heavy rain squalls can be expected, arrangements should be made to avoid additional water entering the U-tube.

2.6 Inclinometers

The use of inclinometers should be subject to at least the following recommendations:

.1 the accuracy should be equivalent to that of the pendulum;

.2 the sensitivity of the inclinometer should be such that the non-steady heeling angle of the ship can be recorded throughout the measurement;

.3 the recording period should be sufficient to accurately measure the inclination. The recording capacity should be generally sufficient for the whole test;

.4 the instrument should be able to plot or print the recorded inclination angles on paper;

.5 the instrument should have linear performance over the expected range of inclination angles;

.6 the instrument should be supplied with the manufacturer’s instructions giving details of calibration, operating instructions, etc.; and

.7 it should be possible to demonstrate the required performance to the satisfaction of the Administration during the inclining test.

3 EQUIPMENT REQUIRED

Besides the physical equipment necessary such as the inclining weights, pendulums, small boat, etc., the following are necessary and should be provided by or made available to the person in charge of the inclining:

.1 engineering scales for measuring pendulum deflections (rules should be subdivided sufficiently to achieve the desired accuracy;

.2 sharp pencils for marking pendulum deflections;

.3 chalk for marking the various positions of the inclining weights;

.4 a sufficiently long measuring tape for measuring the movement of the weights and locating different items on board;

.5 a sufficiently long sounding tape for sounding tanks and taking freeboard readings;

.6 one or more well maintained specific gravity hydrometers with range sufficient to cover 0.999 to 1.030, to measure the specific gravity of the water in which the ship is floating (a hydrometer for measuring specific gravity of less than 1.000 may be needed in some locations);

.7 other hydrometers as necessary to measure the specific gravity of any liquids on board;

.8 graph paper to plot inclining moments versus tangents;

.9 a straight edge to draw the measured waterline on the lines drawing;

.10 a pad of paper to record data;

.11 an explosion-proof testing device to check for sufficient oxygen and absence of lethal gases in tanks and other closed spaces such as voids and cofferdams;

.12 a thermometer; and

.13 draught tubes (if necessary).

4 TEST PROCEDURE

The inclining experiment, the freeboard/draught readings and the survey may be conducted in any order and still achieve the same results. If the person conducting the inclining test is confident that the survey will show that the ship is in an acceptable condition and there is the possibility of the weather becoming unfavourable, then it is suggested that the inclining be performed first and the survey last. If the person conducting the test is doubtful that the ship is complete enough for the test, it is recommended that the survey be performed first since this

could invalidate the entire test, regardless of the weather conditions. It is very important that all weights, the number of people on board, etc., remain constant throughout the test.

4.1 Initial walk through and survey

The person responsible for conducting the inclining test should arrive on board the ship well in advance of the scheduled time of the test to ensure that the ship is properly prepared for the test. If the ship to be inclined is large, a preliminary walk through may need to be done the day preceding the actual incline. To ensure the safety of personnel conducting the walk through, and to improve the documentation of surveyed weights and deficiencies, at least two persons should make the initial walk through. Things to check include: all compartments are open, clean, and dry, tanks are well ventilated and gas-free, movable or suspended items are secured and their position documented, pendulums are in place, weights are on board and in place, a crane or other method for moving weights is available, and the necessary plans and equipment are available. Before beginning the inclining test, the person conducting the test should:

.1 consider the weather conditions. The combined adverse effect of wind, current and sea may result in difficulties or even an invalid test due to the following:

.1 inability to accurately record freeboards and draughts;

.2 excessive or irregular oscillations of the pendulums;

.3 variations in unavoidable superimposed heeling moments;

In some instances, unless conditions can be sufficiently improved by moving the ship to a better location, it may be necessary to delay or postpone the test. Any significant quantities of rain, snow, or ice should be removed from the ship before the test. If bad weather conditions are detected early enough and the weather forecast does not call for improving conditions, the Administration representative should be advised prior to departure from the office and an alternative date scheduled;

.2 make a quick overall survey of the ship to make sure the ship is complete enough to conduct the test and to ensure that all equipment is in place. An estimate of items which will be outstanding at the time of the inclining test should be included as part of any test procedure submitted to the Administration. This is required so that the Administration representative can advise the shipyard/naval architect if in their opinion the ship will not be sufficiently complete to conduct the incline and that it should be rescheduled. If the condition of the ship is not accurately depicted in the test procedure and at the time of the inclining test the Administration representative considers that the ship is in such condition that an accurate incline cannot be conducted, the representative may refuse to accept the incline and require that the incline be conducted at a later date;

.3 enter all empty tanks after it is determined that they are well ventilated and gas-free to ensure that they are dry and free of debris. Ensure that any pressed-up tanks are indeed full and free of air pockets. The anticipated liquid loading for the incline should be included in the procedure required to be submitted to the Administration;

.4 survey the entire ship to identify all items which need to be added to the ship, removed from the ship, or relocated on the ship to bring the ship to the lightship condition. Each item should be clearly identified by weight and vertical and longitudinal location. If necessary, the transverse location should also be recorded. The inclining weights, the pendulums, any temporary equipment and dunnage, and the people on board during the inclining test are all among the weights to be removed to obtain the lightship condition. The person calculating the lightship characteristics from the data gathered during the incline and survey and/or the person reviewing the inclining test may not have been present during the test and should be able to determine the exact location of the items from the data recorded and the ship's drawings. Any tanks containing liquids should be accurately sounded and the soundings recorded;

.5 it is recognized that the weight of some items on board, or that are to be added, may have to be estimated. If this is necessary, it is in the best interest of safety to be on the safe side when estimating, so the following rules of thumb should be followed:

.1 when estimating weights to be added:

.1.1 estimate high for items to be added high in the ship; and

.1.2 estimate low for items to be added low in the ship;

.2 when estimating weights to be removed:

.2.1 estimate low for items to be removed from high in the ship; and

.2.2 estimate high for items to be removed from low in the ship;

.3 when estimating weights to be relocated:

.3.1 estimate high for items to be relocated to a higher point in the ship; and

.3.2 estimate low for items to be relocated to a lower point in the ship.

4.2 Freeboard/draught readings

4.2.1 Freeboard/draught readings should be taken to establish the position of the waterline in order to determine the displacement of the ship at the time of the inclining test. It is recommended that at least five freeboard readings, approximately equally spaced, be taken on each side of the ship or that all draught marks (forward, midship, and aft) be read on each side of the ship. Draught mark readings should be taken to assist in determining the waterline defined by freeboard readings, or to verify the vertical location of draught marks on ships where their location has not been confirmed. The locations for each freeboard reading should be clearly marked. The longitudinal location along the ship should be accurately determined and recorded since the (moulded) depth at each point will be obtained from the ship's lines. All freeboard measurements should include a reference note clarifying the inclusion of the coaming in the measurement and the coaming height.

