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SUB-COMMITTEE ON SHIP DESIGN AND CONSTRUCTION
2nd session
Agenda item 25

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REPORT TO THE MARITIME SAFETY COMMITTEE

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LIST OF ANNEXES

1 GENERAL

1.1 The Sub-Committee on Ship Design and Construction (SDC) held its second session from 16 to 20 February 2015 under the chairmanship of Mrs. A. Jost (Germany). The Vice-Chairman, Capt. N. Campbell (South Africa), was also present.

1.2 The session was attended by delegations from Member Governments; by Associate Members of IMO; by observers from intergovernmental organizations; and by non-governmental organizations in consultative status, as listed in document SDC 2/INF.1.

Opening address

1.3 The Secretary-General welcomed participants and delivered his opening address. In particular, he requested the delegation of Denmark to convey, on behalf of the IMO membership, the Secretariat and the Secretary-General, deepest sympathy and heartfelt condolences to the families of the victims of the recent terrorist incident in Copenhagen. He also drew the attention of the Sub-Committee to the serious issue of irregular migration by sea and expressed his appreciation for the considerable efforts of the Italian Coastguard and Navy regarding the recent rescue of large numbers of migrants in the Mediterranean Sea. The full text of his statement can be downloaded from the IMO website at the following link:
http://www.imo.org/MediaCentre/SecretaryGeneral/Secretary-GeneralsSpeechesToMeetings/Pages/Default.aspx

Statement by the delegation of Denmark

1.4 In responding to the remarks of the Secretary-General regarding the recent terrorist attack in Copenhagen, the delegation of Denmark expressed its deep appreciation for all the support received at IMO and updated the Sub-Committee on the most recent findings. The full text of its statement is set out in annex 22.

Statement by the delegation of Italy

1.5 In responding to the remarks of the Secretary-General regarding maritime migrants, the delegation of Italy informed the Sub-Committee of Italy's response to the most recent sinking of boats with migrants in the Mediterranean Sea. The full text of its statement is set out in annex 22.

Chairman's remarks

1.6 In responding to the Secretary-General's opening address, the Chairman, having also requested the delegation of Denmark to convey the Sub-Committee's deepest sympathy and condolences to the families of the victims of the recent terrorist incident in Copenhagen, thanked the Secretary-General for his words of guidance and encouragement and assured him that his advice and requests would be given every consideration in the deliberations of the Sub-Committee.

Adoption of the agenda and related matters

1.7 The Sub-Committee adopted the agenda (SDC 2/1) and agreed to be guided in its work, in general, by the annotations contained in document SDC 2/1/1 (Secretariat) and the arrangements in document SDC 2/1/2 (Secretariat). The agenda, as adopted, together with the list of documents considered under each agenda item, is set out in document SDC 1/INF.12.

2 DECISIONS OF OTHER IMO BODIES

2.1 The Sub-Committee noted the decisions and comments pertaining to its work made by PPR 1, MSC 93, CCC 1, MEPC 67 and MSC 94, as reported in documents SDC 2/2 and SDC 2/2/1 (Secretariat), and took them into account in its deliberations when dealing with the relevant agenda items.

2.2 In this regard, the Sub-Committee noted that MSC 94 had approved the *Guidance on drafting of amendments to the 1974 SOLAS Convention and related mandatory instruments* (MSC.1/Circ.1500) and had instructed its subsidiary bodies to start using the guidance with immediate effect.

3 AMENDMENTS TO SOLAS CHAPTER II-1 SUBDIVISION AND DAMAGE STABILITY REGULATIONS

General

3.1 The Sub-Committee recalled that SDC 1 had re-established the SDS Correspondence Group with terms of reference as set out in paragraph 7.18 of document SDC 1/26, and had instructed the group to submit a report to this session.

3.2 The Sub-Committee also recalled that SDC 1, whilst noting that no documents were submitted on matters related to limiting the down-flooding points on the bulkhead deck for passenger ships, had invited Member Governments and international organizations to submit comments to SDC 2.

Outcome of MSC 93

3.3 The Sub-Committee noted that MSC 93 had considered document MSC 93/10/20 (China) providing a proposal on the extent of penetration for ro-ro passenger ships with long lower hold (LLH) and the index R for passenger ships with a length of 150 m or under, and had decided to refer that document to SDC 2 for consideration in conjunction with matters related to the survivability of passenger ships under the existing output on "Revision of SOLAS chapter II-1 subdivision and damage stability regulations".

3.4 The Sub-Committee also noted that MSC 93, in considering the report of the Working Group on Passenger Ship Safety (MSC 93/WP.6) related to the survivability of passenger ships, had:

.1 endorsed the group's view that there was no need for a two-phased approach to consider an increase in subdivision index *R*;

.2 endorsed the recommendation of the FSA Experts Group on the validation of the EMSA and GOALDS studies, and forwarded document MSC 93/6/2 (FSA Experts Group) to SDC 2 for use when considering an increase in the subdivision index *R*;

.3 instructed the Sub-Committee to continue the technical consideration of an increase in the required subdivision index *R* as part of the comprehensive package of revisions to SOLAS chapter II-1 subdivision and damage stability regulations, taking into account the outcome of the EMSA 3 studies as they became available;

.4 agreed that there would be a need for the FSA Experts Group to validate the EMSA 3 study and that this could be done by authorizing, at a future session of the Committee, a meeting of the FSA Experts Group a day prior to SDC 3 in 2016, with a view to the group reporting its outcome directly to the Sub-Committee; and

.5 instructed SDC 2 to include the item of "double hull in way of main engine-rooms" under this existing planned output (5.2.1.13).

Outcome of MSC 94

3.5 The Sub-Committee further noted that MSC 94, with regard to MSC 93 having agreed that there would be a need for the FSA Experts Group to validate the EMSA 3 study related to survivability of passenger ships, had noted the proposal (see paragraph 3.4.4) that the Committee should instruct SDC 2 to consider the timing of the FSA Experts Group so that SDC 3 would have sufficient time to consider the outcome of the group. Consequently, MSC 94 had endorsed the proposal and requested SDC 2 to consider the matter and advise MSC 95 accordingly.

Report (part 2) of the working group established at SDC 1

3.6 The Sub-Committee considered part 2 of the report of the SDS Working Group at SDC 1 (SDC 2/3) and, having approved it in general, noted that the group's report had been considered in detail by the SDS Correspondence Group (SDC 2/3/2, SDC 2/3/3 and Add.1) established at SDC 1.

Report of the correspondence group

3.7 The Sub-Committee considered the report of the correspondence group (SDC 2/3/2, SDC 2/3/3 and Add.1) and, having approved it in general, noted that the group had progressed the work on the revision of SOLAS chapter II-1 subdivision and damage stability regulations and the associated Explanatory Notes, as set out in the annexes to the report, but that a considerable amount of work still remained.

Matters concluded at SDC 1

Double bottom requirements (SOLAS regulation II-1/9)

3.8 The Sub-Committee had for its consideration the following documents:

.1 SDC 2/3/1 (Denmark, Germany, Netherlands) proposing improvements to the draft text of SOLAS regulation II-1/9 on double bottoms in cargo ships other than tankers, taking also into account document SDC 1/7/5 (Republic of Korea), which refers to an unclear definition of "small wells", and stating the opinion of the co-sponsors that the improvement of a good understanding and a safe and uniform application of regulation II-1/9 cannot be ensured by amending the draft Explanatory Notes only, but that the text of regulation II-1/9 needs to be amended as well;

.2 SDC 2/3/4 (Austria, et al.) proposing to extend the improvements to the draft text of SOLAS regulation II-1/9, as proposed in document SDC 2/3/1, to passenger ships, acknowledging that the matter concerns mostly cargo ships, and noting, however, that regulation II-1/9 has been streamlined for both cargo and passenger ships; and

.3 SDC 2/3/8 (United States) proposing additional amendments to those proposed in document SDC 2/3/1 regarding the SOLAS regulation II-1/9 requirement for double bottom wells, in order to simplify and further clarify the regulation.

3.9 Following an in-depth discussion, the Sub-Committee noted the views expressed that in the proposed amendments to regulation II-1/9.3.3, set out in annex 1 to document SDC 2/3/1, the following sentence should be further considered by the working group, as the wording is vague:

> "For cargo ships of less than 80 m in length the alternative arrangements shall provide a level of safety satisfactory to the Administration.",

and agreed to refer the aforementioned documents (see paragraph 3.8) to the working group for further consideration, with a view to finalizing the draft amendments to regulation II-1/9 (see paragraph 3.24).

Watertight doors (regulation II-1/13)

3.10 The Sub-Committee considered document SDC 2/3/7 (Austria, et al.) proposing draft amendments to SOLAS regulation II-1/13 to introduce protection against the crushing of people during daily operation of watertight doors, while retaining the SOLAS requirement to close them firmly in case of an emergency.

3.11 In considering the above document, the Sub-Committee noted the following views expressed during the discussion:

.1 the aforementioned proposal is outside the scope of this output, as it is related to safety systems and training, and therefore a proposal for a new unplanned output is necessary before work can commence;

.2 while some expressed the view that the technology to prevent crushing accidents already exists, others were of the view that such technology still needs to be developed for maritime application;

.3 the technology for watertight doors was developed over a century ago and it is time to undertake a comprehensive review of all watertight door regulations; and

.4 there are other means to prevent crushing accidents besides the installation of anti-crushing devices and these means should also be considered.

3.12 Taking into account the divergent views expressed during the discussion, the Sub-Committee decided to invite MSC 95 to consider the aforementioned views and decide how best to proceed on this matter.

Watertight hatches (regulation II-1/16)

3.13 The Sub-Committee considered document SDC 2/3/10 (Denmark, Netherlands), proposing to extend the application of SOLAS regulations II-1/7-2 and II-1/16 to the construction and testing of watertight doors to watertight hatches on cargo ships, and stating the opinion of the co-sponsors that the improvement of a good understanding and a safe and uniform application of regulation II-1/7-2 and II-1/16 cannot be ensured by amending the Explanatory Notes only, but that the text of regulation II-1/7-2 and II-1/16 needs to be amended as well.

3.14 Following discussion, the Sub-Committee agreed to refer document SDC 2/3/10 to the working group for further consideration, with a view to finalizing the draft amendments to SOLAS regulations II-1/7-2 and II-1/16.

Matters related to water on deck for special category spaces (regulation II-1/7-2.3)

3.15 In considering document SDC 2/17 (RINA) proposing the inclusion of "special category spaces" in SOLAS regulation II-I/7-2.3 for ro-ro passenger ships and stating that the presence of any water on a ro-ro deck leads to a very complex and important issue for the survivability and safety of the crew and passengers, the Sub-Committee, having noted diverging views on the issue, recalled the decision of SDC 1 that no further consideration of this matter was necessary (SDC 1/26, paragraphs 6.3 and 6.4) and agreed that this document should not be referred to the working group and that no further action should be taken on this matter.

Double hull in way of main engine-rooms

3.16 The Sub-Committee considered document SDC 2/3/9 (United States) proposing an amendment to SOLAS regulation II-1/8-1 to improve the availability of a passenger ship's power supply in cases of flooding due to side raking damage. In this context, three potential main engine-room arrangements were proposed, one being a double side requirement. A stability requirement was also proposed to close a gap in existing SOLAS regulation II-1/8-1.2 regarding essential system availability in the event of flooding of any single watertight compartment.

3.17 Following discussion, the Sub-Committee agreed to refer document SDC 2/3/9 to the working group for further consideration.

Survivability of passenger ships

Report of the correspondence group and related submissions

3.18 The Sub-Committee considered the report of the correspondence group (SDC 2/3/11) related to the survivability of passenger ships and, having approved it in general, noted that the report summarizes the work and recommendations of the SDS Correspondence Group regarding the possible revision of SOLAS regulation II-1/6 subdivision and damage stability regulations relating to the required subdivision index "R", as contained in the SOLAS 2009 Consolidated Edition. In this connection, the Sub-Committee also noted that the group had recognized that it was necessary to await the outcome of the EMSA 3 project, and its validation by the FSA Experts Group prior to SDC 3, in order to finalize this work.

3.19 The Sub-Committee had for its consideration the following documents:

.1 SDC 2/3/5 (Austria, et al.) presenting considerations to establish a dataset containing the attained subdivision index A for passenger ships in service, with a view to assisting regulatory development in the area of safety;

.2 SDC 2/3/6 (Austria, et al.) reporting on the development of two studies in the area of passenger-ship risk level related to damage stability and providing information on documents SDC 2/INF.4 (EC) and SDC 2/INF.3 (Germany, CESA);

.3 SDC 2/INF.3 (Germany, CESA) presenting a validation study on the survivability of small passenger and special-purpose ships after damage, commissioned by the German Ministry of Transport and Digital Infrastructure (BMVI). The study comprises intact and damage stability calculations for systematic design variations of eight typical ship types; and

.4 SDC 2/INF.4 (EC) introducing and describing the interim results of a third study commissioned by the European Maritime Safety Agency (EMSA) on the acceptable and practicable passenger-ship risk level related to damage stability.

3.20 Following discussion, the Sub-Committee decided as follows:

.1 matters related to watertight doors should only be considered after consideration of agenda item 16 (Review of conditions under which passenger ship watertight doors may be opened during navigation and development of amendments to SOLAS regulation II-1/22 and MSC.1/Circ.1380) (see paragraph 16.5);

.2 the highest priority for this output, at this session, is to finalize the draft amendments to SOLAS chapter II-1, parts B to B-4;

.3 the technical consideration of an increase in the required subdivision index R, which depends on the outcome of the EMSA 3 project and the validation of the project by the FSA Experts Group, should have a lower priority in the working group;

.4 the working group should have a preliminary assessment of the proposal contained in document SDC 2/3/5 (see also paragraph 3.19.1) for consideration by the Sub-Committee; and

.5 the title of this output needs to be changed, in SMART terms, to reflect the ongoing work on the subdivision index R and the finalization of the draft amendments to SOLAS chapter II-1 subdivision and damage stability regulation.

Timing of the FSA Experts Group

3.21 Having noted that MSC 94, with regard to the validation of the EMSA 3 study related to survivability of passenger ships, had requested SDC 2 to consider the timing of the FSA Experts Group so that SDC 3 would have sufficient time to consider the outcome of the group and advise MSC 95 accordingly (see also paragraph 3.5), the Sub-Committee decided to instruct the SDS Working Group to consider this matter further and advise the Sub-Committee accordingly (see paragraphs 3.33).

Limiting the down-flooding points on the bulkhead deck for passenger ships

3.22 Having noted that no documents had been submitted on this matter to SDC 1 or to the current session, and recalling paragraph 5.12 of the *Guidelines on the organization and method of work of the Maritime Safety Committee and the Marine Environment Protection Committee and their subsidiary bodies* (MSC-MEPC.1/Circ.4/Rev.3), the Sub-Committee agreed that there was insufficient information to continue the work on limiting the down-flooding points on the bulkhead deck for passenger ships.

3.23 Taking the above decision into account, the Sub-Committee invited the Committee to note that the work on limiting the down-flooding points on the bulkhead deck for passenger ships had been completed.

Establishment of the Subdivision and Damage Stability (SDS) Working Group

3.24 In light of the above decisions, the Sub-Committee established the Subdivision and Damage Stability (SDS) Working Group and instructed it, taking into account the comments made and decisions taken in plenary, to:

.1 consider amendments to the draft SOLAS text, as may be necessary in light of the report of the correspondence group (SDC 2/3/2), taking into account documents SDC 2/3/1, SDC 2/3/4, SDC 2/3/8 and SDC 2/3/10;

.2 finalize matters related to double hull in way of main engine-rooms, taking into account document SDC 2/3/9, and advise the Sub-Committee accordingly;

.3 finalize the draft amendments to SOLAS chapter II-1 and the draft Explanatory Notes, based on part 2 of the report of the working group at SDC 1 (SDC 2/3) and the report of the correspondence group (SDC 2/3/2, SDC 2/3/3 and Add.1);

.4 if time permits, further consider matters related to the survivability of passenger ships, taking into account the report of the correspondence group (SDC 2/3/11) and documents SDC 2/3/5, SDC 2/3/6, SDC 2/INF.3, SDC 2/INF.4, MSC 93/6/2 and MSC 93/10/20, and advise the Sub-Committee accordingly;

.5 consider whether it is necessary to establish a correspondence group and, if so, prepare terms of reference for consideration by the Sub-Committee; and

.6 submit a written report (part 1) on the draft SOLAS amendments; submit part 2 of the report on chapter 2 of the draft OSV Chemical Code and the draft Explanatory Notes and continue working through the week to submit part 3 of the report to SDC 3 as soon as possible after this session, so that it can be taken into account by a correspondence group, if established.

Report of the SDS Working Group (part 1)

3.25 Having considered the part of the report of the SDS Working Group (SDC 2/WP.3 and Addenda) dealing with the agenda item, the Sub-Committee took action as outlined below.

Draft amendments to SOLAS chapter II-1

3.26 The Sub-Committee noted the decisions taken by the group on matters related to the development of the draft amendments to SOLAS chapter II-1, as set out in paragraph 5 of document SDC 2/WP.3.

3.27 In considering the draft amendments prepared by the group (SDC 2/WP.3, annex), the Sub-Committee noted the concern raised by the delegation of the Bahamas that replacing the term "leaves port" with "voyage commences" in regulations II-1/21 and II-1/22, which is intended to also account for ships that operate to and from offshore anchorages or installations, lacked clarity because there is no common understanding or definition of the term "voyage". The delegation also pointed out that regulations II-1/20 to II-1/24 use a range of different terms in this context, and that they intended to address this issue at MSC 95.

3.28 Having noted the above issue, the Sub-Committee agreed to the draft amendments to SOLAS chapter II-1, as set out in annex 1, for submission to MSC 95 for approval with a view to subsequent adoption.

3.29 In light of the above decision, the Sub-Committee noted that the group, taking into account the provisions in paragraphs 3.2.1.3.16.2, 3.2.1.3.18 and 3.2.1.3.19 of the *Guidance on drafting of amendments to the 1974 SOLAS Convention and related mandatory instruments* (MSC.1/Circ.1500), had completed part III of the check/monitoring sheet and records for regulatory development. In this connection, the Sub-Committee agreed to the check/monitoring sheet and records for regulatory development, as set out in appendixes 1 and 2 to annex 1, respectively, for submission to MSC 95 for approval in conjunction with the draft amendments to SOLAS chapter II-1.

Draft Explanatory Notes to SOLAS chapter II-1

3.30 The Sub-Committee noted that, due to time constraints, the group could not finalize the draft Explanatory Notes and endorsed the group's recommendation to establish a correspondence group to further consider the matter with a view to finalization at SDC 3 (see paragraph 3.34).

Survivability of passenger ships

3.31 The Sub-Committee noted that, due to time constraints and taking into account the need for further input from the validation of the results of the EMSA 3 project, the group was unable to consider the report of the correspondence group (SDC 2/3/11) and documents SDC 2/3/5 and SDC 2/3/6, SDC 2/INF.3, SDC 2/INF.4, MSC 93/6/2 (Chairman of the FSA Experts Group) and MSC 93/10/20. In this context, the Sub-Committee endorsed the group's recommendation to further consider this issue at SDC 3.

3.32 Having noted the group's discussion on whether the formula for the new required subdivision index *R* being developed should maintain the factor N_2 related to LSA arrangements (SDC 2/WP.3/Add.1, paragraphs 13 and 14), the Sub-Committee endorsed the group's recommendation on removing the linkage of LSA arrangements to the formula for the required subdivision index *R* and requested the Secretariat to advise SSE 2 accordingly, so that the SSE Sub-Committee can consider the matter regarding any possible consequences for SOLAS regulation III/21.

Timing of the FSA Experts Group

3.33 The Sub-Committee endorsed the group's recommendation for the FSA Experts Group to meet from 10 to 12 November 2015, with a view to approval by MSC 95 and subsequent endorsement by C 114 (see also paragraph 3.21).

Re-establishment of the SDS Correspondence Group

3.34 In order to further progress the work on this output intersessionally, the Sub-Committee re-established the Correspondence Group on Subdivision and Damage Stability (SDS), under the coordination of the United States,[*] and instructed it to:

.1 finalize the draft Explanatory Notes, based on the report of the correspondence group (SDC 2/3/2, SDC 2/3/3 and Add.1) and parts 3 and 4 of the report of the SDS Working Group (SDC 2/WP.3/Add.1 and SDC 3/3); and

.2 submit a report to SDC 3 (see also paragraphs 4.9 and 17.7).

Extension of target completion year

3.35 In light of those decisions, the Committee was invited to extend the target completion year for this output to 2017.

4 GUIDELINES ON SAFE RETURN TO PORT FOR PASSENGER SHIPS

General

4.1 The Sub-Committee recalled that SDC 1 had re-established the SDS Correspondence Group with terms of reference as set out in paragraph 8.7 of document SDC 1/26, and had instructed the group to submit a report to this session.

4.2 The Sub-Committee also recalled that MSC 94, following consideration of document MSC 94/6/1 (Bahamas, Liberia, IACS, CLIA) (MSC 94/21, paragraphs 6.4 to 6.8), had agreed to include a new output in the post-biennial agenda of the Committee on "Computerized stability support for the master in case of flooding for existing passenger ships", assigning the SDC Sub-Committee as the coordinating organ with a view to including provisions in SOLAS chapter II-1 for ships constructed before 1 January 2014.

Report of the correspondence group and related submissions

4.3 The Sub-Committee considered the report of the correspondence group (SDC 2/4 and SDC 2/4/1) and noted that the report summarizes the work and recommendations of the SDS Correspondence Group regarding the provision of operational information to the master after a flooding casualty in fulfilment of SOLAS regulation II-1/8-1.3 to include potential revision of the *Guidelines on operational information for masters of passenger ships for safe return to port by own power or under tow* (MSC.1/Circ.1400). The Sub-Committee also noted that there was seldom complete unanimity within the group on any of the items discussed; therefore, all matters (including part 2 of the report, containing the draft Revised guidelines) need to be further discussed and resolved at this session.

[*] **Coordinator:**
Mr. James Person
Naval Architecture Division
Office of Design and Engineering Standards
U.S. Coast Guard Headquarters
Washington, DC 20593
United States
Tel: +1 (202) 372 1369
Email: james.l.person@uscg.mil

4.4 In the context of the above, the Sub-Committee also noted document SDC 2/INF.6 (Finland) providing information about possible additional guidance regarding placement and technical requirements of flooding sensors to be installed on passenger ships, and noted the view that better definitions and guidance for flooding sensors are needed to be included in the *Guidelines for the approval of stability instruments* (MSC.1/Circ.1229).

4.5 Following consideration of the report of the correspondence group and having noted the above document, the Sub-Committee agreed on the need to consider the consequences of the decision of SDC 1 with regard to onboard stability computers. In this context, observation of trim, heel and draught, as well as strength, should be dealt with by shore-based computers. Consequently, the Sub-Committee instructed the working group to consider the aforementioned issues before concluding the work on the revision of the *Guidelines on operational information for masters of passenger ships for safe return to port by own power or under tow* (MSC.1/Circ.1400).

Instructions to the SDS Working Group

4.6 Having considered the above views, the Sub-Committee instructed the SDS Working Group, established under agenda item 3, if time permits, to finalize the draft *Revised guidelines on operational information for masters of passenger ships for safe return to port by own power or under tow* (MSC.1/Circ.1400), taking into account the report of the correspondence group (SDC 2/4 and SDC 2/4/1) and document SDC 2/INF.6.

Report of the working group

4.7 Having considered the relevant part of the report of the SDS Working Group (SDC 2/WP.3/Add.1), the Sub-Committee approved it in general and noted that, due to time constraints, the group was unable to further consider the draft *Revised guidelines on operational information for masters of passenger ships for safe return to port by own power or under tow* (MSC.1/Circ.1400). In this context, the Sub-Committee endorsed the group's recommendation to instruct a correspondence group to further consider the matter with a view to finalization at SDC 3.

Instructions to the SDS Correspondence Group

4.8 Consequently, the Sub-Committee instructed the SDS Correspondence Group established under agenda item 3 (see paragraph 3.34) to finalize the draft *Revised guidelines on operational information for masters of passenger ships for safe return to port by own power or under* tow (MSC.1/Circ.1400), taking into account the report of the correspondence group (SDC 2/4 and SDC 2/4/1) and document SDC 2/INF.6.

Extension of target completion year

4.9 In light of the above decisions, the Committee was invited to extend the target completion year for this output to 2016.

5 SECOND GENERATION INTACT STABILITY CRITERIA

General

5.1 The Sub-Committee recalled that SDC 1, having considered matters related to ice accretion in timber deck cargo, invited Member Governments and international organizations to submit comments and proposals on the amended draft text of chapter 6 of part B of the 2008 IS Code, as set out in annex 2 to document SDC 1/5, to this session.

5.2 The Sub-Committee recalled also that SDC 1 had re-established the IS Correspondence Group, with terms of reference as set out in paragraph 5.9 of document SDC 1/26, to continue the work on the development of second generation intact stability criteria, taking into account the updated plan of action agreed at that session (SDC 1/WP.5, annex).

Report of the correspondence group and related submissions

5.3 The Sub-Committee considered the report of the correspondence group (SDC 2/5 and SDC 2/INF.10) and noted that the group had continued its work on the development of second generation intact stability criteria (SDC 2/5), including the collection of relevant technical information (SDC 2/INF.10).

5.4 In the context of the above, the Sub-Committee considered the following documents:

.1 SDC 2/5/1 and SDC 2/INF.7 (China) providing comments on and proposing revision of the level 2 criteria of parametric rolling, based on sample calculations on 71 ships (SDC 2/INF.10, annex 28) and test study for all five failure models, including parametric rolling tests for 5 ships. The research on CFD approach application in parametric rolling prediction conducted by China is contained in document SDC 2/INF.7;

.2 SDC 2/5/2 (China) commenting on level 2 criteria of pure loss of stability and proposing amendments to the criteria, based on sample calculations on 73 ships;

.3 SDC 2/5/3 (China) containing sample calculation results for vulnerability to surf-riding/broaching and further commenting on the surf-riding/broaching criteria based on analysis of the calculation results. In order to evaluate the influence of the criteria on ships more comprehensively, China performed level 1 and 2 checks for 13 sample ships according to the updated surf-riding/broaching criteria (SDC 2/INF.10, annex 32);

.4 SDC 2/5/4 (China) containing sample vessel calculation results of dead-ship failure mode, and comments on level 2 vulnerability criteria for dead-ship stability failure mode based on the calculation results; and

.5 SDC 2/5/5 (Japan) explaining the rationale of 15 degrees as the appropriate stable heel angle requirement in draft vulnerability criteria for pure loss of stability in waves. Although the IS Correspondence Group proposed draft amendments to the 2008 IS Code regarding vulnerability criteria and the standards (levels 1 and 2) related to pure loss of stability, some undecided elements still exist. One of them is critical stable heel angle in waves. In discussion at the group, one delegation requested Japan to publish the background of this element. This document is a response to that request.

5.5 Following consideration of the report of the IS Correspondence Group and the above-mentioned related documents, the Sub-Committee noted the views expressed that during the work on the development of the vulnerability criteria, the correspondence group executed comprehensive sample calculations using many different ships, as reported at SLF 55, SDC 1 and SDC 2 as well as preliminary ones reported at SLF 53 and SLF 54. In this context, further work of this kind would require tremendous efforts from the Member Governments and, therefore, should be avoided for the vulnerability criteria other than for dead ship and excessive acceleration modes.

Review of action plan for intact stability work

5.6 The Sub-Committee further instructed the IS Working Group to review the plan of action for intact stability work (SDC 1/WP.5, annex) and prepare a revised plan identifying priorities, time frames and objectives for the work to be accomplished.

Establishment of the Intact Stability (IS) Working Group

5.7 Following discussion, the Sub-Committee established the IS Working Group, taking into account the comments and decisions made in plenary, to:

.1 finalize the draft amendments to the 2008 IS Code regarding vulnerability criteria and the standards (levels 1 and 2) related to parametric roll resonance, pure loss of stability and broaching-to; and further develop the draft amendments to dead-ship condition and excessive accelerations on the basis of the report of the correspondence group (SDC 2/5 and SDC 2/INF.10), taking into account documents SDC 2/5/1, SDC 2/5/2, SDC 2/5/3, SDC 2/5/4, SDC 2/5/5 and SDC 2/INF.7;

.2 further develop the direct stability assessment procedures (level 3) for the stability failure modes (i.e. pure loss of stability, parametric roll, surf-riding/broaching, dead-ship condition and excessive accelerations), taking into account documents SLF 54/3, SLF 54/3/1, SLF 54/INF.12 and SDC 1/5/1;

.3 finalize the draft amendments to chapter 6 of part B of the 2008 IS Code on matters related to ice accretion in timber deck cargo, based on annex 2 to document SDC 1/5;

.4 review the plan of action contained in the annex to document SDC 1/WP.5, taking into account the progress made during the session, and prepare a revised plan, identifying the priorities, time frames and objectives for the work to be accomplished;

.5 consider whether it is necessary to re-establish a correspondence group and, if so, prepare terms of reference for consideration by the Sub Committee; and

.6 submit a written report (part 1), continue working through the week and submit part 2 of the report to SDC 3 as soon as possible after this session, so that it can be taken into account by the correspondence group, if established.

Report of the IS Working Group (part 1)

5.8 Having considered the part of the report of the working group (SDC 2/WP.4) dealing with this agenda item, the Sub-Committee approved it in general and took action as outlined hereunder.

Draft amendments to the 2008 IS Code regarding vulnerability criteria

5.9 The Sub-Committee agreed, in principle, to the draft amendments to the 2008 IS Code regarding vulnerability criteria and the standards (levels 1 and 2) related to parametric roll, pure loss of stability and surf-riding / broaching (SDC 2/WP.4, annexes 1 to 3).

Interim application of the draft criteria

5.10 In light of the above decision, the Sub-Committee noted that some members of the group were of the opinion that to ensure correct application, implementation and data validation of the current drafts for the vulnerability criteria of levels 1 and 2 for the failure mode of pure loss of stability, parametric rolling and surf-riding/broaching, it is considered appropriate to keep the possibility to review the drafts should this be found necessary after the interim application. In this context, the Sub-Committee invited Member Governments and international organizations to bring the criteria to the attention of ship designers, shipyards, shipowners and other interested parties, and to observe and test the application of the finalized vulnerability criteria, in order to gain experience on their use.

Formulas and values contained in the vulnerability criteria

5.11 Having endorsed the group's recommendation, the Sub-Committee instructed the Secretariat that, when reproducing any future document containing the vulnerability criteria (i.e. annexes 1 to 3 to document SDC 2/WP.4), appropriate action should be taken in order to maintain all formulas and symbols used within the paragraphs or tables in "Times New Roman" font.

Application of the criteria concerning restricted and unrestricted service

5.12 The Sub-Committee noted the group's opinion that additional text concerning the application of the criteria regarding restricted and unrestricted service in the context of the vulnerability criteria should be added, when appropriate, to chapter 1 of part B of the 2008 IS Code, as a consequential amendment.

Draft Explanatory Notes

5.13 The Sub-Committee noted the group’s opinion that there is a need to develop explanatory notes regarding the application of the criteria, in order to ensure uniform implementation and correct interpretation of the information provided. This concerns, in particular, the development of adequate provisions and guidelines for presentation and preparation of the stability information given by the second generation intact stability criteria. In this context, the Sub-Committee also noted that the group had agreed that this matter should be addressed in a correspondence group when considering the development of the explanatory notes (see paragraph 5.17).

Draft amendments to the 2008 IS Code regarding ice accretion on cargo ships carrying timber deck cargoes

5.14 The Sub-Committee agreed to the draft amendments to chapter 6 of part B of the 2008 IS Code and the associated MSC resolution, regarding ice accretion on cargo ships carrying timber deck cargoes, as set out in annex 2, for submission to MSC 95 for adoption.

Review of the plan of action

5.15 The Sub-Committee endorsed the revised plan of action for this output (SDC 2/WP.4, annex 5), prepared by the group based on the progress made during the session.

5.16 In the context of the above, the Sub-Committee noted the group's opinion that future amendments being developed to part B of the 2008 IS Code (Recommendations for certain types of ships and additional guidelines) should be integrated into the Code under the structure contained in paragraph 32 of document SDC 2/WP.4.

Re-establishment of the IS Correspondence Group

5.17 The Sub-Committee, taking into account the progress made at this session, agreed to re-establish the Correspondence Group on Intact Stability, under the coordination of Japan*, with the assistance of Norway*, for matters related to the second generation intact stability criteria and amendments to part B of the 2008 IS code on towing and lifting (agenda item 7), and instructed it, under this agenda item, to (see also paragraph 7.10):

.1 continue to work on the items contained in the updated plan of action for the second generation intact stability criteria (SDC 2/WP.4, annex 5), taking into account relevant documents from previous sessions, and, in particular:

.1 finalize the draft text of amendments to the 2008 IS Code regarding vulnerability criteria and standards (levels 1 and 2) related to dead-ship condition and excessive accelerations;

.2 prepare a draft text of the Explanatory Notes for vulnerability criteria; and

.3 enhance a working version of the guidelines for "direct stability assessment and operational guideline"; and

.2 submit a report to SDC 3.

Extension of target completion year

5.18 In light of the above decisions, the Committee was invited to extend the target completion year for this output to 2019.

* **Coordinators**:

Dr. Eng. Naoya Umeda
Associate Professor
Department of Naval Architecture
and Ocean Engineering
Osaka University
2-1 Yamadaoka, Suita
Osaka 565-0871, JAPAN
Tel/Fax: + 81 6 6879 7587/7594
Email: umeda@naoe.eng.osaka-u.ac.jp

Mr. Anders Nedregard Mathisen
Senior Approval Engineer
Cargo Vessels
Norwegian Maritime Authority
Tel: + 47 52 74 53 54
Email: anm@sdir.no

6 AMENDMENTS TO THE CRITERION FOR MAXIMUM ANGLE OF HEEL IN TURNS IN THE 2008 IS CODE

General

6.1 The Sub-Committee recalled that SDC 1, having considered documents SDC 1/14 (Japan) and SDC 1/14/1 (Poland) and noted the views expressed on the need to further consider the proposed amendments to chapter 3 of part A of the 2008 IS Code regarding the criterion for maximum angle of heel in turns, had invited Member Governments and international organizations to submit comments to this session.

Proposed amendments to the 2008 IS Code

6.2 In considering the proposed amendments to the 2008 IS Code on this matter, the Sub-Committee had for its consideration the following documents:

.1 SDC 2/6 (IACS) commenting on the submissions to SLF 55 and SDC 1 on matters related to the maximum angle of heel in turns and concluding that further validation work is necessary before any changes to the 2008 IS Code are made; and

.2 SDC 2/INF.5 (IACS) presenting an assessment on the effect of the turning coefficient (C) on the calculated angle of heel in turns as given in the 2008 IS Code and in document SDC 1/14/1 (Poland). A sample of 37 passenger ships (16 cruise ships, 16 RoPax ships and five yachts) was used in this assessment and the results are presented in the annex.

6.3 Having considered the aforementioned documents, the Sub-Committee agreed that, at this stage, it is premature to revise chapter 3 of part A of the 2008 IS Code regarding the criterion for maximum angle of heel in turns without further studies, real ship measurements and model test data. Therefore, the Sub-Committee agreed that no further action on this output should be taken.

6.4 Notwithstanding the above decision, the Sub-Committee noted that the observer from RINA was concerned that attention was still being devoted to versions of a formula that take no account of the actual turning radius of the ship, variations in which certainly exist and strongly affect the angles of heel to be expected. In this context, RINA proposed such an equation for inclusion in paragraph 3.1.2.1 of part A of the 2008 IS Code (SLF 54/12, annex 1). The formula currently employed in the 2008 IS Code inherently assumes a fixed relationship between the turn radius as a proportion of ship length and the degree of speed loss in a turn. The Sub-Committee also noted that the observer from RINA remains of the view that in light of the many variables, any simplistic formula can only ever be suitable for very early-stage estimates of heeling behaviour, and then only if the formula employed has been calibrated against actual trial results for similar ships.

Completion of the work on the output

6.5 Having considered the above views, the Sub-Committee invited the Committee to note that the work on the output had been completed.

7 AMENDMENTS TO PART B OF THE 2008 IS CODE ON TOWING, LIFTING AND ANCHOR HANDLING OPERATIONS

General

7.1 The Sub-Committee recalled that SDC 1, in considering the report of the correspondence group (SDC 1/5) and having noted the views expressed regarding matters related to escort towing, the stability criteria for lifting operations and possible unintended mandatory application of some provisions within part B of the 2008 IS Code, had decided not to finalize the proposed amendments at that stage.

7.2 The Sub-Committee also recalled that, in light of the above decision, SDC 1 had invited Member Governments and international organizations to submit comments and proposals to this session.

7.3 The Sub-Committee had for its consideration the following documents:

.1 SDC 2/7 (Denmark, et al.) comprising the work developed by interested parties during the intersessional period on development of amendments to part B of the 2008 IS Code on towing, lifting and anchor handling operations;

.2 SDC 2/7/1 (Netherlands) proposing amendments to the text provided in annexes 3 (Proposed amendments common to all the operational modes, with special emphasis on chapters 3 and 4 of part B of the 2008 IS Code) and 6 (Proposed amendments to chapter 2 of part B of the 2008 IS Code regarding vessels engaged in lifting operations) to document SDC 1/5 with respect to the stability of vessels engaged in lifting operations;

.3 SDC 2/7/2 (China) commenting on the draft intact stability criteria for towing vessels, set out in document SDC 1/5, and proposing amendments to the criteria;

.4 SDC 2/7/3 (Germany) commenting on documents SDC 2/7/1 and SDC 2/INF.11 supporting the distinction between lifting operations in exposed waters and unexposed waters, as suggested in paragraphs 11 and 12 of document SDC 2/7/1; and

.5 SDC 2/INF.11 (Netherlands) containing the result of an impact assessment for ships engaged in lifting operations in waters that are not exposed, following the draft amendments to the 2008 IS Code, as proposed in annex 6 to document SDC 1/5.

7.4 In considering the above documents, the Sub-Committee noted the following views:

.1 all documents submitted under this output (see paragraph 7.3) should be referred to the working group for further consideration;

.2 with regard to annex 2 to document SDC 2/7 (Proposed amendments to the 2008 IS Code with respect to stability information for vessels engaged in towing), the heeling calculation for vessels engaged in towing is based on the geometry. In this connection, it is recognized that the heeling calculation based on geometry only is not sufficient to represent the hazard phenomena that this type of vessel may be exposed to;

.3 the heeling moment formula contained in document SDC 2/7/1 should be considered in the working group, taking into account specific standards associated with this approach; and

.4 all the work related to anchor-handling matters is very close to finalization, and therefore it should be finalized at this session, for submission to MSC 95 for approval.

Instructions to the Working Group on Intact Stability

7.5 Having considered the above views, the Sub-Committee instructed the Working Group on Intact Stability established under agenda item 5 (see paragraph 5.7), taking into account comments and decisions made in plenary and documents SDC 2/7/1, SDC 2/7/2, SDC 2/7/3 and SDC 2/INF.11, to finalize the draft amendments to part B of the 2008 IS Code, based on annexes 1 to 3 to document SDC 2/7, with a view to approval by MSC 95.

Report of the working group

7.6 Having considered the relevant part of the report of the working group (SDC 2/WP.4), the Sub-Committee approved it in general and took action as described in the following paragraphs.

Draft amendments to parts A and B of the 2008 IS Code on anchor-handling operations

7.7 The Sub-Committee agreed to the draft amendments to the introduction of the 2008 IS Code regarding vessels engaged in anchor-handling operations, as set out in annex 3, for submission to MSC 95 for approval with a view to subsequent adoption.

7.8 The Sub-Committee agreed to the draft amendments to part B of the 2008 IS Code regarding vessels engaged in anchor-handling operations, as set out in annex 4, for submission to the Committee for adoption in conjunction with the adoption of the above amendments to the introduction of the Code (see also paragraph 7.7).

Vessels engaged in lifting and towing operations, including escort towing

7.9 The Sub-Committee noted the deliberations and the progress made by the group on matters related to vessels engaged in lifting and towing operations, including escort towing.

Instructions to the IS Correspondence Group

7.10 Having considered the above matters, the Sub-Committee instructed the IS Correspondence Group established under agenda item 5 (see also paragraph 5.17), taking into account the outcome of the IS Working Group (SDC 2/WP.4), to further consider the proposed amendments to the part B of the 2008 IS Code concerning towing (including escort towing, if information is made available by the members of the group) and lifting operations, as contained in the part 2 of the report of the IS Working Group established at SDC 2.

Extension of target completion year

7.11 In light of the above decisions, the Committee was invited to extend the target completion year for this output to 2016.

8 GUIDELINES ADDRESSING THE CARRIAGE OF MORE THAN 12 INDUSTRIAL PERSONNEL ON BOARD VESSELS ENGAGED IN INTERNATIONAL VOYAGES

8.1 The Sub-Committee recalled that SDC 1, having recognized that further work was necessary on the carriage of more than 12 industrial personnel on board vessels engaged in international voyages and having noted the views expressed on the urgent need to complete this work by the target completion date, had instructed the Correspondence Group on Interim guidelines for Offshore Wind Farm Vessels to develop guidance on how the definition of industrial personnel should be used in practice, based on document SDC 1/WP.6 and part 2 of the working group's report (SDC 2/9).

Report (part 2) of the working group established at SDC 1

8.2 The Sub-Committee considered the relevant section of part 2 of the report of the Working Group on Construction at SDC 1 (SDC 2/9) and, having approved it in general, noted that the group's report had been considered in detail by the Correspondence Group on Interim guidelines for Offshore Wind Farm Vessels (SDC 2/8) established at SDC 1.

Report of the correspondence group and related submission

8.3 The Sub-Committee considered the report of the correspondence group (SDC 2/8) and noted that the group had prepared draft *Guidelines addressing the carriage of more than 12 industrial personnel on board vessels engaged on international voyages* (SDC 2/8, annex). In this connection, the group considered an interpretation of the definition of "a passenger" (SOLAS chapter I, regulation 2(e)(i)). The Sub-Committee also noted that this issue is very closely linked with the question of whether industrial personnel whose primary place of work is off the vessel (unlike special personnel in the 2008 SPS Code) can be said to fall within the category of "other persons" in SOLAS chapter I, regulation 2(e)(i).

8.4 The Sub-Committee further noted that paragraph 8 of the report (SDC 2/8) raises the question of a longer-term strategy, including the possibility of amending to SOLAS chapter I, regulation 2(e), and that such a decision on a longer-term strategy would necessitate an interim solution.

8.5 In the context of the above, the Sub-Committee had for its consideration document SDC 2/8/1 (Vanuatu), commenting on the report of the correspondence group regarding the draft *Guidelines addressing the carriage of more than 12 industrial personnel on board vessels engaged on international voyage* (SDC 2/8, annex). The Sub-Committee noted the view of the delegation of Vanuatu that none of the existing definitions fully captured "industrial personnel", and that in advance of a decision about defining "industrial personnel" there can be no agreement about how "industrial personnel" can benefit from the principles of safety of life at sea in SOLAS by contributing to the Safety Management Systems on board. Additionally, the delegation of Vanuatu suggested that the scope of the use of the definition of "industrial persons" clearly reflected an intended usage restricted for vessels engaged in industrial activities associated with offshore energy projects.

8.6 The Sub-Committee also noted the view of the delegation of Australia against having a new category of personnel called "industrial personnel". In this context, provision 1.2.3 of the 2008 SPS Code states that "The Code is not intended for ships used to transport and accommodate industrial personnel that are not working on board." It should be recalled that DE 51, and subsequently MSC 84, regarded "industrial personnel" as "passengers" and not "special personnel" so as to ensure that they are not treated any differently from "passengers" because of their employment status. The delegation was of the opinion that the issues raised by provision 1.2.3 of the 2008 SPS Code can be best overcome through the application of a unified interpretation or an amendment to the definition of "special personnel" so that it includes "industrial personnel". The full text of their statement is set out in annex 22.

8.7 The Sub-Committee also noted the following other views:

.1 the definition of industrial personnel, as prepared by the correspondence group and as set out in paragraph 9 of the annex to document SDC 2/8, would be the first step in order to progress the work on this output;

.2 the meaning of the term "or accommodated", as set out in paragraph 9.1 of the annex to the document SDC 2/8, was unclear;

.3 SOLAS provisions are not appropriate for small vessels on international voyages, and the term "industrial personnel" should denote those involved in offshore work. Therefore, amendments to SOLAS chapter I are not acceptable;

.4 in case it was decided to amend SOLAS chapter I, it may be necessary to prepare many consequential amendments to various other chapters of the Convention;

.5 amending the SPS Code could be a solution for parts of this issue. However, at this stage, it was considered outside the scope of this output; and

.6 the SPS Code would need a complete revision and could to be made mandatory as a long-term solution for this matter.

8.8 In light of the above, the Sub-Committee decided to finalize the definition of industrial personnel based on the definition prepared by the correspondence group (see also paragraph 8.7.1). In this connection, the Sub-Committee agreed to delete the square brackets in the definition and retain the text.

Establishment of the Drafting Group on Offshore Industry Vessels

8.9 Following the discussion, the Sub-Committee established a Drafting Group on Offshore Industry Vessels and instructed it (see also paragraph 9.5), taking into account the comments and decisions made in plenary and documents SDC 2/9, SDC 2/8 and SDC 2/8/1, to:

.1 develop a draft MSC circular on the definition of industrial personnel, as developed by the correspondence group and set out in paragraph 9 of the annex to document SDC 2/8; and

.2 prepare draft terms of reference for a correspondence group for consideration by the Sub-Committee.

Report of the drafting group

8.10 Having considered the relevant part of the report of the drafting group (SDC 2/WP.6), the Sub-Committee approved it in general and took action as described hereunder.

8.11 The Sub-Committee noted that, with a view towards providing clearer and more appropriate examples of offshore industrial activities, the group had agreed to make minor changes to the footnotes and editorial corrections to the text of the definition of industrial personnel, as set out in the annex to document SDC 2/WP.6. In this connection, the Sub-Committee also noted that the group had agreed to delete the words "facilities such as systems for the" of the "industrial activities" and delete the reference "see also paragraphs 11 and 12 below" for "appropriate medical standards", in the footnotes.

8.12 Having noted the group's deliberations regarding the draft MSC circular, the Sub-Committee noted in particular that the group had recognized the urgent need for the definition in the context of the evolving offshore energy sector. However, having noted that further work would be required for the long-term, and that the draft MSC circular on the definition is a short-term solution, this should be mentioned in the introductory paragraphs.

8.13 Subsequently, the Sub-Committee agreed to the draft MSC circular on *Definition of industrial personnel,* as set out in annex 5, for submission to MSC 95 for approval.

8.14 Notwithstanding the above decision, the Sub-Committee noted that the delegation of Argentina, during the discussion of document SDC 2/8, had recalled that it had expressed concern about the impact that the definition of "industrial personnel" could have, from a legal point of view, in the application of international conventions. The Sub-Committee also noted that, in the view of the same delegation the draft MSC circular (SDC 2/WP.6, annex) provides a definition that does not fall within the context of any IMO instrument, but makes an indirect reference to SOLAS chapter I, regulation 2(e). In this context, the delegation advised that it would examine in detail the legal consequences that the new definition has in the scope of international transport and that, therefore, it reserved acceptance of the use of this definition in the scope of the SOLAS Convention and other IMO instruments.

8.15 The Sub-Committee also noted that while the delegation of Canada could agree with the definition, the delegation was concerned about moving forward to request MSC 95 to approve the definition of "industrial personnel" without providing the Committee with the instrument for its implementation. For that reason, this delegation was of the opinion that the Sub-Committee should only note, instead of agree to, the above draft MSC circular.

Completion of the work on the output

8.16 The Sub-Committee invited the Committee to note that the work on the output had been completed.

9 CLASSIFICATION OF OFFSHORE INDUSTRY VESSELS AND A REVIEW OF THE NEED FOR A NON-MANDATORY CODE FOR OFFSHORE CONSTRUCTION SUPPORT VESSELS

9.1 The Sub-Committee recalled that SDC 1 had established the Correspondence Group on Interim guidelines for Offshore Wind Farm Vessels with the terms of reference set out in paragraph 18.8 of document SDC 1/26, and had instructed it to submit a report to this session.

Report (part 2) of the working group established at SDC 1

9.2 The Sub-Committee considered the relevant section of part 2 of the report of the Working Group on Construction at SDC 1 (SDC 2/9) and, having approved it in general, noted that the group's report had been considered in detail by the Correspondence Group on Interim guidelines for Offshore Wind Farm Vessels (SDC 2/9/1) established at SDC 1.

Report of the correspondence group

9.3 The Sub-Committee considered the report of the correspondence group (SDC 2/9/1) and noted that the group focused most attention on the definition of industrial personnel (see section 8) as it was deemed important to make progress on that issue in order to inform the future development of both sets of guidelines (draft *Guidelines on offshore service craft (OSC)* and draft *Guidelines for offshore construction vessels (OCV)*). As such, only limited progress had been made on those guidelines. In this context, the Sub-Committee also noted the

progress of the draft *Guidelines for offshore service craft (OSC) over 24 m in length used in offshore windfarm service to date* (SDC 2/9/1, annex). The Sub-Committee further noted that the draft OSC Guidelines essentially provide for a two-way solution – one providing for vessels designed to meet an SPS Code standard, and the other to provide a standard more akin to the requirements in the 2000 HSC Code.

9.4 Following discussion, the Sub-Committee agreed that further work was necessary intersessionally on both sets of guidelines (draft *Guidelines on offshore service craft (OSC)* and draft *Guidelines for offshore construction vessels (OCV)*).

Instructions to the Drafting Group on Offshore Industry Vessels

9.5 Subsequently, the Sub-Committee instructed the Drafting Group on Offshore Industry Vessels established under agenda item 8 (*Guidelines addressing the carriage of more than 12 industrial personnel on board vessels engaged in international voyages*), taking into account the decisions made in plenary and documents SDC 2/9 and SDC 2/9/1, to prepare draft terms of reference for a correspondence group, for consideration by the Sub-Committee.

Report of the drafting group

9.6 Having considered the relevant part of the report of the drafting group (SDC 2/WP.6), the Sub-Committee approved it in general and took action as described below.

9.7 In considering the draft terms of reference for a correspondence group, prepared by the group, the Sub-Committee agreed to delete subparagraph .3 (SDC 2/WP.6, paragraph 13.3) as there had been no discussion in plenary with regard the application of the OSC and OCV guidelines to non-Convention ships, and other vessels for the offshore energy industry.

Establishment of a correspondence group

9.8 Following discussion and in order to make further progress on this output intersessionally, the Sub-Committee agreed to establish a Correspondence Group on Offshore Industry Vessels, under the coordination of the United Kingdom,* and instructed it to:

.1 finalize the draft *Guidelines for offshore service craft (OSC) used in windfarm service*, based on the annex to document SDC 2/9/1, taking account comments in documents SDC 2/9 and SDC 1/INF.14;

.2 further develop, with a view towards finalization, the draft *Guidelines for offshore construction vessels (OCV) used in windfarm service*, based on annex 3 to document SDC 1/WP.6, incorporating amendments from and taking into account document SDC 2/9, and also taking into account paragraph 13 of document SDC 2/9/1;

.3 submit a report to SDC 3.

* **Coordinator:**
Mr. Paul Wilkins
Principal and Policy Lead for Offshore & Cargo Ships
MCA, Bay 2/29 Spring Place, Vessel Standards Branch
Spring Place, 105 Commercial Road,
Southampton, SO15 1EG
United Kingdom
Tel: +44 (0) 238 032 9137
Mob: +44 (0) 79 1872 4844
Email: offshore@mcga.gov.uk

9.9 In the context of the above, the Sub-Committee noted that, in considering the terms of reference, the delegation of Canada had noted that the work on the development of the guidelines is very specific to offshore service craft and offshore construction vessels, which are very specific types of vessels. However, the development of those guidelines would not resolve the issue of transportation of industrial personnel on other types of offshore industry vessels and the delegation would like the work to continue to find mid-term and long-term solutions for all types of offshore industry vessels.

9.10 The Sub-Committee also noted that the delegation of Vanuatu had pointed out that part of paragraph 13.3 of document SDC 2/WP.6 concerned application to non- or under Convention vessels. In this context, many codes request Administrations to consider how to apply those codes to under Convention vessels and that was the first aspect the delegation was considering, especially given the nature of the offshore service craft, as a priority. That particular aspect of that part of the terms of reference should not be eliminated, if at all possible.

10 AMENDMENTS TO SOLAS REGULATION II-1/11 AND DEVELOPMENT OF ASSOCIATED GUIDELINES TO ENSURE THE ADEQUACY OF TESTING ARRANGEMENTS FOR WATERTIGHT COMPARTMENTS

General

10.1 The Sub-Committee recalled that SDC 1 had established the Correspondence Group on Amendments to SOLAS regulation II-1/11 and development of associated guidelines to ensure the adequacy of testing arrangements for watertight compartments, with terms of reference as set out in paragraph 9.12 of document SDC 1/26, in order to make further progress on this output intersessionally.

Report of the correspondence group and related submissions

10.2 The Sub-Committee considered the report of the correspondence group (SDC 2/10 and SDC 2/INF.8) and noted that the majority of the group was of the view that amendments to SOLAS regulation II-1/11 (Initial testing of watertight bulkheads, etc.) are necessary, while some members were opposed to amendments. The Sub-Committee also noted that the group had prepared the draft *Guidelines for procedures of testing tanks and tight boundaries* (SDC 2/INF.8, annex 7) for consideration by the Sub-Committee.

10.3 In the context of the above, the Sub-Committee considered the following documents:

.1 SDC 2/10/1 (Japan) providing views on how structural strength of watertight compartments should be secured and why Administrations should confirm the appropriateness of quality management system of shipyards in applying the alternative tests;

.2 SDC 2/10/2 (Greece) providing comments on the report of the correspondence group (SDC 2/10 and SDC 2/INF.8) and pointing out that the group's report gives the impression that a clear majority was in favour of IACS' technical background and of amending SOLAS, whereas a careful read (and count) of the members' replies (SDC 2/INF.8) indicates that the group actually was split on both issues; and

.3 SDC 2/10/3 (INTERTANKO) commenting on the report of the correspondence group (SDC 2/10 and SDC 2/INF.8). INTERTANKO strongly disagrees with the group's recommendation to amend SOLAS regulation II-1/11. The main reason is that this is the only SOLAS regulation that mandates a full-scale test to ensure the watertightness of tanks intended to carry liquids on ships.

10.4 Following consideration of the report of the correspondence group and the above related documents, the Sub-Committee noted the following views:

.1 the compelling need to amend SOLAS regulation II-1/11 was demonstrated in the justification for this output;

.2 extensive use of hydrostatic testing is outdated and should be complemented by up-to-date testing methods, taking into account modern production methods characterized by block assembly of highly pre-outfitted modules; therefore, SOLAS regulation II-1 should be amended accordingly;

.3 the MSC had agreed on the need to consider possible amendments to SOLAS; however, the report of the correspondence group was non-conclusive and there was no clear majority supporting such amendments;

.4 there is no compelling need for amending SOLAS regulation II-1/11 as this would lower safety standards;

.5 ships built in very good shipyards can still have structural problems (i.e. a quality management system does not guarantee quality in the construction);

.6 a quality management system cannot replace full scale testing; and

.7 alternative arrangement systems can be considered on a case-by-case basis by Administrations; therefore, guidelines for procedures of testing tanks and tight boundaries should be developed.

10.5 Having considered the above views, the Sub-Committee could not agree to the draft amendments to SOLAS regulation II-1/11, noting that a clear majority was not in favour of the amendments. In this context, the Sub-Committee also noted that for a number of years it has tried to find consensus on this matter.

10.6 With regard to the draft *Guidelines on procedures for testing tanks and tight boundaries* and the draft *Guidance on verification of quality management systems*, as set out in annexes 7 and 8 to document SDC 2/INF.8, the Sub-Committee recognized that interested delegations could submit comments to MSC 95 on the matter.

Completion of the work on the output

10.7 Taking the above decisions into account, the Sub-Committee invited the Committee to note that the work on the output had been completed.

11 PROVISIONS TO ENSURE THE INTEGRITY AND UNIFORM IMPLEMENTATION OF THE 1969 TM CONVENTION

General

11.1 The Sub-Committee recalled that SDC 1 agreed to the draft unified interpretations to the 1969 TM Convention and the associated draft TM.5 circular, as set out in annex 4 to document SDC 1/26, for submission to MSC 93 for approval. In this connection, MSC 93 approved the *Unified interpretations relating to the International Convention on Tonnage Measurement of Ships, 1969* (TM.5/Circ.6).

11.2 The Sub-Committee also recalled that SDC 1 had invited Member Governments and international organizations to submit comments and proposals to SDC 2 with regard to further development of draft unified interpretations to the 1969 TM Convention, to address items identified in documents SDC 1/4/1 and SDC 1/4/4 (IACS), and further consideration of matters related to the development of a reduced gross tonnage parameter for accommodation spaces (SDC 1/26, paragraph 4.19).

Measurement of hull recesses for coolers

11.3 The Sub-Committee considered document SDC 2/11 (IACS) seeking clarification on the measurement of hull recesses and external closed system piping (coolers) associated with engine cooling, and noted that IACS members have considered arrangements where coolers associated with the engine cooling system are either installed in hull recesses (box-coolers) where the recess is open to the sea and usually protected by mesh, or on the outside of the hull, either protected by grills or similar means of protection or unprotected. In this context, as far as the treatment of recesses is concerned, IACS members have reached the understanding that they should not be included in the total volume for the Gross Tonnage (GT), as per regulation 6(3) of the 1969 TM Convention.

11.4 Following discussion, the Sub-Committee agreed that it was premature, at this stage, to take any action on this matter until experience with the implementation of the *Unified interpretations relating to the International Convention on Tonnage Measurement of Ships, 1969* (TM.5/Circ.6) is acquired.

Further development of draft interpretations of the 1969 TM Convention

11.5 In considering document SDC 2/11/1 (United States) responding to the invitation by SDC 1 for proposals to further develop the draft interpretations to the 1969 TM Convention (SDC 1/26, paragraph 4.19), the Sub-Committee noted that the delegation of the United States was of the opinion that the issues raised by documents SDC 1/4/1 and SDC 1/4/4 (IACS) are complex, with neither involving a single, clearly identifiable principle subject to clarification, or an identified pressing need for resolution. The Sub-Committee also noted that the delegation supported the assessment of the drafting group to which they had been referred that both issues would require significant development (SDC 1/WP.7, paragraphs 4 and 5), noting that the issues were not subject to any prior work under this planned output.

11.6 Following discussion, the Sub-Committee agreed that, currently, no further development of the draft interpretations to the 1969 TM Convention was necessary

Reduced gross tonnage for crew accommodation spaces

11.7 The Sub-Committee considered document SDC 2/11/2 (Germany) commenting on document SDC 1/26 and proposing a draft resolution to encourage improved living conditions on board ships by means of a reduced gross tonnage parameter for assessing fees. In this context, the Sub-Committee noted that, building on the extensive work conducted on this issue by the Sub-Committee and the support expressed at SDC 1 for the simplified approach offered by document SDC 1/4/2 (Germany), Germany had developed a draft resolution for the Sub-Committee's consideration. This resolution draws extensively on a proposal offered by document SLF 55/9/3 (Germany, India, United States, ITF), but includes changes intended to remove the linkage to minimum standards, and incorporates revised interpretations on measurement methods and treatment of stairwells and passageway, along with clarifications and corrections, based on subsequent work (SDC 1/4, SDC 1/INF.4 and SDC 1/WP.7).

11.8 In light of the above and following an in-depth discussion, the Sub-Committee noted that there was some support for the proposal contained in document SDC 2/11/2; however, the draft text could be improved. Notwithstanding the above, the Sub-Committee also noted the concerns that a simplified reduced gross tonnage parameter may lower the safety requirements of ships that are just above 500 tons, and that a recommendatory instrument would not be an incentive for shipowners to improve seafarer's living conditions on board ships and to aim to increase training accommodation. Consequently, the Sub-Committee did not agree to the draft Assembly resolution on *Reduced gross tonnage for crew accommodation spaces* or the draft Assembly resolution on *Recommendations on calculating reduced gross tonnage for crew accommodation spaces*, as set out in annexes 1 and 2, respectively, to document SDC 2/11/2.

Completion of the work on the output

11.9 Taking the above decisions into account, the Sub-Committee invited the Committee to note that the work on the output had been completed.

12 GUIDELINES FOR USE OF FIBRE REINFORCED PLASTIC (FRP) WITHIN SHIP STRUCTURES

12.1 The Sub-Committee recalled that SDC 1, in order to progress the work on the matter intersessionally, established the Correspondence Group on Development of guidelines for use of Fibre Reinforced Plastic (FRP) within Ship Structures with terms of reference as set out in paragraph 11.8 of document SDC 1/26, and instructed it to submit a report to this session

Report of the correspondence group and related submission

12.2 The Sub-Committee considered the report of the correspondence group (SDC 2/12) and, having approved it in general, noted that the group had reached consensus on the use of regulation II-2/17 for approval of FRP composite structures on SOLAS ships. However, there were different opinions on the extent of applicability of this regulation. The majority of the group was of the opinion that any extent of FRP composite structures should be possible to approve through regulation II-2/17, if means are provided to maintain the safety of the ship in an alternative way. The Sub-Committee noted the opinion of the majority of the group that extended use of FRP composite structures should also be approved through regulation II-2/17, but had agreed that it may be useful to follow the procedures in the *Guidelines for the approval of alternatives and equivalents as provided for in various IMO instruments* (MSC.1/Circ.1455), in particular, for extended uses of FRP composite structures.

12.3 With regard to the draft guidelines to be used for assessment and testing of FRP structures, the Sub-Committee noted that the group had decided that general chapters should be moved to appendices, and the appendices should be referenced in the main part of the document, which summarizes the most important instructions for an assessment and provides a scrutiny of the regulations. In this connection, the first chapter of the draft guidelines has been rewritten in order to include a simplified introduction to the guidelines for non-specialists.

12.4 In this context, the Sub-Committee had for its consideration document SDC 2/12/1 (United States) commenting on the report of the correspondence group (SDC 2/12) and proposing that IACS and Administrations consider using the standard ASTM F3059 with regard to the fire resistance requirements for Fibre Reinforced Plastic (FRP) gratings used for safe access to tanker bows (resolution MSC.62(67)).

12.5 During the discussion, the Sub-Committee noted the following views expressed:

.1 FRP construction should not be accepted without further extensive review and evaluation by this and other sub-committees. The acceptance of combustible FRP construction for ships subject to SOLAS chapter II-2 has many far-reaching implications that must be fully considered before any decisions can be taken by the Organization;

.2 the acceptance of combustible FRP construction involves much more than just the fire safety and structural strength of the material. With the exception of type IIC and IIIC construction, the adoption of the 1974 SOLAS Convention and all subsequent amendments, as well as the 2010 FTP and FSS Codes, is based on the use of steel or equivalent construction. Any analysis of the use of FRP must consider the possible need for amending all of the provisions contained in these instruments;

.3 there are a number of concerns with the guidelines as currently drafted. One of the concerns is the lack of acceptance criteria in the draft guidelines. Acceptance criteria are always an issue when evaluating assessments. The draft guidelines do not provide assistance in this regard;

.4 further development of the guidelines is needed, and it is preferred to use the existing *Guidelines for the approval of alternatives and equivalents as provided for in various IMO instruments* (MSC.1/Circ.1455), as the basis for assessments at this stage;

.5 it is premature to finalize the draft guidelines at this stage, it could be finalized as an interim solution;

.6 FRP offers immense potential for the efficiency of shipping and will contribute significantly to reducing energy demand and GHG emissions in line with the policy goals of this Organization and its Member Governments;

.7 these innovative materials have already left the R&D stage and have been developed through full scale demonstration projects and trial periods to a high level of maturity verifying them being fit for purpose; and

.8 specific guidelines are needed in order to adequately define verification and testing in an unambiguous manner and allow homogeneous implementation worldwide.

12.6 In considering the above views in conjunction with the report of the correspondence group (SDC 2/12), the Sub-Committee:

.1 with regard to a review of SOLAS chapter II-2 in order to eliminate inconsistencies in the use of FRP composite, or the development of a unified interpretation as a short-term solution (SDC 2/12, paragraph 14), decided that this was outside of the scope of this output; and

.2 agreed that, at this stage, the working group should finalize the draft interim guidelines until experience is gained in its application.

Establishment of the Working Group on Fire Protection

12.7 In light of the above decisions, the Sub-Committee established the Working Group on Fire Protection and instructed it, taking into account the comments and decisions taken in plenary, to:

.1 finalize the draft *Interim guidelines for use of FRP elements within ship structures: Fire safety issues* and the associated MSC draft circular, based on the annex to document SDC 2/12, for consideration by the Sub-Committee, with a view to approval by MSC 95; and

.2 consider whether it is necessary to re-establish a correspondence group and, if so, prepare terms of reference for consideration by the Sub-Committee.

Report of the working group

12.8 Having considered the part of the report of the Working Group on Fire Protection (SDC 2/WP.5) dealing with the item, the Sub-Committee took action as outlined hereunder.

Draft *Interim guidelines for use of Fibre Reinforced Plastic (FRP) elements within ship structures: Fire safety issues*

12.9 The Sub-Committee agreed to the draft *Interim guidelines for use of Fibre Reinforced Plastic (FRP) elements within ship structures: Fire safety issues* and the associated draft MSC circular, as set out in annex 6, for submission to MSC 95 for approval. Subsequently, the Sub-Committee authorized the Secretariat to effect any minor editorial corrections that may be identified in the draft Interim guidelines.

12.10 In this connection, the Sub-Committee noted that, without prejudicing future decisions, the delegation of the United States reserved its position on the draft *Interim guidelines for use of Fibre Reinforced Plastic (FRP) elements within ship structures: Fire safety issues* and the associated draft MSC circular.

12.11 The Sub-Committee also noted that the delegation of Norway had expressed the opinion that the draft interim guidelines need to be further developed to include more solutions, limitations and acceptance criteria relating to the use of FRP. The draft Interim guidelines are limited to the identification of issues that should be considered and solved if Administrations find it viable that an alternative design process can commence, and should not replace the alternative design assessment required by SOLAS. The Sub-Committee further noted that this opinion was also supported by the delegations of Croatia and Italy.

Draft Unified interpretation of the Guidelines for safe access to tanker bows (resolution MSC.62(87))

12.12 The Sub-Committee, with a view to providing more specific guidance on the fire resistance requirements for Fibre Reinforce Plastic (FRP) gratings used for safe access to tanker bows, agreed to the draft unified interpretation of the *Guidelines for safe access to tanker bows* (resolution MSC.62(87)) and the associated draft MSC circular, as set out in annex 7, for submission to MSC 95 for approval.

Completion of the work on the output

12.13 Taking the above decisions into account, the Sub-Committee invited the Committee to note that the work on the output had been completed.

13 AMENDMENTS TO SOLAS CHAPTER II-2, THE FTP CODE AND MSC/CIRC.1120 TO CLARIFY THE REQUIREMENTS FOR PLASTIC PIPES ON SHIPS

General

13.1 The Sub-Committee recalled that SDC 1, having noted several general views expressed on technical matters and application issues, had agreed that further detailed consideration of the requirements for plastic pipes on ships was necessary and had invited Member Governments and international organizations to submit proposals to this session.

Proposed revisions to resolution A.753(18)

13.2 In light of the above, the Sub-Committee considered document SDC 2/13 (Denmark) presenting a proposal to revise the fire endurance requirements matrix in appendix 4 of the *Guidelines for the application of plastic pipes on ships* (resolution A.753(18)), in order to bring the matrix in line with the proposed amendments to the resolution.

13.3 During the discussion, the Sub-Committee noted the following views:

.1 there were concerns that the classification in just three groups of pipes (filled with flammable liquids, filled with non-flammable liquids, and dry pipes and ducts) does not reflect the importance of the different systems; therefore, it is recommended that a more detailed classification of pipes be used;

.2 the proposals for the modifications introduced by footnotes 11 and 13 of the fire endurance requirements matrix of appendix 4 of the guidelines cannot be supported. This would, to a large extent, eliminate the use of plastic pipes on ro-ro cargo decks and in accommodation areas (including open decks) on passenger ships, although the compelling need for such a drastic measure has not been fully demonstrated;

.3 the classification of pipes and the related functional requirements should be further considered in the working group, in order to reflect the different functions and importance of the systems; and

.4 there is a need for the clarification of SOLAS regulations II-2/5.3.2.4 and II-2/6.2 and the Fire Test Procedures Code, as interpreted by MSC/Circ.1120, as proposed initially in document MSC 88/23/8 (Canada, United Kingdom).

Instructions to the Working Group on Fire Protection

13.4 Having considered the above views, the Sub-Committee instructed the Working Group on Fire Protection established under agenda item 12 (see paragraph 12.6), taking into account comments and decisions made in plenary, to:

.1 finalize the draft amendments to the *Guidelines for the application of plastic pipes on ships* (resolution A.753(18)), as amended by resolution MSC.313(88), based on document SDC 2/13: and

.2 consider any inconsistencies that may have arisen with MSC/Circ.1120, taking into account document MSC 88/23/8.

Report of the working group

13.5 Having considered the relevant part of the report of the working group (SDC 2/WP.5), the Sub-Committee approved it in general and took action as described in the following paragraphs.

13.6 The Sub-Committee agreed to the draft amendments to the *Guidelines for the application of plastic pipes in ships* (resolution A.753(18)), as amended by resolution MSC.313(88), and the associated draft MSC resolution, as set out in annex 8, for submission to MSC 95 for adoption. In this context, the Sub-Committee authorized the Secretariat to identify minor editorial corrections in the *Guidelines for the application of plastic pipes in ships* and include them in the draft amendments prepared by the group.

13.7 In this connection, the Sub-Committee noted the view of the delegations of Canada, Denmark and Norway that the guidelines should, in the future, be made mandatory in order to ensure uniform application of plastic pipes in ships, particularly, since the use of plastic pipes in ships has increased in recent years.

Completion of the work on the output

13.8 Taking the above decisions into account, the Sub-Committee invited the Committee to note that the work on the output had been completed.

14 AMENDMENTS TO SOLAS AND FSS CODE TO MAKE EVACUATION ANALYSIS MANDATORY FOR NEW PASSENGER SHIPS AND REVIEW OF THE RECOMMENDATION ON EVACUATION ANALYSIS FOR NEW AND EXISTING PASSENGER SHIPS

General

14.1 The Sub-Committee recalled that MSC 92, having noted the outcome of the consideration by the Working Group on Passenger Ship Safety (MSC 92/WP.8/Rev.1) of documents MSC 92/6/2, MSC 92/6/4, MSC 92/6/10 and MSC.1/Circ.1238 related to evacuation analysis, agreed to instruct SDC 1 to consider the mandatory application of evacuation analysis to non-ro-ro passenger ships and advise MSC 93 accordingly.

14.2 The Sub-Committee also recalled that SDC 1, having considered the draft justification to expand the scope of this planned output, had invited Member Governments and international organizations to submit comments and proposals to this session.

14.3 The Sub-Committee noted that MSC 93, having considered document MSC 93/20/4 (France, Germany, Spain and CLIA) proposing to expand the existing output on "Review of the recommendations on evacuation analysis for new and existing passenger ships (5.1.1.3)" to include amendments to SOLAS regulation II-2/13 and chapter 13 of the FSS Code, to make mandatory the application of evacuation analysis to all types of passenger ships, had agreed to expand the scope of the output by replacing the existing title with "Amendments to SOLAS and FSS Code to make evacuation analysis mandatory for new passenger ships and review of the recommendation on evacuation analysis for new and existing passenger ships", and to include it in the biennial status report of the Sub-Committee and provisional agenda for SDC 2, with a target completion date of 2016. In this connection, the Committee confirmed that there should be no requirements for survey or certification associated with this work.

14.4 The Sub-Committee had for its consideration the following documents:

.1 SDC 2/14 (Japan) providing proposals on amendments to the "method to determine the travel time (T) by simulation tools for the advanced evacuation analysis" in the *Guidelines for an advanced evacuation analysis of new and existing passenger ships* (MSC.1/Circ.1238, annex 2, appendix);

.2 SDC 2/14/1 (Germany, Netherlands) proposing the amendment to the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, to make mandatory the application of evacuation analysis to all types of new passenger ships. The proposed amendments are based on the existing regulation for ro-ro passenger ships, as stated in SOLAS regulation II-2/13.7.4;

.3 SDC 2/14/2 (Germany, Netherlands) proposing items for the amendment of the *Guidelines on evacuation analyses for new and existing passenger ships* (MSC.1/Circ.1238) to cover all types of passenger ships; and

.4 SDC 2/INF.9 (Japan) introducing an outline of the recent research carried out by the National Maritime Research Institute (NMRI), as an example of research on evacuation analysis in conjunction with smoke movement simulation, taking into account walking speed decrease owing to smoke (visibility) and ship's list.

14.5 Having considered the above documents, and following discussion, the Sub-Committee noted the following views:

.1 there is a need for the *Guidelines for evacuation analysis for new and existing passenger ships* (MSC.1/Circ.1238) to be made a mandatory instrument for all passenger ships, not only ro-ro passenger ships;

.2 all capabilities (e.g. mobility and fitness) need to be considered during an evacuation analysis; and

.3 taking into account that the text of SOLAS regulation II-2/13 impacts other ships (e.g. special purpose vessels), the working group should consider ship types that may be impacted.

14.6 The Sub-Committee also noted the statement of the observer from IFSMA requesting that a full-scale realistic evacuation of the first ship of class be performed, as in other modes of transport. In the observer's opinion, simulation has its use, but its limitations have to be appreciated.

14.7 The Sub-Committee further noted that all the delegates who spoke supported, in general, the proposals contained in the documents submitted to this session and that they should be referred to the working group for detailed consideration. In this context, the preferred scope of application is for 36 passengers.

Instructions to the Working Group on Fire Protection

14.8 Having considered the above views, the Sub-Committee instructed the Working Group on Fire Protection, established under agenda item 12 (see paragraph 12.6), taking into account comments and decisions made in plenary, to:

.1 further consider the draft amendments to the *Guidelines for evacuation analysis for new and existing passenger ships* (MSC.1/Circ.1238), taking into account documents SDC 2/14, SDC 2/14/2 and SDC 2/INF.9;

.2 further consider the draft amendments to SOLAS regulation II-2/13, taking into account document SDC 2/14/1; and

.3 prepare SMART terms of reference for a correspondence group, based on paragraph 16 of document SDC 2/14/2, taking into account the progress made at this session.

Report of the working group

14.9 Having considered the relevant part of the report of the working group (SDC 2/WP.5), the Sub-Committee approved it in general and took action as described in the following paragraphs.

Application and purpose of evacuation analysis to various types of passenger ships and special-purpose ships

14.10 The Sub-Committee noted the group's discussion regarding the application and purpose of evacuation analysis to various types of passenger ships and special-purpose ships, as follows:

.1 the draft SOLAS amendments mandating evacuation analysis should apply to ro-ro passenger ships constructed on or after the date on which regulation II-2/13.7.4 applies, and other passenger ships carrying more than 36 passengers constructed on or after the date of entry into force of the amendments;

.2 evacuation analysis to be mandatory for special-purpose ships carrying more than 240 persons on board;

.3 with regard to the use of the term "passengers" in the *Guidelines for evacuation analysis for new and existing passenger ships* (MSC.1/Circ.1238) and "persons" in the SPS Code, the group was of the view that if there was a need to address inconsistencies between the Guidelines and the SPS Code, this would be better done through amendments to the SPS Code; and

.4 with regard to the proposed new SOLAS regulation II-2/13.3.2.7.4 on simulation of embarkation into LSA during the evacuation analysis, there was little support for including it as a SOLAS regulation and instead the group concluded that it would be more appropriate to try to include such additional requirements in the revised *Guidelines for evacuation analysis for new and existing passenger ships*.

Draft amendments to SOLAS regulation II-2/13

14.11 The Sub-Committee agreed to the draft amendments to SOLAS regulation II-2/13 on evacuation analysis, as set out in annex 9, for submission to MSC 95 for approval with a view to subsequent adoption.

14.12 In light of the above decision, the Sub-Committee noted that the group, taking into account the provisions in paragraphs 3.2.1.3.16.2, 3.2.1.3.18 and 3.2.1.3.19 of the *Guidance on drafting of amendments to the 1974 SOLAS Convention and related mandatory instruments* (MSC.1/Circ.1500), had completed part III of the check/monitoring sheet and records for regulatory development. In this connection, the Sub-Committee agreed to the check/monitoring sheet and records for regulatory development, as set out in appendixes 1 and 2 to annex 9, respectively, for submission to MSC 95 for approval in conjunction with the draft amendments to SOLAS regulation II-2/13.

Establishment of a correspondence group

14.13 Following discussion and taking into account the progress made at this session, the Sub-Committee agreed to establish a Correspondence Group on Evacuation Analysis, under the coordination of Germany,* and instructed it, taking into account documents MSC 93/22 (paragraph 20.11), MSC 93/20/4, SDC 1/26 (paragraph 13.5 and 13.6), SDC 1/13, SDC 2/14, SDC 2/14/2, SDC 2/INF.9, SDC 2/WP.5 (paragraphs 26 to 33) and the decisions taken at SDC 2, to:

.1 prepare draft amendments to the *Guidelines for evacuation analysis for new and existing passenger ships* (MSC.1/Circ.1238) to address mandatory application of evacuation analysis to passenger ships including a review of the defined scenarios;

.2 consider including in the *Guidelines for evacuation analysis for new and existing passenger ships* (MSC.1/Circ.1238) the need for operational procedures that support evacuation, as well as considering the results of the evacuation analysis to identify operational requirements during an evacuation;

.3 discuss and if deemed necessary prepare specific requirements for evacuation of open deck areas, as mentioned in document SDC 2/14/2 (paragraph 13);

.4 identify and consider additional evacuation scenarios together with the necessary requirements to be included in the draft amendments to the *Guidelines for evacuation analysis for new and existing passenger ships* (MSC.1/Circ.1238); and

.5 submit a written report to SDC 3.

* **Coordinator:**
Dr. Ing. Daniel Povel
Safety, Risk & System Engineering
DNV GL Maritime Advisory (DNV GL SE)
Brooktorkai 18
20457 Hamburg
Germany
Email: SDC2_CG_evacuation@dnvgl.com

15 INTERPRETATION OF SOLAS REGULATION II-2/13.6 ON MEANS OF ESCAPE FROM RO-RO CARGO SPACES

General

15.1 The Sub-Committee recalled that SDC 1, having noted general views on matters related to the interpretation of SOLAS regulation II-2/13.6 on means of escape from ro-ro cargo spaces, had agreed that more time was needed to consider the matter in detail and invited Member Governments and international organizations to submit comments and proposals to this session.

15.2 The Sub-Committee had for its consideration document SDC 2/15 (IACS) seeking clarification on the arrangement of a safe escape route from ro-ro spaces on cargo ships, as required by SOLAS regulation II-2/13.6, and providing the Sub-Committee with a proposal on how to proceed with this matter. In this context, the Sub-Committee noted that IACS remains of the opinion that Sweden's proposal for a "continuous fire shelter" (SDC 1/17/1) goes beyond that required by SOLAS regulation II-2/13.6 for ro-ro spaces on cargo ships, noting that a "continuous fire shelter" is explicitly required for special category spaces on ro-ro passenger ships as per SOLAS regulation II-2/13.5.

15.3 During the discussion, the Sub-Committee noted the following views:

.1 the matter presented in document SDC 2/15 is not an interpretation issue, but a need to amend the SOLAS Convention;

.2 with regard to paragraph 7 of document SDC 2/15, regulation II-2/13.6 states that there should be two safe means of escape, bearing in mind that the ro-ro spaces on cargo ships could be carrying dangerous goods and that, in regulation II-2/19, there is no requirement with regard to means of escape;

.3 in ro-ro spaces on cargo ships authorized for the carriage of dangerous goods, one of the means of escape should be protected from fire and, for those spaces where dangerous goods are not being carried, there would be no need for either of these means of escape to be protected from fire. It is possible that this may require an amendment to the regulation;

.4 there is no need to amend SOLAS; the proposal from Sweden at SDC 1 (SDC 1/17/1) and the proposal in paragraph 8 of document SDC 2/15 are acceptable; and

.5 safe escape is only used in SOLAS regulation II-2/13; therefore, instead of amending the regulation, an interpretation would be more appropriate.

15.4 In considering the above views, the Sub-Committee noted that there was support for developing an interpretation rather than a SOLAS amendment and that most of those who had spoken considered the proposal by IACS (SDC 2/15) to be acceptable; however, it needed to be further considered by a working group.

Instructions to the Working Group on Fire Protection

15.5 In light of the above views, the Sub-Committee instructed the Working Group on Fire Protection established under agenda item 12 (see paragraph 12.6), taking into account comments and decisions made in plenary and documents SDC 1/17, SDC 1/17/1, SDC 1/17/2 and SDC 2/15, to finalize the draft interpretation of SOLAS regulation II-2/13.6 on "Means of escape from ro-ro cargo spaces."

Report of the working group

15.6 Having considered the relevant part of the report of the working group (SDC 2/WP.5), the Sub-Committee approved it in general and, having noted the group's discussion regarding means of escape from ro-ro spaces (SDC 2/WP.5, paragraph 35 to 42), agreed to the draft unified interpretation of SOLAS regulation II-2/13.6 and the associated draft MSC circular, as set out in annex 10, for submission to MSC 95 for approval.

15.7 In light of the above decision, the Sub-Committee noted that the delegation of the United Kingdom had expressed concerns about the draft unified interpretation prepared by the group. The full text of their statement is set out in annex 22.

16 REVIEW OF CONDITIONS UNDER WHICH PASSENGER SHIP WATERTIGHT DOORS MAY BE OPENED DURING NAVIGATION AND DEVELOPMENT OF AMENDMENTS TO SOLAS REGULATION II-1/22 AND MSC.1/CIRC.1380

General

16.1 The Sub-Committee recalled that MSC 92, having considered the report of the Working Group on Passenger Ship Safety (MSC 92/WP.8/Rev.1) and document MSC 92/23/2 (Norway, Spain, United Kingdom and United States), had decided to include, in the 2014-2015 biennial agenda of the SDC Sub-Committee, an output on "Review of conditions under which passenger ship watertight doors may be opened during navigation and development of amendments to SOLAS regulation II-1/22 and MSC.1/Circ.1380", with a target completion year of 2015.

16.2 The Sub-Committee also recalled that MSC 93 had instructed SDC 2 to include items on "Open watertight doors" and "Monitoring and assessing risk from operation of watertight doors" under this output, taking into account the watertight door aspects in document MSC 93/6/8.

16.3 The Sub-Committee further recalled that, owing to time constraints, SDC 1 could not consider this matter and had invited Member Governments and international organizations to submit comments and proposals to SDC 2.

Proposed amendments to SOLAS regulation II-1/22 and MSC.1/Circ.1380

16.4 The Sub-Committee had for its consideration document SDC 2/16 (Canada, United States) proposing revisions to SOLAS regulation II-1/22 and the related *Guidance for watertight doors on passenger ships which may be opened during navigation* (MSC.1/Circ.1380). It was noted that the revisions are intended to ensure that requirements that govern when watertight doors may be opened during navigation do not inadvertently provide a weak link in the required damage stability survivability of passenger ships. It was also noted that it was envisioned that the proposed revision to SOLAS regulation II-1/22 would be incorporated into the comprehensive package of amendments to the SOLAS chapter II-1 subdivision and damage stability regulations that is being developed under agenda item 3, which will apply to new passenger ships only.

16.5 Following an in-depth discussion, the Sub-Committee, having noted that there was overwhelming support for the proposed amendments to SOLAS regulation II-1/22 set out in document SDC 2/16, agreed to include the aforementioned amendments in the package of amendments to SOLAS chapter II-1 on subdivision and damage stability regulations. Subsequently, the Sub-Committee agreed to the draft amendment to SOLAS regulation II-1/22, as set out in annex 1, for submission to MSC 95 for approval and subsequent adoption (see paragraph 3.28).

16.6 With regard to the *Guidance for watertight doors on passenger ships which may be opened during navigation* (MSC.1/Circ.1380), the Sub-Committee, having noted the following views:

.1 that the proposal contained in document SDC 2/16 is for new passenger ships and, because MSC.1/Circ.1380 applies to new and existing ships, revising the latter would have unintended consequences to existing ships;

.2 taking into account that MSC.1/Circ.1380 took five years to develop, a thorough revision would be required by the Sub-Committee and there are currently no concrete proposals on this matter; and

.3 MSC.1/Circ.1380 need not be amended and could continue to be applied to existing ships,

agreed to the draft MSC circular on revised *Guidance for watertight doors on passenger ships which may be opened during navigation*, as set out in annex 11, for submission to MSC 95 for approval in conjunction with the associated draft amendments to SOLAS regulation II-1/22. In this connection, the Sub-Committee agreed that the application date of the guidance is the date of entry into force of the aforementioned amendments. Subsequently, the Sub-Committee agreed that no further revision was necessary to MSC.1/Circ.1380.

16.7 Subsequently, the Sub-Committee noted that, despite what it considered to be much improved provisions applying to new ships, the delegation of the United Kingdom, supported by the delegation of Norway, stated that its outstanding concerns with the original *Guidance for watertight doors on passenger ships which may be opened during navigation* (MSC.1/Circ.1380) could not be addressed and its concerns remained.

Completion of the work on the output

16.8 Taking the above decisions into account, the Sub-Committee invited the Committee to note that the work on the output had been completed.

17 AMENDMENTS TO SOLAS CHAPTER II-1 AND ASSOCIATED GUIDELINES ON DAMAGE CONTROL DRILLS FOR PASSENGER SHIPS

17.1 The Sub-Committee recalled that MSC 93, following consideration of the recommendations of the Working Group on Passenger Ship Safety (MSC 93/WP.6), had agreed to include in the biennial status report of the SDC Sub-Committee and the provisional agenda of SDC 2 a new unplanned output on "Amendments to SOLAS chapter II-1 and associated guidelines on damage control drills for passenger ships", with a target completion year of 2016, in association with the HTW Sub-Committee as and when requested by the Sub-Committee.

17.2 The Sub-Committee decided to consider document SDC 2/17 (RINA) document under agenda item 3 (see paragraph 3.15).

17.3 The Sub-Committee had for its consideration document SDC 2/17/1 (United States) proposing a new SOLAS regulation II-1/19-1 to require monthly damage control drills on passenger ships. The delegation was of the opinion that this new requirement does not fit neatly into any existing regulations in SOLAS chapter II-1, part B-4, but, as damage control drills are closely related to the requirements for damage control information in regulation II-1/19, a new regulation II-1/19-1 was considered an appropriate location. In this context, the Sub-Committee noted that, in the view of the delegation of the United States, the proposed new regulation will need guidelines to help ensure uniform implementation of the required damage control drills.

Instructions to the SDS Working Group

17.4 Following discussion, and noting the views that further consideration of frequency and harmonization of drills was necessary, the Sub-Committee instructed the SDS Working Group established under agenda item 3 to further consider the draft amendments to SOLAS chapter II-1 and associated guidelines on damage control drills for passenger ships, taking into account the comments made and decisions taken in plenary and document SDC 2/17/1, and advise the Sub-Committee accordingly.

Report of the working group

17.5 Having considered the relevant part of the report of the SDS Working Group (SDC 2/WP.3), the Sub-Committee approved it in general and took action as described hereunder.

17.6 The Sub-Committee noted that the group had briefly considered the proposal in document SDC 2/17/1 (United States) regarding damage control drills for passenger ships. However, the group concluded that further consideration was necessary regarding drill frequency, the alignment with other testing requirements (e.g. SOLAS regulation II-1/21), a definition for damage control station, etc. Therefore, the group decided to include this item in the terms of reference for a correspondence group.

Instructions to the SDS Correspondence Group

17.7 Subsequently, the Sub-Committee instructed the SDS Correspondence Group established under agenda item 3 (see paragraph 3.34) to develop the draft amendments to SOLAS chapter II-1 and associated guidelines on damage control drills for passenger ships, taking into account the document SDC 2/17/1 and the recommendation in part 1 of the report of the SDS Working Group at SDC 2 (SDC 2/WP.3, paragraph 5.6).

18 GUIDELINES FOR WING-IN-GROUND CRAFT

General

18.1 The Sub-Committee recalled that SDC 1, having noted a general summary provided by the Republic of Korea on a WIG craft accident that occurred in 2012 and the views expressed regarding the scope of application of the Interim guidelines and the need to further amend them with a view to developing well-founded requirements and safety measures, had requested the Secretariat to prepare a consolidated text of the guidelines with the proposed amendments contained in documents DE 56/18, DE 57/14, SDC 1/20, SDC 1/20/1 and SDC 1/20/2, for further consideration at SDC 2.

18.2 The Sub-Committee also recalled that SDC 1 had invited Member Governments and international organizations to submit comments and proposals on the aforementioned consolidated text to SDC 2.

Consideration of the consolidated text

18.3 The Sub-Committee had for its consideration the following documents:

.1 SDC 2/18 (Secretariat) containing the consolidated text of the *Guidelines for wing-in-ground (WIG) craft* with the proposed amendments contained in documents DE 56/18, DE 57/14, SDC 1/20, SDC 1/20/1 and SDC 1/20/2;

.2 SDC 2/18/1 (France) containing proposals on the drafting of final guidelines for wing-in-ground (WIG) craft and reaffirming the intention for the Interim guidelines to be developed further to incorporate certain essential aeronautical knowledge, so as to enhance the safety of the goods and persons carried on board WIG craft;

.3 SDC 2/18/2 (China) proposing amendments to the *Interim guidelines for wing-in-ground (WIG) craft* (MSC/Circ.1054) based on China's theoretical research and model test; and

.4 SDC 2/18/3 (Russian Federation) providing comments and proposals on the consolidated text of the *Interim guidelines for wing-in-ground (WIG) craft* (MSC.1/Circ.1054 and Corr.1) prepared by the Secretariat (SDC 2/18).

18.4 Following consideration, the Sub-Committee noted the views that there are still many issues to be considered, for example the scope of application of the draft guidelines, and that it would be necessary for a correspondence group to be established to further progress the draft consolidated text of the *Guidelines for wing-in-ground (WIG) craft* (SDC 2/18), taking into account the latest proposals contained in the aforementioned documents (see paragraph 18.3).

Establishment of a correspondence group

18.5 In order to make further progress on this output intersessionally, the Sub-Committee agreed to establish a Correspondence Group on Wing-in-Ground Craft, under the coordination of China*, and instructed it, taking into account comments made and decisions taken at SDC 2, to:

.1 consider the scope of application of the draft *Guidelines for wing-in-ground (WIG) craft*;

.2 finalize the draft *Guidelines for wing-in-ground (WIG) craft* based on document SDC 2/18, taking into documents DE 56/25 (annex 25), SDC 2/18/1, SDC 2/18/2 and SDC 2/18/3; and

.3 submit a report to SDC 3.

19 REVIEW OF GENERAL CARGO SHIP SAFETY

General

19.1 The Sub-Committee recalled that SDC 1, following discussion on the proposal to establish an extended survey system for general cargo ships and to strengthen the maintenance responsibilities for ship machinery in the context of the SMS and ship survey requirements, had noted the views expressed regarding the application of the IACS UR Z7, the positive outcome of a relative cost benefit assessment carried out by IACS and the possibility of administrative and economic burdens caused by extending the survey system.

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* **Coordinator:**
Mr. Da Bin Sun
Director of Ship Supervision Department
Maritime Safety Administration of China
No. 238 Zhong Yang Road
Nanjing, China
Code: 210009
Tel: + 86 25 83520193
Mob: + 86 18801581918
Email: sundabin@msa.gov.cn

19.2 The Sub-Committee also recalled that SDC 1, having agreed that more time was needed to consider the matter in detail, had invited Member Governments and international organizations to submit comments and proposals to SDC 2.

19.3 Having noted that no documents were submitted to DE 57, SDC 1 and SDC 2 on this output and following discussion, the Sub-Committee noted that this work is part of a comprehensive work of the Committee on general cargo ship safety. Notwithstanding the above, the Sub-Committee, having recalled paragraph 5.12 of the *Guidelines on the organization and method of work of the Maritime Safety Committee and the Marine Environment Protection Committee and their subsidiary bodies* (MSC-MEPC.1/Circ.4/Rev.3), agreed that there was insufficient information to continue the work on this output.

Completion of the work on the output

19.4 Taking the above decision into account, the Sub-Committee invited the Committee to note that the work on the output had been completed.

20 AMENDMENTS TO THE 2011 ESP CODE

General

20.1 The Sub-Committee recalled that SDC 1 had agreed to draft amendments to the 2011 ESP Code, as set out in annex 5 to document SDC 1/26, prepared by IACS in order to deal with updates to the IACS UR Z10 series. Subsequently, the aforementioned draft amendments had been approved by MSC 93 and adopted by MSC 94 by resolution MSC.381(94).

Proposed amendments to the 2011 ESP Code

20.2 The Sub-Committee had the following documents for its consideration:

.1 SDC 2/20 (IACS) containing proposed amendments to the 2011 ESP Code, which takes into account the procedure agreed at DE 57, and endorsed by MSC 92, in order to deal with updates to the IACS UR Z10 series. It was noted that no proposals were made at that time to amend any of the annexes to annex A, parts A and B, or annex B, parts A and B, to the Code; and

.2 SDC 2/INF.2 (IACS) providing in its annex a "track changes" version of the 2011 ESP Code, as per the agreed procedure at DE 57, showing proposed updates to the Code to provide alignment with the IACS UR Z10 series.

20.3 In considering the list of the proposed amendments set out in paragraph 4 of document SDC 2/20, the Sub-Committee:

.1 concurred with the insertion of the reference to the *Revised recommendations for entering enclosed spaces aboard ships* (resolution A.1050(27)) in annex A, parts A and B, paragraph 5.2.2;

.2 concurred with the deletion of paragraphs 5.2.9 and 5.2.10, following the updating of paragraph 5.2.2 (see subparagraph .1 above), in annex A, parts A and B, except for the first sentence, which should be retained. The reason for the partial deletion is that these paragraphs are contained in the revised recommendations (resolution A.1050(27)), except for the first sentence;

.3 concurred with the insertion of the reference to the *Revised recommendations for entering enclosed spaces aboard ships* (resolution A.1050(27)) in annex B, parts A and B, paragraph 5.2.1.1;

.4 concurred with the deletion of paragraphs 5.2.6 and 5.2.7, following the updating of paragraph 5.2.1.1 (see subparagraph .3 above), in annex B, parts A and B, except for the first sentence, which should be retained; and

.5 noted that IACS had withdrawn the proposal for consequential editorial update in annexes A and B, parts A and B, paragraph 5.6.7, as this issue had already been addressed by the Secretariat.

20.4 Subsequently, the Sub-Committee agreed to the draft amendments to the 2011 ESP Code, as set out in annex 12, for submission to MSC 95 for approval, with a view to adoption.

21 UNIFIED INTERPRETATION TO PROVISIONS OF IMO SAFETY, SECURITY, AND ENVIRONMENT-RELATED CONVENTIONS

General

21.1 The Sub-Committee recalled that this was a continuous item on its biennial agenda, established by MSC 78, so that IACS could submit any newly developed or updated unified interpretations for the consideration of the Sub-Committee with a view to developing appropriate IMO interpretations, if deemed necessary.

Application of SOLAS regulation II-1/3-6, as amended, and the revised Technical Provisions on means of access for inspections

21.2 The Sub-Committee considered document SDC 2/21 (IACS), which provides in its annex a copy of the latest version of IACS UI SC191 relating to the application of SOLAS regulation II-1/3-6, as amended, and the revised Technical Provisions on means of access for inspections.

21.3 In this connection, in considering the actions requested set out in paragraph 9 of document SDC 2/21, the Sub-Committee:

.1 noted the latest substantive updates to IACS UI SC191;

.2 noted that the footnote to paragraph 3.1 of SOLAS regulation II-1/3-6, referring to the *Revised recommendations for entering enclosed spaces aboard ships*, adopted by the Organization by resolution A.1050(27), has already been updated by the Secretariat in the SOLAS Consolidated Edition 2014;

.3 noted that the latest version of IACS UI SC191 has been updated to refer to the 2011 ESP Code (resolution A.1049(27)), as amended, rather than resolution A.744(18);

.4 agreed to the proposal that these updates and editorial changes should be considered with a view to updating MSC.1/Circ.1464/Rev.1 (and Corr.1);

.5 noted that, while conducting the latest review of the provisions relating to SOLAS regulation II-1/3-6, as amended, and the revised Technical Provisions on means of access for inspections, it has come to the attention of IACS that both IACS UI SC191 and MSC.1/Circ.1464/Rev.1 include several references to MSC/Circ.686. In this context, the observer from IACS was of the view that it may be appropriate to review the *Guidelines on the means of access to structures for inspection and maintenance of oil tankers and bulk carriers* (MSC/Circ.686), approved by MSC 65 in May 1995, in particular considering the 2011 ESP Code (resolution A.1049(27)), as amended; and

.6 noted that IACS members will uniformly implement the amendments to IACS UI SC191, as detailed in the annex to the document, on ships contracted for construction from 1 July 2015, unless they are provided with written instruction to apply a different interpretation by the Administration on whose behalf they are authorized to act as a Recognized Organization (RO).