4.2.2 Draught and freeboard readings should be read immediately before or immediately after the inclining test. Weights should be on board and in place and all personnel who will be on board during the test, including those who will be stationed to read the pendulums, should be on board and in location during these readings. This is particularly important on small ships. If readings are made after the test, the ship should be maintained in the same condition as during the test. For small ships, it may be necessary to counterbalance the list and trim effects of the freeboard measuring party. When possible, readings should be taken from a small boat.

4.2.3 A small boat should be available to aid in the taking of freeboard and draught mark readings. It should have low freeboard to permit accurate observation of the readings.

4.2.4 The specific gravity of the flotation water should be determined at this time. Samples should be taken from a sufficient depth of the water to ensure a true representation of the flotation water and not merely surface water, which could contain fresh water from run-off of rain. A hydrometer should be placed in a water sample and the specific gravity read and recorded. For large ships, it is recommended that samples of the flotation water be taken forward, midship, and aft and the readings averaged. For small ships, one sample taken from midships should be sufficient. The temperature of the water should be taken and the measured specific gravity corrected for deviation from the standard, if necessary. A correction to water specific gravity is not necessary if the specific gravity is determined at the inclining experiment site. Correction is necessary if specific gravity is measured when sample temperature differs from the temperature at the time of the inclining (e.g., if check of specific gravity is done at the office).

4.2.5 A draught mark reading may be substituted for a given freeboard reading at that longitudinal location if the height and location of the mark have been verified to be accurate by a keel survey while the ship was in dry-dock.

4.2.6 A device, such as a draught tube, can be used to improve the accuracy of freeboard/draught readings by damping out wave action.

4.2.7 The dimensions given on a ship's lines drawing are normally moulded dimensions. In the case of depth, this means the distance from the inside of the bottom shell to the inside of the deck plate. In order to plot the ship's waterline on the lines drawing, the freeboard readings should be converted to moulded draughts. Similarly, the draught mark readings should be corrected from extreme (bottom of keel) to moulded (top of keel) before plotting. Any discrepancy between the freeboard/draught readings should be resolved.

4.2.8 The mean draught (average of port and starboard readings) should be calculated for each of the locations where freeboard/draught readings are taken and plotted on the ship's lines drawing or outboard profile to ensure that all readings are consistent and together define the correct waterline. The resulting plot should yield either a straight line or a waterline which is either hogged or sagged. If inconsistent readings are obtained, the freeboards/draughts should be retaken.

4.3 The incline

4.3.1 Prior to any weight movements the following should be checked:

.1 the mooring arrangement should be checked to ensure that the ship is floating freely (this should be done just prior to each reading of the pendulums);

.2 the pendulums should be measured and their lengths recorded. The pendulums should be aligned so that when the ship heels, the wire will be close enough to the batten to ensure an accurate reading but will not come into contact with the batten. The typical satisfactory arrangement is shown in figure A1-2.4.6;

.3 the initial position of the weights is marked on the deck. This can be done by tracing the outline of the weights on the deck;

.4 the communications arrangement is adequate; and

.5 all personnel are in place.

4.3.2 A plot should be run during the test to ensure that acceptable data are being obtained. Typically, the abscissa of the plot will be heeling moment W(x) (weight times distance x) and the ordinate will be the tangent of the heel angle (deflection of the pendulum divided by the length of the pendulum). This plotted line does not necessarily pass through the origin or any other particular point for no single point is more significant than any other point. A linear regression analysis is often used to fit the straight line. The weight movements shown in figure A2-4.3.2-1 give a good spread of points on the test plot.

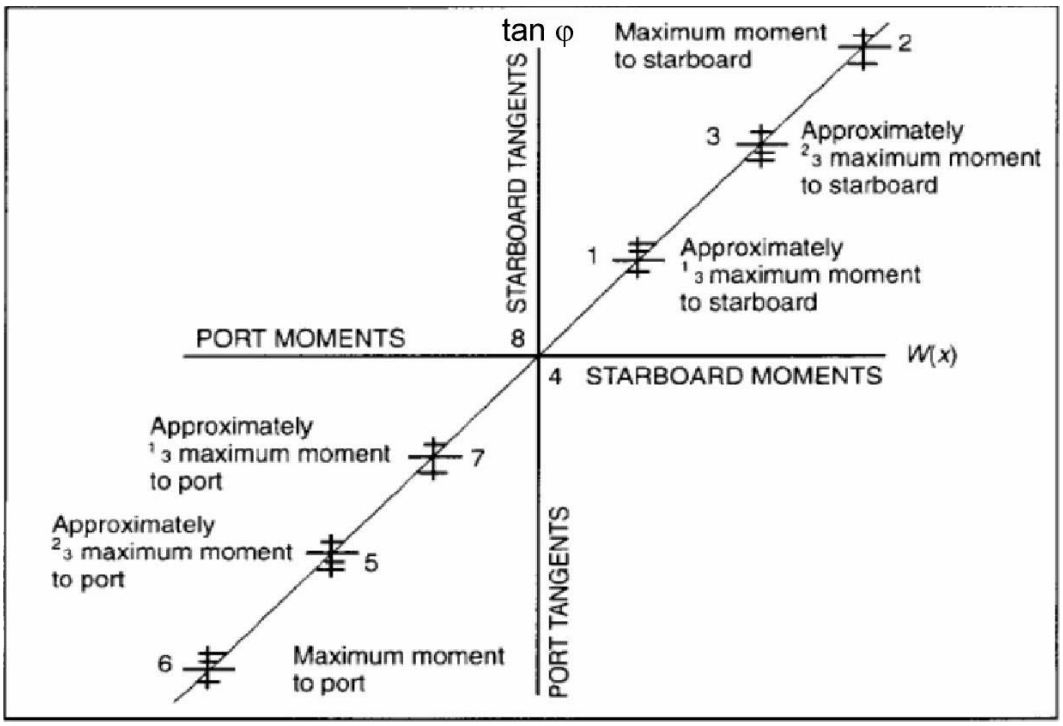


Figure A1-4.3.2-1

The plotting of all the readings for each of the pendulums during the inclining experiment aids in the discovery of bad readings. Since *W(x)/tan φ* should be constant, the plotted line should be straight. Deviations from a straight line are an indication that there were other moments acting on the ship during the inclining. These other moments should be identified, the cause corrected, and the weight movements repeated until a straight line is achieved. Figures A1-4.3.2-2 to A1-4.3.2-5 illustrate examples of how to detect some of these other moments during the inclining, and a recommended solution for each case. For simplicity, only the average of the readings is shown on the inclining plots.