21.4 In considering matters related to the possible need for the revision of *Guidelines on the means of access to structures for inspection and maintenance of oil tankers and bulk carriers* (MSC/Circ.686), the Sub-Committee, having noted the views that this matter needs further consideration in order to clarify if there was a need for a new output, requested the Secretariat to prepare a proposal for submission to SDC 3.

21.5 Following consideration, the Sub-Committee agreed to the draft MSC circular on Amendments to MSC.1/Circ.1464/Rev.1 (SDC 2/WP.7, annex 1), as set out in annex 13, for submission to MSC 95 for approval. In addition, the Sub-Committee requested the Secretariat to update the footnote in SOLAS regulation II-1/3-6.3.1 by replacing "resolution A.864(20)" with "resolution A.1050(27)", to take into account that resolution A.864(20) has been revoked.

Continuous hatchways (regulation 36(6) of the Protocol of 1988 relating to the International Convention on Load Lines, 1966)

21.6 In considering document SDC 2/21/1 (IACS), providing in its annex a copy of IACS UI LL79 on "continuous hatchways" in terms of regulation 36(6) of the Protocol of 1988 relating to the International Convention on Load Lines, 1966, the Sub-Committee agreed to the draft unified interpretations on regulation 36(6) of the Protocol of 1988 relating to the International Convention on Load Lines, 1966, and the associated draft MSC circular (SDC 2/WP.7, annex 2), as set out in annex 14, for submission to MSC 95 for approval.

Clarifications to the Code on Noise Levels on Board Ships

21.7 The Sub-Committee, further to the discussions at SDC 1 (SDC 1/26, paragraphs 21.8 to 21.10), considered document SDC 2/21/2 (IACS) providing draft unified interpretations relating to the Code on Noise Levels on Board Ships, as adopted by resolution MSC.337(91), which took effect on 1 July 2014, in order to facilitate global and unified implementation of the Code. In this connection, the Sub-Committee agreed to the draft *Unified interpretations of the Code on Noise Levels on Board Ships* (resolution MSC.337(91)), and the associated draft MSC circular (SDC 2/WP.7, annex 3), as set out in annex 15, for submission to MSC 95 for approval.

21.8 Notwithstanding the above decision, the Sub-Committee noted the following views from the delegation of Sweden:

.1 With regard to the proposed interpretation for chapter 1, paragraph 1.3.8 of the Code, the delegation of Sweden is of the opinion that passenger spaces that are also occupied by off-duty crew members, such as recreation rooms and open recreation areas (e.g. discos and casinos), are considered to be "other passenger spaces" to which the Code does not apply. However, if the passenger spaces are work areas for the crew, at the minimum the occupational exposure limits in chapter 5, paragraph 1.1 of the Code should apply. Therefore, the interpretation should be amended to clarify this; and

.2 With regard to the proposed interpretation for chapter 3, paragraphs 3.3.5 and 3.3.6, the delegation of Sweden proposed the deletion of the last part of these two interpretations stating "unless they are designed to be kept closed in the normal operating condition". The delegation is of the opinion that it may be difficult to evaluate during a survey which air conditioning vents are designed to be kept closed. Furthermore, any of the systems may be designed to be closed during normal operation.

Means of escape from machinery control rooms and main workshops

21.9 The Sub-Committee had for its consideration document SDC 2/21/3 (Liberia, IACS) discussing arrangements with respect to spaces where insulation would be adversely affected by contact with accumulated or condensed water, with a view to amending *Unified interpretations of SOLAS chapter II-2, the FSS Code, the FTP Code and related fire test procedures* (MSC/Circ.1120).

21.10 Following consideration, the Sub-Committee noted that the interpretation to SOLAS regulation II-2/9.3.3 contained in MSC/Circ.1120 applies to both steel and aluminium construction. In an effort to understand the reason for the lining and gutterbar in figure 3, the figure was traced back to a correspondence group report (FP 39/6/6). Unfortunately, there was no clarifying information. However, the Sub-Committee also noted that the lining and the gutterbar provide some protection to the 100 mm of the exposed bulkhead. This protection may be critical to the structural integrity for aluminium construction, and it would be preferred that the proposal be limited to steel construction, where the only concern is the transmission of heat.

21.11 Notwithstanding the above, the Sub-Committee agreed to the draft amendment to *Unified interpretations of SOLAS chapter II-2, the FSS Code, the FTP Code and related fire test procedures* (MSC/Circ.1120) and the associated draft MSC circular (SDC 2/WP.7, annex 4), as set out in annex 16, for submission to MSC 95 for approval.

Means of escape from machinery spaces on passenger ships

21.12 In considering document SDC 2/21/4 (IACS) providing in its annex a set of draft unified interpretations on the means of escape from machinery spaces on passenger ships, as required by SOLAS regulation II-2/13.4.1, the Sub-Committee noted that, since 2010, IACS has identified a number of areas within the requirements relating to the means of escape in machinery spaces on passenger ships for which it is considered that interpretations or clarifications of several vague expressions would be of benefit so as to facilitate consistent and global implementation of these requirements, which have a significant impact on ship design and construction from an early stage. In this regard IACS had established a project team that worked between 2013 and 2014 to develop unified interpretations on selected topics.

21.13 In this connection, the Sub-Committee noted the following views:

.1 with regard to figure 1, which shows a cross-section of the access to a hatch and a ladder, there was support for the explanation that the ladder is contained within the 800 mm diameter, always providing that at least 600 mm is left in front of the ladder, since that is the recommended access for enclosed space entry with the possibility of carrying an SCBA. In this regard, IACS was requested to modify the figure to explicitly show the 600 mm dimension in its diagram; and

.2 paragraph 6 of the document, which aims to allow the ladder in the escape trunk to be included in the free area of 800 mm by 800 mm, could not be accepted. Experience on board ships shows, in particular, that for persons of more than average height it is difficult to climb ladders in confined spaces. In order to allow a safe and swift escape from the engine room, a free area in the escape trunk of 800 mm by 800 mm is absolutely necessary. Inclusion of the ladder to a certain undefined extent may seriously obstruct the escape routes. Moreover, when the escape trunk needs to be entered by persons wearing breathing apparatus, a free area of at least 800 mm by 800 mm is absolutely necessary.

21.14 Following discussion and considering the above-mentioned views, the Sub-Committee agreed to the draft unified interpretations of SOLAS regulations II-2/9 and II-2/13 and the associated draft MSC circular (SDC 2/WP.7, annex 5), as set out in annex 17, for submission to MSC 95 for approval.

Means of escape from machinery spaces on cargo ships

21.15 The Sub-Committee considered document SDC 2/21/5 (IACS) providing in its annex a set of draft unified interpretations on means of escape from machinery spaces on cargo ships, as required by SOLAS regulation II-2/13.4.2, and agreed to draft unified interpretations of SOLAS regulations II-2/9 and II-2/13 (see also paragraphs 21.13 and 21.14) and the associated draft MSC circular (SDC 2/WP.7, annex 5), as set out in annex 17, for submission to MSC 95 for approval.

Means of escape from accommodation spaces, service spaces and control stations on cargo ships

21.16 The Sub-Committee considered document SDC 2/21/6 (IACS) providing a draft unified interpretation on means of escape from accommodation spaces, service spaces and control stations on cargo ships, as required by SOLAS regulation II-2/13.3.3, and agreed to draft Unified interpretations of SOLAS regulations II-2/9 and II-2/13 and associated draft MSC circular (SDC 2/WP.7, annex 5), as set out in annex 17, for submission to MSC 95 for approval.

Interpretation of SOLAS regulation II-2/9.7.3.2 on ventilation ducts in "B" class divisions

21.17 The Sub-Committee had for its consideration document SDC 2/21/7 (IACS) seeking clarification regarding SOLAS regulation II-2/9.7.3.2 in relation to the wall thickness and insulation of ventilation ducts when passing through "B" class divisions on ships carrying not more than 36 passengers. In this connection, the Sub-Committee noted that the interpretation of SOLAS regulation II-2/9.2.2.2.2.1 in *Unified interpretations of SOLAS chapter II-2, the FSS Code, the FTP Code and related fire test procedures* (MSC/Circ.1120) provides guidance on the construction of "B-0" class bulkhead extensions and indicates that they may be made of 1 mm thickness steel plates.

21.18 During the discussion, the Sub-Committee noted the following views:

.1 the minimum thickness of 1 mm for sleeves is the only part of the proposed interpretation that could be accepted;

.2 with regard to insulating the ventilation duct or sleeve when passing through a B-15 class division, it is observed that SOLAS regulation II-2/9.7.3.2 makes no mention of insulating for B-class or maintaining the fire class of the division;

.3 it is also observed that regulation II-2/9.7.3.1 does require insulation of the duct or the sleeve for A-class. Thus, the proposed requirement for insulation when passing through a B-15 division is beyond what is required in SOLAS; and

.4 with regard to applying the requirements to ventilation ducts with a cross-sectional area of 0.02 m^2 or less, regulation II-2/9.7.3.2 states that the requirement is only for ventilation ducts exceeding 0.02 m^2. Thus, extending the requirement to smaller ducts could be considered to be a new requirement beyond what is required in SOLAS.

21.19 Having considered the above-mentioned views, the Sub-Committee could not agree to the proposed unified interpretation contained in document SDC 2/21/7.

Means of escape from machinery control rooms and main workshops

21.20 The Sub-Committee recalled that, having considered document SDC 1/21/2 (IACS), which sought clarification on the implementation of the draft amendments to SOLAS regulation II-2/13 approved by MSC 92, especially relating to the terms "a continuous fire shelter" and "main workshop", SDC 1 had endorsed the views of the Bahamas (SDC 1/26, paragraph 21.5) and subsequently invited IACS to submit a finalized unified interpretation on the matter.

21.21 In light of the above, the Sub-Committee considered document SDC 2/21/8 (IACS), providing a draft unified interpretation on "Means of escape from machinery control rooms and main workshops" as required by the amended SOLAS regulation II-2/13, adopted by resolution MSC.365(93), which is expected to enter into force on 1 January 2016.

21.22 In the context of the above, the Sub-Committee noted:

.1 the concerns expressed with regard to figures 3 and 4, which propose, as an example, an escape from the machinery control room through the main workshop, which does not have fire integrity and which could be gratings that do not, therefore, provide continuous fire shelter within the machinery space. In this context, such a space with gratings cannot be considered an escape;

.2 with regard to the provision of an escape route through a workshop, taking into account that fixed machine tools and work benches may well be located in this space, it is necessary to specify that the route passing through this space must be at least 600 mm wide. Such a route should be kept clear of obstructions at all times; and

.3 the last footnote of the annex to document SDC 2/21/8 does not seem to be appropriate. In spite of the fact that the aforementioned footnote is based on SOLAS provisions (regulation II-2/9) as far as the control rooms for

propulsion machinery spaces are concerned and that fire integrity of their boundaries is not required, it is not a safe provision for such spaces, even more so bearing in mind that escape routes are required to be provided from such spaces and that they undoubtedly constitute a first screen of safety in machinery spaces.

21.23 Having considered the above-mentioned views, the Sub-Committee agreed to the draft unified interpretations of SOLAS regulations II-2/9 and II-2/13 and the associated draft MSC circular (SDC 2/WP.7, annex 5) set out in annex 17, for submission to MSC 95 for approval.

Fire integrity of the boundaries of ro-ro/vehicle spaces on passenger and cargo ships

21.24 The Sub-Committee recalled that, having considered document SDC 1/21/4 (IACS), which sought clarification on the implementation of SOLAS regulation II-2/9 adopted by resolution MSC.338(91), especially the fire integrity of fittings or equipment that are fitted on the relevant decks and bulkheads (such as hatches, external access doors and movable ramps), SDC 1 had invited IACS to submit unified interpretations on the matter to SDC 2, taking into account the comments made at that session (SDC 1/26, paragraphs 21.11 and 21.12).

21.25 In light of the above, the Sub-Committee considered document SDC 2/21/9 (IACS) providing draft unified interpretations on the fire integrity of boundaries of ro-ro/vehicle spaces as required by the version of SOLAS regulation II-2/9 (resolution MSC.338(91)), which entered into force on 1 July 2014.

21.26 In the context of the above, the Sub-Committee noted that one delegation could not support interpretations 2, 3 and 5 of the annex to document SDC 2/21/9. However, all those that spoke could not support interpretation 5 alone regarding ducts to be insulated to A-30, unless the sleeves and fire damper, according to SOLAS regulation II-2/9.7.3.1, are installed. Insulating to A-30 does not address any openings into the ducts and any means of preventing communication between spaces. Thus, the wording can be used to justify a duct serving several spaces being provided only with insulation and no fire dampers. Additional wording needs to be added about the ducting passing through the space, but not serving the space. Such wording is similar to that of SOLAS regulation II-2/9.7.3.1.2.

21.27 Having considered the above-mentioned views, the Sub-Committee agreed to the draft "Unified Interpretations on the fire integrity of boundaries of ro-ro/vehicle spaces", except for paragraph 5, which is in square brackets, and to the associated draft MSC circular, as set out in annex 17, for submission to MSC 95 for approval. Subsequently, the Sub-Committee invited IACS to submit comments to MSC 95 on this matter.

Outstanding issue from DE 56 and DE 57

21.28 The Sub-Committee noted the outstanding issue from DE 56 and DE 57 brought to the attention of the Sub-Committee by the observer from IACS. In this context, DE 56 had considered document DE 56/13/2 (IACS) providing in its annex a copy of revision 1 to IACS Unified Interpretation SC 227, which relates to SOLAS regulation II-1/3-2 on dedicated seawater ballast tanks. In this connection, the original version of UI 227 had been considered at DE 52 without any further action being taken. Subsequently, DE 56 had agreed to a draft MSC circular on "Unified interpretation of SOLAS regulation II-1/3-2" for submission to MSC 90 for approval. However, following concerns expressed by several delegations and observers, MSC 90 did not approve this draft MSC circular and requested DE 57 to reconsider it.

21.29 The Sub-Committee noted that DE 57 had agreed to consider this matter further at DE 58. However, the issue was not discussed at SDC 1. In this context, the observer from IACS advised the Sub-Committee that IACS intends to submit a document to SDC 3 on this issue. The Sub-Committee invited interested delegations to contact IACS in the intersessional period, prior to SDC 3, with specific comments and proposals regarding the text of the draft MSC circular that was referred to DE 57 from MSC 90 (MSC 90/28, paragraph 9.38).

22 BIENNIAL AGENDA AND PROVISIONAL AGENDA FOR SDC 3

Outcome of MSC 94

22.1 In considering matters related to the biennial agenda and provisional agenda, the Sub-Committee recalled that MSC 94 (SDC 2/2/1) had agreed to include a new output in the post-biennial agenda of the Committee on "Computerized stability support for the master in case of flooding for existing passenger ships", assigning the SDC Sub-Committee as the coordinating organ, with a view to including provisions in SOLAS chapter II-1 for ships constructed before 1 January 2014.

22.2 The Sub-Committee also recalled that MSC 94, in preparation for the High-level Action Plan for the 2016-2017 biennium, had instructed the sub-committees to prepare their proposed biennial agendas for the coming biennium at their forthcoming sessions, for consideration at MSC 95, requesting the Secretariat to assist them in the usual manner.

Biennial status report and proposed biennial agenda for the 2016-2017 biennium

22.3 Taking into account the progress made at the session, the Sub-Committee prepared the biennial status report (SDC 2/WP.2, annex 1) and the proposed biennial agenda for the 2016-2017 biennium (SDC 2/WP.2, annex 2), as set out in annexes 18 and 19, respectively, for consideration and action, as appropriate, by MSC 95.

Proposed provisional agenda for SDC 3

22.4 Taking into account the progress made at the session, the Sub-Committee prepared the proposed provisional agenda for SDC 3 (SDC 2/WP.2, annex 3), as set out in annex 20, for consideration by MSC 95.

Correspondence groups established at the session

22.5 The Sub-Committee established correspondence groups on the following subjects, due to report to SDC 3:

.1 subdivision and damage stability (see paragraph 3.34);

.2 intact stability (see paragraph 5.15);

.3 classification of offshore industry vessels and a review of the need for a non-mandatory code for offshore construction support vessels (see paragraph 9.8);

.4 fire protection (see paragraph 14.13); and

.5 guidelines for wing-in-ground craft (see paragraph 18.5).

Arrangements for the next session

22.6 The Sub-Committee agreed to establish at its next session working and/or drafting groups on the following subjects:

.1 subdivision and damage stability (agenda items 3, 4 and 17);

.2 intact stability (agenda items 5 and 7);

.3 fire protection (agenda item 14);

.4 classification of offshore industry vessels and review of the need for a non-mandatory code for offshore construction support vessels (agenda item 9); and

5 *Guidelines for wing-in-ground craft* (agenda item 18),

whereby the Chairman, taking into account the submissions received on the respective subjects, would advise the Sub-Committee before SDC 3 on the final selection of such groups.

Date of the next session

22.7 The Sub-Committee noted that the third session of the Sub-Committee has been tentatively scheduled to take place from 18 to 22 January 2016.

23 ELECTION OF CHAIRMAN AND VICE-CHAIRMAN FOR 2016

23.1 In accordance with the Rules of Procedure of the Maritime Safety Committee, the Sub-Committee unanimously elected Mr. Kevin Hunter (United Kingdom) as Chairman and Mrs. Turid Stemre (Norway) as Vice-Chairman, both for 2016.

Expression of appreciation

23.2 The Sub-Committee expressed its sincere thanks and appreciation to Mrs. Anneliese Jost of Germany for her excellent services to the DE Sub-Committee over many years and, in particular, during the last two years when she served this Sub-Committee as its Chairman.

23.3 Subsequently, the Sub-Committee also expressed its sincere thanks and appreciation to Mr. Nigel Campbell of South Africa for his excellent services to the SLF Sub-Committee over many years and, in particular, during the last two years when he served this Sub-Committee as its Vice-Chairman.

24 ANY OTHER BUSINESS

Development of the OSV Chemical Code

24.1 In considering document SDC 2/24 (Secretariat) reporting on the outcome of PPR 1 and PPR 2 concerning the development of the OSV Chemical Code, the Sub-Committee noted that:

.1 PPR 1, having approved the report of the Working Group on the Development of the OSV Chemical Code, had agreed to refer the draft text of chapter 2 on ship survival capability and location of cargo tanks, and chapter 5 on cargo transfer, to the Sub-Committee for consideration (SDC 2/24, annexes 1 and 2, respectively);

.2 PPR 1 had also requested the Sub-Committee to consider all existing stability requirements in the different IMO codes and guidelines related to OSVs and to determine which stability standards would offer an equivalent level of safety when operating in different operational modes; and

.3 PPR 2 had re-established the Correspondence Group on the Development of the OSV Chemical Code and instructed it, taking into account comments and decisions made at PPR 2 and the outcome of SDC 2 and SSE 2 concerning the development of the relevant chapters of the draft Code, to finalize the text of the draft OSV Chemical Code.

24.2 In the context of the above, the Sub-Committee considered document SDC 2/24/2 (Norway) commenting on chapter 2 on "Ship survival capability and location of cargo tanks", for the transport and handling of limited amounts of hazardous and noxious liquid substances in bulk on offshore support vessels (OSV Chemical Code), and noting that in annex 1 to document SDC 2/24 there are two options for OSVs carrying larger amounts of hazardous and noxious liquid substances in bulk. The Sub-Committee noted that the delegation of Norway was concerned, primarily, that one of these options seems to lower the ship survival capability standard compared to the current regulations and, in their view, it is not sufficient for such ships.

24.3 In commenting on the matter, the delegation of the United States supported the view of Norway that the first option in square brackets, under paragraph 2.1.3.3 of annex 1 to document SDC 2/24, lowers the intended ship survival capability standard compared to the current regulations and that the second option using a survivability standard similar to the IBC Code is appropriate for vessels carrying an unlimited volume of hazardous product. The United States proposed that, rather than simply deciding between the two drastically different options in document SDC 2/24, the text be modified to incorporate an intermediate survivability standard using the current initial option, to be applied when the carriage of hazardous products is above resolution A.673(16)'s current definition of limited quantities, but less than the threshold value to be determined by the PPR Sub-Committee.

In this regard, the United States pointed out that this is a three-tiered approach. The survivability standard is applied on the basis of total cargo hazard. The lowest tier matches that of the *Guidelines for the design and construction of offshore supply vessels, 2006* (resolution MSC.235(82)), as amended by resolution MSC.335(90). The middle tier matches the first option in square brackets, which is the existing standard for well stimulation vessels and the more stringent option previously provided by the SLF Sub-Committee in response to this question. Finally, it pointed out that the highest tier reflects the direction of the proposed OSV Chemical Code, as the application of chapter 2 of the IBC Code is appropriate for the unlimited case.

In the view of the United States, this three-tiered approach would ensure that the survival standard is not lowered from the existing standard, because the earlier threshold values can be maintained. It also maintains different options for ship survivability depending on the total quantities and the hazard of the substances carried.

24.4 Having considered the proposal by the United States, the Sub-Committee agreed that it should be taken into account in conjunction with the proposal contained in document SDC 2/24/2.

24.5 In this connection, the Sub-Committee noted that chapter 5 of the draft OSV Chemical Code concerns cargo transfer, in order to ensure the safe handling of all cargo, and agreed to refer this chapter to SSE 2 and CCC 2, as set out in annex 2 to document SDC 2/24, for consideration and to advise PPR 3 accordingly.

24.6 With regard to the request from PPR 1 to consider all existing stability requirements in the different IMO codes and guidelines related to OSVs and to determine which stability standards would offer an equivalent level of safety when operating in different operational modes (paragraph 24.1.2), the Sub-Committee invited PPR 3 to reconsider the above request with a view to clarifying the scope and purpose of the work to be undertaken, taking into account that the above request could require an extensive amount of work over many years to complete.

Instructions to the SDS Working Group

24.7 Following discussion, the Sub-Committee instructed the SDS Working Group established under agenda item 3 (Amendments to SOLAS chapter II-1 subdivision and damage stability regulations), taking into account comments and decisions made in plenary, to finalize the draft text of chapter 2 on "Ship survival capability and location of cargo tanks", taking into account documents SDC 2/24 and SDC 2/24/2.

Report of the SDS Working Group

24.8 Having considered the part of the report of the SDS Working Group (SDC 2/WP.3/Add.1) related to the matter, the Sub-Committee endorsed the following comments by the group:

.1 in paragraph 2.1.2, the text in square brackets should be finalized by the PPR Sub-Committee, taking into account the decision of the PPR Sub-Committee with respect to the format of the product list;

.2 in sections 2.6 and 2.7, the quantity threshold values indicated in square brackets (i.e. 150 m^3, 800 m^3 and 1200 m^3) should be decided by the PPR Sub-Committee;

.3 a provision was added to clearly indicate that the requirements of chapter 2 of the draft OSV Chemical Code are an addition to the applicable SOLAS requirements for cargo ships; and

.4 chapter 2 of the draft OSV Chemical Code is generally based on provisions from the IBC Code and, therefore, is not harmonized with the SOLAS chapter II-1 requirements (e.g. regulation II-1/9, etc.).

24.9 Subsequently, the Sub-Committee agreed to refer the text of chapter 2 of the draft OSV Chemical Code to PPR 3, as set out in annex 1 to document SDC 2/WP.3/Add.1, in conjunction with the comments by the group (see paragraph 24.8), for consideration and action as appropriate.

Windows on passenger and special purpose ships

24.10 In considering document SDC 2/24/1 (Marshall Islands, Norway, Panama, IACS) discussing the SOLAS requirements relating to the fire protection of windows on passenger ships and special purpose ships and suggesting that there is an unintended error in the text of regulation II-2/9.4.1.3.3, the Sub-Committee noted that, for passenger ships carrying not more

than 36 passengers (and special-purpose ships carrying more than 60 (but not more than 240) persons on board), the wording of the provisions in SOLAS regulation II-2/9.4.1.3.3 is considered by the co-sponsors to be technically inappropriate (since reference is only made to table 9.1, i.e. the applicable table for passenger ships carrying more than 36 passengers). The Sub-Committee also noted that, after the issues above have been discussed at this session, the co-sponsors will consider submitting a subsequent document on this issue to MSC 95, under its agenda item on "Any other business".

24.11 During the discussion, the Sub-Committee noted the view expressed by several delegations that SOLAS regulation II-2/9.4.1.3.3 does apply to passenger ships carrying not more than 36 passengers. For large passenger ships, they pointed out that SOLAS chapter II-2 requires that special attention be given to the fire integrity of windows facing open or enclosed lifeboat and life raft embarkation areas, etc. The 1991 amendments extended this requirement to small passenger ships in SOLAS regulation II-2/33.2.

Instructions to the FP Working Group

24.12 Having considered this matter, the Sub-Committee instructed the Working Group on Fire Protection, established under agenda item 12 (*Guidelines for use of Fibre Reinforced Plastic (FRP) within ship structures*), taking into account comments and decisions made in plenary and document SDC 2/24/1, to prepare a justification for an unplanned output to clarify the intent of the application of SOLAS regulation II-2/9.4.1.3.3.

Report of the FP Working Group

24.13 Having considered the part of the report of the Working Group on Fire Protection (SDC 2/WP.5) related to the matter, the Sub-Committee agreed to the justification for a new unplanned output on clarification of the requirements in SOLAS chapter II-2 for fire integrity of windows on passenger ships carrying not more than 36 passengers and special purpose ships with more than 60 (but not more than 240) persons on board, as set out in annex 21, for consideration by MSC 95 under the work programme (agenda item 19).

Expressions of appreciation

24.14 The Sub-Committee expressed appreciation to the following delegates and member of the Secretariat, who had recently relinquished their duties, retired or been transferred to other duties, or were about to do so, for their invaluable contribution to its work and wished them a long and happy retirement or, as the case might be, every success in their new duties:

- Captain Marcelo Pamplona (Brazil) (on retirement)
- Dr. Leigh Mazany (Canada) (on transfer)
- Randy Eberly (United States) (on retirement)
- Kurt Heinz (United States) (on retirement)
- Gary Andrew Prosser (IALA) (on relocation)
- Captain Ted Thompson (CLIA) (on retirement)
- Captain Moin Ahmed (IMO) (on transfer)

25 ACTION REQUESTED OF THE COMMITTEE

The Maritime Safety Committee, at its ninety-fifth session, is invited to:

.1 consider the divergent views expressed regarding proposed amendments to SOLAS regulation II-1/13 to introduce protection against the crushing of people during the daily operation of watertight doors and decide how best to proceed on this matter (paragraphs 3.10 to 3.12);

.2 note that the work on limiting the down-flooding points on the bulkhead deck for passenger ships has been completed, as no documents were submitted on this matter for two sessions of the Sub-Committee (paragraphs 3.22 and 3.23);

.3 approve the draft amendments to SOLAS chapter II-1 on subdivision and damage stability regulations, with a view to adoption at MSC 96, taking into account the check/monitoring sheet and records for regulatory development prepared by the Sub-Committee (paragraph 3.28 and annex 1);*

.4 note that documents MSC 93/6/2 and MSC 93/10/20 referred to the Sub-Committee by MSC 93 will be further considered at SDC 3 (paragraph 3.31);

.5 approve the holding of an intersessional meeting of the FSA Experts Group from 10 to 12 November 2015, for validation of the EMSA 3 study related to survivability of passenger ships (paragraphs 3.21 and 3.33);

.6 note the progress made on matters related to the draft *Guidelines on safe return to port for passenger ships* (paragraphs 4.7 to 4.9);

.7 adopt the draft amendments to chapter 6 of part B of the 2008 IS Code, and the associated draft MSC resolution, regarding ice accretion on cargo ships carrying timber deck cargoes (paragraph 5.14 and annex 2);

.8 endorse the decision of the Sub-Committee to complete output 5.2.1.1 since, at this stage, it is premature to revise chapter 3 of part A of the 2008 IS Code regarding the criterion for maximum angle of heel in turns without further studies, real ship measurements and model test data (paragraph 6.3);

.9 approve the draft amendments to the introduction of the 2008 IS Code regarding vessels engaged in anchor-handling operations, with a view to subsequent adoption at MSC 96 (paragraph 7.7 and annex 3);

.10 approve, in principle, the draft amendments to part B of the 2008 IS Code regarding vessels engaged in anchor-handling operations, with a view to adoption in conjunction with the adoption of associated amendments to the introduction of the 2008 IS Code (paragraphs 7.7 and 7.8 and annex 4);

.11 consider the discussion related to the carriage of more than 12 industrial personnel on vessels engaged in international voyages and possible solutions (paragraph 8.7);

* Refer to the *Guidance on drafting of amendments to the 1974 SOLAS Convention and related mandatory instruments* (MSC.1/Circ.1500).

.12 approve the draft definition of industrial personnel, regarding the carriage of more than 12 industrial personnel on board vessels engaged in international voyages and the associated draft MSC circular (paragraph 8.13 and annex 5);

.13 note that the Sub-Committee decided to complete its consideration of amendments to SOLAS regulation II-1/11 and development of associated guidelines to ensure the adequacy of testing arrangements for watertight compartments, since consensus could not be reached on the draft amendments (paragraphs 10.4 to 10.7);

.14 approve the draft *Interim guidelines for use of Fibre Reinforced Plastic (FRP) elements within ship structures: Fire safety issues*, and the associated draft MSC circular (paragraph 12.9 and annex 6);

.15 approve the draft *Unified interpretation of* the *Guidelines for safe access to tanker bows* (resolution MSC.62(87) and the associated draft MSC circular (paragraph 12.12 and annex 7);

.16 adopt the draft amendments to the *Guidelines for the application of plastic pipes in ships* (resolution A.753(18)), as amended by resolution MSC.313(88), and the associated draft MSC resolution (paragraph 13.6 and annex 8);

.17 approve the draft amendments to SOLAS regulation II-2/13 on evacuation analysis, with a view to adoption at MSC 96, taking into account the check/monitoring sheet and records for regulatory development prepared by the Sub-Committee (paragraphs 14.11 and 14.12 and annex 9);*

.18 approve the draft unified interpretation of SOLAS regulation II-2/13.6 and the associated draft MSC circular (paragraph 15.6 and annex 10);*

.19 approve the draft amendments to SOLAS regulation II-1/22 on watertight doors, with a view to adoption at MSC 96 (paragraphs 3.28 and 16.5 and annex 1);*

.20 approve the draft *Guidance for watertight doors on passenger ships which may be opened during navigation* and the associated draft MSC circular (paragraph 16.6 and annex 11);

.21 note the progress made on matters related to amendments to SOLAS chapter II-1 and associated guidelines on damage control drills for passenger ships (paragraphs 17.6 and 17.7);

.22 note that the consideration of matters related to cargo ship safety has been completed (paragraphs 19.3 and 19.4);

.23 approve the draft amendments to the 2011 ESP Code, with a view to subsequent adoption at MSC 96 (paragraph 20.4 and annex 12);

.24 approve the draft amendments to MSC.1/Circ.1464/Rev.1 and the associated draft MSC circular (paragraph 21.5 and annex 13);

* Refer to the *Guidance on drafting of amendments to the 1974 SOLAS Convention and related mandatory instruments* (MSC.1/Circ.1500).

.25 approve the draft unified interpretations on regulation 36(6) of the Protocol of 1988 relating to the International Convention on Load Lines, 1966, and the associated draft MSC circular (paragraph 21.6 and annex 14);

.26 approve the draft unified interpretations of the Code on Noise Levels on Board Ships (resolution MSC.337(91)), and the associated draft MSC circular (paragraph 21.7 and annex 15);

.27 approve the draft amendment to *Unified interpretations of SOLAS chapter II-2, the FSS Code, the FTP Code and related fire test procedure*s (MSC/Circ.1120) and the associated draft MSC circular (paragraph 21.11 and annex 16);

.28 approve the draft unified interpretations of SOLAS regulations II-2/9 and II-2/13 and the associated draft MSC circular, taking into account that paragraph 5 is in square brackets (paragraph 21.14 and annex 17);

.29 approve the biennial status report of the Sub-Committee (paragraph 22.3 and annex 18);

.30 approve the proposed biennial agenda of the Sub-Committee for the 2016-2017 biennium (paragraph 22.3 and annex 19);

.31 approve the proposed provisional agenda for SDC 3 (paragraph 22.4 and annex 20);

.32 note that the Sub-Committee referred chapter 5 of the draft OSV Chemical Code on cargo transfer to SSE 2 and CCC 2, for consideration and to advise PPR 3 accordingly (paragraph 24.5);

.33 note that the Sub-Committee invited PPR 3 to reconsider its request to the Sub-Committee to consider all existing stability requirements in the different IMO codes and guidelines related to OSVs, with a view to clarifying the scope and purpose of the work to be undertaken (paragraph 24.6);

.34 note that the Sub-Committee referred the text of chapter 2 of the draft OSV Chemical Code to PPR 3, for coordination purposes (paragraphs 24.8 and 24.9);

.35 consider the justification for a new unplanned output on clarification of the requirements in SOLAS chapter II-2 for fire integrity of windows on passenger ships carrying not more than 36 passengers and special-purpose ships with more than 60 (but not more than 240) persons on board, and take action as appropriate (paragraph 24.13 and annex 21); and

.36 approve the report in general.

***

ANNEX 1

DRAFT AMENDMENTS TO SOLAS CHAPTER II-1

Part A
General

Regulation 1 – Application

1 The existing paragraphs 1.1 and 1.3.2 are amended to read as follows:

"1.1 Unless expressly provided otherwise, this chapter shall apply to ships the keels of which are laid or which are at a similar stage of construction on or after ~~1 January 2009~~[dd/mm/yy].

…

1.3 For the purpose of this chapter:

…

.2 the expression all ships means ships constructed before, on or after ~~1 January 2009~~[dd/mm/yy];"

2 The existing paragraph 1.3.4 is deleted.

Regulation 2 – Definitions

3 The existing text of paragraph 2 is replaced with the following:

"2 *Amidships* is at the middle of the length (*L*)."

4 The existing paragraphs 9, 10, 13 and 19 are amended to read as follows:

"9 *Draught (d)* is the vertical distance from the keel line at ~~mid-length~~amidships to the waterline in question.

10 *Deepest subdivision draught (d_s)* is the ~~waterline which corresponds to the~~ summer load line draught of the ship.

…

13 *Trim* is the difference between the draught forward and the draught aft, where the draughts are measured at the forward and aft ~~terminals~~perpendiculars respectively, as defined in the International Convention on Load Lines in force, disregarding any rake of keel.

…

19 *Bulkhead deck* in a passenger ship means the uppermost deck ~~at any point in the subdivision length (L_s)~~ to which the main bulkheads and the ship's shell are carried watertight ~~and the lowermost deck from which passenger and crew evacuation will not be impeded by water in any stage of flooding for damage cases defined in regulation 8 and in part B-2 of this chapter~~. The bulkhead deck may be a stepped deck. ~~In a cargo ship the freeboard deck may be taken as the bulkhead deck.~~"

5 The existing paragraph 26 is deleted and remaining paragraphs are renumbered respectively.

Part B
Subdivision and stability

Regulation 4 – General

6 The existing paragraph 1 and the footnote to existing paragraph 1 are deleted.

7 The following new paragraphs 1 and 2 are introduced before the existing paragraph 2:

"1 Unless expressly provided otherwise, the requirements in parts B-1 to B-4 shall apply to passenger ships.

2 For cargo ships, the requirements in parts B-1 to B-4 shall apply as follows:

2.1 In part B-1:

2.1.1 Unless expressly provided otherwise, regulation 5 shall apply to cargo ships and regulation 5-1 shall apply to cargo ships other than tankers, as defined in regulation I/2(h);

2.1.2 Regulation 6 to regulation 7-3 shall apply to cargo ships having a length (*L*) of 80 m and upwards, but may exclude those ships subject to the following instruments and shown to comply with the subdivision and damage stability requirements of that instrument:

.1 Annex I to MARPOL, except that combination carriers (as defined in SOLAS regulation II-2/3.14) with type B freeboards shall be in compliance with regulation 6 to regulation 7-3*; or

.2 the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code)*; or

.3 the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code)*; or

.4 the damage stability requirements of regulation 27 of the 1966 Load Lines Convention as applied in compliance with resolutions A.320(IX) and A.514(13), provided that in the case of cargo ships to which regulation 27(9) applies, main transverse watertight bulkheads, to be considered effective, are spaced according to paragraph (12)(f) of resolution A.320(IX), except that ships intended for the carriage of deck cargo shall be in compliance with regulation 6 to regulation 7-3; or

.5 the damage stability requirements of regulation 27 of the 1988 Load Lines Protocol, except that ships intended for the carriage of deck cargo shall be in compliance with regulation 6 to regulation 7-3; or

.6 the subdivision and damage stability standards in other instruments** developed by the Organization.

2.2 Unless expressly provided otherwise, the requirements in parts B-2 and B-4 shall apply to cargo ships.

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* *Guidelines for verification of damage stability requirements for tankers* (MSC.1/Circ.1461).

** .1 For offshore supply vessels of not more than 100 m in length (*L*), the *Guidelines for the design and construction of offshore supply vessels, 2006* (resolution MSC.235(82), as amended by resolution MSC.335(90)); or

.2 For special purpose ships, the *Code of safety for special purpose ships, 2008* (resolution MSC.266(84)).**"**

8 The existing paragraphs 2 to 4 are renumbered respectively.

Part B-1
Stability

9 The existing regulation 5 is amended to read as follows:

"**Regulation 5 – Intact stability***

1 Every passenger ship, regardless of size and every cargo ship having a length (*L*) of 24 m and upwards, shall be inclined upon its completion ~~and the elements of its stability determined~~. The light ship displacement and the longitudinal, transverse and vertical position of its centre of gravity shall be determined. In addition to any other applicable requirements of the present regulations, ships having a length of 24 m and upwards ~~constructed on or after 1 July 2010~~ shall as a minimum comply with the requirements of part A of the 2008 IS Code.

2 The Administration may allow the inclining test of an individual cargo ship 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, as required by regulation 5-1. A lightweight survey shall be carried out upon completion and the ship shall be inclined whenever in comparison with the data derived from the sister ship, a deviation from the lightship displacement exceeding 1% for ships of 160 m or more in length and 2% for ships of 50 m or less in length and as determined by linear interpolation for intermediate lengths or a deviation from the lightship longitudinal centre of gravity exceeding 0.5% of ~~L_s~~*L* is found**.**

…

5 At periodical intervals not exceeding five years, a lightweight survey shall be carried out on all passenger ships to verify any changes in lightship displacement and longitudinal centre of gravity. The ship shall 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_s~~L is found or anticipated.

~~* Refer to the Code on Intact Stability for All Types of Ships covered by IMO Instruments, adopted by the Organization by resolution A.749(18), as amended. From 1 July 2010, the International Code on Intact Stability, 2008, adopted by resolution MSC.267(85), is expected to enter into force.~~"

Regulation 5-1 – Stability information to be supplied to the master

10 The existing footnote to the title of the regulation is amended to read as follows:

"* Refer also to the *Guidelines for the preparation of intact stability information* (MSC/Circ.456)~~; Guidance on the intact stability of existing tankers during transfer operations (MSC/Circ.706);~~ and the *Revised guidance to the master for avoiding dangerous situations in following and quartering seas* (MSC.1/Circ.1228)."

11 The existing paragraph 2.1 is amended to read as follows:

".1 curves or tables of minimum operational metacentric height (*GM*) and maximum permissible trim versus draught which assures compliance with the ~~relevant~~ intact and damage stability requirements where applicable, alternatively corresponding curves or tables of the maximum allowable vertical centre of gravity (*KG*) and maximum permissible trim versus draught, or with the equivalents of either of these curves or tables;"

12 The existing paragraphs 3 and 4 are replaced with the following:

"3 The intact and damage stability information required by regulation 5-1.2 shall be presented as consolidated data and encompass the full operating range of draught and trim. Applied trim values shall coincide in all stability information intended for use on board. Information not required for determination of stability and trim limits should be excluded from this information.

4 If the damage stability is calculated in accordance with regulation 6 to regulation 7-3 and, if applicable, with regulations 8 and 9.8, a stability limit curve is to be determined using linear interpolation between the minimum required *GM* assumed for each of the three draughts d_s, d_p and d_l. When additional subdivision indices are calculated for different trims, a single envelope curve based on the minimum values from these calculations shall be presented. When it is intended to develop curves of maximum permissible *KG* it shall be ensured that the resulting maximum *KG* curves correspond with a linear variation of *GM*.

5 As an alternative to a single envelope curve, the calculations for additional trims may be carried out with one common *GM* for all of the trims assumed at each subdivision draught. The lowest values of each partial index A_s, A_p and A_l across these trims shall then be used in the summation of the attained subdivision index *A* according to regulation 7.1. This will result in one *GM* limit curve based on the *GM* used at each draught. A trim limit diagram showing the assumed trim range shall be developed."

13 The existing paragraph 5 is renumbered and amended to read as follows:

"~~5~~6 When curves or tables of minimum operational metacentric height (*GM*) or maximum allowable *KG* versus draught are not ~~appropriate~~provided, the master ~~should~~shall ensure that the operating condition does not deviate from ~~a studied~~approved loading conditions, or verify by calculation that the stability ~~criteria~~requirements are satisfied for this loading condition."

Regulation 6 – Required subdivision index R*[*]

14 In paragraph 2, the existing chapeau and paragraph 2.2 are amended to read as follows:

"2 For ~~all~~ ships to which the damage stability requirements of this ~~chapter~~part apply, the degree of subdivision to be provided shall be determined by the required subdivision index *R*, as follows:

...

.2 In the case of cargo ships not less than 80 m in length (L_{s}) and not greater than 100 m in length (L_s):

…"

Regulation 7 – Attained subdivision index *A*

15 The first sentence of the existing paragraph 1 is amended to read as follows:

"1 An~~The~~ attained subdivision index *A* is obtained by the summation of the partial indices A_s, A_p and A_l, ~~(~~weighted as shown and~~)~~ calculated for the draughts d_s, d_p and d_l defined in regulation 2 in accordance with the following formula:"

16 The existing paragraphs 2 and 3 are amended to read as follows:

"2 As a minimum, ~~In~~ the calculation of *A*~~, the level trim~~ shall be ~~used~~carried out at level trim for the deepest subdivision draught d_s and the partial subdivision draught d_p. The ~~actual~~estimated service trim ~~shall~~may be used for the light service draught d_l. If, in any anticipated service condition within the draught range from d_s to d_l, the trim variation in comparison with the calculated trims is greater than 0.5% of L_{s}, one or more additional calculations of *A* are to be ~~submitted~~performed for the same draughts but ~~different~~including sufficient trims ~~so~~ to ensure that, for all intended service conditions, the difference in trim in comparison with the reference trim used for one calculation will be ~~less~~not more than 0.5% of L_{s}. Each additional calculation of *A* shall comply with regulation 6.1.

3 When determining the positive righting lever (*GZ*) of the residual stability curve in the intermediate and final equilibrium stages of flooding, the displacement used should be that of the intact loading condition. All calculations should be done with the ship freely trimming. ~~That is, the constant-displacement method of calculation should be used.~~"

Regulation 7-1 – Calculation of the factor p_i

17 In the existing paragraph 1, the text of the notation for the mean transverse distance *b* is amended to read as follows:

"*b* = the mean transverse distance in metres measured at right angles to the centreline at the deepest subdivision ~~loadline~~draught between the shell and an assumed vertical plane extended between the longitudinal limits used in calculating the factor p_i and which is a tangent to, or common with, all or part of the outermost portion of the longitudinal bulkhead under consideration. This vertical plane shall be so orientated that the mean transverse distance to the shell is a maximum, but not more than twice the least distance between the plane and the shell. If the upper part of a longitudinal bulkhead is below the deepest subdivision ~~loadline~~draught the vertical plane used for determination of *b* is assumed to extend upwards to the deepest subdivision waterline. In any case, b is not to be taken greater than *B/2*."

Regulation 7-2 – Calculation of the factor s_i

18 The existing paragraphs 2 to 5 are amended to read as follows:

"2 For passenger ships and cargo ships fitted with cross-flooding devices t~~T~~he factor $s_{\text{intermediate},i}$ is ~~applicable only to passenger ships (for cargo ships $s_{\text{intermediate},i}$ should be taken as unity) and shall be~~ taken as the least of the *s*-factors obtained from all flooding stages including the stage before equalization, if any, and is to be calculated as follows:

$$S_{\text{intermediate},i} = \left[\frac{GZ_{\max}}{0.05} \cdot \frac{Range}{7}\right]^{\frac{1}{4}}$$

where $GZ_{\max}$ is not to be taken as more than 0.05 m and *Range* as not more than 7. $s_{\text{intermediate},i} = 0$, if the intermediate heel angle exceeds 15º for passenger ships and 30° for cargo ships.

For cargo ships not fitted with cross-flooding devices the factor $s_{\text{intermediate},i}$ is taken as unity, except if the Administration considers that the stability in intermediate stages of flooding may be insufficient, it should require further investigation thereof.

For passenger and cargo ships, w~~W~~here cross-flooding devices are fitted~~fittings are required~~, the time for equalization shall not exceed 10 min.

3 The factor $s_{\text{final},i}$ shall be obtained from the formula:

~~$$S_{\text{final},i} = K \cdot \left[\frac{GZ_{\max}}{0.12} \cdot \frac{Range}{16}\right]^{\frac{1}{4}}$$~~

~~where:~~

~~$GZ_{\max}$ is not to be taken as more than 0.12 m;~~

~~*Range* is not to be taken as more than 16°;~~

$$S_{\text{final},i} = K \cdot \left[\frac{GZ_{\max}}{TGZ_{\max}} \cdot \frac{Range}{TRange}\right]^{\frac{1}{4}}$$

where:

GZ_{max} is not to be taken as more than TGZ_{max};

Range is not to be taken as more than *TRange*;

TGZ_{max} = 0.20 m, for ro-ro passenger ships each damage case that involves a ro-ro space,

TGZ_{max} = 0.12 m, otherwise;

TRange = 20º, for ro-ro passenger ships each damage case that involves a ro-ro space,

TRange = 16º, otherwise;

$K = 1$ if $\theta_e \leq \theta_{min}$

$K = 0$ if $\theta_e \geq \theta_{max}$

$K = \sqrt{\frac{\theta_{max} - \theta_e}{\theta_{max} - \theta_{min}}}$ otherwise,

where:

θ_{min} is 7° for passenger ships and 25° for cargo ships; and

θ_{max} is 15° for passenger ships and 30° for cargo ships.

4 The factor $s_{mom,i}$ is applicable only to passenger ships (for cargo ships $s_{mom,i}$ shall be taken as unity) and shall be calculated at the final equilibrium from the formula:

$$S_{\text{mom},i} = \frac{(GZ_{\max} - 0.04) \cdot Displacement}{M_{\text{heel}}}$$

where:

Displacement is the intact displacement at the ~~subdivision~~respective draught (d_s, d_p or d_l).

M_{heel} is the maximum assumed heeling moment as calculated in accordance with subparagraph 4.1; and

$s_{mom,i} \leq 1$

4.1 The heeling moment M_{heel} is to be calculated as follows:

$$M_{heel} = \text{maximum } (M_{passenger} \text{ or } M_{wind} \text{ or } M_{survivalcraft})$$

4.1.1 $M_{passenger}$ is the maximum assumed heeling moment resulting from movement of passengers, and is to be obtained as follows:

$$M_{passenger} = (0.075 \cdot N_p) \cdot (0.45 \cdot B) \text{ (tm)}$$

where:

N_p is the maximum number of passengers permitted to be on board in the service condition corresponding to the deepest subdivision draught under consideration; and

B is the ~~beam~~breadth of the ship as defined in regulation 2.8.

Alternatively, the heeling moment may be calculated assuming the passengers are distributed with 4 persons per square metre on available deck areas towards one side of the ship on the decks where muster stations are located and in such a way that they produce the most adverse heeling moment. In doing so, a weight of 75 kg per passenger is to be assumed.

4.1.2 M_{wind} is the maximum assumed wind ~~force~~moment acting in a damage situation:

$$M_{wind} = (P \cdot A \cdot Z) / 9{,}806 \text{ (tm)}$$

where:

P = 120 N/m^2;

A = projected lateral area above waterline;

Z = distance from centre of lateral projected area above waterline to $T/2$; and

T = ~~ship's~~ respective draught, (d_s, d_p or $d_\#$).

…

5 Unsymmetrical flooding is to be kept to a minimum consistent with the efficient arrangements. Where it is necessary to correct large angles of heel, the means adopted shall, where practicable, be self-acting, but in any case where controls to equalization devices are provided they shall be operable from above the bulkhead deck of passenger ships and the freeboard deck of cargo ships. These fittings together with their controls shall be acceptable to the Administration. [*]Suitable information concerning the use of equalization devices shall be supplied to the master of the ship.

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[*] Reference is made to the "*Revised ~~R~~recommendation on a standard method for* ~~establishing compliance with the requirements for~~ *evaluating cross-flooding arrangements* ~~in passengers ships~~", adopted by the Organization by resolution ~~A.266(VIII)~~MSC.362(92), as may be amended.

…

5.2 ~~In all cases,~~The factor s_i is to be taken as zero in those cases where the final waterline, taking into account sinkage, heel and trim, immerses:

…

5.3 The factor s_i is to be taken as zero if, taking into account sinkage, heel and trim, any of the following occur in any intermediate stage or in the final stage of flooding:

.1 immersion of any vertical escape hatch in the bulkhead deck of passenger ships and the freeboard deck of cargo ships intended for compliance with chapter II-2;

.2 any controls intended for the operation of watertight doors, equalization devices, valves on piping or on ventilation ducts intended to maintain the integrity of watertight bulkheads from above the bulkhead deck of passenger ships and the freeboard deck of cargo ships become inaccessible or inoperable; and

.3 immersion of any part of piping or ventilation ducts located within the assumed extent of damage and carried through a watertight boundary ~~that is located within any compartment included in damage cases contributing to the attained index *A*, if not fitted with watertight means of closure at each boundary.~~if this can lead to the progressive flooding of compartments not assumed as flooded.

…

5.5 Except as provided in paragraph 5.3.1, openings closed by means of watertight manhole covers and flush scuttles, ~~small watertight hatch covers,~~ remotely operated sliding watertight doors, sidescuttles of the non-opening type as well as watertight access doors and watertight hatch covers required to be kept closed at sea need not be considered."

Regulation 8 – Special requirements concerning passenger ship stability

19 The existing paragraphs 1 to 3 are amended to read as follows:

"1 A passenger ship intended to carry 400 or more persons shall have watertight subdivision abaft the collision bulkhead so that s_i = 1 for a damage involving all the compartments within 0.08*L* measured from the forward perpendicular for the three loading conditions used to calculate the attained ~~on which is based the calculation of the~~ subdivision index *A*. ~~and for a damage involving all the compartments within 0.08*L* measured from the forward perpendicular.~~If the attained subdivision index *A* is calculated for different trims, this requirement must also be satisfied for those loading conditions.

2 A passenger ship intended to carry 36 or more persons is to be capable of withstanding damage along the side shell to an extent specified in paragraph 3. Compliance with this regulation is to be achieved by demonstrating that s_i, as defined in regulation 7-2, is not less than 0.9 for the three loading conditions used to calculate the attained~~on which is based the calculation of the~~ subdivision index *A*. If the attained subdivision index *A* is calculated for different trims, this requirement must also be satisfied for those loading conditions.

3 The damage extent to be assumed when demonstrating compliance with paragraph 2, is to be dependent on ~~both *N* as defined in regulation 6~~the total number of persons carried, and ~~L_s~~*L* ~~as defined in regulation 2~~, such that:

…

.2 where 400 or more persons are to be carried, a damage length of 0.03~~L_s~~*L*, but not less than 3 m is to be assumed at any position along the side shell, in conjunction with a penetration inboard of 0.1*B* but not less than 0.75 m measured inboard from the ship side, at right angles to the centerline at the level of the deepest subdivision draught;

…

.4 where 36 persons are carried, a damage length of 0.015~~L_s~~*L* but not less than 3 m is to be assumed, in conjunction with a penetration inboard of 0.05*B* but not less the 0.75 m; and"

Regulation 8-1 – System capabilities and operational information after a flooding casualty on passenger ships

20 In section 2, the existing text is amended to read as follows:

"A passenger ship ~~constructed on or after 1 July 2010~~ shall be designed so that the systems specified in regulation II-2/21.4 remain operational when the ship is subject to flooding of any single watertight compartment."

21 In section 3, the existing chapeau is amended to read as follows:

"For the purpose of providing operational information to the Master for safe return to port after a flooding casualty, passenger ships ~~constructed on or after 1 January 2014~~ shall have:"

Part B-2
Subdivision, watertight and weathertight integrity

Regulation 9 – Double bottoms in passenger ships and cargo ships other than tankers

22 The existing paragraph 3 is amended to read as follows:

"3.1 Small wells constructed in the double bottom in connection with drainage arrangements ~~of holds, etc.~~ shall not extend downward more than necessary. The vertical distance from the bottom of such a well to a plane coinciding with the keel line shall not be less than *h*/2 or 500 mm, whichever is greater, or compliance with paragraph 8 of this regulation shall be shown for that part of the ship. ~~A well extending to the outer bottom is, however, permitted at the after end of the shaft tunnel.~~

3.2 Other wells (e.g. for lubricating oil under main engines) may be permitted by the Administration if satisfied that the arrangements give protection equivalent to that afforded by a double bottom complying with this regulation. ~~In no case shall the vertical distance from the bottom of such a well to a plane coinciding with the keel line be less than 500 mm.~~

3.2.1 For a cargo ship of 80 m in length and upwards or for a passenger ship, proof of equivalent protection is to be shown by demonstrating that the ship is capable of withstanding bottom damages as specified in paragraph 8. Alternatively, wells for lubricating oil below main engines may protrude into the double bottom below the boundary line defined by the distance *h* provided that the vertical distance between the well bottom and a plane coinciding with the keel line is not less than *h*/2 or 500 mm, whichever is greater.

3.2.2 For cargo ships of less than 80 m in length the arrangements shall provide a level of safety satisfactory to the Administration."

23 The existing paragraphs 6 to 8 are amendments to read as follows:

"6 Any part of a cargo ship of 80 m in length and upwards or of a passenger ship ~~or a cargo ship~~ that is not fitted with a double bottom in accordance with paragraphs 1, 4 or 5, as specified in paragraph 2, shall be capable of withstanding bottom damages, as specified in paragraph 8, in that part of the ship. For cargo ships of less than 80 m in length the alternative arrangements shall provide a level of safety satisfactory to the Administration.

7 In the case of unusual bottom arrangements in a cargo ship of 80 m in length and upwards or a passenger ship ~~or a cargo ship~~, it shall be demonstrated that the ship is capable of withstanding bottom damages as specified in paragraph 8. For cargo ships of less than 80 m in length the alternative arrangements shall provide a level of safety satisfactory to the Administration.

8 Compliance with paragraphs 3.1, 3.2.1, 6 or 7 is to be achieved by demonstrating that s_i, when calculated in accordance with regulation 7-2, is not less than 1 for all service conditions when subject to ~~a~~ bottom damage ~~assumed at any position along the ship's bottom and~~ with an extent specified in subparagraph .2 below for any position in the affected part of the ship:

.1 Flooding of such spaces shall not render emergency power and lighting, internal communication, signals or other emergency devices inoperable in other parts of the ship.

.2 Assumed extent of damage shall be as follows:

	For 0.3 *L* from the forward perpendicular of the ship	Any other part of the ship
Longitudinal extent	1/3 $L^{2/3}$ or 14.5 m, whichever is less	1/3 $L^{2/3}$ or 14.5 m, whichever is less
Transverse extent	*B*/6 or 10 m, whichever is less	*B*/6 or 5 m, whichever is less
Vertical extent, measured from the keel line	~~B/20 or 2 m, whichever is less~~ *B*/20, to be taken not less than 0.76 m and not more than 2 m	~~B/20 or 2 m, whichever is less~~ *B*/20, to be taken not less than 0.76 m and not more than 2 m

.3 If any damage of a lesser extent than the maximum damage specified in .2 would result in a more severe condition, such damage should be considered."

Regulation 10 – Construction of watertight bulkheads

24 The existing paragraph 1 is amended to read as follows:

"1 Each watertight subdivision bulkhead, whether transverse or longitudinal, shall be constructed having scantlings as specified in regulation 2.17. In all cases, watertight subdivision bulkheads shall be capable of supporting at least the pressure due to a head of water up to the bulkhead deck in passenger ships and freeboard deck in cargo ships."

Regulation 12 – Peak and machinery space bulkheads, shaft tunnels, etc.

25 The existing paragraph 1 is amended to read as follows:

"1 A collision bulkhead shall be fitted which shall be watertight up to the bulkhead deck in passenger ships and freeboard deck in cargo ships. This bulkhead shall be located at a distance from the forward perpendicular of not less than 0.05*L* or 10 m, whichever is the less, and, except as may be permitted by the Administration, not more than 0.08*L* or 0.05*L* + 3 m, whichever is the greater."

26 The following new paragraph 2 is introduced after the existing paragraph 1:

"2 The ship shall be so designed that s_i calculated in accordance with regulation 7-2 will not be less than 1 at the deepest subdivision draught loading condition, level trim or any forward trim loading conditions, if any part of the ship forward of the collision bulkhead is flooded without vertical limits."

27 The remaining paragraphs are renumbered and amended to read as follows:

"~~2~~3 Where any part of the ship below the waterline extends forward of the forward perpendicular, e.g. a bulbous bow, the distances stipulated in paragraph 1 shall be measured from a point either:

.1 at the mid-length of such extension;

.2 at a distance 0.015L forward of the forward perpendicular; or

.3 at a distance 3 m forward of the forward perpendicular,

whichever gives the smallest measurement.

~~3~~4 The bulkhead may have steps or recesses provided they are within the limits prescribed in paragraph 1 or ~~3~~2.

~~4~~5 No doors, manholes, access openings, ventilation ducts or any other openings shall be fitted in the collision bulkhead below the bulkhead deck in passenger ships and freeboard deck in cargo ships.

~~5~~6.1 Except as provided in paragraph 6~~5~~.2, the collision bulkhead may be pierced below the bulkhead deck in passenger ships and freeboard deck in cargo ships by not more than one pipe for dealing with fluid in the forepeak tank, provided that the pipe is fitted with a screw-down valve capable of being operated from above the bulkhead

deck in passenger ships and freeboard deck in cargo ships, the valve ~~chest~~ being ~~secured~~located inside the forepeak ~~at~~to the collision bulkhead. The Administration may, however, authorize the fitting of this valve on the after side of the collision bulkhead provided that the valve is readily accessible under all service conditions and the space in which it is located is not a cargo space. Alternatively, for cargo ships, the pipe may be fitted with a butterfly valve suitably supported by a seat or flanges and capable of being operated from above the freeboard deck. All valves shall be of steel, bronze or other approved ductile material. Valves of ordinary cast iron or similar material are not acceptable.

~~5~~6.2 If the forepeak is divided to hold two different kinds of liquids the Administration may allow the collision bulkhead to be pierced below the bulkhead deck in passenger ships and freeboard deck in cargo ships by two pipes, each of which is fitted as required by paragraph 6~~5~~.1, provided the Administration is satisfied that there is no practical alternative to the fitting of such a second pipe and that, having regard to the additional subdivision provided in the forepeak, the safety of the ship is maintained.

~~6~~7 Where a long forward superstructure is fitted, the collision bulkhead shall be extended weathertight to the deck next above the bulkhead deck in passenger ships and freeboard deck in cargo ships. The extension need not be fitted directly above the bulkhead below provided ~~it is~~that all parts of the extension, including any part of the ramp attached to it are located within the limits prescribed in paragraph 1 or 3~~2~~, with the exception permitted by paragraph 8~~7~~ and that the part of the deck which forms the step is made effectively weathertight. The extension shall be so arranged as to preclude the possibility of the bow door or ramp, where fitted, causing damage to it in the case of damage to, or detachment of, a bow door or any part of the ramp.

~~7~~8 Where bow doors are fitted and a sloping loading ramp forms part of the extension of the collision bulkhead above the bulkhead deck in passenger ships and freeboard deck in cargo ships the ramp shall be weathertight over its complete length. In cargo ships the part of the ramp which is more than 2.3 m above the ~~bulkhead~~ freeboard deck may extend forward of the limit specified in paragraph 1 or ~~2~~3. Ramps not meeting the above requirements shall be disregarded as an extension of the collision bulkhead.

~~8~~9 The number of openings in the extension of the collision bulkhead above the freeboard deck shall be restricted to the minimum compatible with the design and normal operation of the ship. All such openings shall be capable of being closed weathertight.

~~9~~10 Bulkheads shall be fitted separating the machinery space from cargo and accommodation spaces forward and aft and made watertight up to the bulkhead deck in passenger ships and freeboard deck in cargo ships. ~~In passenger ships~~ ~~a~~An afterpeak bulkhead shall also be fitted and made watertight up to the bulkhead deck or the freeboard deck. The afterpeak bulkhead may, however, be stepped below the bulkhead deck or the freeboard deck, provided the degree of safety of the ship as regards subdivision is not thereby diminished.

~~10~~11 In all cases stern tubes shall be enclosed in watertight spaces of moderate volume. In passenger ships the stern gland shall be situated in a watertight shaft tunnel or other watertight space separate from the stern tube compartment and of such volume that, if flooded by leakage through the stern gland, the bulkhead deck

will not be immersed. In cargo ships other measures to minimize the danger of water penetrating into the ship in case of damage to stern tube arrangements may be taken at the discretion of the Administration."

Regulation 13 – Openings in watertight bulkheads below the bulkhead deck in passenger ships

28 The existing paragraph 11.1 is amended to read as follows:

"11.1 Where trunkways or tunnels for access from crew accommodation to the ~~stokehold~~machinery spaces, for piping, or for any other purpose are carried through watertight bulkheads, they shall be watertight and in accordance with the requirements of regulation 16-1. The access to at least one end of each such tunnel or trunkway, if used as a passage at sea, shall be through a trunk extending watertight to a height sufficient to permit access above the bulkhead deck. The access to the other end of the trunkway or tunnel may be through a watertight door of the type required by its location in the ship. Such trunkways or tunnels shall not extend through the first subdivision bulkhead abaft the collision bulkhead."

Regulation 15 – Openings in the shell plating below the bulkhead deck of passenger ships and the freeboard deck of cargo ships

29 The existing paragraphs 4, 5.1, 8.2.1 and 8.4 are amended to read as follows:

"4 Efficient hinged inside deadlights so arranged that they can be easily and effectively closed and secured watertight, shall be fitted to all sidescuttles except that abaft one eighth of the ship's length from the forward perpendicular and above a line drawn parallel to the bulkhead deck at side and having its lowest point at a height of 3.7 m plus 2.5% of the breadth of the ship above the deepest subdivision draught, the deadlights may be portable in passenger accommodation ~~other than that for steerage passengers~~, unless the deadlights are required by the International Convention on Load Lines in force to be permanently attached in their proper positions. Such portable deadlights shall be stowed adjacent to the sidescuttles they serve.

5.1 No sidescuttles shall be fitted in any spaces which are appropriated exclusively to the carriage of cargo ~~or coal~~.

…

8.2.1 Subject to the requirements of the International Convention on Load Lines in force, and except as provided in paragraph 8.3, each separate discharge led through the shell plating from spaces below the bulkhead deck of passenger ships and the freeboard deck of cargo ships shall be provided with either one automatic non-return valve fitted with a positive means of closing it from above the bulkhead deck of passenger ships and the freeboard deck of cargo ships or with two automatic non-return valves without positive means of closing, provided that the inboard valve is situated above the deepest subdivision draught and is always accessible for examination under service conditions. Where a valve with positive means of closing is fitted, the operating position above the bulkhead deck of passenger ships and the freeboard deck of cargo ships shall always be readily accessible and means shall be provided for indicating whether the valve is open or closed.

…

8.4 Moving parts penetrating the shell plating below the deepest subdivision draught shall be fitted with a watertight sealing arrangement acceptable to the Administration. The inboard gland shall be located within a watertight space of such volume that, if flooded, the bulkhead deck in passenger ships and freeboard deck in cargo ships will not be submerged. The Administration may require that if such compartment is flooded, essential or emergency power and lighting, internal communication, signals or other emergency devices must remain available in other parts of the ship."

Regulation 16 – Construction and initial tests of watertight closures~~doors, sidescuttles, etc.~~

30 The existing paragraphs 1 and 2 are amended to read as follows:

"~~1 In all ships:~~

1.1 T~~t~~he design, materials and construction of all watertight closures such as doors, hatches, sidescuttles, gangway and cargo ports, valves, pipes, ash-chutes and rubbish-chutes referred to in these regulations shall be to the satisfaction of the Administration;

1.2 S~~s~~uch valves, doors, hatches, and mechanisms shall be suitably marked to ensure that they may be properly used to provide maximum safety; and

1.3 T~~t~~he frames of vertical watertight doors shall have no groove at the bottom in which dirt might lodge and prevent the door closing properly.

2 ~~In passenger ships and cargo ships~~ W~~w~~atertight doors and hatches shall be tested by water pressure to ~~a~~the maximum head of water they might sustain in a final or intermediate stage of flooding. For cargo ships not covered by damage stability requirements, watertight doors and hatches shall be tested by water pressure to a head of water measured from the lower edge of the opening to one metre above the freeboard deck. Where testing of individual doors and hatches is not carried out because of possible damage to insulation or outfitting items, testing of individual doors and hatches may be replaced by a prototype pressure test of each type and size of door or hatch with a test pressure corresponding at least to the head required for the individual location. The prototype test shall be carried out before the door or hatch is fitted. The installation method and procedure for fitting the door or hatch on board shall correspond to that of the prototype test. When fitted on board, each door or hatch shall be checked for proper seating between the bulkhead, the frame and the door or between deck, the coaming and the hatch."

Regulation 16-1 – Construction and initial tests of watertight decks, trunks, etc.

31 The existing paragraphs 2 and 3 are amended to read as follows:

"2 In passenger ships, ~~W~~where a ventilation trunk passing through a structure penetrates a watertight area of the bulkhead deck, the trunk shall be capable of withstanding the water pressure that may be present within the trunk, after having taken into account the maximum heel angle ~~allowable~~ during ~~intermediate stages of~~ flooding, in accordance with regulation 7-2.

3 In ro-ro passenger ships, ~~W~~where all or part of the penetration of the bulkhead deck is on the main ro-ro deck, the trunk shall be capable of withstanding impact pressure due to internal water motions (sloshing) of water trapped on the ro-ro deck."

Regulation 17 – Internal watertight integrity of passenger ships above the bulkhead deck

32 The existing paragraph 3 is amended to read as follows:

"3 ~~The open end of a~~Air pipes terminating within a superstructure which are not fitted with watertight means of closure shall be considered as unprotected openings when applying regulation 7-2.6.1.1.~~shall be at least 1 m above the waterline when the ship heels to an angle of 15º, or the maximum angle of heel during intermediate stages of flooding, as determined by direct calculation, whichever is the greater. Alternatively, air pipes from tanks other than oil tanks may discharge through the side of the superstructure. The provisions of this paragraph are without prejudice to the provisions of the International Convention on Load Lines in force.~~"

Part B-4
Stability management

33 The existing title and paragraph 1 of regulation 20 are amended to read as follows:

"**Regulation 20 – Loading of ~~passenger~~ ships**

1 On completion of loading of the ship and prior to its departure, the master shall determine the ship's trim and stability and also ascertain and record that the ship is upright and in compliance with stability criteria in relevant regulations. The determination of the ship's stability shall always be made by calculation or by ensuring that the ship is loaded according to one of the pre-calculated loading conditions within the approved stability information. The Administration may accept the use of an electronic loading and stability computer or equivalent means for this purpose."

Regulation 21 – Periodical operation and inspection of watertight doors, etc. in passenger ships

34 The existing paragraph 1 is amended to read as follows:

"1 Drills for the operating of watertight doors, sidescuttles, valves and closing mechanisms of scuppers, ash-chutes and rubbish-chutes shall take place weekly. In ships in which the voyage exceeds one week in duration a complete drill shall be held before ~~leaving port~~the voyage commences, and others thereafter at least once a week during the voyage."

Regulation 22 – Prevention and control of water ingress, etc.

35 The existing paragraph 2 is amended to read as follows:

"2 Watertight doors located below the bulkhead deck in passenger ships and freeboard deck in cargo ships having a maximum clear opening width of more than 1.2 m shall be kept closed when the ship is at sea, except for limited periods when absolutely necessary as determined by the Administration."

36 The new footnote to existing paragraph 3 is added as follows:

"3 A watertight door may be opened during navigation to permit the passage of passengers or crew, or when work in the immediate vicinity of the door necessitates it being opened. The door must be immediately closed when transit through the door is complete or when the task which necessitated it being open is finished.*

* Refer to the *Guidance for watertight doors on passenger ships which may be opened during navigation* (MSC.1/Circ.[…]."

37 The existing paragraph 4 is deleted and the subsequent paragraphs are renumbered accordingly.

38 The existing paragraphs 5 to 7 are amended to read as follows:

"5 Portable plates on bulkheads shall always be in place before the ~~ship leaves port~~voyage commences, and shall not be removed during navigation except in case of urgent necessity at the discretion of the master. The necessary precautions shall be taken in replacing them to ensure that the joints are watertight. Power-operated sliding watertight doors permitted in machinery spaces in accordance with regulation 13.10 shall be closed before the ~~ship leaves port~~voyage commences and shall remain closed during navigation except in case of urgent necessity at the discretion of the master.

6 Watertight doors fitted in watertight bulkheads dividing cargo between deck spaces in accordance with regulation 13.9.1 shall be closed before the voyage commences and shall be kept closed during navigation.~~;~~ ~~t~~The time ~~of opening~~ such doors ~~in port~~are opened or closed ~~and of closing them before the ship leaves port~~ shall be entered in the log-book.

7 Gangway, cargo and fuelling ports fitted below the bulkhead deck in passenger ships and freeboard deck in cargo ships shall be effectively closed and secured watertight before the ship leaves port, and shall be kept closed during navigation."

39 In paragraph 8, the existing chapeau is amended to read as follows:

"8 The following doors, located above the bulkhead deck in passenger ships and freeboard deck in cargo ships, shall be closed and locked before the ship proceeds on any voyage and shall remain closed and locked until the ship is at its next berth:"

40 The existing paragraph 14 is amended to read as follows:

"14 Where in a between-deck, the sills of any of the sidescuttles referred to in regulation 15.3.2 are below a line drawn parallel to the bulkhead deck at side in passenger ships and freeboard deck at side in cargo ships, and having its lowest point 1.4 m plus 2.5% of the breadth of the ship above the water when the ship departs from any port, all the sidescuttles in that between-deck~~s~~ shall be closed watertight and locked before the ship leaves port, and they shall not be opened before the ship arrives at the next port. In the application of this paragraph the appropriate allowance for fresh water may be made when applicable.

.1 The time of opening such sidescuttles in port and of closing and locking them before the ship leaves port shall be entered in such log-book as may be prescribed by the Administration.

.2 For any ship that has one or more sidescuttles so placed that the requirements of paragraph 14 would apply when it was floating at its deepest subdivision draught, the Administration may indicate the limiting mean draught at which these sidescuttles will have their sills above the line drawn parallel to the bulkhead deck at side in passenger ships and freeboard deck at side in cargo ships, and having its lowest point 1.4 m plus 2.5% of the breadth of the ship above the waterline corresponding to the limiting mean draught, and at which it will therefore be permissible to depart from port without previously closing and locking them and to open them at sea on the responsibility of the master during the voyage to the next port. In tropical zones as defined in the International Convention on Load Lines in force, this limiting draught may be increased by 0.3 m."

41 In regulation 24, the existing title and paragraph 3 are amended to read as follows:

"**Regulation 24 – Additional requirements for ~~P~~prevention and control of water ingress, etc. in cargo ships**

…

3 Watertight doors or ramps fitted to internally subdivide large cargo spaces shall be closed before the voyage commences and shall be kept closed during navigation.~~:~~ ~~t~~The time ~~of opening~~ such doors ~~in port~~are opened or closed ~~and of closing them before the ship leaves port~~ shall be entered in the log-book."

Part C
Machinery Installations

Regulation 35-1 – Bilge pumping arrangements

42 The existing paragraph 1 is deleted and remaining paragraphs are renumbered respectively.

43 The existing text of the renumbered paragraphs 1.3 and 1.6 is amended to read as follows:

"~~2~~1.3 All bilge pipes used in or under ~~coal bunkers or~~ fuel storage tanks or in boiler or machinery spaces, including spaces in which oil-settling tanks or oil fuel pumping units are situated, shall be of steel or other suitable material.

…

~~2~~1.6 Provision shall be made for the drainage of enclosed cargo spaces situated on the bulkhead deck of a passenger ship and on the freeboard deck of a cargo ship, provided that the Administration may permit the means of drainage to be dispensed with in any particular compartment of any ship or class of ship if it is satisfied that by reason of size or internal subdivision of those spaces the safety of the ship is not

thereby impaired. For the special hazards associated with loss of stability in ships fitted with fixed pressure water-spraying fire-extinguishing systems see II-2/20.6.1.4."

44 In the renumbered paragraph 2.2, the text of the whole volume of the passenger and crew spaces below the bulkhead deck *P* is amended to read as follows:

"*P* = the whole volume of the passenger and crew spaces below the bulkhead deck (cubic metres), which are provided for the accommodation and use of passengers and crew, excluding baggage, store~~,~~ and provision ~~and mail~~ rooms;"

45 In the renumbered paragraph 2.4, the existing chapeau is amended to read as follows:

"~~3~~2.4 On a ship of 91.5 m in length *L* and upwards or having a bilge pump numeral, calculated in accordance with paragraph ~~3~~2.2, of 30 or more, the arrangements shall be such that at least one power bilge pump shall be available for use in all flooding conditions derived from consideration of minor damages as specified in regulation 8~~which the ship is required to withstand~~, as follows:"

46 The existing text of the renumbered paragraph 2.10 is amended to read as follows:

"~~3~~2.10 Provision shall be made to prevent the compartment served by any bilge suction pipe being flooded in the event of the pipe being severed or otherwise damaged by collision or grounding in any other compartment. For this purpose, where the pipe is at any part situated nearer the side of the ship than one fifth of the breadth of the ship (as defined in regulation 2 and measured at right angles to the centreline at the level of the deepest subdivision ~~load line~~draught), or is in a duct keel, a non-return valve shall be fitted to the pipe in the compartment containing the open end."

APPENDIX 1

CHECK/MONITORING SHEET FOR THE PROCESSING OF AMENDMENTS TO THE CONVENTION AND RELATED MANDATORY INSTRUMENTS (PROPOSAL/DEVELOPMENT)

Part III – Process monitoring to be completed during the work process at the sub-committee and checked as part of the final approval process by the Committee (Refer to section 3.2.1.3)**

1	The sub-committee, at an initial engagement, has allocated sufficient time for technical research and discussion before the target completion date, especially on issues needing to be addressed by more than one sub-committee and for which the timing of relevant sub-committees meetings and exchanges of the result of consideration needed to be carefully examined.	no[1]
2	The scope of application agreed at the proposal stage was not changed without the approval of the Committee.	yes
3	The technical base document/draft amendment addresses the proposal's issue(s) through the suggested instrument(s); where it does not, the sub-committee offers the Committee an alternative method of addressing the problem raised by the proposal.	yes
4	Due attention has been paid to the *Interim guidelines for the systematic application of the grandfather clauses* (MSC/Circ.765-MEPC/Circ.315).	yes
5	All references have been examined against the text that will be valid if the proposed amendment enters into force.	yes
6	The location of the insertion or modified text is correct for the text that will be valid when the proposed text enters into force on a four-year cycle of entry into force, as other relevant amendments adopted might enter into force on the same date.	yes
7	There are no inconsistencies in respect of scope of application between the technical regulation and the application statement contained in regulation 1 or 2 of the relevant chapter, and application is specifically addressed for existing and/or new ships, as necessary.	yes[2]
8	Where a new term has been introduced into a regulation and a clear definition is necessary, the definition is given in the article of the Convention or at the beginning of the chapter.	yes
9	Where any of the terms "fitted", "provided", "installed" or "installation" are used, consideration has been given to clarifying the intended meaning of the term.	yes

[1] Due to complexity of the issue two sessions initially allocated for completion of this output were not sufficient.

[2] The approach for the applicability may not be in line with the new *Guidance on drafting of amendments to the 1974 SOLAS Convention and related mandatory instruments* (MSC.1/Circ.1500).

10	All necessary related and consequential amendments to other existing instruments, including non-mandatory instruments, in particular to the forms of certificates and records of equipment required in the instrument being amended, have been examined and included as part of the proposed amendment(s).	yes[3]
11	The forms of certificates and records of equipment have been harmonized, where appropriate, between the Convention and its Protocols.	not applicable
12	It is confirmed that the amendment is being made to a currently valid text and that no other bodies are concurrently proposing changes to the same text.	yes
13	All entry-into-force criteria (building contract, keel laying and delivery) have been considered and addressed.	yes
14	Other impacts of the implementation of the proposed/approved amendment have been fully analysed, including consequential amendments to the "application" and "definition" regulations of the chapter.	yes
15	The amendments presented for adoption clearly indicate changes made with respect to the original text, so as to facilitate their consideration.	yes
16	For amendments to mandatory instruments, the relationship between the Convention and the related instrument has been observed and addressed, as appropriate.	not applicable
17	The related record format has been completed or updated, as appropriate.	yes

* Parts I and II should be completed by the submitter of a proposed new amendment, to the fullest extent possible.

** Part III should be completed by the drafting/working group that prepared the draft text using "yes", "no" or "not applicable".

[3] Consequential amendments to several resolutions and circulars have been examined but not included as part of the proposed amendments at this stage.

APPENDIX 2

RECORDS FOR REGULATORY DEVELOPMENT

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

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

1	**Title (number and title of regulation(s))**
SOLAS chapter II-1: Construction – Structure, subdivision and stability, machinery and electrical installations	
2	**Origin of the requirement (original proposal document)**
SLF 51/17, paragraph 3.25 and annex 3 and SLF 51/3/2, paragraph 4 and the annex	
3	**Main reason for the development (extract from the proposal document)**
The Sub-Committee agreed to a justification for the inclusion of a new item on "Revision of SOLAS chapter II-1 subdivision and damage stability regulations" (not for the general revision but for refinement of the revised SOLAS chapter II-1) in the work programme of the Sub-Committee (SLF 51/17, paragraph 3.25). In the process of developing Explanatory Notes for the new SOLAS chapter II-1 subdivision and damage stability regulations, various regulations have been identified as either needing or potential candidates for future improvement. An initial list of these SOLAS chapter II-1 regulations and associated comments was provided in annex 2 to document SLF 50/3. This list has now been updated to include the additional items agreed to at SLF 50 (see SLF 50/19, paragraph 3.17), and other additional items arising from the correspondence group's further development work on the explanatory notes. The updated list of SOLAS chapter II-1 regulations identified for possible future improvement and associated comments are attached in the annex (SLF 51/3/2, paragraph 4).	
4	**Related output**
Amendments to SOLAS chapter II-1 subdivision and damage stability regulations (5.2.1.13)	
5	**History of the discussion (approval of work programmes, sessions of sub-committees, including CG/DG/WG arrangements)**
SLF 51 agreed to the justification for the inclusion of a new item on "Revision of SOLAS chapter II-1 subdivision and damage stability regulations" (not for the general revision but for refinement of the revised SOLAS chapter II-1) in the work programme of the Sub-Committee (SLF 51/17, paragraph 3.25 and annex 3 and SLF 51/3/2, paragraph 4 and the annex). **MSC 85** endorsed the proposal by SLF 51 and agreed to include, in the SLF Sub-Committee's work programme, a high-priority item on "Revision of SOLAS chapter II-1 subdivision and damage stability regulations", with two sessions needed to complete the item (MSC 85/26, paragraph 23.35). **SLF 52**, having considered documents SLF 52/17/1, SLF 52/17/2, SLF 52/17/3, SLF 52/17/4, SLF 52/17/5 and SLF 52/17/6, submitted to that session under the agenda item "Any other business", had decided to consider the aforementioned documents in detail at SLF 53, and, to progress work on the issue intersessionally, had instructed the SDS Correspondence Group to prepare relevant draft amendments to SOLAS chapter II-1 and the associated Explanatory Notes (SLF 52/19, paragraphs 17.3 and 17.4).	

SLF 53, in considering the report of the SDS Correspondence Group (SLF 53/14), the Sub-Committee, noted that the group had extensive discussions on the draft amendments to SOLAS chapter II-1 and its Explanatory Notes (resolution MSC.281(85)) and had prepared a summary table, showing the state of progress, for further consideration by the SDS Working Group. The Sub-Committee agreed to instruct the SDS Working Group to further consider the draft amendments to SOLAS chapter II-1 and its Explanatory Notes. Having considered the report of the working group (SLF 53/WP.6), SLF 53 agreed, in principle, to the proposed amendments to SOLAS chapter II-1 and its related Explanatory Notes for further consideration by the SDS Correspondence Group. (SLF 53/19, paragraphs 14.3, 14.7 and 14.9)

SLF 54 considered the report of the SDS Correspondence Group (SLF 54/8/1) and, having approved it in general, noted that the group had progressed the work on the revision of SOLAS chapter II-1 subdivision and damage stability regulations and the associated Explanatory Notes considerably; however, a vast amount of work still remained. The Sub-Committee endorsed the draft amendments to SOLAS chapter II-1 and the associated Explanatory Notes as agreed by the correspondence group, noting that further discussion was required on outstanding matters. SLF 54 instructed the SDS Working Group, established under agenda item 6 (see paragraph 6.6), to further develop the draft amendments to SOLAS chapter II-1 and the associated Explanatory Notes. The Sub-Committee, having noted that the working group could not finalize the draft amendments to SOLAS chapter II-1 and the associated Explanatory Notes (SLF 54/WP.5/Rev.1, paragraphs 44.3 to 44.6), agreed to extend the target completion year for this output to 2013 and instructed the SDS Correspondence Group to finalize the draft amendments to SOLAS chapter II-1 and the related Explanatory Notes. (SLF 54/17, section 8)

SLF 55 considered the report of the SDS Correspondence Group (SLF 55/8/2 and Add.1) and, having approved it in general, noted that the group had progressed the work on the revision of SOLAS chapter II-1 subdivision and damage stability regulations and the associated Explanatory Notes considerably, but a vast amount of work still remained. The Sub-Committee instructed the SDS Working Group to further develop the draft amendments to SOLAS chapter II-1 and the associated Explanatory Notes. SLF 55 noted that the group could not finalize all the outstanding issues related to the revision of SOLAS chapter II-1 subdivision and damage stability regulations and, therefore, invited the Committee to extend the target completion year for this output to 2014. The Sub-Committee instructed the SDS Correspondence Group finalize the draft amendments to SOLAS chapter II-1 and the related Explanatory Notes and produce a clean text of the draft amendments to SOLAS chapter II-1, where all agreed changes, including those agreed at SLF 55, are shown as shaded and strike-through text, with the draft amendments separated from the Explanatory Notes. (SLF 55/17, section 8)

SDC 1 recalled that SLF 55 had re-established the SDS Correspondence Group and instructed it to submit a report to the first session of the SDC Sub-Committee. The Sub-Committee considered the report of the correspondence group (SDC 1/7 and Add.1) and, having approved it in general, noted that the group had progressed the work on the revision of SOLAS chapter II-1 subdivision and damage stability regulations and the associated Explanatory Notes considerably, but noted that a vast amount of work was still needed. SDC 1 instructed the Stability Working Group to finalize the draft amendments to SOLAS chapter II-1. Having considered the part of the report of the Stability Working Group (SDC 1/WP.5/Add.1) dealing with this item, the Sub-Committee agreed, in principle, to the proposed amendments to SOLAS chapter II-1 and endorsed the group's decision to continue working on them. SDC 1 agreed to establish the SDS Correspondence Group and instructed it to finalize the draft amendments to SOLAS chapter II-1, part B-4 and regulation 35-1. (SDC 1/26, section 7)

SDC 2 considered the first part of the report of the correspondence group (SDC 2/3/2) and, having approved it in general, instructed the SDS Working Group to finalize the draft amendments to SOLAS chapter II-1, taking into account documents SDC 2/3/1, SDC 2/3/4, SDC 2/3/8, SDC 2/3/9 and SDC 2/3/10. Having considered the part of the report of the SDS Working Group (SDC 2/WP.3) dealing with this item, the Sub-Committee agreed to the proposed amendments to SOLAS chapter II-1, with a view of approval at MSC 95 and subsequent adoption at MSC 96. (SDC 2/25, paragraphs 3.26 to 3.29).
6 Impact on other instruments (e.g. codes, performance standards, guidance circulars, certificates/records format, etc.)
Explanatory Notes to the SOLAS chapter II-1 subdivision and damage stability regulations (MSC.281(85)); *Guidelines on operational information for masters of passenger ships for safe return to port by own power or under tow* (MSC.1/Circ.1400).
7 Technical background
7.1 Scope and objective (to cross check with items 4 and 5 in part II of the checklist)
Refinement of SOLAS chapter II-1. The proposed amendments apply to new cargo and passenger ships.
7.2 Technical/operational background and rationale (summary of FSA study, etc., if available or, engineering challenge posed, etc.)
N/A
7.3 Source/derivation of requirement (non-mandatory instrument, industry standard, national/regional requirement)
In the process of developing Explanatory Notes for the new SOLAS chapter II-1 subdivision and damage stability regulations, various regulations have been identified as either needing or potential candidates for future improvement.
7.4 Short summary of requirement (what is the new requirement – in short and lay terms)
Refinement of the existing SOLAS regulations II-1/1, II-1/2, II-1/4, II-1/5, II-1/5-1, II-1/6, II-1/7, II-1/7-1, II-1/7-2, II-1/8, II-1/8-1, II-1/9, II-1/10, II-1/12, II-1/13, II-1/15, II-1/16, II-1/16-1, II-1/17, II-1/20, II-1/21, II-1/22, II-1/24 and II-1/35-1.
7.5 Points of discussions (controversial points and conclusion)
.1 Having considered the need of amending SOLAS regulation II-1/8-1.3 (SDC 2/4), the group agreed that residual strength calculations need not to be included in the operational information and, therefore, no changes were made to the regulation. However, further consideration should be given to the development of guidance regarding residual strength, under agenda item 4, for inclusion in the *Guidelines on safe return to port for passenger ships* (MSC.1/Circ.1400).

.2 The group, keeping in mind that there are no mandatory requirements on damage stability for cargo ships less than 80 m in length, decided that no further changes to the proposed amendments to SOLAS regulation II-1/9 need to be made with regard to cargo ships of this size. However, the concern regarding consistent application of the alternative arrangements provision for such ships needs to be specifically addressed in the Explanatory Notes.

.3 The group considered the proposals in document SDC 2/3/10 (Denmark and Netherlands) regarding the requirements for watertightness of hatches which become immersed after damage. After extensive discussion, the proposed amendments were agreed to as set out in the annex. However, to address concerns that these amendments could potentially be misunderstood to require additional hatches to be watertight, it was decided to develop an associated explanatory note to indicate this is only setting a design standard for hatches that required to be watertight by other regulations. Also it should not override the requirements in the Load Lines Convention. There were also discussions regarding the inspection and maintenance of these watertight hatches, but it was decided not to include these elements in the amendments to SOLAS chapter II-1.

.4 The group considered the proposal in document SDC 2/3/9 (United States) regarding double hulls in way of main engine-rooms on passenger ships. In the extensive discussion that followed, various concerns were expressed regarding the specific aim of the proposed requirement with respect to the existing system redundancy requirement in SOLAS regulation 8-1.2, the definition of main engine-rooms, the option for redundant port and starboard engine-rooms in the context of excessive heel, ensuring this only regarded flooding and did not include structural or mechanical damage, the proposed B/20 double-side dimension, and the longitudinal separation distance for redundant main engine-rooms. There were also general concerns expressed that this was another deterministic requirement that was not in line with the probabilistic damage stability methodology, and that other options should be pursued to achieve the intended outcome. Therefore, this item could not be finalized, as instructed, and could be further considered at SDC 3.

.5 The group could also not agree on the additional proposal in document SDC 2/3/9 to add a stability requirement to close a gap in existing regulation 8-1.2 regarding essential system availability when subject to flooding of any single watertight compartment.

.6 The group briefly considered the proposal in document SDC 2/17/1 (United States) regarding damage control drills for passenger ships. However, the group concluded that further consideration was necessary regarding drill frequency, the alignment with other testing requirements (e.g. SOLAS regulation II-1/21), a definition for damage control station, etc. Therefore, this item will be included in the terms of reference for the correspondence group, if established.

.7 The issue of application dates for these amendments was raised. It was noted that this issue was initially considered at SLF 55 with the outcome that these amendments should apply to new ships only. This has been the premise that has been used in developing the amendments and is reflected in the proposed amendments to SOLAS regulations II-1/1.1.1 and II-1/1.1.3.2 in the annex. It was further noted by the group that this approach for the applicability may not be in line with the *Guidance on drafting of amendments to the 1974 SOLAS Convention and related mandatory instruments* (MSC.1/Circ.1500).

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ANNEX 2

DRAFT MSC RESOLUTION

AMENDMENTS TO PART B 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 MSC.267(85) by which it adopted the International Code on Intact Stability, 2008 (2008 IS Code),

NOTING the provisions regarding the procedure for amendments to part B (recommendatory part) of the 2008 IS Code, stipulated in paragraph 27.2 of regulation II-1/2 of the International Convention for the Safety of Life at Sea (SOLAS), 1974 (1974 SOLAS Convention), as amended by resolution MSC.269(85), and in paragraph (16).2 of regulation I/3 of the Protocol of 1988 relating to the International Convention on Load Lines, 1966 (1988 Load Lines Protocol), as amended by resolution MSC.270(85),

RECOGNIZING the need to include provisions regarding ice accretion on cargo ships carrying timber deck cargoes in the 2008 IS Code,

HAVING CONSIDERED, at its [ninety-fifth session], the proposed amendments to part B of the 2008 IS Code, prepared by the Sub-Committee on Ship Design and Construction, at its second session,

1 ADOPTS amendments to part B of the 2008 IS Code, the text of which is set out in the annex to the present resolution;

2 RECOMMENDS Governments concerned to use the amendments to 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;

3 INVITES Contracting Governments to the 1974 SOLAS Convention and Parties to the 1988 Load Lines Protocol to note that the above amendments to the 2008 IS Code will take effect on [*date of adoption*].

ANNEX

AMENDMENTS TO PART B OF THE OF THE INTERNATIONAL CODE ON INTACT STABILITY, 2008 (2008 IS CODE)

PART B
RECOMMENDATIONS FOR CERTAIN TYPES OF SHIPS AND ADDITIONAL GUIDELINES

CHAPTER 6
ICING CONSIDERATIONS

6.2 Cargo ships carrying timber deck cargoes

1 A new paragraph 6.2.3 is added after the existing paragraph 6.2.2, as follows:

"6.2.3 Allowance for ice accretion

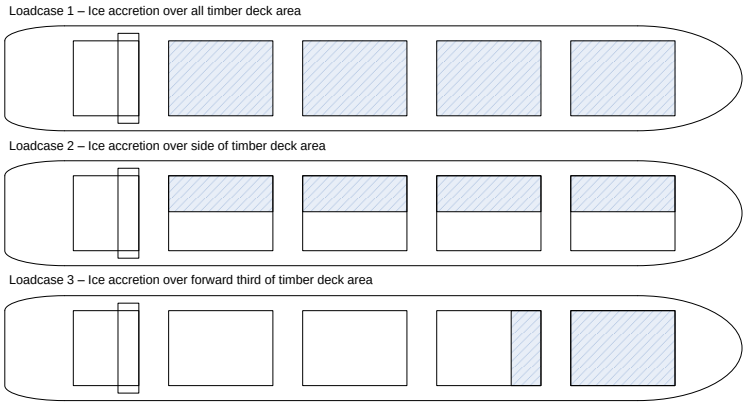
.1 The ice accretion weight, w (kg/m^2), may be taken as follows:

$$w = 30 \cdot \frac{2.3(15.2L_{pp} - 351.8)}{l_{FB}} \cdot f_{tl} \cdot \frac{l_{bow}}{0.16L}$$

where:

f_{tl} = timber and lashing factor = 1.2
L = length of ship in m
l_{FB} = freeboard height in mm
l_{bow} = length of bow flare region in m, to be taken as the distance from the longitudinal position at which the maximum breadth occurs on a water line located 0.5 metres below the freeboard deck at side to the foremost point of the bow at that waterline.

.2 The ice accretion weight, w (kg/m^2), over the timber deck region should be applied to each of the load cases as illustrated in figure 1:



Note. Load cases are to be applied in stability calculations

Figure 1 – Ice accretion load cases for timber deck cargoes"

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ANNEX 3

DRAFT AMENDMENTS TO THE INTRODUCTION OF THE 2008 IS CODE

1 Purpose

1 The chapeau of paragraph 1.2 is amended to read as follows:

"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 as well as certain ship operations, unless otherwise stated:"

2 In paragraph 1.2, a new subparagraph .7 is inserted as follows:

.7 ships engaged in anchor handling operations;

and the remaining subparagraphs are renumbered accordingly.

2 Definitions

3 A new paragraph 2.27 is inserted after the existing paragraph 2.26 as follows:

"2.27 *Ship engaged in anchor handling operations* means a ship engaged in operations with deployment, recovering and repositioning of anchors and the associated mooring lines of rigs or other vessels. Forces associated with anchor handling are generally associated with the winch line pull and may include vertical, transverse, and longitudinal forces applied at the towing point and over the stern roller."

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ANNEX 4

DRAFT AMENDMENTS TO PART B OF THE 2008 IS CODE

1 The title of part B is amended to read as follows:

"Part B
Recommendations for ships engaged in certain types of operations, certain types of ships and additional guidelines"

Chapter 1 – General

1.2 Application

2 A new paragraph 1.2.2 is inserted after the existing paragraph 1.2.1 as follows:

"1.2.2 The recommendations contained herein may also apply to other ships subject to similar external forces, when determining the adequacy of stability."

and the existing paragraphs 1.2.2 and 1.2.3 are renumbered accordingly.

Chapter 2 – Recommended design criteria for certain types of ships

3 A new section 2.7 is inserted as follows:

"**2.7 Ships engaged in anchor-handling operations**

2.7.1 Application

2.7.1.1 The provisions given hereunder apply to ships engaged in anchor-handling operations.

2.7.1.2 A *wire* means a dedicated line (wire rope, synthetic rope or chain cable) used for the handling of anchors by means of an anchor handling winch.