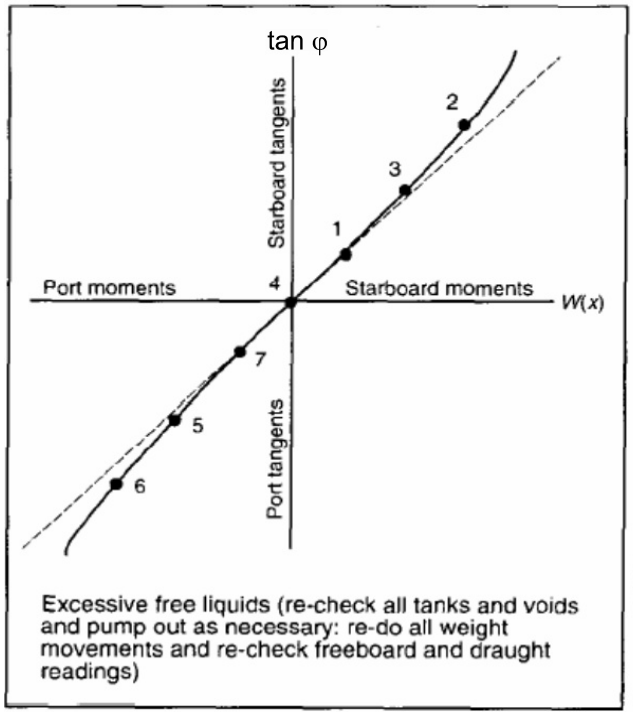


Figure A1-4.3.2-2

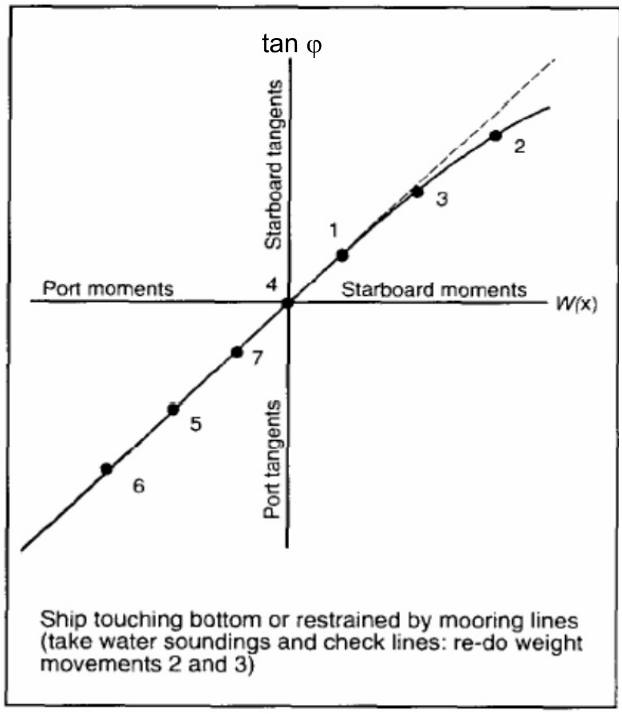


Figure A1-4.3.2-3

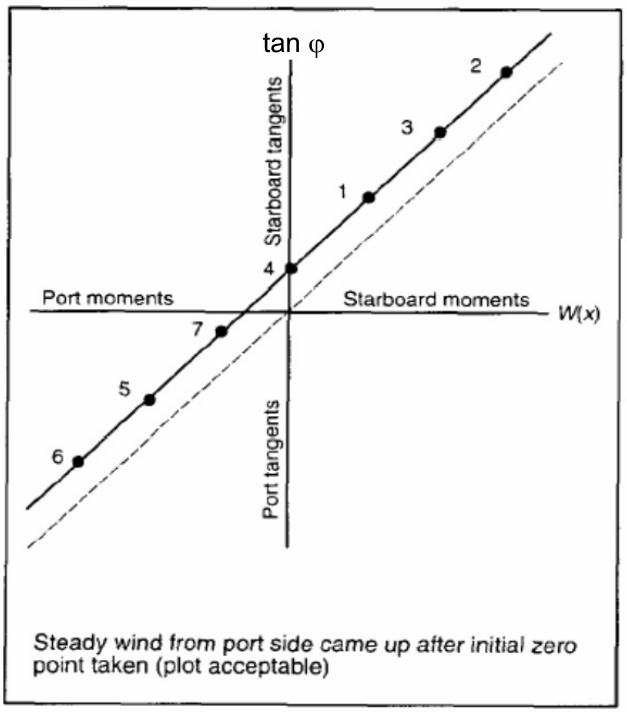


Figure A1-4.3.2-4

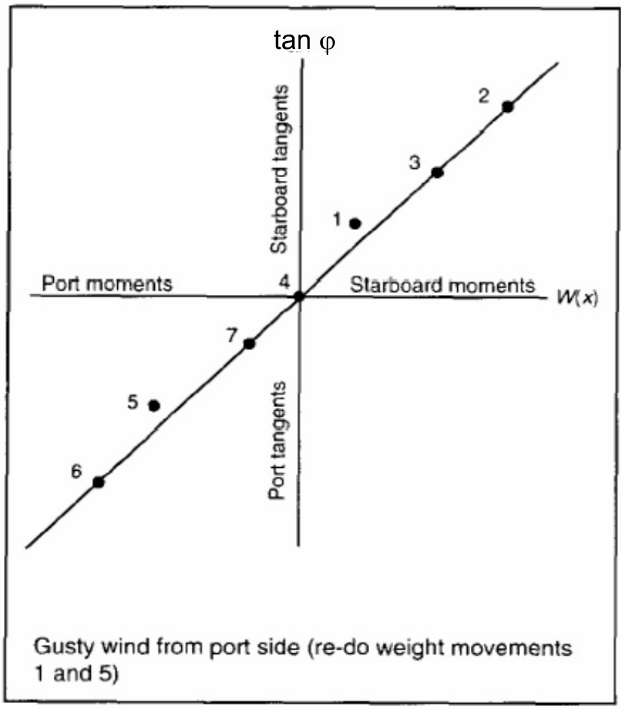


Figure A1-4.3.2-5

4.3.3 Once everything and everyone is in place, the zero position should be obtained and the remainder of the experiment conducted as quickly as possible, while maintaining accuracy and proper procedures, in order to minimize the possibility of a change in environmental conditions during the test.

4.3.4 Prior to each pendulum reading, each pendulum station should report to the control station when the pendulum has stopped swinging. Then, the control station will give a "standby" warning and then a "mark" command. When "mark" is given, the batten at each position should be marked at the location of the pendulum wire. If the wire was oscillating slightly, the centre of the oscillations should be taken as the mark. If any of the pendulum readers does not think the reading was a good one, the reader should advise the control station and the point should be retaken for all pendulum stations. Likewise, if the control station suspects the accuracy of a reading, it should be repeated for all the pendulum stations. Next to the mark on the batten should be written the number of the weight movement, such as zero for the initial position and one to seven for the weight movements.

4.3.5 Each weight movement should be made in the same direction, normally transversely, so as not to change the trim of the ship. After each weight movement, the distance the weight was moved (centre to centre) should be measured and the heeling moment calculated by multiplying the distance by the amount of weight moved. The tangent is calculated for each pendulum by dividing the deflection by the length of the pendulum. The resultant tangents are plotted on the graph. Provided there is good agreement among the pendulums with regard to the $tan\ \varphi$ value, the average of the pendulum readings may be graphed instead of plotting each of the readings.

4.3.6 Inclining data sheets should be used so that no data are forgotten and so that the data are clear, concise, and consistent in form and format. Prior to departing the ship, the person conducting the test and the Administration representative should initial each data sheet as an indication of their concurrence with the recorded data.