2.7.2 Heeling levers

2.7.2.1 A heeling lever, HL_{φ}, generated by the action of a heeling moment caused by the vertical and horizontal components of the tension applied to the wire should be calculated as:

$$HL_{\varphi} = (M_{AH} / \Delta_2) \cos \varphi$$

where:

M_{AH} = $F_p \bullet (h \sin \alpha \bullet \cos \beta + y \bullet \sin \beta)$;

Δ_2 = displacement of a loading condition, including action of the vertical loads added (F_v), at the centreline in the stern of ship;

F_v = $F_p \bullet \sin \beta$;

α = the horizontal angle between the centreline and the vector at which the wire tension is applied to the ship in the upright position, positive outboard;

β = the vertical angle between the waterplane and the vector at which the wire tension is applied to the ship, positive downwards, should be taken at the maximum heeling moment angle as:

= $tan^{-1}(y/(h \bullet sin\ \alpha))$; but not less than $cos^{-1}(1.5\ B_P/\ F_P\ cos\ \alpha)$, using consistent units;

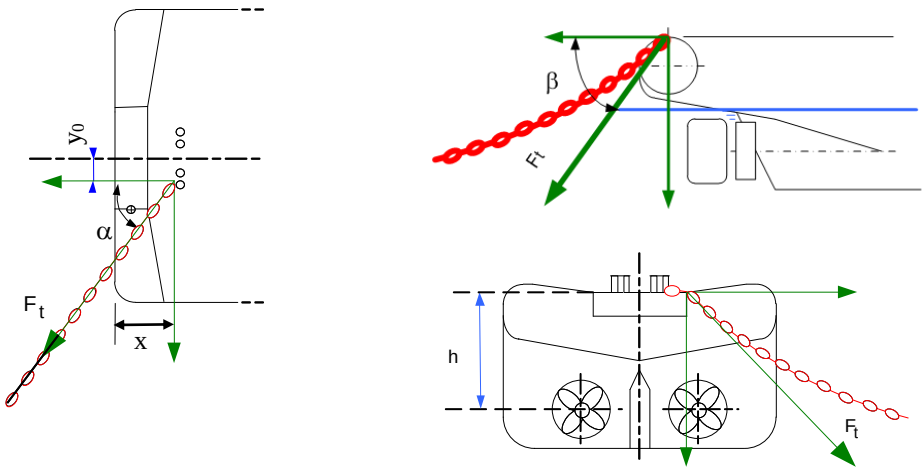


Figure 2.7.2 – Diagrams showing the intended meaning of parameters α, β, x, y and h. **F_t** ***shows the vector of the applied wire tension.***

B_P = the Bollard pull that is the documented maximum continuous pull obtained from a static pull test on sea trial, carried out in accordance with annex A of MSC/Circ.884 or an equivalent standard acceptable to the Administration;

F_p = (Permissible tension) the wire tension which can be applied to the vessel as loaded while working through a specified tow pin set, at each α, for which all stability criteria can be met. F_p should in no circumstance be taken as greater than F_d;

F_d = (Design maximum wire tension) the maximum winch wire pull or maximum static winch brake holding force, whichever is greater;

h = the vertical distance (m) from the centre the propulsive force acts on the ship to either:

- the uppermost part at the towing pin, or
- a point on a line defined between the highest point of the winch pay-out and the top of the stern or any physical restriction of the transverse wire movement;

y = the transverse distance (m) from the centreline to the outboard point at which the wire tension is applied to the ship given by:

$y_0 + x \tan \alpha$; but not greater than $B/2$;

B = the moulded breadth (m);

y_0 = the transverse distance (m) between the vessel centreline to the inner part of the towing pin or any physical restriction of the transverse wire movement;

x = the longitudinal distance (m) between the stern and the towing pin or any physical restriction of the transverse wire movement.

2.7.3 Permissible tension

2.7.3.1 The permissible tension as function of α, defined in paragraph 2.8.2, should not be greater than the tension given by paragraph 2.8.3.2,

2.7.3.2 Permissible tension as function of α can be calculated by direct stability calculations, provided that the following are met:

.1 the heeling lever should be taken as defined in paragraph 2.7.2 for each α;

.2 the stability criteria in paragraph 2.7.4, should be met;

.3 α should not be taken less than 5 degrees, except as permitted by paragraph 2.7.3.3; and

.4 Intervals of α should not be more than 5 degrees, except that larger intervals may be accepted, provided that the permissible tension is limited to the higher α by forming working sectors.

2.7.3.3 For the case of a planned operation to retrieve a stuck anchor in which the vessel is on station above the anchor and the vessel has low or no speed, α may be taken as less than 5 degrees.

2.7.4 Stability criteria

2.7.4.1 For the loading conditions intended for anchor-handling, but before commencing the operation, the stability criteria given in paragraph 2.2 of part A, or the equivalent stability criteria given in paragraph 2.4 of part B, where a vessel's characteristics render compliance with paragraph 2.2 of part A impracticable should apply. During operation, under the action of the heeling moment, the criteria under paragraphs 2.7.4.2 to 2.7.4.4 should apply.

2.7.4.2 The residual area between the righting lever curve and the heeling lever curve calculated in accordance with paragraph 2.7.2 should not be less than 0.070 metre-radians. The area is determined from the first intersection of the two curves, φ_e, to the angle of the second intersection, φ_c, or the angle of down-flooding, φ_f, whichever is less.

2.7.4.3 The maximum residual righting lever GZ between the righting lever curve and the heeling lever curve calculated in accordance with paragraph 2.7.2 should be at least 0.2 m.

2.7.4.4 The static angle at the first intersection, φ_e, between the righting lever curve and the heeling lever curve calculated in accordance with paragraph 2.7.2 should not be greater than:

.1 the angle at which the righting lever equals 50 per cent of the maximum righting lever;

.2 the deck edge immersion angle; or

.3 15^o,

whichever is less.

2.7.4.5 A minimum freeboard at stern, on centerline, of at least 0.005 L should be maintained in all operating conditions, with a displacement given by Δ_2, as defined in paragraph 2.7.2. In the case of the anchor retrieval operation covered by paragraph 2.7.3.3, a lower minimum freeboard may be accepted provided that due consideration has been given to this in the operation plan.

2.7.5 Constructional precautions against capsizing

2.7.5.1 A stability instrument may be used for determining the permissible tension and checking compliance with relevant stability criteria.

Two types of stability instrument may be used on board:

- either a software checking the intended or actual tension on the basis of the permissible tension curves; or

- a software performing direct stability calculations to check compliance with the relevant criteria, for a given loading condition (before application of the tension force), a given tension and a given wire position (defined by angles α and β)

2.7.5.2 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.

2.7.5.3 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 working deck and 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.

2.7.5.4 The winch systems should be provided with means of emergency release.

2.7.5.5 For vessels engaged in anchor-handling operations the following recommendations for the anchor-handling arrangements should be considered:

.1 stop pins or other design features meant to impede the movement of the wire further outboard should be installed; and

.2 the working deck should be marked with contrasting colours or other identifiers such as guide pins, stop pins or similar easily identifiable points that identify operational zones for the line to aid operator observation.

2.7.6 Operational procedures against capsizing

2.7.6.1 A comprehensive operational plan should be defined for each anchor-handling operation, according to the guidelines given in paragraph 3.8, where at least, but not only, the following procedures and emergency measures should be identified:

.1 environmental conditions for the operation;

.2 winch operations and movements of weights;

.3 compliancy with the stability criteria, for the different expected loading conditions;

.4 permissible tensions on the winches as function of α; in accordance with paragraph 3.8;

.5 stop work and corrective procedures; and

.6 confirmation of the master's duty to take corrective action when necessary.

2.7.6.2 The arrangement of cargo stowed on deck should be such as to avoid any obstruction of the freeing ports or sudden shift of cargo on deck.

2.7.6.3 Counter-ballasting to correct the list of the vessel during anchor-handling operations should be avoided."

Chapter 3 – Guidance in preparing stability information

3.4 Standard conditions of loading to be examined

3.4.1 Loading conditions

4 A new paragraph 3.4.1.7 is inserted as follows:

"Reserved (Towing Operations)"

5 A new paragraph 3.4.1.8 is inserted as follows:

"3.4.1.8 For a vessel engaged in an anchor-handling operation, the standard loading conditions should be as follows, in addition to the standard loading conditions for a cargo ship in paragraph 3.4.1.2:

.1 service loading condition at the maximum draft at which anchor-handling operations may occur with the heeling levers as defined in paragraph 2.8.2 for the line tension the vessel is capable of with a minimum of 67 % stores and fuel, in which all the relevant stability criteria as defined in paragraph 2.8.4 are met;

.2 service loading condition at the minimum draft at which anchor-handling operations may occur with the heeling levers as defined in paragraph 2.8.2 for the line tension the vessel is capable of with 10 % stores and fuel, in which all the relevant stability criteria as defined in paragraph 2.8.4 are met;"

3.4.2 Assumptions for calculating loading conditions

6 In paragraph 3.4.2.3, the following sentence is inserted at the end:

"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)."

7 Subparagraph 3.4.2.7.5 is deleted.

8 Subparagraph 3.4.2.8.2 is deleted and the remaining paragraphs are renumbered accordingly.

9 The following new paragraphs 3.4.2.9 to 3.4.2.11 are added as follows:

"3.4.2.9 For ships engaged in harbour, coastal or ocean going towing, escort towing, anchor-handling or lifting operations, allowance should be made for the anticipated weight of cargo on and below deck, chain in lockers, anticipated type of wire or rope on storage reels and wire on the winches when calculating loading conditions.

3.4.2.10 For ships engaged in anchor-handling operations, the compliance with the relevant stability criteria should be made for each set of towing pins and its associated permissible line tensions, including any physical element or arrangement that can restrict the line movement.

3.4.2.11 For ships engaged in anchor-handling operations, the reference loading conditions in paragraph 3.4.1.8 should meet the stability criteria in paragraph 2.8.4 when applying the design tension F_d, for the tow pin set nearest to centreline, as a minimum for the lowest α equal to 5 degrees."

3.5 Calculation of stability curves

10 A new section 3.5.4 is added as follows:

"**3.5.4 Calculation of stability curves for ships engaged in anchor-handling operations to which section 2.8 applies**

3.5.4.1. Curves (or tables) of the permissible tension as a function of permissible KG (or GM) are to be provided for the draught (or displacement) and trim values covering the intended anchor-handling operations. The curves (or tables) should be developed under the following assumptions:

.1 the maximum allowable KG from the approved stability booklet;

.2 information of permissible tension curve or table for each set of towing pins, including any physical element or arrangement that can restrict the line movement as function of the stability limiting curve should be included;

.3 where desirable, a permissible tension curve or table should be provided for any specific loading condition;

.4 the draught (or displacement), trim and KG (or GM) to be taken into consideration are those before application of the tension; and

.5 where tables are provided that divide the operational, cautionary, and stop work zones, referred to in paragraph 3.8.2 ("Green", "Yellow" or "Amber", "Red" colour codes, respectively) the limiting angles associated with physical features of the stern, including the roller, may be used to define the boundaries between the operational and cautionary zones (green/yellow boundary) and the cautionary and stop work zones (yellow/red boundary)."

3.6 Stability booklet

11 A new paragraph 3.6.3 is added as follows:

"3.6.3 The stability manual for ships engaged in anchor handling operations should contain additional information on:

.1 maximum bollard pull, winch pull capacity and brake holding force;

.2 details on the anchor-handling arrangement such as location of the fastening point of the wire, type and arrangement of towing pins, stern roller, all points or elements where the tension is applied to the ship;

.3 identification of critical downflooding openings;

.4 guidance on the permissible tensions for each mode of operation and for each set of towing pins, including any physical element or arrangement that can restrict the wire movement, as function of all relevant stability criteria; and

.5 recommendations on the use of roll reduction systems.

and the existing paragraphs 3.6.4 and 3.6.5 are renumbered as paragraphs 3.6.5 and 3.6.6 accordingly.

3.8 Operating booklets for certain ships

12 A new section 3.8 is added as follows:

"**3.8 Operational and planning manuals for ships engaged in anchor-handling for which section 2.8 applies:**

3.8.1 To assist the master an operational and planning manual containing guidelines for planning and performing specific operations should be provided on board. The guidelines should contain sufficient information to enable the master to plan and operate the ship in compliance with the applicable requirements contained in this Code. The following information should be included as appropriate:

.1 anchor- handling arrangements, including:

- detail arrangement of anchor handling deck equipment (winches, wire stoppers, towing pins, etc.);
- typical arrangement of cargo on deck (anchors, wires, chain cables, etc.);
- chain lockers used for mooring deployment;
- anchor-handling/towing winch;
- tugger winches;
- stern roller, including lateral limits on both ends;
- lifting appliances, if any and if forming a physical restriction as per paragraph 3.4.2.10; and
- typical paths of wires between winches and stern roller, showing the limit sectors; and

.2 detailed data of the permissible tensions, stability limiting curves, and recommendations for calculating ship's loading conditions including sample calculations.

3.8.2 An operation plan should be agreed to by the master of the vessel and a copy archived on a remote location before the operation commences. Guidelines and procedures to define a step-wise operational plan for a specific operation should contain instructions for:

.1 identifying and calculating loading conditions for all relevant stages of operation, taken into account the expected fuel and stores consumption, alterations on deck load, effects of deployment or recovering of the wire on the winches and chain lockers;

.2 planning ballast operations;

.3 defining the most favourable consumption sequence and identifying the most onerous situations;

.4 identifying the possibility or prohibition of using the roll reduction systems in all operational stages;

.5 operation with open chain lockers, e.g. additional loading conditions for asymmetric filling or other measures to reduce the possibility of flooding;

.6 collect updated weather forecasts, and to define environmental conditions for anchor handling operations;

.7 the use of limiting stability curves and intended tensions;

.8 defining the stop work limits:

.a permissible tensions and operational sectors for α;

.b heeling angles in compliance with the stability criteria; and

.c environmental conditions;

.9 implement and define corrective and emergency procedures;

.10 define:

.a an operational zone in which normal operations up to the permissible tension are to occur (i.e. a "Green" zone);

.b a cautionary zone (i.e., a "Yellow" or "Amber" zone) where operations may be reduced or halted to assess the ship's options to return to the operational or Green Zone: the cautionary zone should be not less than an angle of 10 degrees unless table 3.8.3 provides otherwise; and

.c a "Stop work" zone (i.e. a "Red" zone) in which the operation should be stopped, for which, in normal operations, the yellow/red boundary should not exceed 45 degrees or the point at which the wire rises above the deck. Notwithstanding this, due consideration may be given to different operations from typical anchor handling operations where the planned operation ensures the safety of the vessel; and

.11 examples of presentation of permissible tensions are presented in annex 3 to part B.

3.8.3 To aid the definition of permissible tensions and zones based on the availability of tension monitoring and an on board stability instrument the following table is provided.

Table 3.8.3

Availability of Tension Monitoring and an onboard Stability Instrument	Tension monitoring is not available	Tension monitoring is available but no stability instrument is available	Both tension monitoring and a stability instrument is available
Permissible tension, F_p	Design Maximum Line Tension, F_p, in the operational zone	F_p as described in Stability Booklet, the operational planning guidelines, or the specific operational plan.	F_p as calculated by the Stability Instrument for the actual loading condition
Permissible table	First α should be 5°. The only permissible tension is the Design maximum wire Tension, F_d. Figures in the table will be F_d for α for which $F_p \geq F_d$. The cautionary zone would include positions where $F_d > F_p \geq$ maximum winch wire pull. The stop work zone is every other position where $F_p <$ the maximum winch wire pull. If criteria is not fulfilled at α = 5° anchor handling should not be performed without winch modification.	Tables may be prepared for different values of draft, trim, KG or GM, or specific predefined loading conditions. Values in the table should range from α = 0 to α = 90º. A table should identify F_p at critical points and the table should be provided for each set of towing pins.	Tables or curves provided in the stability booklet may be used where F_p throughout the nonspecific operational zone exceeds the maximum anticipated wire tension; otherwise, tables or curves calculated for the actual loading condition must be developed.
Zones	The operational zone should be defined as the sector between the two outboard α values for which $F_p \geq F_d$. The cautionary zone should be defined as the sector between the α at which $F_p = F_d$ and α at which F_p = maximum winch wire pull. The stop work zone should cover every other position. The sectors should be documented in the Stability Booklet, the operational planning	The zones may be developed based on normal operational practices contained in the operational planning guidelines, e.g. the operational zone on the stern roller, cautionary zone for not more than 15deg past the stern roller and the red zone otherwise or developed for a specific operation where the outboard α values at which F_p = maximum anticipated wire tension minus 10º	The zones may be developed based on normal operational practices contained in the operational planning guidelines, e.g. the operational zone on the stern roller, cautionary zone for not more than 15deg past the stern roller and the red zone otherwise or developed for a specific operation where the outboard α values at which F_p = maximum anticipated wire tension minus 10º

	guidelines, or the specific operational plan. The sector diagram may be prepared for multiple loading conditions. If the limiting α is less than 5° anchor handling operations should not be performed without winch modifications.	defines the operational zone, if α is greater than 20º. If this α is less than 20º, the operational zone is defined as the sector between ½ the outboard α values at which F_p = maximum anticipated wire tension. In each case, the cautionary zone is defined between the limit of the operational zone and the α value at which F_p = maximum anticipated wire tension. In each case, the operational zone must be identified for the anticipated wire tension.	defines the operational zone, if α is greater than 20º. If this α is less than 20º, the operational zone is defined as the sector between ½ the outboard α values at which F_p = maximum anticipated wire tension. In each case, the cautionary zone is defined between the limit of the operational zone and the α value at which F_p = maximum anticipated wire tension. In each case, the operational zone must be identified for the anticipated wire tension.

"

and the existing section 3.8 is renumbered as section 3.9.

Chapter 4 – Stability calculations performed by stability instruments

4.1 Stability instruments

4.1.4 Functional requirements

13 A new paragraph 4.1.4.2 is added as follows:

"4.1.4.2 For ships engaged in anchor-handling operations planning tools should be provided in compliance with operational manual requirements. Information such as ballasting and consumables sequences, permissible tension, working sectors, heeling angles and use of roll-reduction devices should be stated."

and the remaining paragraphs are renumbered accordingly.

Part B – Annexes

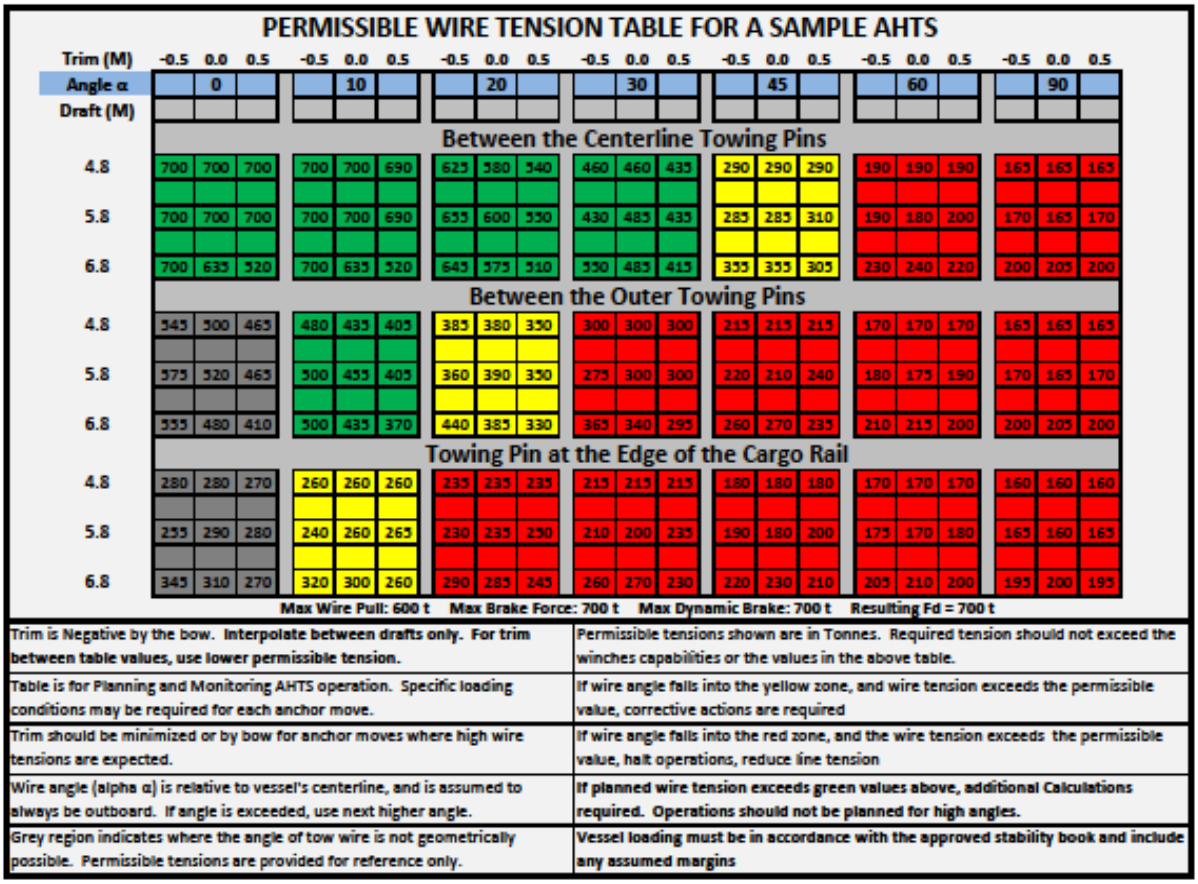
14 A new annex 3 is added at the end of part B as follows:

"**Annex 3**

Recommended model for graphic or tabular presentation of permissible tensions for use in anchor handling operations.

The insertion of a recommended model for the presentation of permissible tensions as function of α might be beneficial for a universal information standard. This uniform presentation will facilitate the circulation and the familiarization of the operators with the ship and its equipment.

A possible graphic presentation of the permissible tension is here included as an example, both table and diagram format.



PERMISSIBLE WIRE TENSION TABLE FOR A SAMPLE AHTS

Trim (M)	-0.5	0.0	0.5	-0.5	0.0	0.5	-0.5	0.0	0.5	-0.5	0.0	0.5	-0.5	0.0	0.5	-0.5	0.0	0.5	-0.5	0.0	0.5
Angle α		0			10			20			30			45			60			90		
Draft (M)																					
Between the Centerline Towing Pins																					
4.8	700	700	700	700	700	690	625	580	540	460	460	435	290	290	290	190	190	190	165	165	165
5.8	700	700	700	700	700	690	655	600	550	430	485	435	285	285	310	190	180	200	170	165	170
6.8	700	635	520	700	635	520	645	575	510	550	485	415	355	355	305	230	240	220	200	205	200
Between the Outer Towing Pins																					
4.8	545	500	465	480	435	405	385	380	350	300	300	300	215	215	215	170	170	170	165	165	165
5.8	575	520	465	500	455	405	360	390	350	275	300	300	220	210	240	180	175	190	170	165	170
6.8	555	480	410	500	435	370	440	385	330	365	340	295	260	270	235	210	215	200	200	205	200
Towing Pin at the Edge of the Cargo Rail																					
4.8	280	280	270	260	260	260	235	235	235	215	215	215	180	180	180	170	170	170	160	160	160
5.8	255	290	280	240	260	265	230	235	250	210	200	235	190	180	200	175	170	180	165	160	165
6.8	345	310	270	320	300	260	290	285	245	260	270	230	220	230	210	205	210	200	195	200	195

Max Wire Pull: 600 t Max Brake Force: 700 t Max Dynamic Brake: 700 t Resulting Fd = 700 t

Trim is Negative by the bow. **Interpolate between drafts only. For trim between table values, use lower permissible tension.**	Permissible tensions shown are in Tonnes. Required tension should not exceed the winches capabilities or the values in the above table.
Table is for Planning and Monitoring AHTS operation. Specific loading conditions may be required for each anchor move.	If wire angle falls into the yellow zone, and wire tension exceeds the permissible value, corrective actions are required
Trim should be minimized or by bow for anchor moves where high wire tensions are expected.	If wire angle falls into the red zone, and the wire tension exceeds the permissible value, halt operations, reduce line tension
Wire angle (alpha α) is relative to vessel's centerline, and is assumed to always be outboard. If angle is exceeded, use next higher angle.	**If planned wire tension exceeds green values above, additional Calculations required. Operations should not be planned for high angles.**
Grey region indicates where the angle of tow wire is not geometrically possible. Permissible tensions are provided for reference only.	**Vessel loading must be in accordance with the approved stability book and include any assumed margins**

Figure 1: Permissible tension table for vessel with 3 tow points

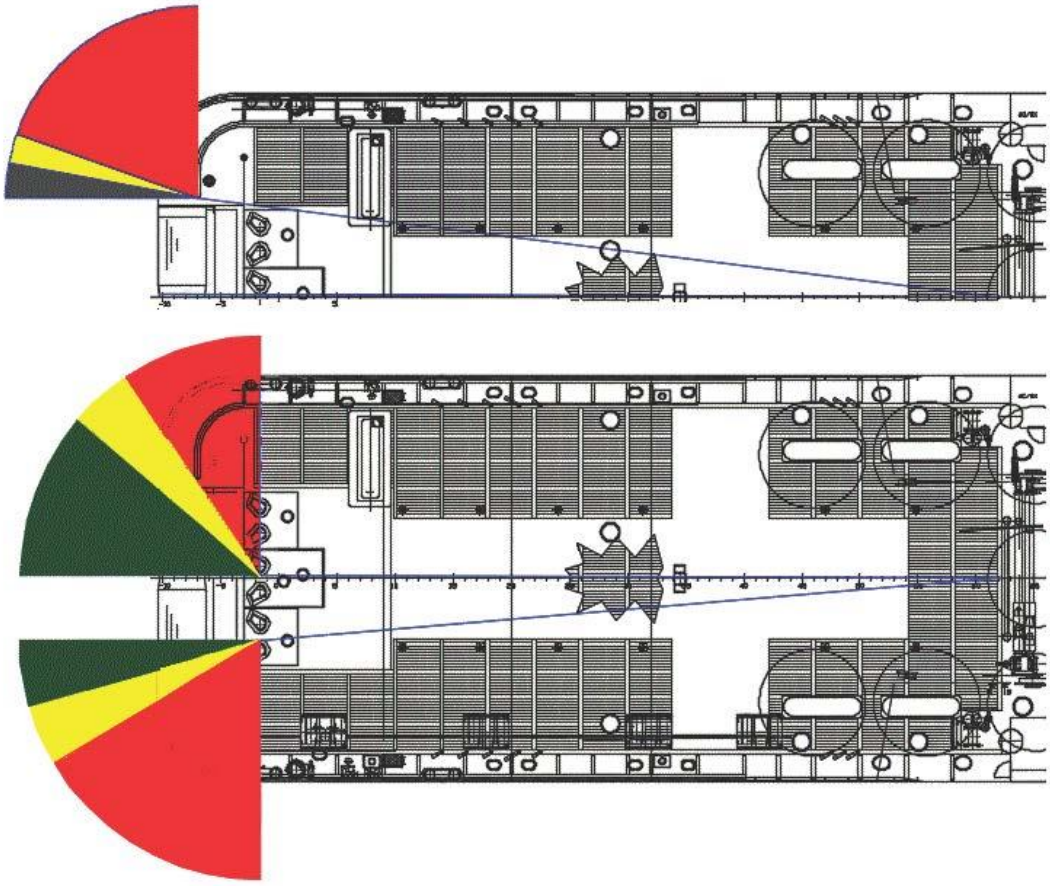


Figure 2: Illustration of the operational, cautionary, and stop work zones (coded respectively "Green", "Yellow" and "Red" zones)

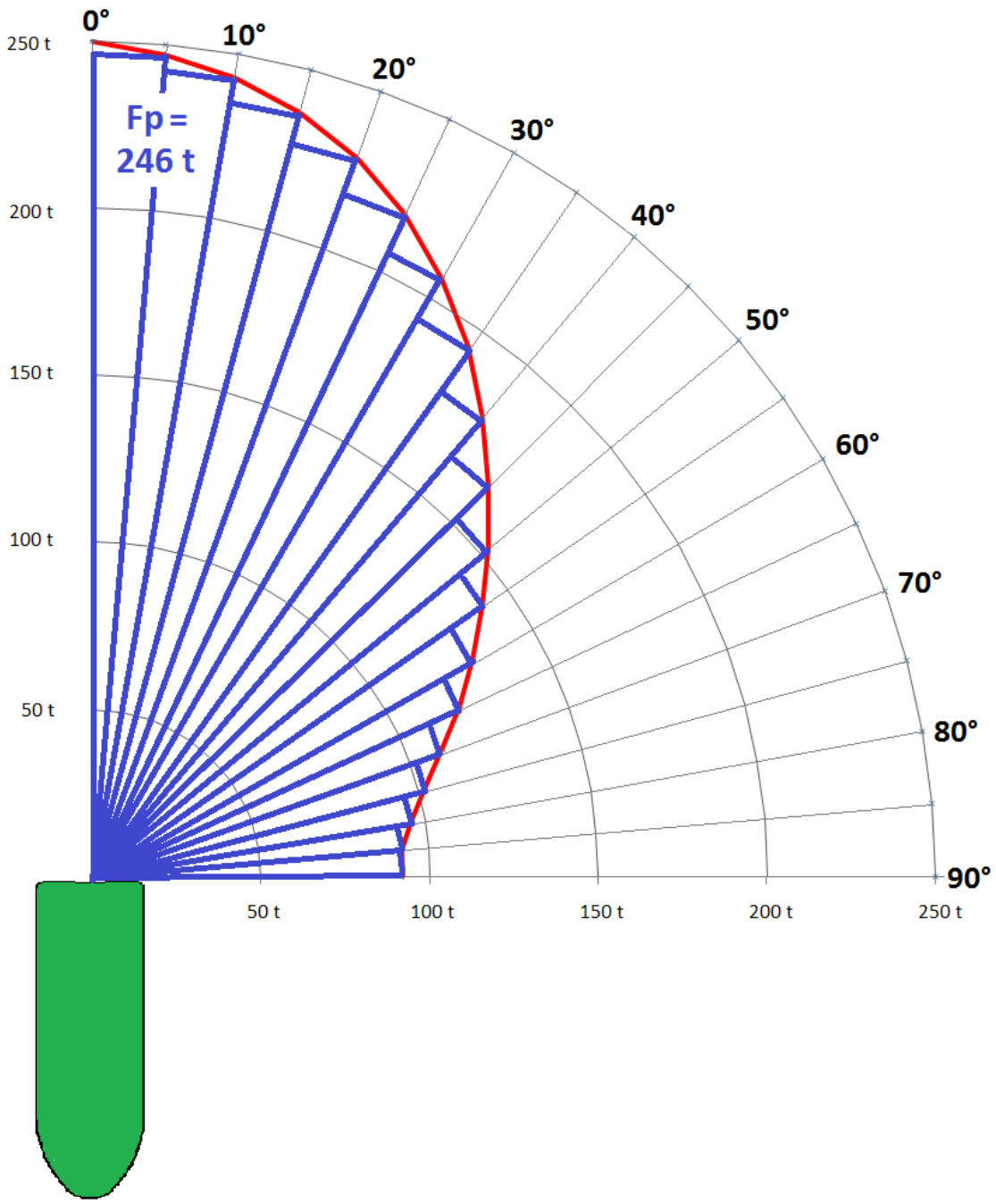


Figure 3: Permissible tension sector diagram based on standard alpha values (5°, 10°, 15°, 90°)

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ANNEX 5

DRAFT MSC CIRCULAR

DEFINITION OF INDUSTRIAL PERSONNEL

1 The Maritime Safety Committee, at its [ninety-fifth session (3 to 12 June 2015)], with a view to ensuring a uniform approach towards the definition of *industrial personnel*, and following a recommendation made by the Sub-Committee on Ship Design and Construction, at its second session, approved the definition for industrial personnel (see paragraph 4).

2 This circular provides guidance to assist Member Governments such that they may develop and implement regulations for the safe carriage of industrial personnel on board offshore industry vessels engaged on international voyages. This provides a short-term solution in recognition of the urgent need for its use by the evolving offshore energy sector.

3 Under SOLAS chapter I, regulation 2(e), every person other than the master of the ship and the members of the crew or other persons employed or engaged in any capacity on board a ship on the business of that ship is a "passenger". Industrial personnel whose main work activities may not be on board the ship may be excluded from being considered as "crew". However, industrial personnel meeting the standards of medical fitness and training set out below and by virtue of the stipulations contained in the definition should not be considered as passengers.

4 *Industrial personnel* means all persons who are not passengers or members of the crew or children of under one year of age, and:

.1 are transported or accommodated on board for the purpose of offshore industrial activities[4];

.2 are able bodied and meet appropriate medical standards[5];

.3 have received basic safety training, according to relevant industry standards[6];

.4 have a fair knowledge of the layout of the ship and the handling of the ship's safety equipment before departure from port (e.g. through a safety briefing); and

.5 are equipped with appropriate personal safety equipment suitable for the risks to safety such personnel are likely to experience on the forthcoming voyage (e.g. immersion suits).

5 Member Governments are invited to use the above definition when regulating vessels for the safe carriage of industrial personnel and to bring it to the attention of all parties concerned.

***

[4] Examples of such activities may include safe transfer of personnel, with other examples referred to under offshore operations in paragraph 6.2.2.11 of resolution A.1079(28).

[5] Equivalent to STCW I/9.

[6] STCW A-VI/1 paragraph 2, or industry standards e.g. Global Wind Organization (GWO), Offshore Petroleum Industry Training Organization (OPITO), Basic Offshore Safety Induction and Emergency Training (OPITO accredited) or equivalent standard. An example for personnel undergoing transfer from ship to foundation or vice versa, will require specific transfer training.

ANNEX 6

DRAFT MSC CIRCULAR

INTERIM GUIDELINES FOR USE OF FIBRE REINFORCED PLASTIC (FRP) ELEMENTS WITHIN SHIP STRUCTURES: FIRE SAFETY ISSUES

1 The Maritime Safety Committee, at its [ninety-fifth session (3 to 12 June 2015)], having considered a proposal by the Sub-Committee on Ship Design and Construction at its second session, approved the *Interim Guidelines for use of Fibre Reinforced Plastic (FRP) elements within ship structures: Fire safety issues*, as set out in the annex.

2 The annexed Interim guidelines should be used as a supplement to the *Guidelines for the approval of alternatives and equivalents as provided for in various IMO instruments* (MSC.1/Circ.1455) and the *Guidelines on alternative design and arrangements for fire safety* (MSC.1/Circ.1002) when approving FRP elements in ship structures.

3 Member Governments are invited to apply the annexed Interim guidelines when approving alternative designs and arrangements for FRP elements in ship structures in accordance with SOLAS regulation II-2/17 (Alternative design and arrangements). The Interim guidelines are intended to ensure that a consistent approach is taken with regard to standards of fire safety of ships making use of FRP elements in their structures and that the level of fire safety afforded by the provisions of SOLAS chapter II-2 is maintained.

4 Member Governments are invited to bring the annexed Interim guidelines to the attention of all parties concerned.

5 Member Governments and industry are invited also to submit information, observations, comments and recommendations based on the practical experience gained through the application of these Interim guidelines and submit relevant safety analyses on FRP elements used within ship structures. The intention is that experience gained during approval processes of FRP elements within ship structures according to SOLAS regulation II-2/17 shall be gathered and used to amend the Interim guidelines, as appropriate.

ANNEX

INTERIM GUIDELINES FOR USE OF FIBRE REINFORCED PLASTIC (FRP) ELEMENTS WITHIN SHIP STRUCTURES: FIRE SAFETY ISSUES

Chapter 1 General

1.1 Fibre Reinforced Plastic (FRP) composite is a lightweight material composition with a high strength to weight ratio and corrosion resistance compared to steel. The fact that FRP composite is combustible makes fire safety a key issue when considering ship structures in this material.

1.2 These guidelines are intended to facilitate the safe use of FRP composites in shipbuilding, taking into account the material particularities. The guidelines have been developed to provide support for Administrations to ensure that fire safety evaluation of FRP composite structures can be made in a consistent way by any flag State.

1.3 There is a diversity of FRP composite compositions with different properties and the scope of their intended use may vary widely; hence the guidelines cannot provide all the necessary information for approval. Nonetheless, it is important that all essential questions are raised during the approval process, which may be remedied by these guidelines. They contain known properties, problems and solutions with regard to fire safety but cannot be considered to cover all possible hazards associated with use of FRP composite materials. Furthermore, use of FRP composite may also affect other parts of a ship's safety than those associated with fire, e.g. those specified in appendix A (Issues other than fire safety).

1.4 As of today, a way to approve FRP composite structures on ships is if they are seen as an alternative design of fire safety, according to SOLAS chapter II-2, regulation 17. These guidelines contain important factors that should be addressed in the engineering analysis required by SOLAS regulation II-2/17. It is recommended that the individuals assigned to review such analysis have expertise in fire safety and also in fire safety engineering or risk assessment.

Chapter 2 Assessing fire safety of FRP composite structures

2.1 Laminates, sandwich panels and stiffeners formed by polymers, fibres and core materials may be combined in different ways to make up FRP composite structures on ships. Some typical FRP composite materials and compositions used in shipbuilding are further described in appendix B *(*FRP composite materials and compositions used in shipbuilding). It also exemplifies fire behaviour of typical FRP composite components and compositions. Relevant fire properties of the particular materials considered in an alternative design must be derived by tests for each specific design case (see appendix E (Fire testing of FRP composite)).

2.2 Use of FRP composite structures on SOLAS vessels is generally not allowed due to requirements on non-combustibility of the materials. Requirements may although be deviated. When design or arrangements deviate from prescriptive requirements of the fire safety chapter in SOLAS, regulation II-2/17.2.2 requires that engineering analysis, evaluation and approval is carried out in accordance with SOLAS regulation II-2/17. Combustible FRP composite structures and related safety measures may thus be regarded as alternative design and arrangements of fire safety. The background to this regulation and its applicability for combustible structures are elaborated in appendix C (SOLAS regulation II-2/17 and FRP composite structures).

2.3 According to SOLAS regulation II-2/17, alternative design and arrangements for fire safety should provide a degree of safety at least equivalent to that achieved by compliance with the prescriptive requirements. The required process to demonstrate that sufficient safety is achieved is described in SOLAS regulation II-2/17, with reference to the *Guidelines on alternative design and arrangements for fire safety* (MSC/Circ.1002). However, as a general requirement the approach used to assess safety must properly describe the affected fire safety of the design and arrangements, i.e. descriptions of uncertainties must be sufficient to establish appropriate safety margins. This is highly important to consider in evaluations of FRP composite structures. As briefly explained in appendix C (SOLAS regulation II-2/17 and FRP composite structures), the approach described in MSC/Circ.1002 is a two-step deterministic fire risk assessment. Depending on the scope, such assessment could appear overly complex or insufficient. Recommendations and requirements for the method used to assess safety of an alternative design involving FRP composite structures are discussed in appendix D (Recommendations regarding the assessment). It may also be relevant to consider the *Guidelines for the approval of alternatives and equivalents as provided for in various IMO instruments* (MSC.1/Circ.1455), which describe an approach which is more adaptable to the scope of the alternative design and arrangements. MSC.1/Circ.1455 was developed to provide a consistent process for the coordination, review and approval of alternative design and arrangements in general, i.e. not only concerning fire safety. It may hence provide additional guidance when the use of FRP composite structures affects other aspects of safety than those related to fire (see appendix A (Issues other than fire safety)). In detail it also describes the risk-based approval process surrounding the assessment. As referred to in SOLAS, the guidelines in this document take basis in MSC/Circ.1002.

2.4 One of the first and most foundational steps in the engineering analysis according to SOLAS regulation II-2/17 (hereafter referred to as "regulation II-2/17 assessment") is to form an approval basis. It is done by identifying the prescriptive requirement(s) deviated by the alternative design and arrangements (SOLAS regulation II-2/17.3.2). With an understanding of their associated functional requirements, the deviated prescriptive requirements are then used to define performance criteria, as described e.g. in MSC/Circ.1002 paragraphs 4.4, 5.1.2 and 6.3.2 and in SOLAS regulation II-2/17.3.4. However, due to limitations in the current regulations, identification of deviated prescriptive requirements may not form a sufficient basis to ensure equivalent safety. When considering FRP composite structures, deviations fundamentally concern the required non-combustibility of structures. With the assumption that non-combustible structures are used, the fire safety regulations include unwritten (implicit) safety requirements. In order to establish an appropriate approval basis, it is therefore required in each design case to perform the necessary investigations to identify all relevant effects on fire safety. This is further described in appendix D (Recommendations regarding the assessment). In particular, the achievement of the purpose statements of the fire safety regulations should be judged independently (without regard to prescriptive requirements). Potential challenges to purpose statements and prescriptive requirements in SOLAS chapter II-2 when considering FRP composite structures are exemplified in chapter *3* (Important factors to consider when evaluating FRP composite structures with starting point in the regulations of SOLAS chapter II-2). Further recommendations regarding an assessment of fire safety involving FRP composite structures are presented in appendix D (Recommendations regarding the assessment).

2.5 A number of fire hazards may be introduced by use of FRP composite structures. A useful starting point for the hazard identification is the investigation of challenges to regulations and thus chapter 3 (Important factors to consider when evaluating FRP composite structures with starting point in the regulations of SOLAS chapter II-2). Fire hazards relevant for further investigation, categorized according to the regulations in SOLAS chapter II-2, are particularly:

.1 fire growth potential;

.2 potential to generate smoke and toxic products;

.3 containment of fire;

.4 firefighting; and

.5 structural integrity.

2.6 The fire hazards and performance of safety measures may be quantified by tools for fire safety engineering and risk assessment and with reference to fire tests (see appendix E (Fire testing of FRP composite)). Sufficient safety may be assured within delimited areas separately, e.g. covered by functional requirements or regulations, or included in a holistic estimation of effects on safety. The former is illustrated along with further examples of an assessment in appendix F (Assessment examples).

2.7 Key terms are defined in MSC/Circ.1002 and MSC.1/Circ.1455, as well as in fire safety engineering guidelines for buildings, e.g. ISO 23932.

Chapter 3 Important factors to consider when evaluating FRP composite structures with starting point in the regulations of SOLAS chapter II-2

The different fire safety regulations in SOLAS chapter II-2 have been analysed with the intention to identify important factors that could be necessary to address when using FRP composite in ship structures. These factors are described in the following paragraphs. According to figure 5, each fire safety regulation consists of a purpose statement and prescriptive requirements. The purpose statements consist of a regulation objective and one or several regulation functional requirements. The purpose statements have been reproduced for each regulation followed by comments on how a ship with FRP composite constructions may challenge the regulation. The regulations are not only investigated based on potential deviations and how these may have an effect on safety but also from a broader sense, i.e. how a ship with FRP composite structures could affect the regulations' purpose statements or envisioned purpose.

Note that this investigation of the regulations is not complete and may not cover all relevant effects on fire safety for a certain design and arrangements with FRP composite structures. The intention is for these guidelines to be developed, concretized and updated based on the regulations. In particular, some of the regulations could be investigated in more detail and from difference perspectives.

3.1 Regulation 1 – Application

There are currently no comments to this regulation with regard to FRP composite.

3.2 Regulation 2 – Fire safety objectives and functional requirements

Paragraph 2 states a number of functional requirements which are embodied in the regulations of the fire safety chapter in order to achieve the fire safety objectives set out in paragraph 1. In particular, the third functional requirement (regulation 2.2.1.3) requires restricted use of combustible material. Fire safety objectives and functional requirements in regulation 2 can be achieved by ensuring compliance with all prescriptive requirements in the fire safety chapter. However, from paragraph 3 it is clear that a ship shall also be considered to meet the functional requirements set out in paragraph 2 and to achieve the fire safety objectives set out in paragraph 1 when the ship's design and arrangements have been reviewed and approved in accordance with SOLAS chapter II-2, regulation 17, on alternative design and arrangements.

Evaluating achievement of the fire safety objectives and functional requirements from a bit more perspective it may be stated that a ship with constructions in FRP composite may achieve some better and some worse than a traditional design. The focus on safety of human life in the fire safety objectives makes it topical to address, not only the safety of passengers, but also the safety of firefighters and crew. Looking at the functional requirements for the whole fire safety chapter in SOLAS especially indicates that the risk when adding combustible materials needs to be accounted for.

3.3 Regulation 3 – Definitions

From the definitions in this regulation a few details may be useful to recapitulate with regard to FRP composite:

3.2 From the definition of "*A*" *class divisions* it should be noted that such divisions are described to be constructed of "steel or other equivalent material" and that they should be so constructed as to be capable to preventing the passage of smoke and flame to the end of the one-hour standard fire test.

3.4 From the definition of "*B*" *class divisions* it should be noted that such divisions are described to be constructed of "approved non-combustible materials" and that they should be so constructed as to be capable to preventing the passage of smoke and flame to the end of the first half hour of the standard fire test.

3.10 From the definition of "*C*" *class divisions* it should be noted that such divisions are described to be constructed of "approved non-combustible materials" and that no other requirements apply.

3.33 From the definition of *non-combustible material* it should be noted that such material is described to neither burn nor to give off flammable vapours in sufficient quantity for self-ignition when heated to approximately 750°C.

3.43 From the definition of *steel or other equivalent material* it should be noted that the phrase refers to any non-combustible material which, by itself or due to insulation provided, has structural and integrity properties equivalent to steel at the end of the applicable exposure to the standard fire test. Hence, there are requirements regarding non-combustibility as well as structural and integrity properties. Note that the former is not limited in time but the latter requirements need only be achieved until the end of the applicable exposure of the standard fire test. An aluminium alloy with appropriate insulation is used to exemplify an equivalent material to steel.

3.47 From the definition of *a standard fire test* it is described to be a test in which specimens of the relevant bulkheads or decks are exposed in a test furnace to temperatures corresponding approximately to the standard time-temperature curve.

3.4 Regulation 4 – Probability of ignition

Purpose statement:

The purpose of this regulation is to prevent the ignition of combustible materials or flammable liquids. For this purpose, the following functional requirements shall be met:

.1 means shall be provided to control leaks of flammable liquids;

.2 means shall be provided to limit accumulation of flammable vapours;

.3 the ignitability of combustible materials shall be restricted;

.4 ignition sources shall be restricted;

.5 ignition sources shall be separated from combustible materials and flammable liquids; and

.6 the atmosphere in cargo tanks shall be maintained out of the explosive range.

Comments:

Using combustible materials in structures is not in conflict with the objective of this regulation. Although it states to aim at preventing the ignition of combustible materials. Looking at the prescriptive requirements they prevent the occurrence of fire by restricting ignition sources and some combustibles. Mainly fuels and the handling of highly flammable substances are concerned, but also a few miscellaneous items in enclosures. Most are ignition sources and the only actual combustible material concerned is primary deck coverings. If applied within accommodation, service or control spaces or on cabin balconies, they shall not readily ignite (regulation 4.4.4). This requirement may seem a bit illogical since a primary deck covering is the first layer fitted on a deck, used to smooth out unevenness, and covered by a floor construction. It is rather the surface of the floor construction which may be exposed to a potential ignition source. Furthermore, the requirement implies the primary deck coverings should be of low flame-spread characteristics, which is a requirement more fitted in regulation 5. However, except from this requirement there are no other prescriptive requirements found on how the ignitability of combustible materials shall be restricted, as stated amongst the functional requirements in the purpose statement.

New hazards may be introduced where FRP composite is used close to more significant ignition sources, such as exhaust pipes or other high-temperature surfaces. This may be argued to challenge the functional requirement on separation of ignition sources from combustible materials. Due to assumptions regarding use of non-combustible structures, this safety function is not clearly stated in prescriptive requirements of this regulation. It is nevertheless important to identify ignition sources and ensure that FRP composite surfaces are properly protected.

It may be argued that leaving combustible FRP composite surfaces unprotected is not in line with the functional requirement concerning restricted combustibility. However, this rather concerns ignition sources and easily ignitable (e.g. by a small flame) combustibles and flammable substances whilst combustible materials which have restricted ignitability, such as FRP composite, are managed in regulation 5. It is noted that an IMO test method for restricted ignitability of products is missing.

3.5 Regulation 5 – Fire growth potential

Purpose statement:

The purpose of this regulation is to limit the fire growth potential in every space of the ship. For this purpose, the following functional requirements shall be met:

.1 means of control for the air supply to the space shall be provided;

.2 means of control for flammable liquids in the space shall be provided; and

.3 the use of combustible materials shall be restricted.

Comments:

This regulation oversees materials and other items in spaces with the intention to limit the fire growth potential. Looking at the functional requirements, neither of the first two are affected by use of FRP composite in ship constructions. The third functional requirement must although be taken into concern as it states that the use of combustible materials shall be restricted. The definition of a non-combustible material is given in regulation 3.33 and defines it as a material that neither burns nor gives off flammable vapours when heated to 750°C. For example vinyl ester, which is often used as resin in FRP composite, will give rise to pyrolysis gases above 500°C and it could therefore be argued that the amount of combustible material is increased when using FRP composite instead of steel.

In the prescriptive requirements, use of non-combustible and combustible materials is primarily managed in paragraph 3. Except interiors and furnishings the requirements concern linings, grounds, draught stops, ceilings, faces, mouldings, decorations, veneers, insulation materials, partial bulkheads etc. These are also the materials that will govern the growth face of a fire, together with e.g. luggage and other loose fittings. In general, all surfaces and linings in accommodation and service spaces must fulfil requirements of a maximum calorific value of 45 MJ/m^2, a maximum volume of combustible material and have low flame-spread characteristics according to the FTP Code. However, since the regulations assume that the bulkhead plate behind any wall construction is steel, there are no requirements regarding the materials behind the wall construction.

The requirements in this regulation could be claimed to apply to surfaces of any sort. Hence, if the same approved materials for linings, grounds, draught stops, ceilings, faces, mouldings, decorations, veneers, etc. are used in a ship with FRP composite constructions as in a traditional (prescriptive) design, it could be claimed that the design complies with the prescriptive requirements in regulation 5. This would generally not increase the fire growth potential in the spaces in the initial stages during evacuation. However, if the FRP composite surfaces are left uncovered or if divisions are constructed with combustible FRP composite just underneath surfaces of low flame-spread characteristics it can be argued that the surface laminate in fact represents the surface lining, to which requirements regarding low flame-spread characteristics and maximum volume of combustible material apply; the requirement on maximum calorific value would then apply to the core. With this reasoning all of these requirements would generally be deviated.

As mentioned above, thermal insulation may be used to provide structural integrity, which will also protect the combustible FRP composite surfaces from fire involvement, for e.g. 60 min. In this case the FRP composite will not add to the fire growth potential in the space within the first hour of a fire having the same intensity as a standard fire test curve.

As mentioned above, this regulation covers materials and other items in spaces with the intention to limit the fire growth potential. All discussions above have considered internal spaces. Since external surfaces on ships are typically made up of painted steel there has not been any reason to regulate this matter. This is another example of where the FRP composite goes beyond the steel-based regulations. Making exterior surfaces in combustible FRP composite will affect the fire growth potential and could e.g. cause vertical fire spread between decks, which is a hazard that must be addressed on these ships. Hazardous exterior surfaces could for example be protected to achieve low flame-spread characteristics or be protected with drencher system. An indirect way to manage the problem is to use fire rated windows, which could avoid fire spread.

3.6 Regulation 6 – Smoke generation potential and toxicity

Purpose statement:

> The purpose of this regulation is to reduce the hazard to life from smoke and toxic products generated during a fire in spaces where persons normally work or live. For this purpose, the quantity of smoke and toxic products released from combustible materials, including surface finishes, during fire shall be limited.

Comments:

Similar to regulation 5, the prescriptive requirements of regulation 6 mostly concern enclosures. All materials involved in a fire will contribute to the production of toxic smoke but during the first stages of a fire it is mainly the exposed surface that will contribute to the generation and toxicity of smoke. This regulation generally controls exposed surface finishes and primary deck coverings.

The FRP composite structure could either be covered with approved surface materials or left unprotected. In spaces where the FRP composite is left unprotected, it could be difficult to fulfil regulation 6.2.1. Furthermore, if an approved surface material is used on the FRP composite it may be argued that the regulations are predicated on that a non-combustible material is used for the underneath ship structures. The generation and toxicity of smoke may, depending on the construction, therefore not be limited to the same extent as in a prescriptive design during an enclosure fire.

When scrutinizing regulations 5 and 6 it is important to realize that both regulations manage smoke production but where the latter mainly has to do with the individual material characteristics. One could say that regulation 5 manages so that an unrestricted area of combustible materials does not catch fire and regulation 6 manages the potential of each square meter that can be involved in a fire.

Thermal insulation may be used to protect the combustible FRP composite surfaces from becoming involved in a fire. For the time that the construction is thermally protected, the FRP composite will not add to the generation or toxicity of the produced smoke. In the event of a fire lasting long enough to involve the FRP composite divisions, an increased generation and toxicity of smoke could be argued to occur, in comparison with a steel ship. This will depend on the selection of plastic materials, where for instance PVC is known to release highly toxic hydrochloric acid (HCl) during combustion. However, comparing the amount of produced HCl from a PVC core FRP composite deck when involved in a fire with the fire products from standard issue interior and luggage in a cabin, based on large scale cabin fire tests carried out by SP Technical Research Institute of Sweden, the FRP composite deck was shown to produce HCl in the region of 14% of what was produced by the cabin with approved materials. In this test they could not find a significant increase in smoke generation and toxicity when the fire also involved a FRP composite division.

It is hard to predict whether the smoke generation and toxicity at a given time would be worse in a ship with FRP composite constructions compared to a steel ship depending on the insulating capacity of the construction. If thermal insulation is used to protect the FRP composite, fire spread will likely be delayed. It could be noted that when a fire starts to involve the protected FRP composite divisions, conditions will already have been uninhabitable for long. An increased smoke generation or toxicity could although be hazardous to persons on the embarkation deck depending on wind direction.

Fires on open deck and involving exterior surfaces in FRP composite could also be affected by the smoke generation and toxicity. However, this may not be as relevant of a problem to consider for exteriors since smoke management is not critical.

3.7 Regulation 7 – Detection and alarm

Purpose statement:

> The purpose of this regulation is to detect a fire in the space of origin and to provide for alarm for safe escape and firefighting activity. For this purpose, the following functional requirements shall be met:
>
> .1 fixed fire detection and fire alarm system installations shall be suitable for the nature of the space, fire growth potential and potential generation of smoke and gases;
>
> .2 manually operated call points shall be placed effectively to ensure a readily accessible means of notification; and
>
> .3 fire patrols shall provide an effective means of detecting and locating fires and alerting the navigation bridge and fire teams.

In general, use of FRP composite does not pose any deviations to prescriptive requirements. The functional requirements although give reason to oversee the need for detection. Considering the first regulation functional requirement, there is no reason to believe that significantly less smoke is produced by FRP composites than organic materials in general. However, since the fire growth potential in some areas may be affected there may also be an additional need for detection. For areas where non-insulated FRP composite structures are used it is particularly critical with quick detection to provide early activation of an extinguishment system. It may therefore be relevant with faster or more reliable smoke detection or to provide it in additional areas of the ship, possibly even in open spaces or void spaces. The potential increased need for detection should be considered in the fire risk assessment and depends on how FRP composite is used

3.8 Regulation 8 – Control of smoke spread

Purpose statement:

> The purpose of this regulation is to control the spread of smoke in order to minimize the hazard from smoke. For this purpose, means for controlling smoke in atriums, control stations, machinery spaces and concealed spaces shall be provided.

As discussed in 3.6 regulation 6 – Smoke generation potential and toxicity the amount of smoke generated in a fire test with FRP composite structures (glass fibre reinforced polyester with Divinycell H80 core) performed by SP was only slightly larger than from a fire in a steel ship. If this is the case for the alternative design and arrangements being evaluated this would indicate that the current requirements for control of smoke spread could be met.

3.9 Regulation 9 – Containment of fire

Purpose statement:

> The purpose of this regulation is to contain the fire in the space of origin. For this purpose the following requirements shall be met:
>
> .1 the ship shall be divided by thermal and structural boundaries;

.2 thermal insulation boundaries shall have due regard to the fire risk of the space and adjacent spaces; and

.3 the fire integrity of the division shall be maintained at openings and penetrations.

Comments:

This regulation prescribes main vertical and horizontal zones and, where necessary, internal bulkheads to be made up by divisions of "A"-class standard. "A"-class means that steel or other equivalent material shall be used. Regulation 3.43 defines steel or other equivalent material as a non-combustible material which, by itself or by insulation provided, has structural and integrity properties equivalent to those of steel at the end of the standard fire test. Unprotected FRP composite generally ignites when exposed to significant fire but could for example be combined with thermal insulation in order to gain fire integrity comparable with A-class standard. Tests carried out by SP have demonstrated that the temperature rise at the unexposed side of a FRD60 (cf. HSC Code) will be as low as 45°C after 60 min of fire exposure (temperature rise and integrity test in accordance with the standard test for bulkheads and decks, see the *Test procedures for fire-resisting divisions of high-speed craft* (MSC 45(65))). This low conduction of heat will prevent heat from being transferred long distances through the ship structure, which may be a fire risk in conventional ships.

The low conductivity of a FRD60 division can also give rise to a faster fire development within the enclosed space, equivalent to an insulated aluminium structure or a heavily insulated steel structure (e.g. "A-60" class). When insulation or any protective surface layer is deteriorated and the surface temperature of the FRP composite reaches its ignition temperature, the FRP composite will start contributing to the fire, which could also accelerate the fire development if additional oxygen is available.

Specific fire integrity and insulation requirements for internal decks and bulkheads depend on a classification made of the spaces and are given in tables in regulation 9. The way spaces are assigned fire categories may need to be reconsidered, in particular for spaces with added fire load by exposed untreated FRP composite. This includes open decks.

If FRP composite is used on open deck, all connections between interior and external spaces must be reconsidered. Design of windows, doors and ventilation systems may for example need to be reconsidered due to the potential external fire hazards, i.e. due to potential spread of smoke and fire into the ship or out to external surfaces.

Regarding penetrations in fire resisting divisions, doors, pipes, window frames etc. are generally also required to be non-combustible when penetrating "A"-class divisions. The integration of such penetrations into a FRP composite division must be documented by fire tests or potentially by engineering judgement. The integration of doors, windows, cable glands, ducts, fire dampers and pipes in FRP composite fire divisions have been successfully demonstrated in tests at e.g. SP.

A robust integration of the insulation systems onto a FRP composite fire division is crucial. The effect of voids between insulation and the composite structure could be further evaluated. Essential systems in a fire situation, such as sprinkler systems, piping, ducts, etc., must have a design of the fastening/support system that is not failing in case of a fire.

3.10 Regulation 10 – Firefighting

Purpose statement:

The purpose of this regulation is to suppress and swiftly extinguish fire in the space of origin. For this purpose the following requirements shall be met:

.1 fixed fire-extinguishing systems shall be installed, having due regard to the fire growth potential of the spaces; and

.2 fire-extinguishing appliances shall be readily available.

Comments:

The first functional requirement states that the fixed fire-extinguishing systems shall have due regard to the fire growth potential of the space. It is only if the fire growth potential differs significantly that it is necessary to take into account FRP composites when designing the fire extinguishing systems. In most cases, fire growth in the FRP composite will not be dimensioning for the fire extinguishing system since more rapid fire developments can generally occur in other combustibles and since the size of a fire depends on the oxygen supply. The fire pump capacity and pressure requirements should therefore generally not need to be changed. However, since early extinguishment is important, it may still be suitable to oversee the firefighting systems and that extinguishment is managed properly.

It may also be necessary to consider fire extinguishing systems and equipment in additional places of a ship with FRP composite constructions. If exterior surfaces are made of FRP composite they may need to be protected in order to prevent that an enclosure fire will not spread to the exteriors if a door or window is left open or broken, e.g. by sprinkler above the openings. It may also be relevant to install drencher systems covering essential parts of the hull or exteriors of superstructure, if there is a risk of fire spread or deterioration of structural performance.

Even though the purpose statements and prescriptive requirements of this regulation only cover fire extinguishing systems and appliances, it is in the context of the regulation title also relevant to consider effects on manual firefighting routines. There are a few significant differences:

.1 first and foremost, the need to perform defensive boundary cooling from the outside of a fire enclosure is removed. It is instead important with an offensive strategy to provide direct cooling of the fire. Boundary cooling is a strategy that requires many resources without actually fighting the fire, but mainly hindering fire spread. A much more efficient way to fight a fire is to quickly reach inside the enclosure. With traditional equipment this may not be possible due to the heat or risk of fire spread if a door is opened. There is although more suitable firefighting equipment already in use, such as the Cutting Extinguisher or Fog Spear. Tests have demonstrated that firefighting by such equipment through small holes in the FRP composite boundaries is very effective. The holes may be pre-fabricated or made by equipment on site. This will allow dampening the fire from outside of the fire origin. Suitable equipment in combination with a reroute of firefighting resources relieved from boundary cooling to either assist in active combat of the fire may increase both effectiveness and efficiency;

.2 furthermore, a fire which has taken root in the FRP composite may be difficult to fully extinguish. This implies more resources will be needed to keep watch over fire scorched areas to ensure that the FRP composite does not reignite. This may not significantly interfere with the critical stages of taking control of the fire;

.3 another aspect of how firefighting routines could be affected is that the improved thermal resistance of FRP composite structures could imply difficulties in finding the seat of the fire from adjacent compartments with a commonly used thermal imaging camera; and

.4 routines regarding potential collapse must also be developed in order to insure the safety of passengers and firefighting crew.

All in all the ability to focus more resources on actively fighting the fire, combined with the introduction of tools to cool hot fire gases from an adjacent compartment could improve the efficiency and effectiveness of fire fighting in ships with FRP composite structures. In any case, effects on firefighting routines must be taken into consideration when making ship structures in FRP composite.

Additional equipment for manual firefighting could also be necessary, e.g. in open deck spaces surrounded by FRP composite surfaces.

3.11 Regulation 11 – Structural integrity

Purpose statement:

> The purpose of this regulation is to maintain structural integrity of the ship, preventing partial or whole collapse of the ship structures due to strength deterioration by heat. For this purpose, the materials used in the ships' shall ensure that the structural integrity is not degraded due to fire.

Comments:

This regulation intends to ensure that structural integrity is maintained in case of a fire. After the purpose statement of the regulation, the following regulation states (regulation 11.2):

> "The hull, superstructures, structural bulkheads, decks and deckhouses shall be constructed of steel or other equivalent material. For the purpose of applying the definition of steel or other equivalent material as given in regulation 3.43, the 'applicable fire exposure' shall be according to the integrity and insulation standards given in tables 9.1 to 9.4. For example, where divisions such as decks or sides and ends of deckhouses are permitted to have 'B-0' fire integrity, the 'applicable fire exposure' shall be half an hour."

Structures shall thus be constructed in steel or other equivalent material, i.e. any non-combustible material which, by itself or due to insulation provided, has structural and integrity properties equivalent to steel at the end of the standard fire test. This prescriptive requirement cannot be complied with if FRP composite structures are used, as it is not a non-combustible material. The structural and integrity properties equivalent to steel may be achieved at the end of the applicable exposure to the standard fire test, for example if the FRP composite is sufficiently insulated. However, unlike the requirements on structural and integrity properties, the requirement on non-combustibility is not time-limited.

Further deviations to prescriptive requirement are found in regulation 11.4 if steel (not "steel or other equivalent material") is not used for structures forming crowns, casings and floor plating of machinery spaces of category A. Use of FRP composite for such structures may need special consideration.

Insulated steel divisions may lose fire integrity after for example 60 min; not due to strength deterioration by heat but due to possible fire spread to adjacent compartments by heat transfer. A prolonged fire could involve and deteriorate a FRP composite structure when thermal insulation or other means are no longer enough to provide structural and integrity performance. A large enough fire could then bring about a local collapse.

Generally steel loses its structural strength at about 400°C to 600°C and an unstiffened FRP composite sandwich panel may lose bonding between core and laminate, and thereby structural performance, when heated to about 150°C (or a temperature where the bonding between core and laminate starts to soften). Improved structural integrity of FRP composite structures may be achieved by use of e.g. stiffeners, pillars or additional layers but steel ships have proved to be able to survive fire for several days without progressive structural collapse occurring. It is crucial that fire hazards introduced during a long-lasting fire are addressed in the engineering analysis.

3.12 Regulation 12 – Notification of crew and passengers

Purpose statement:

> The purpose of this regulation is to notify crew and passengers of a fire for safe evacuation. For this purpose, a general emergency alarm system and a public address system shall be provided.

Comments:

There are no obvious challenges posed to this regulation by the use of FRP composite. A public address system may although be indirectly affected if special instructions must be made to avoid passengers to reside in certain areas where there is a risk of collapse. An exterior fire could also affect the possibility to use certain exterior areas or life-saving appliances.

3.13 Regulation 13 – Means of escape

Purpose statement:

> The purpose of this regulation is to provide means of escape so that persons on board can safely and swiftly escape to the lifeboat and liferaft embarkation deck. For this purpose, the following functional requirements shall be met:
>
> .1 safe escape routes shall be provided;
>
> .2 escape routes shall be maintained in a safe condition, clear of obstacles; and
>
> .3 additional aids for escape shall be provided as necessary to ensure accessibility, clear marking, and adequate design for emergency situations.

Comments:

This regulation aims to provide means for persons to safely and swiftly escape a fire, assemble and proceed to their embarkation station. Looking at the prescriptive requirements, regulation 13.3.1.3 requires all stairways in accommodation spaces, service spaces and control stations to be of steel frame construction or other equivalent material sanctioned by the Administration. If they are made of FRP composites they need to be evaluated in the fire safety analysis. The same applies to stairways and ladders in machinery spaces (regulation 13.4.1). Such constructions are although generally not considered in other materials than steel, even on ships in FRP composite. It may be noted that safe havens and escape ways manufactured from composites are used in the offshore industry.

In order to achieve safe escape routes, regulation 13 requires fire integrity and insulation in several places, referring to values in regulation 9 (tables 9.1 to 9.4). A sufficiently insulated FRP composite division could be claimed to achieve these requirements (since non-combustibility is not required).

In a FRP composite structure the temperature on the unexposed side could, down to the high insulation capacity of the composite construction, be very low even after 60 min of fire. The heat from a fire will therefore to a larger extent stay in the fire enclosure and not easily be transmitted to adjacent spaces. This could be advantageous in an escape situation.

3.14 Regulation 14 – Operational readiness and maintenance

Purpose statement:

> The purpose of this regulation is to maintain and monitor the effectiveness of the fire safety measures the ship is provided with. For this purpose the following functional requirements shall be met:
>
> .1 fire protection systems and firefighting systems and appliances shall be maintained ready for use; and
>
> .2 fire protection systems and firefighting systems and appliances shall be properly tested and inspected.

Comments:

The functional requirements are not affected by use of FRP composite. The fire protection systems and firefighting systems and appliances must be maintained ready for use and should be properly tested and inspected on a ship with FRP composite structures, as on any ship. Even if the regulation may be directly applied and no deviations are posed, the content covered by this regulation may be affected. Depending on the alternative design and arrangements there may be a need for faster extinguishment, increased capacity or improved reliability and hence e.g. more maintenance.

3.15 Regulation 15 – Instructions, onboard training and drills

Purpose statement:

> The purpose of this regulation is to mitigate the consequences of fire by means of proper instructions for training and drills of persons on board in correct procedures under emergency conditions. For this purpose, the crew shall have the necessary knowledge and skills to handle fire emergency cases, including passenger care.

Comments:

Except from the need for increased knowledge of fire fighters considering strategies, techniques, routines etc. (see 4.10) there are no direct differences on a ship with FRP composite structures in comparison with a traditionally built ship. In similarity with regulation 14, the content covered by this regulation may be affected e.g. depending on the systems considered in the alternative design and arrangements.

3.16 Regulation 16 – Operations

Purpose statement:

> The purpose of this regulation is to provide information and instructions for proper ship and cargo handling operations in relation to fire safety. For this purpose, the following functional requirements shall be met:
>
> .1 fire safety operational booklets shall be provided on board; and
>
> .2 flammable vapour releases from cargo tank venting shall be controlled.

Comments:

There are no known challenges posed to this regulation for a ship with FRP composite structures. In similarity with regulation 14, the content covered by this regulation may nevertheless be affected depending on the solutions considered in the alternative design and arrangements.

3.17 Regulation 17 – Alternative design and arrangements

Purpose statement:

> The purpose of this regulation is to provide a methodology for alternative design and arrangements for fire safety.

Comments:

The method described in regulation 17 (and MSC/Circ.1002) and its suitability when assessing fire safety in FRP composite constructions is discussed in chapter 6 of these guidelines.

3.18 Regulation 18 – Helicopter facilities

Purpose statement:

> The purpose of this regulation is to provide additional measures in order to address the fire safety objectives of this chapter for ships fitted with special facilities for helicopters. For this purpose, the following functional requirements shall be met:
>
> .1 helideck structure shall be adequate to protect the ship from the fire hazards associated with helicopter operations;
>
> .2 firefighting appliances shall be provided to adequately protect the ship from the fire hazards associated with helicopter operations;
>
> .3 refuelling and hangar facilities and operations shall provide the necessary measures to protect the ship from the fire hazards associated with helicopter operations; and
>
> .4 operation manuals and training shall be provided.

Comments:

Helicopter decks have previously been built with FRP composite materials on non SOLAS ships but will require special evaluations, including testing, and tailored detection and extinguishment.

3.19 Regulation 19 – Carriage of dangerous goods

Purpose statement:

The purpose of this regulation is to provide additional safety measures in order to address the fire safety objectives of this chapter for ships carrying dangerous goods. For this purpose, the following functional requirements shall be met:

.1 fire protection systems shall be provided to protect the ship from the added fire hazards associated with carriage of dangerous goods;

.2 dangerous goods shall be adequately separated from ignition sources; and

.3 appropriate personnel protective equipment shall be provided for the hazards associated with the carriage of dangerous goods.

Comments:

None of the prescriptive requirements are likely to be affected by use of FRP composite constructions. There may although be reason to evaluate potential hazards from leakage of dangerous goods onto a FRP composite deck, not only from a fire perspective. Certain dangerous goods may for example cause the FRP composite to deteriorate if they come in contact. These and other hazardous non-fire related scenarios must be considered. With regard to fire the time to collapse may change due to a potentially larger fire involving combustible surrounding exterior FRP composite surfaces.

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

Purpose statement:

The purpose of this regulation is to provide additional safety measures in order to address the fire safety objectives of this chapter for ships fitted with vehicle, special category and ro-ro spaces. For this purpose, the following functional requirements shall be met:

.1 fire protection systems shall be provided to adequately protect the ship from the fire hazards associated with vehicle, special category and ro-ro spaces;

.2 ignition sources shall be separated from vehicle, special category and ro-ro spaces; and

.3 vehicle, special category and ro-ro spaces shall be adequately ventilated.

Comments:

This regulation describes requirements for ventilation, alarm and detection systems, fire extinguishing equipment and structural requirements for spaces with vehicles. In passenger ships carrying more than 36 passengers, the boundary bulkheads or decks of the ro-ro space are by regulation 20.5 required to achieve A-60 (with some exceptions where the structural fire protection can be reduced to A-0). This cannot be achieved if such divisions are made in FRP composite. Furthermore, even if not required by prescriptive requirements, it may prove necessary to better address the first regulation functional requirement by passive or active measures, e.g. by an additional active fire extinguishing system on exterior surfaces. For ro-ro spaces which are not of special category the fire safety requirements are different and in generally considered less stringent.

3.21 Regulation 21 – Casualty threshold, safe return to port and safe areas

Purpose statement:

> The purpose of this regulation is to establish design criteria for a ship's safe return to port under its own propulsion after casualty that does not exceed the casualty threshold stipulated in paragraph 3 and also provides functional requirements and performance standards for safe areas.

Comments:

Passenger ships constructed on or after 1 July 2010 having a length of 120 m or above or having three or more main vertical zones shall comply with this regulation. Ships made with hull in FRP composite are seldom favourable to construct longer than 100 m. FRP composite may although be used in superstructures of the ship. In any case it may be relevant to evaluate e.g. whether the definition of the casualty threshold in regulation 21.3 is appropriate for ships in FRP composite.

3.22 Regulation 22 – Design criteria for systems to remain operational after a fire casualty

Purpose statement:

> The purpose of this regulation is to provide design criteria for systems required to remain operational for supporting the orderly evacuation and abandonment of a ship, if the casualty threshold, as defined in regulation 21.3 is exceeded.

Comments:

Passenger ships constructed on or after 1 July 2010 having a length of 120 m or above or having three or more main vertical zones shall comply with this regulation. Ships made with hull in FRP composite are seldom favourable to construct longer than 100 m. FRP composite may although be used in superstructures of the ship. In any case it may be relevant to evaluate e.g. whether there are additional hazards from the potential fire size and potential smoke production from FRP structures with regard to evacuation and abandonment.

3.23 Regulation 23 – Safety centre on passenger ships (SP)

Purpose statement:

> The purpose of this regulation is to provide a space to assist with the management of emergency situations.

Comments:

Passenger ships constructed on or after 1 July 2010 shall have a safety centre on board complying with the requirements of this regulation. From the safety centre all fire safety systems should be available, such as ventilation systems, alarm systems, fire detection and alarm system, fire and emergency pumps etc. In general this is not affected by the FRP composite construction material, but it may be more necessary to consider collapse when determining the location of the safety centre.

APPENDIX A

ISSUES OTHER THAN FIRE SAFETY

1 Use of FRP composite may affect other parts of a ship's safety than those associated with fire. Potential issues are listed below, categorized as issues which are indirectly related to fire safety and issues which are unrelated to fire safety. It should be noted that the list of issues in this appendix is not exhaustive and is meant to be used as examples:

2 An example of an issue indirectly related to fire safety is:

If e.g. additional drencher systems are installed in combination with FRP composite, drainage and pumping arrangements may need to be installed in the same manner as in SOLAS regulations II-2/19 and II-2/20.

3 Issues unrelated to fire safety are:

.1 water intrusion over time in FRP elements:

Experience with FRP has demonstrated that resin-fibre construction may absorb water over years. This moisture is believed to be the source of free water found in otherwise sound voids.

.2 required use of steel or other equivalent material in the International Convention on Load Lines 1966 (1966 LL Convention), which states:

i) Regulation 12: All access doors in bulkheads at ends of enclosed superstructures shall be fitted with doors of steel or other equivalent material.

ii) Regulation 15: Pontoon hatch covers: Gives criterion for deflection (z-direction) due to uniformly distributed load on pontoon hatch covers. The formula (criterion) is assuming steel as material in the hatches.

iii) Regulation 16: Hatchways closed by weather tight covers of steel or other equivalent materials: gives criterion for deflection (z-direction) due to uniformly distributed load on pontoon hatch covers. The formula (criterion) is assuming steel as material in the hatches. In addition, hatch covers as per regulation 16 shall be made of steel or other equivalent materials.

iv) Regulation 19: Ventilators "shall be made of steel or other equivalent materials".

These issues could be managed through the opening for performance-based design in regulation 2.4 of the 1966 LL Convention " Ships of wood or of composite construction, or of other materials the use of which the Administration has approved, or ships whose construction features are such as to render the application of this annex unreasonable or impracticable, shall be assigned freeboards as determined by the Administration."

.3 electromagnetic compatibility (EMC)

In a ship made of steel the hull acts as a counterpoise from external and internal electrical and radio interferences, e.g. lightning or EMC. In a FRP structure the same grounding mechanism is not present which could interfere and cause problems for the radio communication, radar, fire detection system, automation, etc.

Special consideration needs to be addressed for complying with standards such as IEC-60533, stating for example that "complex electric and/or electronic systems require EMC planning in all phases of design and installation, considering the electromagnetic environment, any special requirements and the equipment performance."

.4 radio communications;

.5 radar issues might need reconsideration. For instance the radar might need adjustments and should be setup for sector transmission, due to radio wave transparency of the structure and radio frequency hazards;

.6 electrical issues need to be reconsidered, for instance:

i) grounding points (FRP structure being non-conductive); reconsider grounding of the equipment installed on board.

ii) insulation measurements.

iii) lightning arrestors.

.7 damage stability with regard to grounding and collision, floatability, structural integrity and impact strength:

i) deformation due to unexpected high sea loads (same resistance to lateral pressure as implied by minimum thickness requirements may conservatively be provided).

ii) deformations or other damage due to local contacts (same resistance to lateral pressure as implied by minimum thickness requirements may conservatively be provided).

Experience with the operation of HSLC of composite construction has demonstrated that, when minimum scantling requirements are complied with, no particular problems concerning robustness to local loads have been experienced.

.8 CO_2 emissions and fuel efficiency; and

.9 life-saving arrangements.

APPENDIX B

FRP COMPOSITE MATERIALS AND COMPOSITIONS USED IN SHIPBUILDING

Introduction

Steel is a robust shipbuilding material with a high limit for destruction, both when it comes to temperature and loading. Un-insulated structural steel divisions generally start to deteriorate at 400-500°C. Permanent deformation and fire spread may although occur to large areas when structures are heated to temperatures below those levels, both due to deformations and due to heat conduction. An exemplified alternative non-combustible material in SOLAS is aluminium, despite relatively poor structural behaviour at elevated temperature. Similarly, FRP composite could provide the same rigid and strong qualities as steel if excessive temperature increase is avoided. Other benefits with FRP composite are the minimization of maintenance, lack of corrosion, prolonged fatigue life, reduced efforts for repairs and, above all, reduction in weight. However, the material is not non-combustible according to SOLAS definitions and this has effects on fire safety. Below follow descriptions of how different materials can be combined to make up FRP composite as well as more details on the different materials. Thereafter follow descriptions of their behaviour when exposed to fire.

B.1 FRP composite compositions

1 A typical FRP composite structure in shipbuilding is the sandwich panel with a lightweight core separating two stiff and strong FRP laminates, as illustrated in figure 1. When the laminates are bonded on the core the composition altogether makes up a lightweight construction material with very strong and rigid qualities. The key to these properties is anchored in the separation of the laminates. It makes them effective in carrying all in-plane loads and bending loads. The core, separating the face sheets, carries local transverse loads as shear stresses, comparable with how webs of stiffeners contribute in stiffened steel panels. The way the materials are combined makes the construction altogether function as a "stretched out I-beam" which may not need additional stiffeners. The FRP composite sandwich panel has a low in-plane modulus of elasticity compared to steel. However, due to the "I-beam" type of construction, the panel becomes very stiff in bending. The FRP composite structure is able to deform elastically under high strains and this can reduce stress concentrations in the interface between for example a steel hull and FRP composite deckhouse or superstructure. This reduces fatigue problems and steel weight.

Figure 1: Illustrations of a FRP composite sandwich panel composition

2 Another FRP composite structure is the single skin panel, consisting of one single fibre reinforced laminate. Other FRP designs are also viable, e.g. triple skin (two cores and three laminates). The composite design could also include stiffeners.

B.2 FRP composite components and fire behaviour

The fire performance of FRP composite structures depends on the used materials and their combined behaviour at elevated temperatures. Knowledge of the materials is therefore crucial. Common core materials in FRP composite structures are for example polymer-based foams, cellulosic or metallic honeycomb cores and balsa wood. The laminate face sheets are generally made by carbon or glass fibre reinforced polymer. There is although a constant development of new FRP composite materials and the variety of materials is large. These guidelines are not extensive when it comes to description of various FRP composite materials but some common materials for marine structures, i.e. where most experience is accumulated, are briefly described below.

B.2.1 Polymers

1 A common processing method is hand layup with resin infusion and curing at elevated temperature (60-80°C) or post-curing. The resins normally used are polyester, vinylester and epoxy. Marine grades of these materials do not differ very much with respect to behaviour in fire or at elevated temperatures; unmodified they give comparable smoke production and heat release. Heat weakens the polymer of a FRP, which means that structural strength is challenged in a fire event. A key property is therefore the heat distortion temperature for the cast resin (not the laminate), where half the stiffness is reached, comparable to glass transition temperatures for polymers. For normal room temperature cured systems the heat distortion temperature is usually about 70-100°C but systems may be produced with significantly improved properties.

2 With regard to fire contribution, figure 2 shows the weight loss (left Y-axis) of a moderately performing polyester polymer used in a FRP laminate as a function of temperature increase and also its derivative (right Y-axis). It can be seen that the polymer will not contribute significantly to a fire until heated to ~350°C, which is a common range for the polymer pyrolysis temperature. It should be noted that this temperature of significant weight loss is significantly higher than the point at which aluminium is structurally useful. Hence, FRP composites do not contribute to a fire until reaching a temperature beyond which a currently acceptable non-combustible material has ceased to either provide structural support or restrict spread of fire.

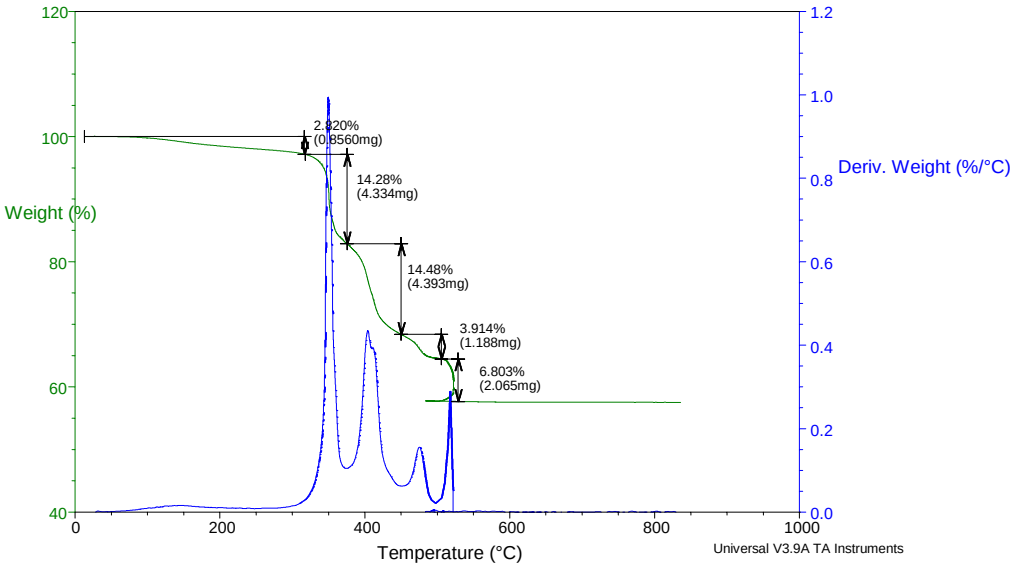

Figure 2: Thermo Gravimetric Analysis of a standard FRP polyester polymer

3 The resins referred to above are all combustible and with comparable smoke production and heat release. There are also numerous modified resin systems that can provide better fire performance in terms of fire, smoke and toxic gas formation properties, sometimes at penalty of processing properties, mechanical properties or increased fire smoke production.

B.2.2 Fibres and reinforcements

1 When it comes to reinforcing fibres, E-glass and carbon fibres are currently most common. Polymeric fibres such as aramids (e.g. Kevlar and Twaron) are also used and other fibre types may be developed in the future

2 E-glass fibres have been common mainly due to a good strength to cost ratio. E-glass fibres remain unaffected in fire until heated to about 830°C when viscous flow starts. Nonetheless, mechanical properties such as strength and stiffness decrease from around 500°C.

3 Carbon fibres are more heat resistant than glass fibres and are also common. They are unaffected by temperatures up to about 350°C and oxidize at a temperature of 650°C to 700°C (i.e. far above the temperature at which typical resins decompose). In addition, carbon fibre mats exhibit better heat distribution properties than glass fibres, which can avoid the occurrence of "hot spots".

4 While the polymer may contribute to the fire and increase its severity, the reinforcing fibres do not normally add to the fire intensity. On the contrary, as they often are quite inert, they serve as a temperature barrier and thermal insulator. A hazard is although the possibility of fibres being spread to the environment from a fire event. Such fibres are known to cause skin/throat/eye irritation in the vicinity of a fire.

B.2.3 Core materials

1 Polymer-based foams and balsa cores are often used in shipbuilding. Figure 3 shows a similar analysis as in figure 2 but for a PVC (polyvinyl chloride) foam core material. It shows no weight loss, and thereby no fire contribution from the material, until reaching ~250°C. Poor smoke and toxicity generation potential of PVC has led to an increased use of other polymer-based foams.

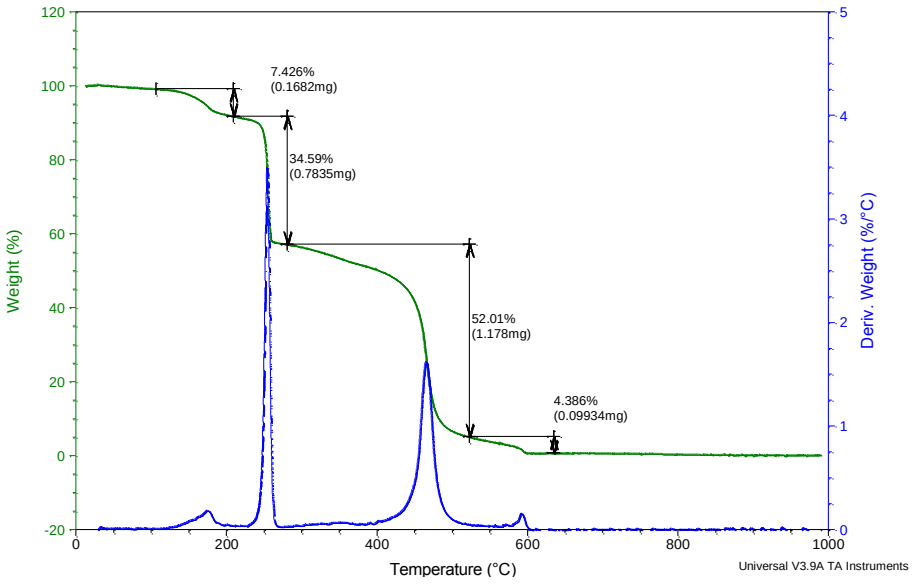

Figure 3: Thermo Gravimetric Analysis of PVC core foam

2 The different core materials have varying responses to fire exposure. Typical behaviour of polymer-based foams at high temperature is melting, softening and shrinking whereas end-grain balsa wood chars (generally at temperatures exceeding 200°C to 250°C). Balsa wood does not have a softening temperature or shrink in the same way as a polymer and the smoke generation potential is generally more limited. Note that in this context PVC and balsa cores have been provided as examples but other cores exist and may be developed. In each case a clear understanding of the fire performance of the core material is necessary.

B.3 Fire performance of FRP composite, key issues and means for improvement

1 The performance of a FRP composite structure when exposed to fire varies with the composition of core and laminates but mainly depends on the following five conditions:

.1 type of polymer and thickness of laminate;

.2 type and density of core;

.3 type and amount of fire protection (e.g. insulation); and

.4 structural support, e.g. stiffeners.

2 In figure 4 is summarized some typical critical temperatures for a FRP composite sandwich panel using standard polyester-based FRP laminates and a PVC foam core. Spontaneous ignition of the laminate could typically occur at 350°C to 400°C and the core material will lose structural integrity at certain temperatures due to phase transitions (melting, vaporizing). However, the composite sandwich construction will generally lose its structural strength at temperatures well below such temperatures (discussed above for the individual materials). For a load bearing structure it is thus a more critical issue to manage structural integrity than ignition and fire involvement. Loss of the mechanical properties of a sandwich panel may be claimed to be associated with delamination, i.e. when a significant part of the laminate is detached from the core. In fire testing sandwich panels under load, it has been found, e.g. for the above mentioned sandwich systems, that overall structural failure of the panel often occurs when the bond of the laminate skin to the core reaches a critical temperature. It is important to note that this will generally occur much sooner than ignition in a fire situation. Softening of the skin to core bond then results in the structure ceasing to act as a sandwich panel and failing by buckling of the resulting thin skin structure. It should although be noted that the thermal insulating quality of the composite allows for local hot spots without compromising an entire structure. It is in other words required that a sufficient percentage of a load bearing element is heated before a collapse occurs. There are also remedies to lower the risk of structural collapse, e.g. supporting stiffeners or pillars.

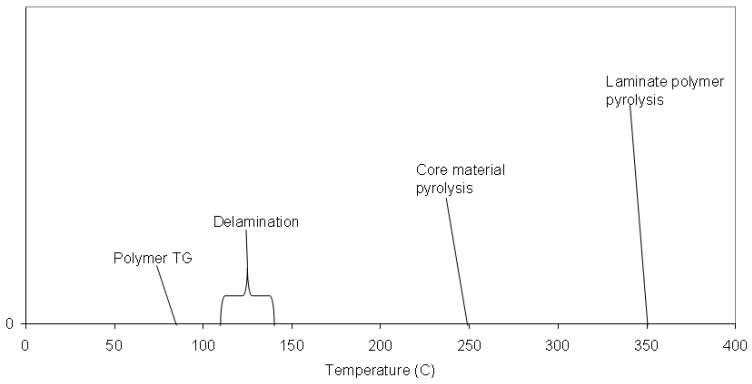

Figure 4: Typical critical temperatures for a FRP composite sandwich (Divinycell H80 core, polyester FRP)

B.3.1 Structural fire performance of FRP composite structures

1 FRP composite can never fulfil A-class requirements as defined by SOLAS, since "A" implies "non-combustible" according to SOLAS regulation II-2/3.2. It further implies 60 min fire resistance, represented by a temperature rise in a large furnace according to the standard temperature-time curve, as defined by the ISO. FRP composite and metallic construction materials differ conceptually from a fire safety point of view. Not only from a reaction to fire perspective (ignitability, smoke and heat production) but also from a resistance to fire perspective (structural integrity and heat transfer). In the SOLAS requirements for fire resistance, metallic materials are expected to keep the temperature increase at the unexposed side of the bulkhead or deck in the standardized fire test below ~200˚C for 0, 30 min or 60 min, depending on the requirements for the particular space. The motive is to control the risk for fire spread to compartments adjacent to the fire compartment. A steel construction could still be load carrying for a long time after such temperatures are reached, whereas e.g. an aluminium construction would start to lose its structural strength at about 200˚C. A steel construction is therefore allowed with insulation on one side of the division, whereas aluminium constructions must be insulated on both sides. The same would be true also for FRP composites.

2 A FRP composite is a good thermal barrier. The fundamental condition for the FRP composite to achieve structural integrity "equivalent" to an A-class division is hence not the temperature requirement at the unexposed side but that structural resistance is maintained for 60 min. As discussed above, a FRP composite structure will generally start to lose structural strength below 200˚C and a FRP composite deck or bulkhead would therefore start to lose its structural integrity long before the temperature at the unexposed side approaches 200ºC. Thus, a FRP composite construction generally achieves SOLAS regulation II-2/9 "Containment of fire" much better than metallic materials due to its insulating capacity but has problems to fulfil SOLAS regulation II-2/11 "Structural integrity". Therefore, if structural collapse due to heat in a FRP composite construction can be avoided, the FRP composite design has a major advantage to metallic materials since fire spread due to heat transfer is a much lower risk in FRP composite than in metallic materials.

3 To achieve structural resistance in FRP it is important to keep temperatures down, achievable through insulation or cooling. Structural fire performance may also be achieved by structurally redundant design, e.g. by using pillars, stiffeners or sandwich panels with over-capacity (e.g. triple skin panels designed so that half of the structure is sufficient to carry the design load). If redundancy of the constructions' loadbearing capacity is incorporated in the design, a fire could be well contained within the fire enclosure for a long time before spreading to other areas through the structure.

4 While structural performance is maintained, a fire will actually be better contained than in a prescriptive steel design since the insulating capacity of the composite will add significantly to the total insulating capacity of the construction. Since the heat is well kept within the fire enclosure, the overall temperature may although also be higher compared to in a steel enclosure. Thus, a more intense fire with higher temperatures is possible using a FRP composite construction but the fire is more localized and less likely to spread due to heat transfer than in a metallic construction. The high temperatures motivate water based extinguishing systems since inertion by evaporated water is well facilitated.

5 If active and passive risk control measures fail and the fire falls out of control due, a heat induced structural collapse could occur. Then the FRP composite could also take part in the developing fire.

B.3.2 Firefighting of FRP composite structures

1 The high insulation capacity also affects the way to fight fires in the construction material. In general when a fire appears on a vessel, water cooling of boundary surfaces of the fire enclosure is a basic strategy in maritime firefighting. When using FRP composites instead of metallic materials, such cooling is more or less meaningless since the outer surfaces of the fire room will have very low temperatures for a long time and also, the insulating capacity of the material will make such construction cooling ineffective. Instead, firefighting must take place inside the fire enclosure. Suitable firefighting equipment is already in use, such as the Cutting Extinguisher or small pre-fabricated inlets for nozzles which allow firefighting without entering the room. This is further discussed in 3.10 (regulation 10 – Firefighting).

2 The combustion of FRP composites is dependent on a thermal breakdown of organic molecules in the material. The insulating quality of the material will initially create a very steep temperature gradient in the material when subjected to a fire. If the material is cooled down, the production of combustible gases is hindered and the fire is stopped. This cooling should be applied at the hot surface. Empirical testing has shown that early application of water (which also requires fast detection) on a burning surface will quench the pyrolysis reactions in the FRP composite quite quickly.

3 If the fire has given sufficient heat exposure for the FRP composite to reach pyrolysis temperatures also deeply within the construction, fire tests have shown that continuous cooling may be necessary to prevent re-ignition. In particular the core works as a thermal barrier, both in heat exposure and during cooling. Thus, for efficient firefighting it is beneficial if surfaces within a fire enclosure are cooled down as soon as possible. Active systems with quick response could hence be useful.

4 A gaseous extinguishment system should be avoided since it will not provide the necessary cooling of the material at the surface. See also the discussion in section B.3.1 concerning evaporation advantages in well-insulated enclosures.

B.3.3 Exterior surfaces in FRP composite

1 Exchanging traditional external steel surfaces for combustible FRP composite will give a fire the ability to propagate vertically if a window breaks or if an external door is left open. Then the fire can potentially spread between decks and fire zones. This issue has been given much attention and full scale tests have been carried out in order to find suitable mitigating measures. To produce FRP face sheets with low flame-spread characteristics or to install a drencher system for external surfaces are alternatives to avoid fire spread. Fire rated windows and doors are other fire safety measures which could be relevant. It may also prove necessary to provide some kind of structural redundancy, as described above, addressing external fire exposure.

APPENDIX C

SOLAS REGULATION II-2/17 AND FRP COMPOSITE STRUCTURES

Below follows a brief historic background to SOLAS chapter II-2, regulation 17. Thereafter follow interpretations of SOLAS regarding its applicability for FRP composite structures, with particular regard to the condition to meet the fire safety objectives and functional requirements. The procedure of an assessment according to SOLAS regulation II-2/17 is thereafter described, followed by a discussion regarding complications necessary to consider when evaluating FRP composite structures.

C.1 Background to SOLAS regulation II-2/17 and the intended scope of its applicability

1 At FP 37 and MSC 61 there were proposals for a comprehensive review of chapter II-2, see e.g. document MSC 61/6/6. The reasoning behind this was partly that the old chapter had become difficult to overview. Another major reason for the review came from the evolution of fire safety science, which was rapidly developing and where a more detailed understanding of the processes in a fire had been gained. Consequently, many building regulations around the world were changed, allowing for buildings to be designed in a more advantageous way with regard to fire safety. The idea was to change from detailed prescriptive requirements to performance-based regulations. The main advantage with performance-based regulations is that they allow for novel designs without compromising fire safety. At MSC 61 the committee agreed that the new chapter should be based on modern fire prevention and firefighting technology and philosophy.

2 To FP 39 Sweden submitted a report discussing the pros and cons with prescriptive regulations and performance-based regulations, (FP 39/INF.23). This report also proposed how the new chapter could be structured in a way allowing for performance-based design while keeping the old prescriptive regulations. Some significant features were the introduction of SOLAS regulation II-2/17 and the purpose statements in each regulation. The objectives of the old chapter were rewritten and divided into Fire safety objectives and Functional requirements as seen in current SOLAS regulation II-2/2.

3 It was very clear during the discussions that it should be possible to introduce novel designs and that any requirement in the present chapter could be challenged by an alternative design providing the same level of fire safety. The main concerns (then and now) are although how to prove that an alternative design provides the same level of safety, and indeed which level of safety the prescriptive requirements provide. For a minor alternative design that only affects a single requirement in the regulations this is relatively simple. When larger changes are proposed, e.g. introducing new structures, the analysis becomes more complex.

4 After further discussions in correspondence groups lead by Japan (reported to FP 40) and the United States (reported to FP 44 and FP 45) it was agreed that an assessment of fire safety when laying claim to SOLAS regulation II-2/17 should be based on guidelines developed in MSC/Circ.1002. These guidelines define "Alternative design and arrangements" for fire safety, as "… fire safety measures …, including alternative shipboard structures and systems based on novel or unique design …". Alternative shipboard structures were mentioned since it was discussed that the use of different materials in the structure could be a possible alternative design. The definition underlines that alteration of fire safety in such a fundamental way as to use alternative materials in structures is in line with SOLAS regulation II-2/17.

C.2 The actual applicability of SOLAS and its regulation II-2/17 for combustible structures

1 SOLAS regulation II-2/17 was developed with the intention to undertake innovative design solutions without compromising fire safety. However, with regard to whether SOLAS regulation II-2/17 in the current version of the SOLAS Convention could be used to approve vessels with combustible FRP composite structures it has repeatedly been argued that this cannot not be permitted since each individual fire safety objective and functional requirement in SOLAS regulation II-2/2 (including regulation II-2/2.2.3, requiring restricted use of combustible materials) must unconditionally be achieved to the same degree as by a ship complying with relevant prescriptive requirements. This is although a misunderstanding, as described below.

2 The SOLAS Convention is structured as illustrated in figure 5 and it aims to promote safety of life at sea. Chapter II-2 concerns fire safety (Construction – Fire protection, fire detection and fire extinction) and its goal is defined through fire safety objectives stated at the beginning of the chapter (regulation II-2/2.1). For these to be achieved, the subsequently stated functional requirements (regulation II-2/2.2) are embodied in the purpose statements of following regulations in the chapter. In the succeeding paragraph (regulation II-2/2.3) it is stated that a ship shall be considered to meet the functional requirements set out in paragraph 2 and to achieve the fire safety objectives set out in paragraph 1 when the ship's design and arrangements comply with the relevant prescriptive requirements in the following regulations. However, it is also made clear that a ship shall be considered to achieve the fire safety objectives and the functional requirements when the ship's design and arrangements have been reviewed and approved in accordance with regulation II-2/17, "Alternative design and arrangements". Compliance with prescriptive requirements is thus only one way to achieve the fire safety objectives and functional requirements of the fire safety chapter.