ANNEX 2

RECOMMENDATIONS FOR SKIPPERS OF FISHING VESSELS ON ENSURING A VESSEL'S ENDURANCE IN CONDITIONS OF ICE FORMATION

1 Prior to departure

1.1 Firstly, the skipper should, as in the case of any voyages in any season, ensure that the vessel is generally in a seaworthy condition, giving full attention to basic requirements such as:

.1 loading of the vessel within the limits prescribed for the season (paragraph 1.2.1 below);

.2 weathertightness and reliability of the devices for closing cargo and access hatches, outer doors and all other openings in the decks and superstructures of the vessel and the watertightness of the sidescuttles and of ports or similar openings in the sides below the freeboard deck to be checked;

.3 condition of the freeing ports and scuppers as well as operational reliability of their closures to be checked;

.4 emergency and life-saving appliances and their operational reliability;

.5 operational reliability of all external and internal communication equipment; and

.6 condition and operational reliability of the bilge and ballast pumping systems.

1.2 Further, with special regard to possible ice accretion, the skipper should:

.1 consider the most critical loading condition against approved stability documents with due regard to fuel and water consumption, distribution of supplies, cargoes and fishing gear and with allowance for possible ice accretion;

.2 be aware of the danger in having supplies and fishing gear stored on open weather deck spaces due to their large ice accretion surface and high centre of gravity;

.3 ensure that a complete set of warm clothing for all members of the crew is available on the vessel as well as a complete set of hand tools and other appliances for combating ice accretion, a typical list thereof for small vessels is shown in section 4 of this annex;

.4 ensure that the crew is acquainted with the location of means for combating ice accretion, as well as the use of such means, and that drills are carried out so that members of the crew know their respective duties and have the necessary practical skills to ensure the vessel's endurance under conditions of ice accretion;

.5 acquaint himself with the meteorological conditions in the region of fishing grounds and en route to the place of destination; study the synoptical maps of this region and weather forecasts; be aware of warm currents in the vicinity of the fishing grounds, of the nearest coastline relief, of the existence of protected bays and of the location of ice fields and their boundaries; and

.6 acquaint himself with the timetable of the radio stations transmitting weather forecasts and warnings of the possibility of ice accretion in the area of the relevant fishing grounds.

2 At sea

2.1 During the voyage and when the vessel is on the fishing grounds the skipper should keep himself informed on all long-term and short-term weather forecasts and should arrange for the following systematic meteorological observations to be systematically recorded:

.1 temperatures of the air and of the sea surface;

.2 wind direction and force;

.3 direction and height of waves and sea state;

.4 atmospheric pressure, air humidity; and

.5 frequency of splashing per minute and the intensity of ice accumulation on different parts of the vessel per hour.

2.2 All observed data should be recorded in the vessel's log-book. The skipper should compare the weather forecasts and icing charts with actual meteorological conditions, and should estimate the probability of ice formation and its intensity.

2.3 When the danger of ice formation arises, the following measures should be taken without delay:

.1 all the means of combating ice formation should be ready for use;

.2 all the fishing operations should be stopped, the fishing gear should be taken on board and placed in the under-deck spaces. If this cannot be done all the gear should be fastened for storm conditions on its prescribed place. It is particularly dangerous to leave the fishing gear suspended since its surface for ice formation is large and the point of suspension is generally located high;

.3 barrels and containers with fish, packing, all gear and supplies located on deck as well as portable mechanisms should be placed in closed spaces as low as possible and firmly lashed;

.4 all cargoes in holds and other compartments should be placed as low as possible and firmly lashed;

.5 the cargo booms should be lowered and fastened;

.6 deck machinery, hawser reels and boats should be covered with duck covers;

.7 lifelines should be fastened on deck;

.8 freeing ports fitted with covers should be brought into operative condition, all objects located near scuppers and freeing ports and preventing water drainage from deck should be taken away;

.9 all cargo and companion hatches, manhole covers, weathertight outside doors in superstructures and deck-houses and portholes should be securely closed in order to ensure complete weathertightness of the vessel, access to the weather deck from inner compartments should be allowed only through the superstructure deck;

.10 a check should be carried out as to whether the amount of water ballast on board and its location is in accordance with that recommended in "Stability guidance to skippers"; if there is sufficient freeboard, all the empty bottom tanks fitted with ballast piping should be filled with seawater;

.11 all fire-fighting, emergency and life-saving equipment should be ready for use;

.12 all drainage systems should be checked for their effectiveness;

.13 deck lighting and searchlights should be checked;

.14 a check should be carried out to make sure that each member of the crew has warm clothing; and

.15 reliable two-way radio communication with both shore stations and other vessels should be established; radio calls should be arranged for set times.

2.4 The skipper should seek to take the vessel away from the dangerous area, keeping in mind that the lee edges of icefields, areas of warm currents and protected coastal areas are a good refuge for the vessel during weather when ice formation occurs.

2.5 Small fishing vessels on fishing grounds should keep nearer to each other and to larger vessels.

2.6 It should be remembered that the entry of the vessel into an icefield presents certain danger to the hull, especially when there is a high sea swell. Therefore the vessel should enter the icefield at a right angle to the icefield edge at low speed without inertia. It is less dangerous to enter an icefield bow to the wind. If a vessel must enter an icefield with the wind on the stern, the fact that the edge of the ice is more dense on the windward side should be taken into consideration. It is important to enter the icefield at the point where the ice floes are the smallest.

3 During ice formation

3.1 If in spite of all measures taken the vessel is unable to leave the dangerous area, all means available for removal of ice should be used as long as it is subjected to ice formation.

3.2 Depending on the type of vessel, all or many of the following ways of combating ice formation may be used:

.1 removal of ice by means of cold water under pressure;

.2 removal of ice with hot water and steam; and

.3 breaking up of ice with ice crows, axes, picks, scrapers, or wooden sledge-hammers and clearing it with shovels.