3 The prescriptive requirements are found in the regulations which follow after the introductory regulations. The regulations cover different areas of fire safety, e.g. ignition, containment of fire, firefighting, etc. Each area of fire safety is defined by the purpose statement at the beginning of the regulation. The purpose statements consist of a regulation objective and functional requirements to be achieved by that regulation and include the functional requirements stated in SOLAS regulation II-22.2, as appropriate. After the purpose statement in each regulation follow the prescriptive requirements.

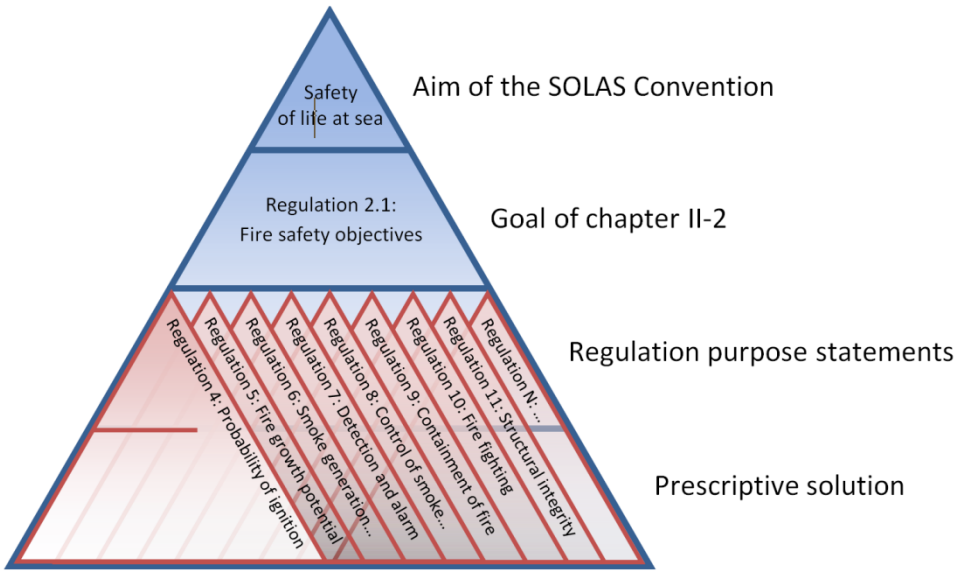

Figure 5: Performance-based structure of SOLAS chapter II-2

4 With regard to achieving the fire safety objectives and meeting the functional requirements of SOLAS chapter II-2 it should be noted that the formulations of these statements are inherently vague. They do not define how well they should be achieved. The fire safety objectives of the fire safety chapter rather define fire safety in a general way and give indication of how safety is viewed and measured (comparable with a physical quantity). What is regarded as fire safety is further defined through the regulation purpose statements. These statements are also quite vague (compare with unit of measure) but the required achievement of these is more clearly defined by the prescriptive requirements (see figure 5). Hence, in the end it is the prescriptive requirements which determine how well the fire safety objectives should be achieved and how well the functional requirement (and purpose statements) should be met. Thus, in light of the fire safety objectives and functional requirements, it is the prescriptive requirements which define what should be considered to be a sufficiently safe ship with regard to fire, i.e. the top of the pyramid in the figure 5. For example, in the fire safety objectives it is stated that the risk of damage caused by fire to the ship should be reduced (regulation II-2/2.1.1.3), which is partly managed by the functional requirement to divide the ship into main vertical and horizontal zones by thermal and structural boundaries (regulation II-2/2.2.1.1). In prescriptive requirements (regulation II-2/9.2.2.1.2) it is defined that the length and width of main vertical zones may be extended to a maximum of 48 m. Laying claim to regulation II-2/17 it is obvious that it should be possible to design larger main vertical zones (e.g. of 100 m in length) if measures are provided to sufficiently increase the level of safety in other ways. Similarly, the functional requirement to restrict the use of combustible materials (regulation II-2/2.2.1.3) is met by compliance with a number of prescriptive requirements managing the use of combustible materials. It is although possible with further use of combustible materials if measures are provided to sufficiently increase the level of safety in other ways.

5 Moving to SOLAS regulation II-2/17, sufficient safety is stated as the ultimate requirement for an alternative design and arrangements; it shall be at least as safe as if prescriptive requirements were complied with (regulation II-2/17.3.4.2). Putting this in context with regulation 2.3, the conclusion becomes that if it is shown that a ship with alternative design and arrangements is at least as safe as if prescriptive requirements were complied with, the functional requirements shall be considered met and the fire safety objectives shall be considered achieved (regulation II-2/2.3). It hence implies that a ship with alternative design and arrangements can be approved even if fire safety objectives or functional requirements are not achieved to the same degree as by compliance with prescriptive requirements. Some may be achieved worse and some better as long as the total level of safety is at least equivalent. This is thus an alternative way to achieve the fire safety objectives and the functional requirements than by compliance with prescriptive requirements. In this context, what is stated in regulation II-2/17.2.1 (and in paragraph 2.1 of the annex to MSC/Circ.1002) may cause confusion since it conditions that a ship with alternative design and arrangements may deviate from prescriptive requirements provided that the design and arrangements meet the fire safety objectives and functional requirements. However, the fire safety objectives and the functional requirements simply express measures or units in which fire safety is measured and not performance criteria. It therefore makes little sense to speak in terms of meeting these statements without expressed criteria. A ship with alternative design and arrangements may thus be claimed to meet the fire safety objectives and functional requirements even if they are not achieved in the same way or some are not met to the same degree as by a ship complying with the relevant prescriptive requirements. What is critical in an evaluation of alternative design and arrangements on the other hand is that performance criteria are selected to provide a degree of safety not less than that achieved if complying with the prescriptive requirements. That determines whether an alternative design and arrangements achieves sufficient safety and thereby also whether the ship meets the fire safety objectives and functional requirements set out in SOLAS regulation II-2/2 (as they should be considered met if the evaluation in accordance with regulation SOLAS II-2/17 is reviewed and approved, as stated by regulation II-2/2.3).

6 The above reasoning shows that structures in FRP composite may be permitted in SOLAS vessels since each fire safety objective and functional requirement (including SOLAS regulation II-2/2.2.1.3, requiring restricted use of combustible materials) must not unconditionally be achieved to the same degree as if prescriptive requirements were complied with. If this is the case, safety must be improved in other ways to provide the same overall degree of safety. Concluding, vessels with structures in FRP composite can be permitted based on regulation II-2/17 in the current version of the SOLAS Convention if sufficient safety is achieved.

C.3 The approach in regulation II-2/17

1 As concluded above, FRP composite structures on SOLAS ships could be treated as alternative fire safety design and arrangements in line with SOLAS regulation II-2/17. According to regulation II-2/17.3, an engineering analysis shall then be carried out based on a method summarized in the regulation, whilst more detailed descriptions of the method are lain out in guidelines, MSC/Circ.1002. These guidelines open up for using performance-based methods of fire safety engineering to verify that the fire safety of a ship with alternative design and arrangements is equivalent to the fire safety stipulated by prescriptive requirements, a concept often referred to as the "equivalence principle". Briefly, the procedure can be described as a two-step deterministic risk assessment carried out by a design team. The two major parts to be performed are:

.1 the preliminary analysis in qualitative terms; and

.2 the quantitative analysis.

2 In the first part, the design team is to define the scope of the analysis, identify hazards and from these develop design fire scenarios as well as develop trial alternative designs. The different components of the preliminary analysis in qualitative terms are documented in a preliminary analysis report which needs consent by the design team before it is sent to the Administration for review. With the Administration's approval, the preliminary analysis report documents the inputs to the next step of the assessment, the quantitative analysis. Now the design fire scenarios are quantified and outcomes are compared with performance criteria determined based on relevant regulations or a commonly used acceptable prescriptive design. The documented level of fire safety of the alternative design and arrangements may therefore not be absolute but relative to the fire safety of a traditional design, which is a product of the fire safety implied by prescriptive regulations. Accounting for uncertainties when comparing levels of fire safety, the final documentation of the engineering analysis based on SOLAS regulation II-2/17 (hereafter referred to as "regulation II-2/17 assessment") should with reasonable confidence demonstrate that the fire safety of the alternative design and arrangements is at least equivalent to that of a prescriptive design.

APPENDIX D

RECOMMENDATIONS REGARDING THE ASSESSMENT

Introduction

When laying claim to SOLAS chapter II-2, regulation 17, an analysis shall show that sufficient safety is achieved by the alternative design and arrangements with regard to introduced fire hazards. Guidelines for such analysis are found in MSC/Circ.1002. However, when considering FRP composite structures it may also be relevant to consider MSC.1/Circ.1455, guidelines which have been developed to provide a consistent process for the coordination, review and approval of alternative design and arrangements in general, i.e. not only fire safety. This may be particularly appropriate when the use of FRP composite affects other aspects of safety than those related to fire. Further assistance may be found in guidance notes for MSC/Circ.1002 and in guidelines on fire safety engineering applied for buildings. Below follow discussions on the required method for analysis, evaluation and approval of FRP composite structures, with regard to uncertainty treatment, sophistication and the practical process. Reference is made to the guidelines referenced in SOLAS, MSC/Circ.1002, but also to MSC.1/Circ.1455. It is particularly pointed out that the assessment must stand in relation to the current scope of the proposed design and arrangements; a simple and well protected structure in FRP composite should not require a complicated or time-consuming assessment.

D.1 Uncertainty treatment

1 Even the most detailed risk assessment contains limitations and uncertainties are involved throughout the whole process. The uncertainties entering when determining the frequencies and probabilities of events are often perceived as the dominating sources of error. Data is insufficient or not fully relevant for the particular events. Common reasons are that statistics have simply not been recorded or that that the data is aged and does not comprise updates in legislation and novel technology. However, even if statistical information is often considered to be "the truth" it should be handled with care since the figures are always changing and may have great errors. Furthermore, statistics can give an image of something that has happened in the past but evaluations of novel ship designs need to be carried out before the ship is put into practice, which implies that statistical data will not be available for such parts of the ship. A general statistical representation may be available for the prescriptive design but the fire risk of the alternative design and arrangement needs to be calculated from knowledge.

2 Attempting to compare a calculated risk of alternative design and arrangements with a statistical representation of a prescriptive design, or an absolute risk criterion, may become extremely uncertain since the different approaches contribute with fundamentally different uncertainties. It could therefore be recommendable to carry out a relative risk assessment, as described in MSC/Circ.1002, even when carrying out a regulation II-2/17 assessment at a more sophisticated level. Thereby uncertainties can be minimized, by founding the risk estimations of the ship designs on similar assumptions (e.g. in models, expert judgement, statistical data etc.). In order to expose the differences in fire safety it is also recommendable that the assessment concerns only the alternative design and arrangements and thereby relevant parts of the ship (a risk measure for the ship as a whole may give a wrong representation of the safety).

3 When determining consequences of events, uncertainties depend on how systematic and detailed the approach is. Models used when estimating the consequences and experience in the expert group are also sources of uncertainties. In the hazard identification uncertainties are also many times linked with the used method, how detailed it is performed and the

competence of the expert group examining the systems. Lack of routines, knowledge and experience are drawbacks which need to be considered when designing a ship with novel technology. The uncertainties can result in missing or wrong scenarios when identifying hazardous events, which can have great effects on the proceeding analysis. In common for all steps of the risk assessment is that many simplifications are made in order to model complicated systems. Much because of the complex matter of assessing the impact of human behaviour when modelling, they tend to be focused on machines and technical components. Leaving the effects of organizational aspects, safety management systems and operator actions outside the scope of the risk assessment will, however, not reduce uncertainties.

D.2 Required method

1 Many different methods for risk assessment, of varying sophistication, can be used to evaluate uncertainties in a ship design, which is the focus when adopting a risk-based approach. All ship designs contain uncertainties and all risk assessments contain uncertainties. As a result, all decisions will be made under some measure of uncertainty. If a risk assessment would result in an absolute certain probability density function of the possible consequences, a decision would be truly "risk-based". However, since uncertainties cannot be eliminated it is important to analyse them and to appraise the effects of uncertainties on the result and the total effect when these uncertainties are considered. Methods for risk assessment are often classified based on the inclusion of quantitative measures (qualitative-quantitative) or on the consideration to likelihood of outcomes (deterministic-probabilistic). A more suitable classification includes the previous features but depends on how uncertainties are treated with varying thoroughness.

2 The guidelines in MSC/Circ.1002 outline a plausible worst-case approach for analysis and evaluation which can be described as a deterministic risk assessment. This kind of consequence analysis, commonly referred to as "engineering analysis", is described in several engineering guides to performance-based analysis of fire protection in buildings, which have formed the basis for the guidelines. MSC/Circ.1002 makes clear that the scope of the analysis depends on the extent of deviations from prescriptive requirements and on the extent of the alternative design and arrangements. However, increased uncertainties do not only increase the scope of the analysis but also affect the required accuracy and sophistication of the method for verification of safety. A more sophisticated approach will further increase the engineering efforts but may be necessary if safety margins are to be kept reasonable and risks are to be properly managed when for example deviations are many, significant or concern many areas or when the design and arrangements are large, complex, novel or outside the scope of prescriptive requirements. Hence, the approach outlined in MSC/Circ.1002 may or may not be sufficient to adequately assess fire safety. Furthermore, if the case is simple, a less complicated kind of risk assessment should be sufficient. Hence, MSC/Circ.1002 "only" presents guidelines; the required sophistication of the method used to assess safety depends on whether it is sufficient to describe the current design and arrangements in terms of fire safety. The adaptability of the method used to verify fire safety and its dependence on the current scope is clearer in MSC.1/Circ.1455 (paragraph 4.13.2). Since the term "engineering analysis" refers to a certain kind of risk assessment, the more general term "regulation II-2/17 assessment" is used hereafter.

3 Moving to SOLAS regulation II-2/17, the stated ultimate requirement for alternative design and arrangements is sufficient safety; an alternative design and arrangements shall be at least as safe as if prescriptive requirements were complied with (regulation II-2/17.3.4.2). If the scope of the deviations posed by the alternative design and arrangements is great it may be relevant to carry out an assessment at that high of a level (see figure 5) and determine an index of safety for the whole (or considered part of the) ship. However, if effects on safety can be managed within the areas of one or a few regulations separately, this will allow for an

assessment at a lower level (e.g. limited to evaluations of fire growth potential or containment of fire). This is also why it was decided to have regulation II-2/17.2.1 read: "provided that the design and arrangements meet the fire safety objectives and the functional requirements", without mentioning whether it is the functional requirements in SOLAS regulation II-2/2 or in any other regulation. A "minor" alternative design and arrangements should be possible to analyse and compare to single affected functional requirements of deviated regulations. As long as it achieves those functional requirements it may not be necessary to evaluate safety at a higher level through the overall fire safety objectives and functional requirements. This although requires that risk control measures are found which target potential deficiencies in the areas of the individual deviated regulations.

4 It should be noted when considering FRP composite structures that a sole ASET-RSET evaluation, common in fire safety engineering, may provide an insufficient assessment. Effects on safety from use of FRP composite may go beyond what is captured by such assessment, e.g. effects appearing after escape from the fire or disproportionate damage. In any case it should be proven that the ship can survive a set of relevant design fires and be its own lifeboat. The design fire scenarios must be specified to represent all the affected safety barriers, i.e. not only those presented as functional requirements in SOLAS, as further elaborated below.

D.3 Establishment of approval basis

1 Modern ships (in particular passenger ships) are built with several fire safety functions or barriers. This will provide an integrated and redundant system that takes into account that some safety systems do not work as intended. A ship (partly) built of FRP composite structures should provide similar robustness and the design process should document that safety system can fail without loss of important safety functions or disproportionate consequences. However, all safety barriers are not clearly stated in the regulations and may be hard to identify.

2 According to SOLAS regulation II-2/17, alternative design and arrangements for fire safety should provide a degree of safety at least equivalent to that achieved by compliance with the prescriptive requirements. To form an approval basis, it is stated that the regulation II-2/17 assessment should include an identification of the prescriptive requirement(s) with which the alternative design and arrangements will not comply (regulation II-2/17.3.2). This is also a foundational part in MSC/Circ.1002 where it is stated that the regulations affecting the proposed alternative design and arrangements, along with their functional requirements, should be clearly understood and documented (paragraph 5.1.2). This is further stressed in paragraph 4.3.4, where it is stated that the preliminary analysis should include a clear definition of the regulations which affect the design and a clear understanding of the objectives and functional requirements of the regulations (i.e. the purpose statement in figure 5). The objectives and functional requirements of the deviated prescriptive requirements can thereafter be used (along with the fire safety objectives) to define performance criteria, as described in paragraphs 4.4 and 6.3.2 in MSC/Circ.1002 and in regulation II-2/17.3.4.

3 When FRP composite is used, the fundamental deviations concern requirements on non-combustibility. However, due to limitations in current regulations, an identification of deviated prescriptive requirements and their associated purpose statements may not form a sufficient basis to evaluate the safety of FRP composite ship designs. The regulations are namely based on assumptions regarding the design and arrangements and all safety requirements are therefore not apparent. In particular, many requirements are made up around steel designs, leaving many implicit requirements unwritten. Hence, use of FRP composite will affect fire safety in many ways, some of which are not covered by the fire safety regulations. An approval basis for equivalent safety may therefore not be sufficiently defined based only on deviations from prescriptive requirements, which is clearer in MSC.1/Circ.1455 (paragraph 4.7.1) than in MSC/Circ.1002 (paragraph 5.1.2).

4 Depending on the degree of scope of the proposed alternative design and arrangements, additional investigations may be called for to consider how the implicit level of fire safety represented in the Convention is affected. This may be relevant for an assessment of any design and arrangements which are truly novel (not simple extensions of the corresponding prescriptive requirements) since all hazards are not addressed by the Convention. A simple comparison with existing prescriptive requirements may not be sufficient and the assessment may hence require special attention.

5 Investigations of effects on the implicit level of fire safety, or identification of missing requirements, can also be claimed necessary regardless of the novelty of the proposed alternative design and arrangements. To further complicate the comparison of safety levels, many prescriptive requirements namely have unclear connections with the purpose statements of their regulations and also with the fire safety objectives of the fire safety chapter, which are supposed to define "fire safety". Some functional requirements could for example be claimed missing based on the prescriptive requirements and for some functional requirements listed at the beginning of regulations there are no associated prescriptive requirements. Deviation from one prescriptive requirement may affect the achievement of a functional requirement of a different regulation etc.

6 A regulation II-2/17 assessment involving FRP composite structures, as any regulation II-2/17 assessment, must be sufficient to describe the introduced novelty in terms of fire safety. Determining the approval basis only based on deviated prescriptive requirements may not be sufficient but additional investigations of effects on the implicit level of fire safety may be necessary. These guidelines attempt to clarify potential explicit and implicit such effects on fire safety when using FRP composite compared to what is implied by the prescriptive requirements from a wide perspective in section 3 (Important factors to consider when evaluating FRP composite structures with starting point in the regulations of chapter II-2). However, it could also be the case that further investigations are needed regarding how the proposed design and arrangements affect the fire safety implied by prescriptive requirements. Investigations could for example be carried out to clarify effects on the fire safety objectives and functional requirements of the fire safety chapter, effects on the structure of the fire safety (effects on the source, exposure or effect part of the fire protection), effects on properties of the fire protection (e.g. effects on the flexibility, sensitivity, complexity, vulnerability, reliability or human intervention) or effects on a fire development (effects on a fire in the incipient, growth, fully developed or decay phase). There are also many established methods for hazard identification which may be used.

7 In order to manage all the identified pros and cons of the alternative design and arrangements with regard to fire safety it is also suggested that they are managed in a better way than how it is described in MSC/Circ.1002 (paragraphs 5.2.1.2 and 5.2.1.3), e.g. by collection and rating in a risk-based presentation, such as a Procon List or Risk Matrix. This will be of significant value when forming fire scenarios. In general when novel design and arrangements are managed it is recommendable to have a larger focus on the initial stages of the regulation II-2/17 assessment, particularly on the identification, collection, rating and selection of fire hazards.

D.4 Approval process

1 It should be stressed that as well as the sophistication of the risk assessment may vary depending on the scope of the proposed design and arrangements, so may the practical process of the assessment. MSC/Circ.1002 describes an approach where the assessment is reviewed at two stages by formal approval of reports. The guidelines in MSC.1/Circ.1455 include the Administration more in the process by putting larger focus on monitoring and having review and approval of the assessment in several more but smaller stages. Regardless of

which guidelines that are referred to, it should be underlined that the actual process may include more steps than in the guidelines but it may also be significantly simplified. For example, proposing use of FRP composite for interior structures, a limited part of the ship or structures which are ubiquitously thermally insulated may not require a lengthy, detailed or very time-consuming assessment. Such structures may be for example cabin modules, gratings or a deck house in FRP composite. However, a wider scope will imply more differences and more intricate effects on fire safety. This may be the case when considering large areas (structures in several main vertical zones or deck) or the whole ship in FRP composite or when exterior surfaces are included, passive fire protection (insulation) is minimized or when optimizing the fire protection of the FRP composite structures in different ways. The needs for verification will then be greater and may increase both the required sophistication of the assessment as well as the number of steps and the involvement of the Administration in the process.

APPENDIX E

FIRE TESTING OF FRP COMPOSITE

Introduction

Many of the fire safety regulations in SOLAS stand in correlation with performance in fire tests. Some relevant characteristic parameters which are currently measured are:

- Speed of flame spread
- Evolved effect and energy
- Combustibility
- Smoke generation
- Toxicity
- Structural resistance to fire

These parameters are measured in different ways depending on the represented fire risk scenarios and with various criteria depending on the hazards involved. The different tests have not developed with particular attention to FRP composite constructions but may still be applicable, even if certain considerations may be necessary. There is although already a market for FRP composite constructions in naval and commercial maritime applications, particularly for high-speed crafts (HSC). For this purpose, new regulations and standardized tests have been implemented applying to such materials in the International Code of Safety for High-Speed Craft (HSC Code). It includes several significant differences with regard to e.g. the safety organization, available egress time and requirements for the materials, but it may still be relevant to refer to the related fire tests when considering FRP composite structures in SOLAS ships. Any standardized or experimentally set up test may be referred to in a regulation II-2/17 assessment but may require evaluations of the test results. Assessments by experts may also allow transferring test results from one FRP composite composition to another.

Below follows a discussion on the limitations of safety validation through tests in general and on uncertainties necessary to consider when using current fire test procedures to validate FRP composite in particular. Thereafter, the most relevant fire tests prescribed by SOLAS and the HSC Code are briefly described, with focus on the particularities with testing FRP composite. For some FRP composite constructions it may be necessary to look beyond the approved fire test procedures and consider other standardized tests or tailored experimental tests, which are discussed at the end of this chapter.

E.1 Uncertainties when using tests to validate FRP composite

1 Testing is a good tool to evaluate whether a construction performs satisfactorily in a certain situation. Full-scale testing is the method that typically will give the most accurate results of how a design will perform, even if natural variations are always present. Since it would be very costly to evaluate all possible scenarios in full-sized tests, some characteristic parameters are generally investigated in certain ways during exposure to plausibly worst-case scenarios. The overall safety performance is hence assumed to stand in correlation with the performance in these characteristic tests, derived from knowledge of fire dynamics and behaviour of materials when exposed to fire.

2 However, FRP composite and steel, which it generally replaces, are inherently very different. Some general particularities with FRP composites are the anisotropy and inhomogeneity, which may give variations in test results depending on the positioning. Another potential difficulty is that the different plies of resin impregnated fibre cloths might delaminate during testing. Produced gases will strengthen this tendency as they seek the outlet of "least resistance". The latter effect will not be captured in a small-scale test since the maximum travel distance for gases in the real fire will be much longer than in e.g. a "Cone Calorimeter" test where the maximum "travel" distance is 5 cm. The "edge" effect will therefore be much more important in a small-scale test than in a full-sized test. Different remedies to problems related to scale is given in the literature and they include edge protection, which in the Cone Calorimeter could be e.g. use of a sample holder that covers the edges completely or to vary the sample size or orientation.

3 Evaluation of two such diverse construction materials through the same tests may be claimed quite obtuse. Today's fire tests are generally constructed to measure some key properties reflecting different disadvantages of traditional (steel) constructions and ideally represent the performance of such constructions when exposed to a severe fire. Some characteristics are although left out in the tests because of the implicit benefits with traditional solutions. Hence, implicit advantages may not be represented in the tests and are neither possible to evaluate. What must be considered further is also the uncertainty associated with performance criteria generally being binary, i.e. pass or no pass. When evaluating designs through tests there is always a lowest level for passing the test, an acceptance criterion. Assurance of identical set-ups and measurements are obviously of greatest significance when tests are carried out by different people and at different labs in countries throughout the whole world. However, even without those uncertainties, a test says nothing concerning the performance not represented in the test, i.e. the performance of the sample if the load, temperature or time in the test increases by 10%, 20% or 50%. In general, the prescriptive fire tests of the International Code for Application of Fire Test Procedures, 2010 (2010 FTP Code) only give pass or no pass. Therefore, no information is given on how the construction performed *during* the test or how long it could have performed with satisfaction. An example of this is the ability of steel bulkheads to withstand high temperatures before structural deterioration. It is because of the implicit advantages with steel, not visible in standardized tests, that there is an additional requirement for many structures to be made in steel or other equivalent material. When aluminium was introduced to merchant shipbuilding it was although necessary to address this in a better way. Aluminium was according to regulations considered as an alternative non-combustible material to steel. However, the relatively poor structural behaviour at elevated temperatures (aluminium does not burn but nevertheless melts in the non-combustibility test) highlighted the simplistic nature of the non-combustibility requirement. Aluminium structures were therefore generally required to be fitted with double sided insulation and were thereby considered equivalent to steel in this regard. Furthermore, when non-metal load-bearing structures are considered for HSC they are subjected to an additional load during structural fire resistance tests in order for the structure to be considered equivalent to a metal construction. Hence, there may be reason to assess whether the standardized tests fully reflect the risks and benefits with the FRP composite structures in case of fire. Implicit properties beyond the tests need to be identified, which is one of the objectives behind these guidelines, and may require verification through additional tests.

E.2 Low flame-spread characteristics

1 The potential for flame spread of a material is tested in equipment where an irradiating panel provides heat input to a surface in order to initiate flaming combustion. The IMO typical example of such equipment is shown in figure 6. Fire is initiated where the distance between panel and sample is the shortest, i.e. where the irradiation intensity is the highest. The radiation level decreases at the test specimen from left to right in figure 6, and the extreme burning point to the right, i.e. the point with the lowest irradiation level for sustained combustion, is given as

a measure of flame spread for the material. The speed of the flame front movement is also quantified in an appropriate way. There are also criteria regarding the peak heat release as well as of the total evolved effect.

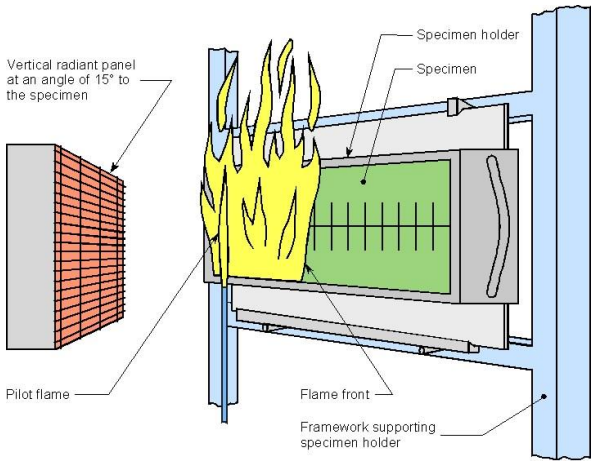

Figure 6: Test for flame spread according to ISO 5658 and the IMO FTP Code

2 When testing FRP composite according to this procedure it is important to comply with the requirement to test the specimen with end-use conditions. The material behind the tested surface material will significantly affect the fire behaviour. A well-insulating material behind a thin ply will keep much more of the heat at the surface and generally worsen the conditions for the tested surface material. Hence, if the end-use is a sandwich panel it is not appropriate to test only the surface laminate on a steel plate or directly in the sample holder. The equipment normally fits a 50 mm thick sample and for FRP composite it is recommendable to include as much of the composite material as possible in the sample holder.

E.3 Generated effect and smoke in small scale

1 The HSC Code includes regulations for furniture and other components which require investigating fire behaviour in a small scale in the "Cone Calorimeter" test equipment defined in the standard ISO 5660 (shown in the schematic picture in figure 7). The 0.1 x 0.1 m specimen is horizontally positioned and subjected to irradiation from electrically heated surfaces above the tested material. Irradiation levels are typically in the range of 25 to 50 kW/m^2.

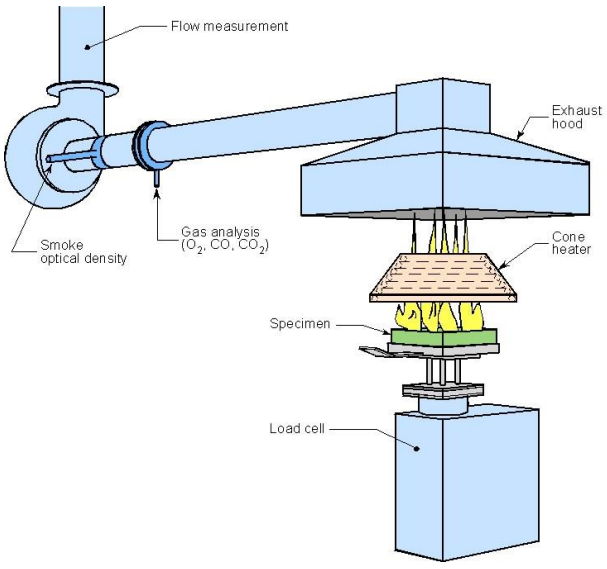

Figure 7: Schematic picture of a Cone Calorimeter

2 Except from time to ignition, the standard ISO 5660 Cone Calorimeter test includes measuring of smoke (obscuration). As figure 7 shows, it is also possible to measure the released heat, for which there is a criterion for the peak value. The time integrated HRR signal provides the total heat release (THR) which must be limited and is a very important material fire characteristic. In figure 8 is shown the HRR curve for such an experiment on a carbon fibre based composite laminate.

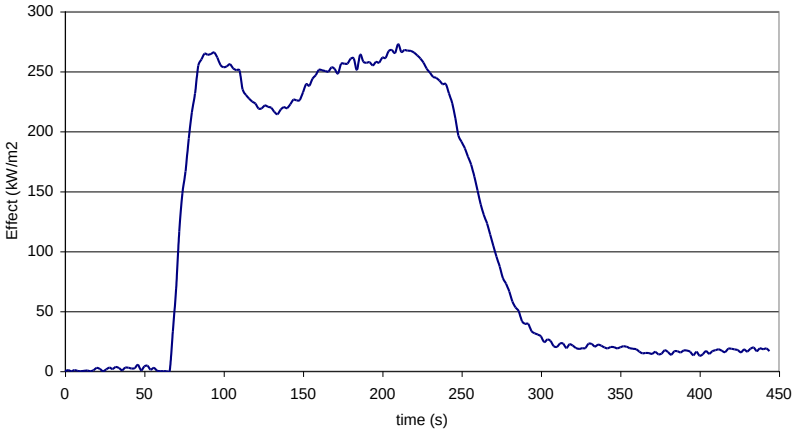

Figure 8: Small-scale experimental results from carbon FRP composite material

E.4 Generated effect and smoke in a large scale

1 The criteria for the Cone Calorimeter are designed to correlate with a large scale "Room Corner" test scenario according to the standard ISO 9705. It is an important standardized equipment for testing material potential for HRR and smoke, schematically pictured in figure 9. In this test, the material to be tested is mounted on walls and ceiling and a propane gas burner positioned in a corner of a full-scale room provides a 100 kW power output for 10 min, followed by a 300 kW output for an additional 10 min period. The HRR and smoke production rate are continuously measured and criteria apply similar to those in the Cone Calorimeter.

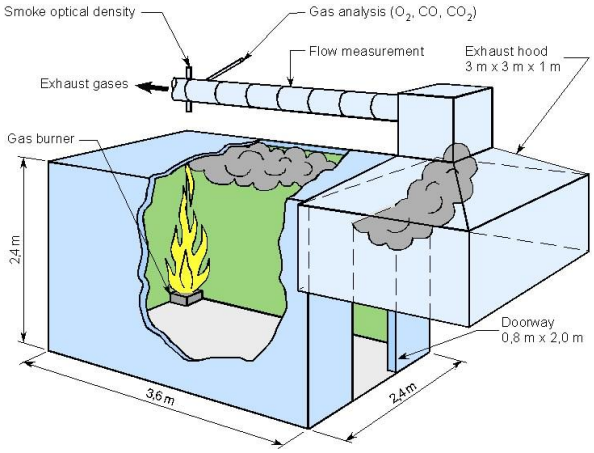

Figure 9: Schematic view of ISO 9705 Room-Corner experimental set-up

2 The standard ISO 9705 test is important for marine applications as it is used in the 2010 FTP Code for experimental verification of FRM, "Fire Restricting Materials", used on HSC. On SOLAS ships requirements are more relaxed and surfaces are often coated with combustible paints that would not pass FRM requirements, in particular if applied to a FRP composite surface. The material behind the surface finish has a major impact on the test results and, due to the high thermal conductivity of FRP composite, this test is therefore rather challenging for FRP composite systems. Furthermore, droplets and debris must also be considered according to the test

requirements. It is thus crucial that FRP composite materials are tested in end-use conditions. It should be noted that in comparison with the test for surface flammability that the room corner test is not only full in scale but also includes further complexities, in particular with regard to effects of enclosure fire dynamics. Flames and smoke are collected in the room and heats up surfaces in a different way and these reradiate between each other. The effects from enclosure fire dynamics also generally make the test harder to pass than the test for spread of flame; that is, materials which pass the room corner test generally also pass the test for spread of flame. For exterior combustible surfaces, the ability to manage effects from enclosure fires could be claimed irrelevant, as these effects will not appear out in the open on exterior surfaces. Hence, for such areas a different test could be more suitable.

E.5 Non-combustibility

The previously described test methods have been presented in an approximate order of difficulty with regard to fire behaviour of the materials. The ultimate fire related material quality is non-combustibility, determining whether the material is at all considered combustible. An accepted method for measuring combustibility is the fire test given by the standard ISO 1182 (see figure 10). A specimen is exposed to 750°C in a cylindrical furnace where temperature increase, flames and weight loss are measured to determine combustion. No organic material will pass this test, unless present only in very small percentages in the sample tested; a 5% content may pass the test but a content above 10% makes it unlikely. Mineral wool generally passes the test with an organic content of 2% to 4%. A standard polymer-based FRP composite will not pass the non-combustibility test, regardless of potential flame-retardants or other additives. Aluminium passes the test and is considered non-combustible despite the fact that it will melt at 570°C.

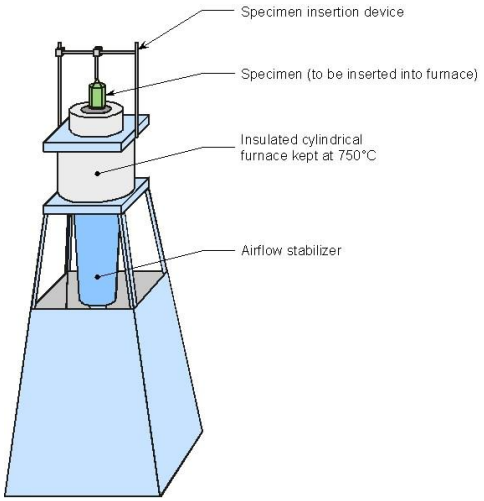

Figure 10: Combustibility test equipment according to ISO 1182

E.6 Smoke generation and toxicity

1 In evaluations of materials it is often relevant to combine properties of fire behaviour (fire growth, fire spread, etc.) with materials' potential for smoke generation and toxicity. For maritime applications, the "smoke box" is used for smoke and toxicology measurements, based on the international standard, ISO 5659. For SOLAS applications this test is only required if results in the test for spread of flame are insufficient. In this method, a 0.5 m^3 closed cubic box (figure 11) is used for exposing a small (75 mm x 75 mm) sample for irradiation and measuring continuously gases and smoke opacity in the box. Criteria concern maximum amount of smoke produced and also maximum concentrations of the following gaseous species: CO, HCl, HF, NO_x, HBr, HCN and SO_2, as given in the 2010 FTP Code. The test

proceeds for 10 min if a maximum has been observed in the smoke obscuration level; otherwise the test proceeds for another 10 min. The toxicity levels when the smoke obscuration reached its peak value are used as the result from the test.

Figure 11: Smoke box equipment

2 In this test, materials generally produce more smoke before ignition than after they have ignited. The same applies to most gases, in particular CO levels which are significantly higher before ignition (the opposite applies for HCN). Hence, FRP composite materials which have been treated to impede ignition and flame spread generally produce smoke and toxic gas in levels which may make it challenging to pass the test.

3 There is no requirement to test insulations, bulkhead panels and similar items for smoke and toxicity, since they are assumed non-combustible. However, regardless if a fire restricting material is used on top of an FRP composite panel, if a surface with low flame-spread characteristics is applied or if the FRP composite panel is left bare it could be claimed that it is the surface of the compartment which should be tested. End-use conditions apply also in this test method and as much of the FRP composite that fits in the 25 mm sample holder should then be included in the test. The long and significant heat exposure will cause materials underneath the potentially burning surface to thermally decompose. Even if the result is not the same as if the underlying materials were directly exposed, they will contribute to the generated smoke and toxic gases to an extent which is representable to the heat exposure in the test and in a fully developed fire.

E.7 Structural resistance

1 For load-bearing structures on SOLAS ships, structural resistance to fire is tested by exposing the sample to a well-defined temperature that increases over time. Typical standardized time-temperature curves are used as reference for the temperature in the furnace as depicted in figure 12.

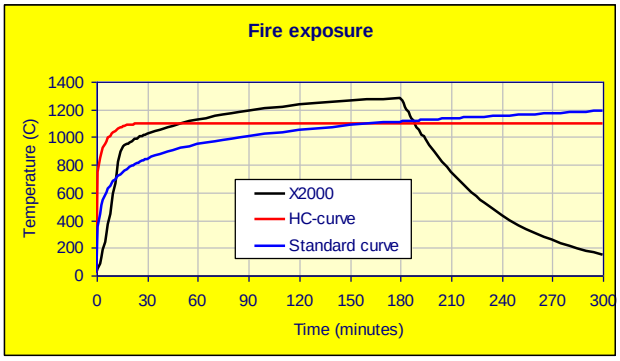

Figure 12: Time-temperature curves used for testing of structural resistance

2 In the structural resistance test the sample insulation properties are tested, i.e. its ability to withstand heat while keeping the temperature down at the unexposed side of the sample. The required performance time in a test and the demand for the backside temperature depends on type of test and type of classification. An example of a structural resistance test, used, e.g. for walls, doors, bulkheads etc., is illustrated in figure 13, where a load-bearing wall with a window is exposed to heat. Another test for a door construction is shown in figure 14.

Figure 13: Large scale structural fire resistance test of a window

Figure 14: Insulation test of a door where thermocouples measure the backside temperature during the heat exposure

3 As discussed above, for SOLAS applications there is no requirement in the test procedures to evaluate the construction load-bearing capabilities. In the HSC Code the divisions corresponding to A-class divisions in SOLAS are referred to as Fire Resisting Divisions (FRD). The main difference is the requirement for an A-class division to be constructed by non-combustible material, which does not apply to an FRD. The structural fire resistance test is basically identical to the test required for A-class divisions, except for an additional load-bearing requirement. This requirement implies that FRD decks and bulkheads shall withstand the standard fire test while subjected to transverse and in-plane loading, respectively. A FRD deck or bulkhead structure must sustain the specified loading whilst exposed to fire in a large scale furnace for 30 min or 60 min in order to be certified as a FRD30 or FRD60 division, respectively. Static or dynamic loading during fire resistance tests may be highly relevant when evaluating FRP composite constructions for SOLAS ships. Penetrations in FRP composite structures could reduce the load-bearing capacity and may call for testing of penetrations in load-bearing structures as well. Tests have been performed with certain FRP composite panels with holes which did not show any such effects. However, effects clearly depend on the made penetrations and on the safety margins included in the design. Fire resistance tests for penetrations on HSC are not performed with applied load.

Figure 15: Small-scale furnace for structural resistance tests

4 Small-scale test methods for structural resistance exist but are used in R&D projects or for product quality control. Maximum size of the tested sample in the small-scale furnace is 0.5 m x 0.6 m (figure 15), which is to be compared to a typical full-sized test as shown in figure 13, where a 3 m x 3 m sample is being tested. In a regulation II-2/17 assessment it may be relevant to refer to other than IMO test standards to evaluate fire-resistance (e.g. ISO 834-12 Fire resistance tests – Elements of building construction, part 12: Specific requirements for separating elements evaluated on less than full scale furnaces and ISO 30021 Plastics – Burning behaviour – intermediate-scale fire-resistance testing of fibre reinforced polymer composites).

E.8 Additional testing

1 Throughout different research projects many experimental tests have been carried out. Except from tests according to all of the standardized test procedures described above, tests have for example been carried for divisions' structural integrity in vertical and horizontal furnaces with various time, integrity requirements and loads (nominal load according to the HSC Code, design load and realistic load). Many solutions for doors, windows and penetrations have also been certified in such tests and different outfitting solutions have been tested in experimental tests with corresponding fire exposure. Fire growth has been evaluated for external combustible FRP composite surfaces based on SP FIRE 105, a standardized test method for testing reaction to fire properties of building façade systems. In the tests, the performance of FRP composite surfaces protected with different passive or active measures were compared with a completely non-combustible surface (hence the multiple layers of paint on a steel ship were ignored). Performance criteria have been developed for external drencher systems to determine under which conditions a drencher may be effective when using FRP composite on external surfaces. Tests have also been performed based on the *Guidelines for the approval of fixed pressure water-spraying and water based fire-extinguishing systems for cabin balconies* (MSC/Circ.1268) which showed that a balcony sprinkler prevented a fully developed cabin fire from spreading to FRP composite surfaces on the balcony and on outboard sides of the ship.

2 Depending on the intended use of FRP composite it may be relevant with further tests, e.g.:

- A joint between steel and FRP composite could be fire tested to ensure that collapse will not occur due to heat conduction from fire in an underlying steel compartment;
- If insulation is used, it may be relevant to test FRP composite which is insufficiently insulated, e.g. a small or large scale furnace test with 0.1 m x 0.1 m or 0.5 m x 0.5 m lack of insulation, or emergency repaired/modified; and
- Structural integrity test of a composite deck exposed to fire from above.

3 Furthermore, even though the "Smoke box" described above is in frequent use for marine applications, it may be requested (e.g. if found relevant in the risk assessment) to handle the issue of smoke toxicity more accurately. This could advantageously be managed through the small-scale "Purser Furnace" method, as defined in the standard ISO/TS 19700. In the test, a small sample (a few grams) is transported through a tubular furnace together with a well-defined flow of primary air. At the furnace outlet, secondary air is provided to a "mixing chamber" where samples are taken for analysis. The method provides the possibility for testing in well-ventilated as well as in under-ventilated fire conditions. Even test parameters for smouldering fires are given by the test protocol. The type of substances found in the fire smoke is very much dependent on oxygen available during combustion. The combustion conditions and the small-scale test method, depicted in figure 16, have shown good correlations with large-scale tests, e.g. performed in the ISO 9705 Room-Corner test scenario (figure 9). The results from this test could for example be compared with toxicity levels in a fully developed fire in order to determine that conditions will not be significantly worsened when the FRP composite as a whole contributes to the fire.

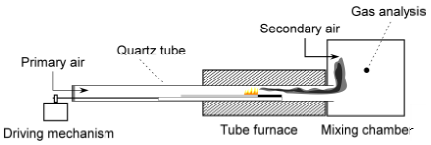

Figure 16: A schematic picture of the ISO/TS 19700 test apparatus

4 It may also be claimed necessary to prove that a FRP composite material is not easily ignited. Even though restricted ignitability is required by functional requirements in SOLAS regulations there is no IMO certifying test to show this property. On land in Europe there is although a corresponding test method called EN ISO 11925-2, Reaction to fire tests – Ignitability of building products subjected to direct impingement of flame – part 2: Single-flame source test. This is a test method which measures the ignitability of building products when exposed to a small flame. Based on numerous fire tests conducted at SP Fire Technology with various FRP composite materials it has although been judged very likely that most exposed surfaces of untreated FRP composite (i.e. the laminate) would pass such a test. This can also be distinguished from the Cone Calorimeter test data in figure 8. The graph does not only show that the FRP composite may become involved in a significant fire but also that it resists the rather significant irradiation of 50 kW/m^2 for at least one minute before becoming involved in a large fire. For reference, 15 to 20 kW/m^2 towards the floor is often referred to as a criterion for when flashover is determined in an enclosure fire. A Molotov cocktail has for example been concluded not to be able to ignite the particular FRP composite surface tested in figure 8. In the aforementioned test method for ignitability of building products, the material is exposed to a flame in the size of a match for 15 or 30 seconds. It can thereby be concluded that FRP composite surfaces generally have restricted ignitability and that what could rather be a problem is fire spread if the surface is exposed to an already established fire. If considered relevant, the ignitability of various FRP composite surfaces may be evaluated through a test, e.g. according to the standard EN ISO 11925-2.

APPENDIX F

EXAMPLE OF ASSESSMENT PROCEDURE

1 In this appendix, examples of a regulation II-2/17 assessment are presented with the ambition to guide Administration in what to require from an assessment involving FRP composite structures. The following three general principles are used:

.1 protect internal structures against exposure to an indoor fire;

.2 protect against fires exposing external surfaces; and

.3 document performance of fire protection using primarily established test procedures.

2 A design preview meeting is typically held between the client, coordinator of the assessment and the Administration prior to the start of the assessment in order to clarify the scope, objectives, process and roles of stakeholders. Then a design team is selected to mirror the complexity of the task, in the sense that the members should together possess all the necessary competence to perform the assessment of fire safety. For example experts in FRP composite materials, fire safety, fire testing, fire safety engineering, risk assessment, fire safety regulation, ship design and operation may all be relevant to include. Even if the design team should be formed at the beginning of the project, it may be necessary to expand it further along. The whole design team will not be part of all parts of the process but it is key that the design team is well represented at the hazard identification. It is also recommendable that the Administration is included in the hazard identification, as well as at key review meetings, as witness to gain insight or to provide direct feedback on preliminary results.

3 An effective hazard identification requires that an investigation of potential challenges to regulations has been performed (see section *3* (Important factors to consider when evaluating FRP composite structures with starting point in the regulations of chapter II-2)) on the basis of a base alternative design, which must be well-defined at this stage. A base alternative design is the fire safety design and arrangements which all trial alternative designs have in common, including the introduced novelty and pre-determined safety measures. Different combinations of safety measures (risk control options) added to the base alternative design defines the trial alternative designs to be evaluated (see example below).

4 As an example, consider the deck house in figure 17 with FRP composite sandwich panel structures (composition as in figure 1). In the base alternative design the inside of the FRP composite surfaces are covered by thermal insulation to achieve 60 min of fire integrity according to the 2010 FTP Code, part 11. The fire integrity is maintained at openings and penetrations.

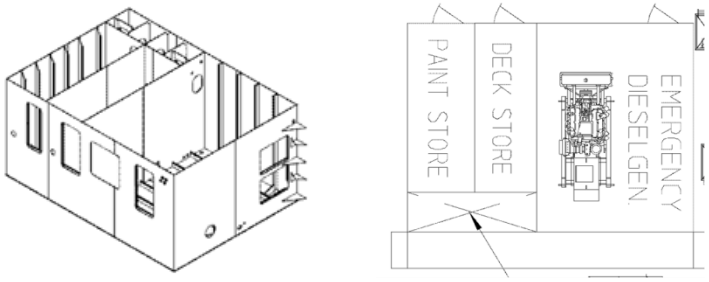

Figure 17: Example deck house structure of FRP composite

5 Since the structures are not made in non-combustible material, deviations to prescriptive requirements are found in SOLAS regulations II-2/9 and II-2/11. Regulation II-2/9 requires A-class divisions with 0 to 60 min fire insulation capability and regulation II-2/11 requires deckhouses to be constructed of steel or other equivalent material. By evaluation of the purpose statements, several more challenges are identified particularly considering the unprotected external surfaces (see section 3 (Important factors to consider when evaluating FRP composite structures with starting point in the regulations of chapter II-2)). Affected functional requirements may be identified as:

.1 restrict ignitability of combustible materials;

.2 restrict the amount of combustible materials;

.3 restrict the fire growth potential of combustible materials;

.4 limit the quantity of smoke and toxic products released from combustible materials during fire;

.5 boundaries shall provide thermal insulation and integrity with due regard to the fire risk of adjacent spaces; and

.6 materials used in the ships' structure shall ensure that the structural integrity is not degraded due to fire.