3.3 When ice formation begins, the skipper should take into account the recommendations listed below and ensure their strict fulfilment:

.1 report immediately ice formation to the shipowner and establish with him constant radio communication;

.2 establish radio communication with the nearest vessels and ensure that it is maintained;

.3 do not allow ice formation to accumulate on the vessel, immediately take steps to remove from the vessel's structures even the thinnest layer of ice and ice sludge from the upper deck;

.4 check constantly the vessel's stability by measuring the roll period of the vessel during ice formation. If the rolling period increases noticeably, immediately take all possible measures in order to increase the vessel's stability;

.5 ensure that each member of the crew working on the weather deck is warmly dressed and wears a safety line securely attached to the guardrail;

.6 bear in mind that the work of the crew on ice clearing entails the danger of frost-bite. For this reason it is necessary to make sure that members of the crew working on deck are replaced periodically;

.7 keep the following structures and gears of the vessel first free from ice:

.7.1 aerials;

.7.2 running and navigational lights;

.7.3 freeing ports and scuppers;

.7.4 lifesaving craft;

.7.5 stays, shrouds, masts and rigging;

.7.6 doors of superstructures and deck-houses; and

.7.7 windlass and hawse holes;

.8 remove the ice from large surfaces of the vessel, beginning with the upper structures (such as bridges, deck-houses, etc.), because even a small amount of ice on them causes a drastic worsening of the vessel's stability;

.9 when the distribution of ice is not symmetrical and a list develops, the ice must be cleared from the lower side first. Bear in mind that any correction of the list of the vessel by pumping fuel or water from one tank to another may reduce stability during the process when both tanks are slack;

.10 when a considerable amount of ice forms on the bow and a trim appears, ice must be quickly removed. Water ballast may be redistributed in order to decrease the trim;

.11 clear ice from the freeing ports and scuppers in due time in order to ensure free drainage of the water from the deck;

.12 check regularly for water accumulation inside the hull;

.13 avoid navigating in following seas since this may drastically worsen the vessel's stability;

.14 register in the vessel's log-book the duration, nature and intensity of ice formation, amount of ice on the vessel, measures taken to combat ice formation and their effectiveness; and

.15 if, in spite of all the measures taken to ensure the vessel's endurance in conditions of ice formation, the crew is forced to abandon the vessel and embark on life-saving craft (lifeboats, rafts) then, in order to preserve their lives, it is necessary to do all possible to provide all the crew with warm clothing or special bags as well as to have a sufficient number of lifelines and bailers for speedy bailing out of water from the life-saving craft.

4 List of equipment and hand tools

A typical list of equipment and hand tools required for combating ice formation:

.1 ice crows or crowbars;

.2 axes with long handles;

.3 picks;

.4 metal scrapers;

.5 metal shovels;

.6 wooden sledge-hammers;

.7 fore and aft lifelines to be rigged each side of the open deck fitted with travellers to which lizards can be attached.

Safety belts with spring hooks should be provided for no less than 50% of the members of the crew (but not less than 5 sets), which can be attached to the lizards.

Notes: 1 The number of hand tools and lifesaving appliances may be increased, at the shipowner's discretion.

2 Hoses which may be used for ice combating should be readily available on board.

***

ANNEX 14

DRAFT AMENDMENTS TO THE 1974 SOLAS CONVENTION

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

PART A
GENERAL

Regulation 2 – Definitions

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

"27 *Intact Stability Code, 2008 (2008 IS Code)* means the International Code on Intact Stability, 2008, consisting of an introduction, part A (the provisions of which shall be treated as mandatory) and part B (the provisions of which shall be treated as recommendatory), as adopted by resolution MSC …(…), provided that:

.1 amendments to the introduction and part A of the Code are adopted, brought into force and take effect in accordance with article VIII of the present Convention concerning the amendment procedures applicable to the annex other than chapter I; and

.2 amendments to part B of the Code are adopted by the Maritime Safety Committee in accordance with its Rules of Procedure."

PART B-1
STABILITY

Regulation 5 – Intact stability information

2 In the existing title of the regulation, the word "information" is deleted.

3 In paragraph 1, the following new sentence is added after the existing sentence:

"In addition to any other applicable requirements of the present regulations, ships having a length of 24 m and upwards constructed on or after [date to be determined] shall as a minimum comply with the requirements of part A of the Intact Stability Code, 2008."

Regulation 5-1 – Stability information to be supplied to the master

4 Subparagraph .1 of paragraph 2 is replaced by the following:

".1 curves or tables of minimum operational metacentric height (GM) versus draught which assures compliance with the intact stability requirements according to the requirements of part A of the Intact Stability Code, 2008 and relevant damage stability requirements, alternatively corresponding curves or tables of the

maximum allowable vertical centre of gravity (KG) versus draught, or with the equivalents of either of these curves;"

5 Subparagraph .3 of paragraph 2 is replaced by the following:

".3 all other data and aids which might be necessary to maintain the required intact stability according to the requirements of part A of the Intact Stability Code, 2008 and stability after damage."

***

ANNEX 15

DRAFT AMENDMENTS TO THE 1988 LL PROTOCOL

ANNEX B
ANNEXES TO THE CONVENTION AS MODIFIED BY THE PROTOCOL OF 1988 RELATING THERETO

ANNEX I
REGULATIONS FOR DETERMINING LOAD LINES

CHAPTER I
GENERAL

Regulation 1 – Strength and intact stability of ships

1 The existing text of paragraph (3) is replaced by the following:

"(3) *Compliance*

(a) Ships constructed before [date to be determined] shall comply with an intact stability standard acceptable to the Administration;

(b) Ships constructed on or after [date to be determined] shall as a minimum comply with the requirements of part A of the Intact Stability Code, 2008."

Regulation 3 – Definitions of terms used in the annexes

2 The following new paragraph (16) is added after the existing paragraph (15):

"(16) *Intact Stability Code, 2008* (2008 IS Code) means the International Code on Intact Stability, 2008, consisting of an introduction, part A (the provisions of which shall be treated as mandatory) and part B (the provisions of which shall be treated as recommendatory), as adopted by resolution MSC …(…), provided that:

.1 amendments to the introduction and part A of the Code are adopted, brought into force and take effect in accordance with article VI of the 1988 LL Protocol concerning the amendment procedure applicable to Annex B to the Protocol; and

.2 amendments to part B of the Code are adopted by the Maritime Safety Committee in accordance with its Rules of Procedure."

CHAPTER II
CONDITIONS OF ASSIGNMENT OF FREEBOARD

Regulation 10 – Information to be supplied to the master

3 The existing text of paragraph (2) is replaced by the following:

"(2) Information shall be approved by the Administration or a recognized organization, and shall be provided to the master. Stability information, and loading information, also related to ship strength when required under paragraph (1), shall be carried on board at all times together with evidence that the information has been so approved."

***

ANNEX 16

RESOLUTION MSC.245(83)
(adopted on 12 October 2007)

RECOMMENDATION ON A STANDARD METHOD FOR EVALUATING CROSS-FLOODING ARRANGEMENTS

THE MARITIME SAFETY COMMITTEE,

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

RECALLING ALSO resolution A.266(VIII) entitled "Recommendation on a standard method for establishing compliance with the requirements for cross-flooding arrangements in passenger ships", adopted by the Assembly at its eighth session,

NOTING that the above Recommendation does not include provisions for cross-flooding arrangements other than pipes (i.e., cross-flooding times through ducts) or a provision to ensure adequate air ventilation for efficient cross-flooding (i.e., to account for the restrictive effect of air counter pressure during cross-flooding),

NOTING ALSO the revised SOLAS chapter II-1 subdivision and damage stability requirements for passenger and cargo ships, adopted by resolution MSC.216(82),

RECOGNIZING the need to establish a methodology for evaluating cross-flooding arrangements on ships subject to the applicable subdivision and damage stability requirements of SOLAS chapter II-1 to ensure uniform treatment of cross-flooding and equalization arrangements,

HAVING CONSIDERED the recommendations made by the Sub-Committee on Stability and Load Lines and on Fishing Vessels Safety at its fiftieth session,

1. ADOPTS the Recommendation on a standard method for evaluating cross-flooding arrangements, the text of which is set out in the Annex to the present resolution;

2. INVITES Governments to apply the annexed Recommendation to cross-flooding calculations and to bring the Recommendation to the attention of all parties concerned.

ANNEX

RECOMMENDATION ON A STANDARD METHOD FOR EVALUATING CROSS-FLOODING ARRANGEMENTS

Table of contents **Page**

1 Definitions

$\sum k$: Sum of friction coefficients in the considered cross-flooding arrangement.

$S\ (m^2)$: Cross-section area of the cross-flooding pipe or duct. If the cross-section area is not circular, then:

$$S_{equiv} = \frac{\pi \cdot D_{equiv}^2}{4}$$

where:

$$D_{equiv} = \frac{4 \cdot A}{p}$$

A = actual cross-section area

p = actual cross-section perimeter

$\theta_0\ (°)$: Angle before commencement of cross-flooding. This assumes that the cross-flooding device is fully flooded but that no water has entered into the equalizing compartment on the opposite side of the damage (see appendix 1).

$\theta_f\ (°)$: Heel angle at final equilibrium ($\theta_f \leq \theta$).

$\theta\ (°)$: Any angle of heel between the commencement of cross-flooding and the final equilibrium at a given time.

$W_f\ (m^3)$: Volume of water which is used to bring the ship from commencement of cross-flooding θ_0 to final equilibrium θ_f.

$W_\theta\ (m^3)$: Volume of water which is used to bring the ship from any angle of heel θ to the final equilibrium θ_f.

$H_0\ (m)$: Head of water before commencement of cross-flooding, with the same assumption as for θ_0.

$H_\theta\ (m)$: Head of water when any angle of heel θ is achieved.

$h_f\ (m)$: Final head of water after cross-flooding ($h_f = 0$, when the level inside the equalizing compartment is equal to the free level of the sea).

2 Formulae

2.1 Time required from commencement of cross-flooding θ_0 to the final equilibrium θ_f:

$$T_f = \frac{2W_f}{S \cdot F} \cdot \frac{\left(1 - \sqrt{\frac{h_f}{H_0}}\right)}{\sqrt{2gH_0}} \cdot \frac{1}{\left(1 - \frac{h_f}{H_0}\right)}$$

2.2 Time required to bring the ship from any angle of heel θ to the final equilibrium θ_f:

$$T_\theta = \frac{2W_\theta}{S \cdot F} \cdot \frac{\left(1 - \sqrt{\frac{h_f}{H_\theta}}\right)}{\sqrt{2gH_\theta}} \cdot \frac{1}{\left(1 - \frac{h_f}{H_\theta}\right)}$$

2.3 Time required from commencement of cross-flooding θ_0 until any angle of heel θ is achieved:

$$T = T_f - T_\theta$$

2.4 Dimensionless factor of reduction of speed through an equalization device, being a function of bends, valves, etc., in the cross-flooding system:

$$F = \frac{1}{\sqrt{\sum k}}$$

where F is not to be taken as more than 1.

Values for k can be obtained from appendix 2 or other appropriate sources.

2.5 Cross-flooding through successive devices of different cross-section:

If the same flow crosses successive flooding devices of cross-section S_1, S_2, S_3… having corresponding friction coefficients k_1, k_2, k_3…, then the total k coefficient referred to S_1 is:

$$\Sigma k = k_1 + k_2 \cdot S_1^2 / S_2^2 + k_3 \cdot S_1^2 / S_3^2 \ldots$$

2.6 If different flooding devices are not crossed by the same volume, each k coefficient should be multiplied by the square of the ratio of the volume crossing the device and the volume crossing the reference section (which will be used for the time calculation):

$$\Sigma k = k_1 + k_2 \cdot S_1^2 / S_2^2 \cdot W_2^2 / W_1^2 + k_3 \cdot S_1^2 / S_3^2 \cdot W_3^2 / W_1^2 \ldots$$

2.7 For cross-flooding through devices in parallel that lead to the same space, equalisation time should be calculated assuming that:

$$S \cdot F = S_1 \cdot F_1 + S_2 \cdot F_2 + \ldots$$

with $F = 1/\sqrt{\Sigma k}$ for each device of cross-section S_i

3 Air pipe venting criteria

3.1 In arrangements where the total air pipe sectional area is 10% or more of the cross-flooding sectional area, the restrictive effect of any air back pressure may be neglected in the cross-flooding calculations. The air pipe sectional area should be taken as the minimum or the net sectional area of any automatic closing devices, if that is less.

3.2 In arrangements where the total air pipe sectional area is less than 10% of the cross-flooding sectional area, the restrictive effect of air back pressure should be considered in the cross-flooding calculations. The following method may be used for this purpose:

The *k* coefficient used in the calculation of cross-flooding time should take into account the drop of head in the air pipe. This can be done using an equivalent coefficient k_e, which is calculated according to the following formula:

$$k_e = k_w + k_a \cdot (\rho_a/\rho_w) \cdot (S_w/S_a)^2$$

where:

k_w	=	k coefficient for the cross-flooding arrangement (water)
k_a	=	k coefficient for the air pipe
ρ_a	=	air density
ρ_w	=	water density
S_w	=	cross-section area of the cross-flooding device (water)
S_a	=	cross-section of air pipe

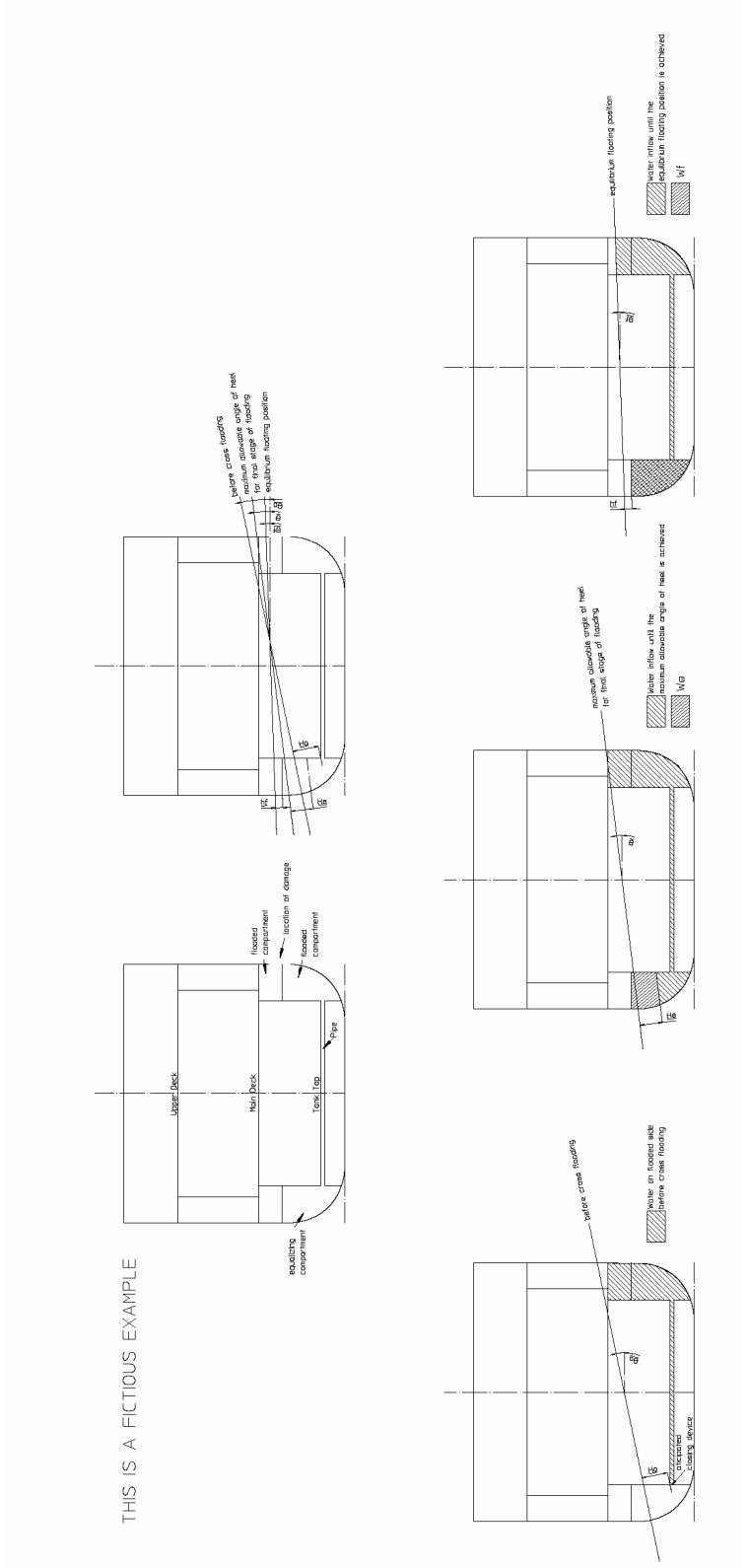
4 Alternatives

As an alternative to the provisions in sections 2 and 3, and for arrangements other than those shown in appendix 2, direct calculation using computational fluid dynamics (CFD), time-domain simulations or model testing may also be used.

APPENDIX 1

EXAMPLE FOR TREATMENT OF HEEL ANGLES AND WATER HEADS AT DIFFERENT STAGES OF CROSS-FLOODING

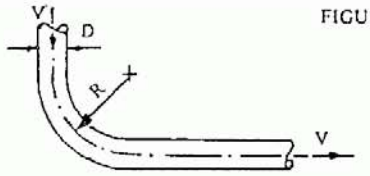
Figure 1



APPENDIX 2

FRICTION COEFFICIENTS IN CROSS-FLOODING ARRANGEMENT

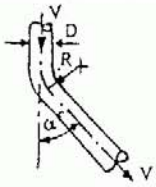
FIGURE 2



R/D	2	3	4	5	6	7
k	.30	.26	.23	.20	.18	.17

90° CIRCULAR BEND

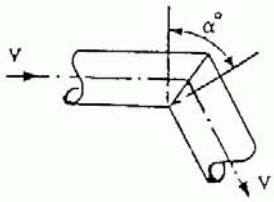
FIGURE 3



α°	15	30	45	60	75	90
k	.06	.12	.18	.24	.27	.30

RADIUS BEND R/D = 2

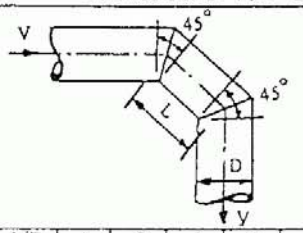
FIGURE 4



α°	5	15	30	45	60	90
k	.02	.06	.17	.32	.68	1.26

MITRE BEND

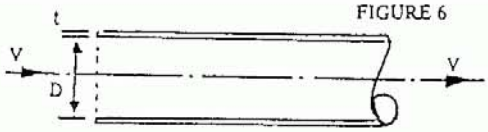
FIGURE 5



L/D	1	2	3	4	5	6
k	.41	.40	.43	.46	.46	.44

90° DOUBLE MITRE BEND

FIGURE 6



t/D	.01	.02	.03	.04	.05	≥.05
k	.83	.68	.53	.46	.44	.43

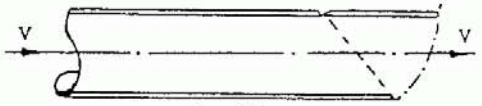
PIPE INLET

FIGURE 7

k = 1.0

PIPE OUTLET

FIGURE 8



k = 0.5

The value of k actually increases with decrease in Froude number, particularly below speeds of 2 m/sec.

NON-RETURN VALVE

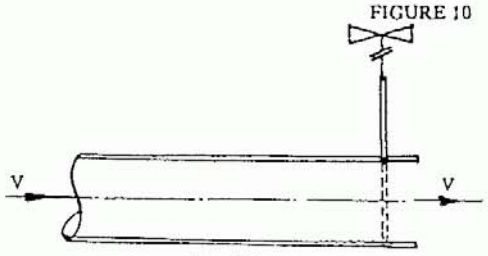
FIGURE 9

$$k = \frac{0.02}{D} \text{ per unit length}$$

The coefficient above is a mean value and does in fact vary as Reynold's number (i.e. varies with V for constant D and ν) as well as with relative roughness.

PIPE FRICTION LOSSES

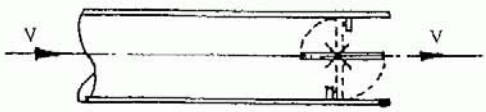
FIGURE 10



k = 0.3

GATE VALVE

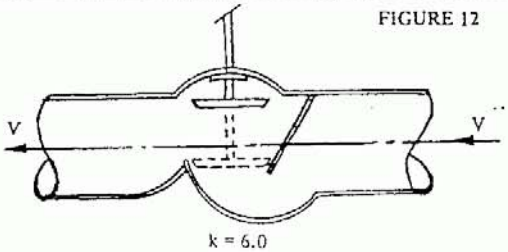
FIGURE 11



k = 0.8

BUTTERFLY VALVE

FIGURE 12



k = 6.0

DISC VALVE

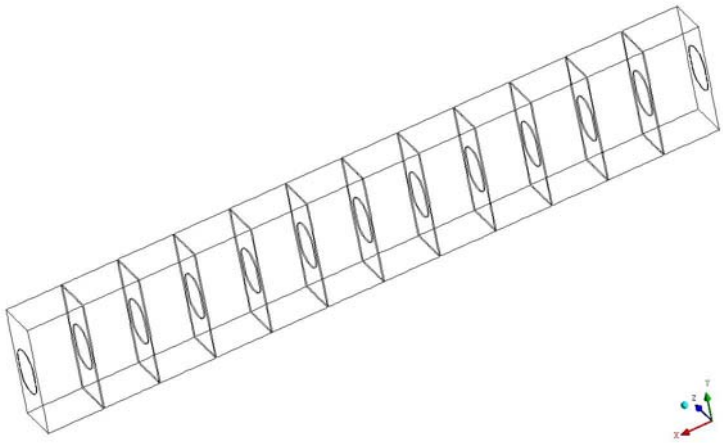
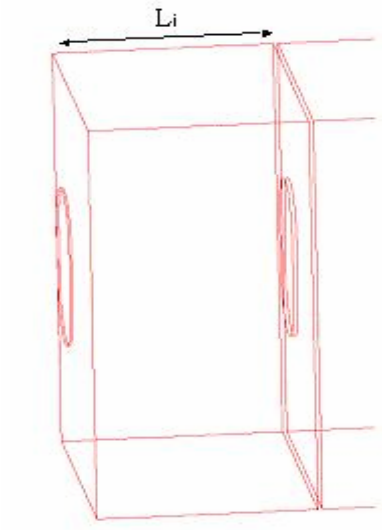


Figure 13
Cross-flooding through a series of structural ducts with 1 manhole

$$k = 0.2748 \cdot L_i + 0.0313 \qquad if \quad 0 < L_i < 1$$
$$k = -0.0986 \cdot L_i^3 + 0.6873 \cdot L_i^2 - 1.0212 \cdot L_i + 0.7386 \qquad if \quad 1 \le L_i \le 4$$
$$k = 1.34 \qquad if \quad L_i > 4$$

Note: k is the friction coefficient related to each space between two adjacent girders. k is evaluated with effective cross-section area therefore in calculations use the real cross-section area A and not S_{equiv}. The pressure loss for entrance in the first manhole is already computed in the calculation, and k = 1 has to be added to take into account the outlet losses.



L_i (in metres)

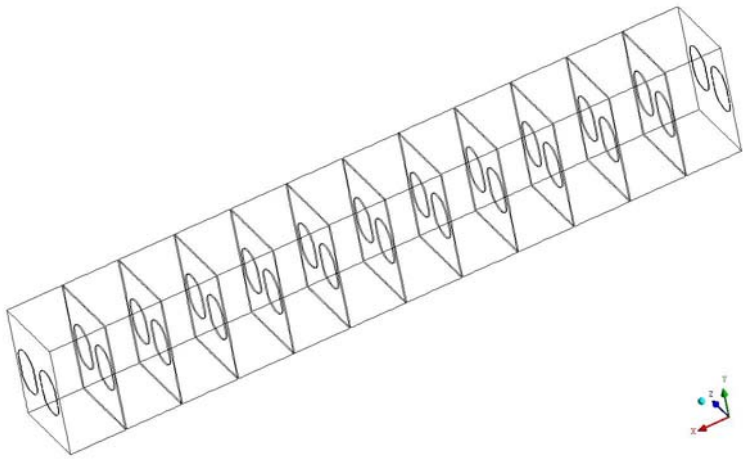


Figure 14
Cross-flooding through a series of structural ducts with 2 manholes

$$k = 0.4045 \cdot L_i + 0.0627 \qquad if \quad 0 < L_i < 1$$
$$k = 0.0424 \cdot L_i^3 - 0.3593 \cdot L_i^2 + 1.1401 \cdot L_i - 0.356 \qquad if \quad 1 \le L_i \le 4$$
$$k = 1.17 \qquad if \quad L_i > 4$$

Note: k is the friction coefficient related to each space between two adjacent girders. k is evaluated with effective cross-section area therefore in calculations use the real cross-section area A and not S_{equiv}. The pressure loss for entrance in the first manhole is already computed in the calculation, and k = 1 has to be added to take into account the outlet losses.

APPENDIX 3

EXAMPLE USING FIGURES FOR A PASSENGER SHIP

Dimension of the considered cross-flooding pipe:

Diameter	$D = 0.39\ m$
Length	$l = 21.0\ m$
Cross-section area	$S = 0.12\ m^2$
Wall thickness	$t = 17.5\ mm$

k-values for the considered cross-flooding system:

Inlet	0.45
Pipe friction $\frac{0.02l}{D}$	1.08
2 radius bends ($\alpha = 45°$)	0.36
Non-return valve	0.50
Outlet	1.00
	$\sum k = 3.39$

Sufficient air venting is assumed to be in place.

From this follows:

$$F = \frac{1}{\sqrt{\sum k}}$$

$$F = \frac{1}{\sqrt{3.39}} = 0.54$$

Time required from commencement of cross flooding θ_o to the final equilibrium condition θ_f:

$$T_f = \frac{2W_f}{S \cdot F} \cdot \frac{\left(1 - \sqrt{\frac{h_f}{H_0}}\right)}{\sqrt{2gH_0}} \cdot \frac{1}{\left(1 - \frac{h_f}{H_0}\right)}$$

Head of water before commencement of cross-flooding:

$$H_0 = 5.3m$$

Volume of water which is used to bring the ship from commencement of cross-flooding to the final equilibrium condition:

$$W_f = 365m^3$$

Final head of water after cross-flooding:

$$h_f = 1.5m$$

$$T_f = \frac{2 \cdot 365m^3}{0.12m^2 \cdot 0.54} \cdot \frac{\left(1 - \sqrt{\frac{1.5m}{5.3m}}\right)}{\sqrt{2 \cdot 9.81 {}^{m}\!/\!_{s^2} \cdot 5.3m}} \cdot \frac{1}{\left(1 - \frac{1.5m}{5.3m}\right)}$$

$$T_f = 721s = 12.0\,\text{min}$$

Time required to bring the vessel from the maximum allowable angle of heel for final stage of flooding θ to the final equilibrium condition θ_f:

$$T_\theta = \frac{2W_\theta}{S * F} \cdot \frac{\left(1 - \sqrt{\frac{h_f}{H_\theta}}\right)}{\sqrt{2gH_\theta}} \cdot \frac{1}{\left(1 - \frac{h_f}{H_\theta}\right)}$$

Maximum allowable angle of heel for final stage of flooding $\theta = 7°$

Head of water when the maximum allowable angle of heel for final stage of flooding is achieved $H_\theta = 3.7m$

Volume of water which is used to bring the vessel from the maximum allowable angle of heel for final stage of flooding to the final equilibrium condition $W_\theta = 160m^3$

$$T_\theta = \frac{2 \cdot 160m^3}{0.12m^2 \cdot 0.54} \cdot \frac{\left(1 - \sqrt{\frac{1.5m}{3.7m}}\right)}{\sqrt{2 \cdot 9.81 {}^{m}\!/\!_{s^2} \cdot 3.7m}} \cdot \frac{1}{\left(1 - \frac{1.5m}{3.7m}\right)}$$

$$T_\theta = 354s = 5.9\,\text{min}$$

Time required from commencement of cross-flooding θ_o until the maximum allowable angle of heel for final stage of flooding θ is achieved:

$T = T_f - T_\theta$ = 12.0 min – 5.9 min = 6.1 min