6 During the hazard identification a number of potential ignition sources and fuels may be identified inside and outside the deck house. With a deterministic (worst-case) approach, two design fire scenarios are defined to evaluate fire safety of the deck house: a flashover fire in the emergency generator space and a significant exterior hydrocarbon fire. Trial alternative designs are said to be formed by adding any combination of risk control measures (RCMs), identified as:

.1 provision of stiffeners at the inside of the exterior bulkheads (to provide structural integrity along with the unexposed laminate in case of an external fire);

.2 use of double sandwich panels (triple skin sandwich panels), where only half are necessary to carry the design load (to structural integrity along with the unexposed laminate in case of an external fire);

.3 provision of a drencher system covering the external surfaces;

.4 redundant supply unit for the drencher system;

.5 provision of low flame-spread characteristics on external surfaces; and

.6 dutomatic surveillance of closure of doors.

7 In quantifying effects on safety there are different approaches (see appendix D (Recommendations regarding the assessment)). Here is exemplified an approach where the ambition is to perform at least as well as a prescriptive design in all areas where fire hazards are introduced independently; this implies that a sufficient safety margin is sought which by conservative safety measures allows to keep the complexity of the assessment at a minimum.

8 Regarding ignitability, this is only considered affected at external surfaces. A fire test is performed in accordance with the standard ISO 11925-2, a test method to evaluate the ignitability of building products when exposed to a small flame, which shows that ignitability is not a problem. A full-scale experimental fire test is performed for different RCMs applied to a FRP composite panel constructed as one of the external sides of the deck house. They show that RCM e above or pre-activation of RCM c prevents ignition during 20 min of significant fire exposure during the fire tests. This is argued sufficient with consideration to the potential for external fire exposure and the organization of manual firefighting. Tests according to part 11 of the 2010 FTP Code are used to demonstrate that fire integrity, fire growth potential and smoke production are managed in case of a fully developed fire inside the spaces. Event tree analysis shows that function of door closing devices is key to prevent an interior fire to grow and spread. It is therefore included in all risk control options (RCOs), which are now concretized as:

- RCO A: RCMs a + c + d + f
- RCO B: RCMs b + c + d + f
- RCO C: RCMs b + c + d + f + extended detection system
- RCO D: RCMs c + d + f + extended detection system
- RCO E: RCMs e, f

9 RCO A and RCO B require that the drencher system is activated if structural integrity is not to be deteriorated and therefore includes a redundant supply unit (RCM c). Smoke production may not be a problem on deck but it can be argued that fire growth is not properly managed. This may be handled by an extended detection system, providing quick and reliable activation of the drencher system, which was therefore added in RCO C. The question is then if the over-capacity in structural integrity provided by RCM b is necessary, hence RCO D. Without further elaborating of these issues it is decided to present RCO E as the suggested final alternative design, since it cost-effectively is considered to provide a reliable solution. The performance criteria to better achieve safety functions where fire hazards have been introduced are thereby considered met.

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ANNEX 7

DRAFT MSC CIRCULAR

UNIFIED INTERPRETATION OF THE GUIDELINES FOR SAFE ACCESS TO TANKER BOWS (RESOLUTION MSC.62(67))

1 The Maritime Safety Committee, at its [ninety-fifth session (3 to 12 June 2015)], with a view to providing more specific guidance on the fire resistance requirements for Fibre Reinforce Plastic (FRP) gratings used for safe access to tanker bows, approved a unified interpretation on the *Guidelines for safe access to tanker bows* (resolution MSC.62(67)), prepared by the Sub-Committee on Ship Design and Construction, at its second session (16 to 20 February 2015), as set out in the annex.

2 Member Governments are invited to use the annexed unified interpretation as guidance when applying resolution MSC.62(67) to approve arrangements using FRP gratings for safe access to tanker bows on or after [*date of approval of the circular*] and to bring the unified interpretation to the attention of all parties concerned.

ANNEX

UNIFIED INTERPRETATION OF THE GUIDELINES FOR SAFE ACCESS TO TANKER BOWS (RESOLUTION MSC.62(67))

Paragraph 1.3 – Gangway and access

Fibre Reinforced Plastic (FRP) gratings used in lieu of steel gratings for safe access to tanker bows shall possess:

.1 low-flame spread characteristics and shall not generate excessive quantities of smoke and toxic products as per the International Code for Application of Fire Test Procedures, 2010 (2010 FTP Code); and

.2 adequate structural fire integrity as per recognized standards* after undergoing tests in accordance with the above standards.

* For example, the Standard Specification for Fibre Reinforced Polymer (FRP) Gratings Used in Marine Construction and Shipbuilding (ASTM F3059-14).

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ANNEX 8

DRAFT MSC RESOLUTION

AMENDMENTS TO THE GUIDELINES FOR THE APPLICATION OF PLASTIC PIPES ON SHIPS (RESOLUTION A.753(18)), AS AMENDED BY MSC.313(88)

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.753(18), by which the Assembly, at its eighteenth session, adopted Guidelines for the application of plastic pipes on ships, to assist maritime Administrations to determine, in a rational and uniform manner, the permitted applications of such materials,

NOTING that the Assembly requested the Committee to keep the guidelines under review and amend them as necessary,

RECALLING FURTHER resolution MSC.313(88), by which the Committee adopted amendments to the *Guidelines for the application of plastic pipes on ships* (resolution A.753(18))

RECOGNIZING that the continual development of plastic materials for use on ships and improvement of marine safety standards since the adoption of resolutions A.753(18) and MSC.313(88) necessitates the periodic revision of the provisions of the *Guidelines for the application of plastic pipes on ships* in order to take into account technological developments and maintain the highest practical level of safety,

HAVING CONSIDERED, at its [ninety-fifth session (3 to 12 June 2015)], amendments to the *Guidelines for the application of plastic pipes on ships*, proposed by the Sub-Committee on Ship Design and Construction, at its second session,

1 ADOPTS amendments to the guidelines for the application of plastic pipes on ships (resolution A.753(18)), as amended by MSC.313(88), the text of which is set out in the annex to the present resolution;

2 INVITES Governments to apply the annexed amendments when considering the use of plastic piping on board ships flying the flag of their State.

ANNEX

AMENDMENTS TO THE GUIDELINES FOR THE APPLICATION OF PLASTIC PIPES ON SHIPS (RESOLUTION A.753(18)), AS AMENDED BY MSC.313(88)

1 In the table of contents, the entry for "2.2.3 Smoke generation" is replaced by the following:

"2.2.3 Smoke generation, containment and toxicity"

2 In the table of contents, the entry for "2.2.4 Toxicity" is deleted and the ensuing entries are renumbered accordingly.

3 In the table of contents, the entry for "4.6 Penetrations of fire divisions" is deleted and the ensuing entries are renumbered accordingly.

4 In the table of contents, the entry for "Appendix 3 – Test method for flame spread of plastic piping" is replaced by the following:

"Appendix 3 – Test methods and criteria for flame spread, smoke generation and toxicity of plastic piping"

5 In paragraph 2.1.1.4, the following text is added at the end of the last sentence:

"(e.g. pipes for vacuum and pressure systems)".

6 In paragraph 2.1.8.2, the following sentence is added at the end:

"This may require additional support of the piping systems."

7 In paragraph 2.2.1.2, between the words "outflow of flammable liquids" and "and worsen the fire situation" the words "or spread of fire through duct piping" are added.

8 In paragraph 2.2.2.1, between the words "piped tunnels and ducts," and "should have low flame spread" the words "if separated from accommodation, permanent manned areas and escape ways by means of an A class bulkhead," are added.

9 In paragraph 2.2.2.1, the reference "resolution A.653(16) as modified for pipes" is replaced by the reference "appendix 3".

10 In paragraph 2.2.2.2, the reference "resolution A.653(16)" in the first sentence is replaced by the reference "appendix 3".

11 In paragraph 2.2.2.2, the reference "resolution A.653(16)" in the second sentence are replaced by the reference "the 2010 FTP Code, annex 1, part 5".

12 In paragraph 2.2.2.2, between the words "modifications are" and "listed in appendix 3" in the last sentence, the word "also" is added.

13 In paragraph 2.2.2.3, the reference "IMO resolution A.653(16) (surface flammability criteria of bulkhead, wall and ceiling linings)" is replaced by the reference "appendix 3".

14 The title of section 2.2.3 is replaced by the following:

"**2.2.3 Smoke generation, containment and toxicity**".

15 In paragraph 2.2.3.1, the reference "SOLAS regulations II-2/34.7 and 49.2 are" is replaced by the reference "SOLAS regulation II-2/6 is".

16 Paragraph 2.2.3.2 is replaced by the following:

"2.2.3.2 Piping materials shall fulfil the requirements of the 2010 FTP Code, annex 1, part 2, on smoke and toxicity test. Procedure modifications are necessary due to the curvilinear pipe surfaces. These procedure modifications are listed in appendix 3".

17 Section 2.2.4 and paragraph 2.2.4.1 are deleted and the ensuing sections and paragraphs of part 2 are renumbered accordingly.

18 Section 4.6 and paragraphs 4.6.1 and 4.6.2 are deleted and the ensuing sections and paragraphs of part 4 are renumbered accordingly.

19 In appendix 1, note 2 to paragraph 1, the words "as set out in paragraphs 7.1, 7.2 and 7.3 of the annex to Assembly resolution A.754(18)" are replaced by the words " as set out in paragraphs 7.1 to 7.4 of part 3 of annex 1 to the 2010 FTP Code".

20 In appendix 1, paragraph 2, the sentence "One of the ends should allow pressurized nitrogen to be connected." is deleted.

21 In appendix 1, note 2 to paragraph 2, the following sentence is added at the end:

"At least largest and smallest diameter or wall thickness should be tested for approval."

22 In appendix 1, paragraph 7 is deleted.

23 Appendix 3 is replaced by the following:

"**Appendix 3**

Test methods and criteria for flame spread, smoke generation and toxicity of plastic piping

Flame spread, smoke generation and toxicity of plastic piping should be determined by the 2010 FTP Code, annex 1, parts 2 and 5 with the modifications listed below.

Tests should be made for each pipe material and should take into account differences in wall thickness.

When conducting testing of plastic piping, testing need not be conducted on every pipe size. Testing should be conducted on pipe sizes with the maximum and minimum wall thicknesses intended to be used. This will qualify all piping sizes for a specific piping material provided that the wall thickness falls within the tested range.

1 Test Specimen Preparation

1.1 For homogenous thermoplastic pipes, the test specimens may be produced as flat plates in the required wall thickness(es)

1.2 The test sample should be fabricated by cutting pipes lengthwise into individual sections and then assembling the sections into a test sample as representative as possible of a flat surface. A test sample should consist of at least two sections. All cuts should be made normal to the pipe wall. The test sample should be 800 mm ± 5 mm long for tests to 2010 FTP Code, annex 1, part 5. The test sample should be 75 mm ± 1 mm square for tests to 2010 FTP Code, annex 1, part 2.

1.3 The number of sections that must be assembled together to form a test sample should be that which corresponds to the nearest integral number of sections which should make a test sample (with an equivalent linearized surface width between 155 mm and 180 mm). The surface width is defined as the measured sum of the outer circumference of the assembled pipe sections that are exposed to the flux from the radiant panel.

1.4 The assembled test sample should have no gaps between individual sections.

1.5 The assembled test sample should be constructed in such a way that the edges of two adjacent sections should coincide with the centreline of the test holder.

1.6 For testing flame spread the individual test sections should be attached to the backing calcium silicate board using wire (No.18 recommended) inserted at 50 mm intervals through the board and tightened by twisting at the back.

1.7 The individual pipe sections should be mounted so that the highest point of the exposed surface is in the same plane as the exposed flat surface of a normal surface.

1.8 The space between the concave unexposed surface of the test sample and the surface of the calcium silicate backing board should be left void.

1.9 The void space between the top of the exposed test surface and the bottom edge of the sample holder frame should be filled with a high temperature insulating wool if the width of the pipe segments extend under the side edges of the sample holding frame.

2 Test Methods

Flame spread of plastic piping should be determined by the 2010 FTP Code, annex 1, part 5. The smoke density and toxicity of gases produced by plastic pipes should be determined by the 2010 FTP Code, annex 1, part 2.

3 Criteria

Flame Spread

Parameters	*Criteria*
CFE(kW/m^2)	*≥20.0*
Q_{sb} (MJ/m^2)	*≥1.5*
Q_t (MJ)	*≤0.7*
Q_p (kW)	*≤4.0*
Burning Droplets	*No burning droplets*

Smoke and Toxicity

Smoke: the D_m value shall not exceed 400 in any test condition

Toxicity: the average value of the gas concentration measured under each test condition shall not exceed the following limits:

Species	Concentration (ppm)
CO	1450
HCl	600
HF	600
HBr	600
HCN	140
SO_2	120
NO_x	350

4 Exemption of the test in accordance with part 2 of the 2010 FTP Code

Piping with both the total heat release (Q_t) of not more than 0.2 MJ and the peak heat release rate (Q_p) of not more than 1.0kW (both values determined in accordance with the 2010 FTP Code, annex 1, part 5) are considered to comply with the requirements the 2010 FTP Code, annex 1, part 5 without further testing (see the 2010 FTP Code, annex 2, paragraph 2.2)."

24 In appendix 4, in the fire endurance requirements matrix, the following new row is added at the end of the matrix:

"

32	Central vacuum cleaners	NA	NA	NA	0	NA	NA	NA	NA	0	0	0

"

25 In appendix 4, footnote 10, the reference "paragraph 3(f) of regulation 13F" is replaced by the reference "paragraph 3.6 of regulation 19".

26 In appendix 4, in location definitions, in the definition of location A – Machinery spaces of category A, the reference "regulation II-2/3.19" is replaced by the reference "regulation II-2/3.31"

27 In appendix 4, in location definitions, in the definition of location B – Other machinery spaces and pump-rooms, the word "pumps," is deleted.

28 In appendix 4, in location definitions, in the definition of location B – Other machinery spaces and pump-rooms, between the words "boilers," and "steam and internal combustion engines" add the words "fuel oil units,".

29 In appendix 4, in location definitions, in the definition of location J – Accommodation, service and control spaces, the reference "regulation II-2/3.10, 3.12, 3.22" is replaced by the reference "regulations II-2/3.1, 3.45, 3.18".

30 In appendix 4, in location definitions, in the definition of location K – Open decks, the reference "regulation II-2/26.2.2(5)" is replaced by the reference "regulation II-2/9.2.2.3.2(5)".

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ANNEX 9

DRAFT AMENDMENTS TO SOLAS REGULATION II-2/13

Regulation 13 – Means of escape

1 The footnote to title of paragraph 3.2 is deleted.

2 The following new paragraphs are added after the existing paragraph 3.2.6.2:

"3.2.7 *Evacuation analysis for passenger ships**

3.2.7.1 Escape routes shall be evaluated by an evacuation analysis early in the design process. This analysis shall apply to:

.1 ro-ro passenger ships [constructed on or after [DD/MM/YY]]; and

.2 other passenger ships constructed on or after [date of entry into force] carrying more than 36 passengers.

3.2.7.2 The analysis shall be used to identify and eliminate, as far as practicable, congestion which may develop during an abandonment, due to normal movement of passengers and crew along escape routes, including the possibility that crew may need to move along these routes in a direction opposite to the movement of passengers. In addition, the analysis shall be used to demonstrate that escape arrangements are sufficiently flexible to provide for the possibility that certain escape routes, assembly stations, embarkation stations or survival craft may not be available as a result of a casualty.

* Refer to *Guidelines for evacuation analysis for new and existing passenger ships* (MSC.1/Circ.1238), as may be amended. "

3 Delete paragraph 7.4.

~~"7.4 Evacuation analysis*~~

~~Escape routes shall be evaluated by an evacuation analysis early in the design process. The analysis shall be used to identify and eliminate, as far as practicable, congestion which may develop during an abandonment, due to normal movement of passengers and crew along escape routes, including the possibility that crew may need to move along these routes in a direction opposite to the movement of passengers. In addition, the analysis shall be used to demonstrate that escape arrangements are sufficiently flexible to provide for the possibility that certain escape routes, assembly stations, embarkation stations or survival craft may not be available as a result of a casualty.~~

~~* Refer to Guidelines for evacuation analysis for new and existing passenger ships (MSC.1/Circ.1238)~~ "

APPENDIX 1

CHECK/MONITORING SHEET FOR THE PROCESSING OF AMENDMENTS TO THE CONVENTION AND RELATED MANDATORY INSTRUMENTS (PROPOSAL/DEVELOPMENT) DRAFT AMENDMENTS TO SOLAS REGULATION II-2/13

Part III – Process monitoring to be completed during the work process at the sub-committee and checked as part of the final approval process by the Committee (Refer to section 3.2.1.3)**

1	The sub-committee, at an initial engagement, has allocated sufficient time for technical research and discussion before the target completion date, especially on issues needing to be addressed by more than one sub-committee and for which the timing of relevant sub-committees meetings and exchanges of the result of consideration needed to be carefully examined.	yes
2	The scope of application agreed at the proposal stage was not changed without the approval of the Committee.	yes
3	The technical base document/draft amendment addresses the proposal's issue(s) through the suggested instrument(s); where it does not, the sub-committee offers the Committee an alternative method of addressing the problem raised by the proposal.	yes
4	Due attention has been paid to the *Interim guidelines for the systematic application of the grandfather clauses* (MSC/Circ.765-MEPC/Circ.315).	yes
5	All references have been examined against the text that will be valid if the proposed amendment enters into force.	yes
6	The location of the insertion or modified text is correct for the text that will be valid when the proposed text enters into force on a four-year cycle of entry into force, as other relevant amendments adopted might enter into force on the same date.	yes
7	There are no inconsistencies in respect of scope of application between the technical regulation and the application statement contained in regulation 1 or 2 of the relevant chapter, and application is specifically addressed for existing and/or new ships, as necessary.	yes
8	Where a new term has been introduced into a regulation and a clear definition is necessary, the definition is given in the article of the Convention or at the beginning of the chapter.	yes
9	Where any of the terms "fitted", "provided", "installed" or "installation" are used, consideration has been given to clarifying the intended meaning of the term.	yes
10	All necessary related and consequential amendments to other existing instruments, including non-mandatory instruments, in particular to the forms of certificates and records of equipment required in the instrument being amended, have been examined and included as part of the proposed amendment(s).	yes

11	The forms of certificates and records of equipment have been harmonized, where appropriate, between the Convention and its Protocols.	not applicable
12	It is confirmed that the amendment is being made to a currently valid text and that no other bodies are concurrently proposing changes to the same text.	yes
13	All entry-into-force criteria (building contract, keel laying and delivery) have been considered and addressed.	yes
14	Other impacts of the implementation of the proposed/approved amendment have been fully analysed, including consequential amendments to the "application" and "definition" regulations of the chapter.	yes
15	The amendments presented for adoption clearly indicate changes made with respect to the original text, so as to facilitate their consideration.	yes
16	For amendments to mandatory instruments, the relationship between the Convention and the related instrument has been observed and addressed, as appropriate.	not applicable
17	The related record format has been completed or updated, as appropriate.	yes

* Parts I and II should be completed by the submitter of a proposed new amendment, to the fullest extent possible.

** Part III should be completed by the drafting/working group that prepared the draft text using "yes", "no" or "not applicable".

APPENDIX 2

RECORDS FOR REGULATORY DEVELOPMENT

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

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

1 Title (number and title of regulation(s))
SOLAS chapter II-2: Construction – fire protection, fire detection and fire extinction; part D: Escape; regulation 13 – Means of escape; draft new paragraph 3.2.7 on Evacuation analysis of passenger ships Proposed deletion of existing SOLAS regulation II-2/13.7.4
2 Origin of the requirement (original proposal document)
SDC 1/WP.8, annex 1 and MSC 93/20/4 (France, Germany, Spain and CLIA)
3 Main reason for the development (extract from the proposal document)
In emergency situations the evacuation of a ship may be a necessary consequence. The process of evacuation will have an effect on passengers and crew members. The present IMO regulations and guidelines on evacuation analysis have been introduced in order to enable a safe evacuation of all persons on board ro-ro passenger ships. The guidelines are based on basic assumptions and benchmark evacuation scenarios to analyse the evacuation process and performance already in the design concept phase. For non-ro-ro passenger ships, these regulations and guidelines are applied either on a voluntary basis or sometimes as part of the approval of alternative designs. (MSC 93/20/4, annex, paragraph 1) Experiences gained by evacuation analyses or accidents with passenger ships have shown that the current voluntary guidelines on evacuation do not satisfy the necessary practical conditions for passenger ships. (MSC 93/20/4, annex, paragraph 2) The current voluntary guideline on evacuation of passenger ships does not satisfy the practical conditions of state of the art passenger ships. In particular, important aspects to avoid congestion when steering people in the evacuation are still missing in the relevant IMO instruments even for evacuation simulation (FP 56/INF.10). The voluntary status of circular MSC.1/Circ.1238 is too weak to improve the current evacuation problem. (MSC 93/20/4, annex, paragraph 7) … It is considered that the mandatory application of evacuation analysis for new passenger ships (ro-ro and non-ro-ro) will harmonize the current industry practice and differing national domestic requirements with the international regulatory framework, bringing benefits to all stakeholders… (MSC 93/20/4, annex, paragraph 8) The proposal will facilitate the global, consistent implementation of the instruments relating to evacuation analysis for all kinds of passenger ships. This output will directly benefit and improve the safety of passengers on board. MSC 93/20/4, annex, paragraph 9)

4	**Related output**
None	
5	**History of the discussion (approval of work programmes, sessions of sub-committees, including CG/DG/WG arrangements)**
MSC 92 agreed to instruct SDC 1 to consider the mandatory application of evacuation analysis to non-ro-ro passenger ships and advise MSC 93 accordingly. (MSC 92/26, paragraph 6.18) **SDC 1** agreed that amendments to SOLAS to make the application of evacuation analysis to new and existing passenger ships mandatory are necessary and requested the Secretariat, with the assistance of interested delegations, to prepare a justification to expand the scope of this output for consideration by the Sub-Committee. (SDC 1/26, paragraph 13.5) **MSC 93**, having considered document MSC 93/20/4 (France, Germany, Spain and CLIA), proposing to expand the existing output on "Review of the recommendations on evacuation analysis for new and existing passenger ships (5.1.1.3)" to include amendments to SOLAS regulation II-2/13 and chapter 13 of the FSS Code, to make mandatory the application of evacuation analysis to all types of passenger ships, agreed to expand the scope of the output 5.1.1.3, replacing the existing title with "Amendments to SOLAS and FSS Code to make evacuation analysis mandatory for new passenger ships and review of the recommendation on evacuation analysis for new and existing passenger ships", and to include it in the biennial status report of the Sub-Committee and provisional agenda for SDC 2, with a target completion date of 2016. The Committee confirmed that there should be no requirements on survey or certification associated with this work. (MSC 93/22, paragraph 20.11)	
6	**Impact on other instruments (e.g. codes, performance standards, guidance circulars, certificates/records format, etc.)**
Guidelines for evacuation analysis for new and existing passenger ships (MSC.1/Circ.1238); Special Purpose Ships (SPS) Code	
7	**Technical background**
7.1	**Scope and objective (to cross check with items 4 and 5 in part II of the checklist)**
Continued mandatory application of evacuation analysis to ro-ro passenger ships constructed on or after the date on which regulation II-2/13.7.4 applies and to new non ro-ro passenger ships carrying more than 36 passengers (see SDC 2/WP.5, paragraphs 25 and 26).	
7.2	**Technical/operational background and rationale (summary of FSA study, etc. if available or, engineering challenge posed, etc.)**
The impact of the **Costa Concordia** accident on the current international regulations for the safety of passenger ships (see MSC 90/28, section 27) The capsizing of the **Costa Concordia** raised new challenges for the Organization that needed to be addressed expeditiously to ensure the safety of passengers at sea. The issue of evacuation analysis is directly related to the safety of passengers on board cruise ships and was listed in the Committee's long-term action plan on passenger ship safety. (MSC 93/20/4, annex, paragraph 5)	

7.3 Source/derivation of requirement (non-mandatory instrument, industry standard, national/regional requirement)
Amending the SOLAS Convention and the FSS Code in order to make the evacuation analysis mandatory for all passenger ships should be supported by amending MSC.1/Circ.1238 in a way as to consider non-ro-ro passenger ships appropriate.
7.4 Short summary of requirement (what is the new requirement – in short and lay terms)
New SOLAS regulation II-2/13.3.2.7 maintaining the mandatory application of evacuation analysis to ro-ro passenger ships constructed on or after the date on which regulation II-2/13.7.4 applies and extending it to new non ro-ro passenger ships carrying more than 36 passengers.
7.5 Points of discussions (controversial points and conclusion)
Point of discussion: How to best capture the date of application of evacuation analysis for ro-ro passenger ships without creating retrospective requirements or gap periods in the application, given the proposed deletion of SOLAS regulation II-2/13.7.4 **Decision:** Options considered were: 1) to include a specific date of application for ro-ro passenger ships matching the date of application of SOLAS regulation II-2/13.7.4 2) to keep regulation II-2/13.7.4 and apply the new proposed regulation to new passenger ships that are not ro-ro. 3) use the general application date of chapter II-2 as found in regulation II-2/1.2. The issue remain unresolved (see SDC 2/WP.5, paragraphs 26 and 27). **Point of discussion:** Threshold number of passengers or persons carried by a passenger ship for the mandatory requirement to apply. **Decision**: ro-ro passenger ships irrespective of the number of passengers and other passenger ships carrying more than 36 passengers. Consequently, special purpose ships carrying 240 persons or more will have to carry out evacuation analysis. **Point of discussion:** Keep the same purpose for the analysis as stipulated in SOLAS regulation II-2/13.7.4 or deviate from it? **Decision:** Copy the purpose for the analysis from SOLAS regulation II-2/13.7.4 **Point of discussion:** Include additional simulation requirements, such as simulation of travel time to embarkation points, in SOLAS or develop them for inclusion in MSC.1/Circ.1238. **Decision:** Keep SOLAS requirements general and include more specific requirements in MSC.1/Circ.1238, as may be revised.

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ANNEX 10

DRAFT MSC CIRCULAR

UNIFIED INTERPRETATION OF SOLAS REGULATION II-2/13.6

1 The Maritime Safety Committee, at its [ninety-fifth session (3 to 12 June 2015)], with a view to providing more specific guidance on means of escape from ro-ro spaces, approved a unified interpretation of SOLAS regulation II-2/13.6, prepared by the Sub-Committee on Ship Design and Construction, at its second session (16 to 20 February 2015), as set out in the annex.

2 Member Governments are invited to use the annexed Unified interpretation as guidance when applying SOLAS regulation II-2/13.6 on or after [*date of approval of circular*] and to bring the unified interpretation to the attention of all parties concerned.

ANNEX

UNIFIED INTERPRETATION OF SOLAS REGULATION II-2/13.6

Regulation 13.6 – *Means of escape from ro-ro spaces*

1 A place where the crew are present to carry out their routine work duties, e.g. during the loading and unloading of a ro-ro deck, or during their ro-ro deck inspections whilst the ship is underway, is considered normally employed.

2 Ro-ro deck inspections could for instance include: fire patrols, inspection of the cargo, check of bilge wells and their alarms, sounding of tanks, cargo deck cleaning, different types of maintenance work (removing of rust, painting, greasing, etc.).

3 Ro-ro spaces should be fitted with at least two means of escape, one located at the fore end and the other at the aft end of the space, from which access is provided to the lifeboat and liferaft embarkation decks. One of the means of escape should be a stairway, the second escape may be a trunk or a stairway

4 The fore and aft ends of the ro-ro space are considered as the areas being within the distance equal to the breadth of the ro-ro space, measured at its widest point, from its forward most and aftmost point.

5 Suitable signs and markings should be provided to indicate the route to the means of escape.

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ANNEX 11

DRAFT MSC CIRCULAR

GUIDANCE FOR WATERTIGHT DOORS ON PASSENGER SHIPS WHICH MAY BE OPENED DURING NAVIGATION

1 The Maritime Safety Committee, at its [ninety-fifth session (3-12 June 2015)], with a view to assisting Administrations in carefully considering the impact of open watertight doors on passenger ships operation and survivability when determining whether a watertight door may be open during navigation under SOLAS regulation II-1/22, approved the annexed *Guidance for watertight doors on passenger ships which may be opened during navigation*, prepared by the Sub-Committee on Ship Design and Construction, at its second session.

2 The guidance contains the following appendix:

Procedure for the determination of the impact of open watertight doors on passenger ship survivability (floatability assessment);

3 Member Governments are invited to apply the annexed guidance to passenger ships constructed on or after [*date of entry into force of the associated amendments to SOLAS regulation II-1/22*] and bring it to the attention of recognized organizations, ship designers, shipbuilders, manufacturers, companies, shipowners, operators and any other parties concerned.

ANNEX

GUIDANCE FOR WATERTIGHT DOORS ON PASSENGER SHIPS WHICH MAY BE OPENED DURING NAVIGATION

1 PREAMBLE

1.1 Watertight subdivision is vital to ship stability and survivability to protect life, property and the marine environment in cases of hull damage after collision or grounding. The number of openings in watertight bulkheads on passenger ships is to be kept to a minimum in accordance with SOLAS regulation II-1/13.1.

1.2 In order to maintain watertight subdivision, while allowing for the safe and effective operation of the ship, all watertight doors are to be kept closed during navigation, except in certain limited circumstances. SOLAS regulation II-1/22.3 allows a watertight door to be temporarily opened to permit the passage of passengers or crew, or when work in the immediate vicinity of the door necessitates it being opened. In this case, the door must be immediately closed when transit through the door is complete or the work is finished.

1.3 The SOLAS chapter II-1 regulations referred to in this guidance means SOLAS chapter II-1 regulations amended by resolution MSC.[…(…)] (entry into force on [*date*]).

2 Introduction

This guidance is intended to ensure that watertight doors which may be opened during navigation do not inadvertently provide a weak link in the required damage stability survivability of passenger ships.

3 Importance of watertight doors

3.1 Failure to recognize the importance of watertight doors can have great impact on the watertight integrity of the ship and have catastrophic consequences. When structural damage occurs to a ship, especially during collision or grounding, there is potential risk for bulkheads and decks to be deformed, thus rendering watertight doors not able to be closed. The risk of progressive flooding following such deformation of the ship's structure may increase if watertight doors are either left open or unable to be closed.

3.2 Another potential risk to ship survivability is when large amounts of water flood a ship, especially after extensive structural damage. The rate of water ingress, which depends on the size of the damaged opening and the water pressure, can quickly flood a compartment. It is therefore essential that a ship has sufficient survivability in case of damage, keeping in mind that when adjacent watertight doors are open, several compartments may be flooded as watertight doors have up to 60 seconds to close per SOLAS regulation II-1/13.5.1.

4 Operation of watertight doors

Power-operated watertight doors are designed to be remotely closed in a short period of time with a force the magnitude of which is sufficient to overcome not only the weight of the door but also water flowing through its opening, both while a ship is listing 15º in either direction. The operation of watertight doors involves possible dangers to persons passing through a closing door and injury or loss of life is likely to occur to anyone trapped in the door's path. The audible alarm that sounds for a few seconds before the door starts moving, and continues sounding while the door is in motion, is intended to reduce the human element risk.

5 SOLAS regulation and technical standards for watertight doors

5.1 SOLAS regulation II-1/13 provides the technical standards for watertight doors in passenger ships. The basis of this regulation is that all watertight doors shall be kept closed during navigation according to SOLAS regulation II-1/22.1, except as follows:

.1 watertight doors may be opened during navigation to permit the passage of passengers or crew. The door must be immediately closed when transit through the door is complete; and

.2 watertight doors may be opened during navigation when work in the immediate vicinity of the door necessitates it being opened. The door must be immediately closed when the task which necessitated it being open is finished.

6 Categories of watertight doors

In order to assist Administrations in determining to what extent watertight doors may be opened during navigation, watertight doors may be categorized into one of three different types of doors:

.1 Category B doors:

A watertight door that may be opened during navigation when work in the immediate vicinity of the door necessitates it being opened, according to SOLAS regulation II-1/22.3. The door must be immediately closed when the task which necessitated it being open is finished.

.2 Category C doors:

A watertight door that may be opened during navigation to permit the passage of passengers or crew, according to SOLAS regulation II-1/22.3. The door must be immediately closed when transit through the door is complete.

.3 Category D doors:

.1 A watertight door of a width of more than 1.2 m in machinery spaces as permitted by SOLAS regulation II-1/13.10, shall remain closed during navigation except in case of urgent necessity at the discretion of the master according to SOLAS regulation II-1/22.4.

.2 Additionally, watertight doors fitted in watertight bulkheads dividing cargo between deck spaces in accordance with SOLAS regulation II-1/13.9.1 or dividing cargo spaces in accordance with SOLAS regulation II-1/14.2, shall be closed before the voyage commences and shall be closed during navigation according to SOLAS regulation II-1/22.5.

7 Considerations to be made on categories B and C watertight doors which may be opened for limited periods, or for passage.

7.1 A watertight door of category B or C should be clearly indicated in the ship's stability information and should always be ready to be immediately closed. Category D doors should also be clearly indicated in the ship's stability information.

7.2 Category B watertight doors could potentially be open for extended periods of time when navigating in non-hazardous areas if necessitated by work in the immediate vicinity of the door. Therefore, in order to provide a measure of residual stability, all category B watertight doors should undergo a floatability assessment as set out in the appendix, and meet the specified floatability criteria in section 3 of the appendix.

8 Factors restricting the operation of watertight doors

Certain operating conditions, or combinations of several factors, should necessitate categories B and C doors being closed during navigation to preserve survivability. In particular, the area in which the ship is operating should be continually evaluated for associated risks with any potentially hazardous conditions. It is recommended that categories B and C doors are kept closed during navigation while the ship is operating:

.1 in waters with high traffic density;

.2 near coastal waters;

.3 in heavy weather;

.4 in dangerous ice conditions;

.5 in waters where soundings are unreliable;

.6 during periods of restricted visibility;

.7 within port limits or compulsory pilotage waters;

.8 when loose objects are nearby, which could potentially prevent the watertight door from being closed; or

.9 under any condition when the ship's master considers the situation to necessitate all watertight doors to be closed.

9 Operational instructions, markings and postings

9.1 Operational instructions

Operational instructions for watertight doors should be included in the ship's stability information and address the situations described in paragraphs 9.2 and 9.3. Additionally:

.1 a copy of the operational instruction should be located at the central operating console at the navigation bridge so as to be readily available to the officer in charge of the navigation watch;

.2 the operational instructions should state the means of verifying the correct position of all watertight doors; and

.3 the operational instructions should cover procedures for operating watertight doors to permit safe passage of passengers, in particular, that watertight doors should only be operated by qualified persons and not by passengers.

9.2 Operational instructions in potentially hazardous situations

9.2.1 A potentially hazardous situation is defined as a situation when the ship is on a voyage and operating in conditions as described in paragraph 8.

9.2.2 The operational instructions should specify that, while the ship is navigating in potentially hazardous situations, every watertight door of category B or C be closed except when a person is passing through it. If such doors are opened for passage then it should be closed immediately after passage.

9.3 Operational instructions in normal situations

9.3.1 A normal situation is defined as a non-hazardous situation when the ship is on a voyage and operating in conditions other than as described in paragraph 8.

9.3.2 The operational instructions should specify that while the ship is navigating in normal situations each watertight door of category B or C be operated in accordance with the assigned category (see paragraph 6).

9.4 Markings and postings

9.4.1 The assigned category and meaning of each category should clearly be marked on both sides of either the watertight door or the bulkhead adjacent to the door in order to ensure correct operation.

9.4.2 The assigned category for each door should be indicated on or near the central operating console located on the navigation bridge in order that the correct status of all doors can be ascertained.

APPENDIX

FLOATABILITY ASSESSMENT

1 Introduction

1.1 This floatability assessment is intended to provide a measure of residual stability if category B watertight doors are opened for extended periods of time when navigating in non-hazardous areas if necessitated by work in the immediate vicinity of the door.

1.2 Care should be exercised not to confuse the "floatability assessment" criteria used in this procedure with the requirements in the SOLAS chapter II-1 damage stability regulations.

2 Damage and flooding extent for the floatability assessment

2.1 A floatability assessment calculation should be performed for each category B watertight door. Only the individual category B watertight door under consideration need be assumed open for the calculation.

2.2 The extent of damage to be assumed for the floatability assessment should be as defined in SOLAS regulation II-1/8.3. In addition, watertight compartments inboard of the transverse extent of damage should be assumed flooded, irrespective of whether any longitudinal bulkheads are fitted with watertight doors, if:

.1 the inboard compartment is within the longitudinal damage extent; and

.2 the inboard compartment is connected by the watertight door under consideration.

If any lesser damage extents than indicated above would result in a more severe condition with respect to the floatability criteria, then such damage extents should be assumed in the calculations. In this context, the damage extent should be assumed as both penetrating and not penetrating the double bottom.

2.3 The floatability assessment should account for the worst case involving the additional flooding of the compartment connected by the category B watertight door under consideration.

3 Criteria for the floatability assessment

3.1 For each assumed flooding case described in section 2, the floatability criteria described below should be met at the deepest subdivision draught at level trim. For this loading condition, the limiting KG or GM should be assumed in the calculations.

.1 The bulkhead deck may be immersed provided that no progressive flooding occurs (i.e. weathertight openings may not be immersed; only watertight openings may be immersed).

.2 The maximum positive righting lever should not be less than 0.05 m.

.3 The range of positive righting levers should not be less than 7°.

.4 The maximum equilibrium heel angle should not exceed 15°.

3.2 The Administration may accept alternative methodologies if it is satisfied that at least the same degree of safety as represented by this procedure is achieved (reference is made to SOLAS regulation II-1/4.3).

EXPLANATORY SKETCHES

Notes:

In case of a ship carrying less than 400 persons, the breach should only be considered between transverse bulkheads (if spaced by more than 0.03L).

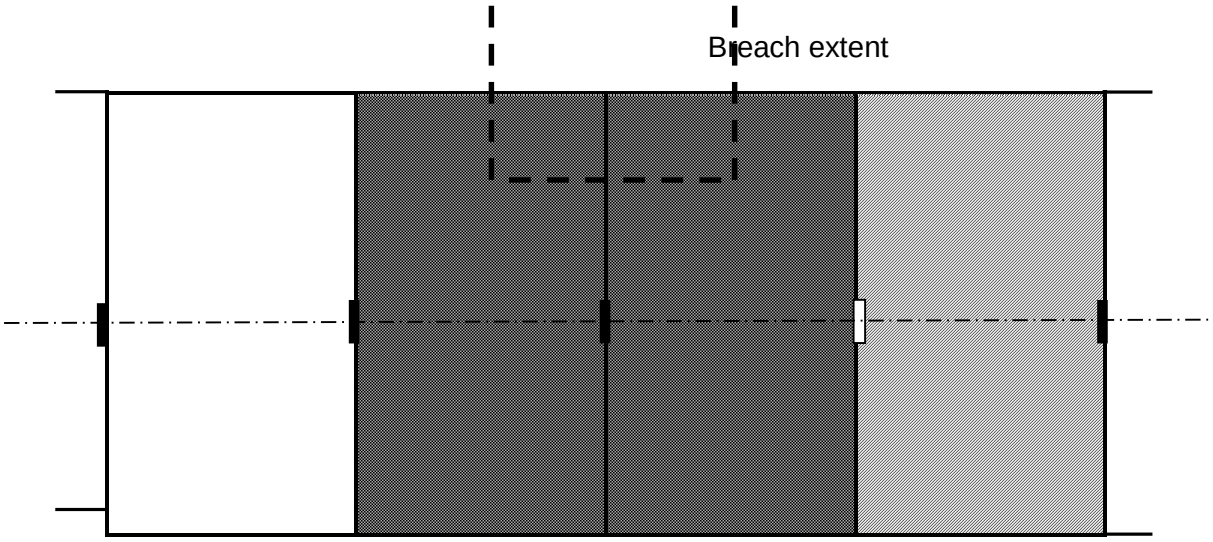
Category B watertight door under consideration and assumed open

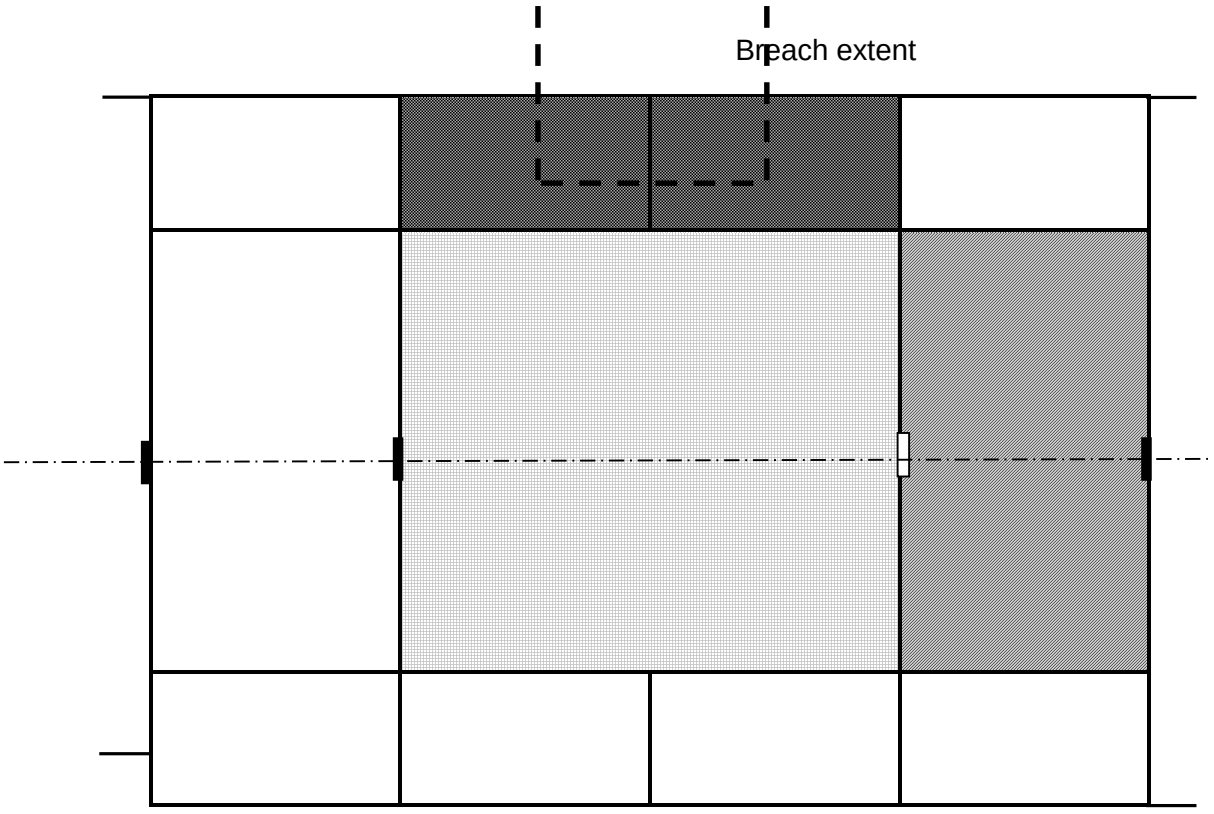
Other category B watertight doors assumed closed

Direct flooding (§2.2)

Additional flooding according to §2.2

Additional flooding according to §2.3




Breach extent

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ANNEX 12

DRAFT AMENDMENTS TO THE 2011 ESP CODE

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

ANNEX A

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

Part A

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

1 Paragraph 4.2.1.3 is amended as follows:

"4.2.1.3 In ballast tanks other than double-bottom tanks, where a hard protective coating is found in POOR condition and it is not renewed, or where soft or semi-hard coating has been applied, or where a hard 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 hard protective coating is found in ballast double-bottom tanks, where a soft or semi-hard coating has been applied, or where a hard protective 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 measurements should be carried out."

2 Paragraph 5.2.2 is amended as follows:

"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, based on recommendations developed by the Organization.[3]

[3] Refer to the *Revised recommendations for entering enclosed spaces aboard ships*, adopted by the Organization by resolution A.1050(27).

3 Paragraph 5.2.9 is amended as follows:

"5.2.9 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 backup 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 lifesaving and evacuation equipment ready for use.~~"

4 Paragraph 5.2.10 is deleted.

Part B

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

5 Paragraph 5.2.2 is amended as follows:

"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, based on recommendations developed by the Organization.[7]

[7] Refer to the *Revised recommendations for entering enclosed spaces aboard ships*, adopted by the Organization by resolution A.1050(27).

6 Paragraph 5.2.9 is amended as follows:

"5.2.9 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.~~"

7 Paragraph 5.2.10 is deleted.

ANNEX B

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

Part A

CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF DOUBLE-HULL OIL TANKERS

8 Paragraph 5.2.1.1 is amended as follows:

"5.2.1.1 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, based on recommendations developed by the Organization.[11]

[11] Refer to the *Revised recommendations for entering enclosed spaces aboard ships*, adopted by the Organization by resolution A.1050(27).

9 Paragraph 5.2.6 is amended as follows:

"5.2.6 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 backup 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 lifesaving and evacuation equipment ready for use.~~"

10 Paragraph 5.2.7 is deleted.

Part B

CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF OIL TANKERS OTHER THAN DOUBLE-HULL OIL TANKERS

11 Paragraph 5.2.1.1 is amended as follows:

"5.2.1.1 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, based on recommendations developed by the Organization.[15]

[15] Refer to the *Revised recommendations for entering enclosed spaces aboard ships*, adopted by the Organization by resolution A.1050(27).

12 Paragraph 5.2.6 is amended as follows:

"5.2.6 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 backup 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.~~"

13 Paragraph 5.2.7 is deleted.

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ANNEX 13

DRAFT MSC CIRCULAR

AMENDMENTS TO MSC.1/CIRC.1464/REV.1

1 The Maritime Safety Committee, at its [ninety-fifth session (3 to 12 June 2015)], with a view to providing more specific guidance on the application of SOLAS regulation II-1/3-6.3.1, as amended, and the revised Technical Provisions for means of access for inspections (resolution MSC.158(78)), approved amendments to MSC.1/Circ.1464/Rev.1, as prepared by the Sub-Committee on Ship Design and Construction, at its second session (16 to 20 February 2015), as set out in the annex.

2 Member Governments are invited to use the annexed amendments to MSC.1/Circ.1464/Rev.1 and to bring them to the attention of all parties concerned.

ANNEX

AMENDMENTS TO THE ANNEX TO MSC.1/CIRC.1464/REV.1

Paragraph 1.1

1 Replace the reference to "resolution A.744(18)" with "the 2011 ESP Code".

Paragraph 1.5

2 Renumber the existing paragraph as "paragraph 1" and insert the following new paragraph 2:

"2 The wording "not intended for the carriage of oil or hazardous cargoes" applies only to "similar compartments", i.e. safe access can be through a pump-room, deep cofferdam, pipe tunnel, cargo hold or double-hull space."

Paragraph 2.10

3 Insert the following new paragraph 10*bis*:

"10*bis* Deck is defined as "weather deck"."

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ANNEX 14

DRAFT MSC CIRCULAR

UNIFIED INTERPRETATIONS OF REGULATION 36(6) OF THE PROTOCOL OF 1988 RELATING TO THE INTERNATIONAL CONVENTION ON LOAD LINES, 1966

1 The Maritime Safety Committee, at its [ninety-fifth session (3 to 12 June 2015)], with a view to providing more specific guidance on the application of regulation 36(6) of the 1988 LL Protocol, approved a unified interpretation of regulation 36(6) of the Protocol of 1988 relating to the International Convention on Load Lines, 1966, as prepared by the Sub-Committee on Ship Design and Construction, at its second session (16 to 20 February 2015), as set out in the annex.

2 Member Governments are invited to use the annexed unified interpretations as guidance when applying regulation 36(6) of the 1988 LL Protocol and to bring the unified interpretation to the attention of all parties concerned.

ANNEX

UNIFIED INTERPRETATIONS OF REGULATION 36(6) OF THE PROTOCOL OF 1988 RELATING TO THE INTERNATIONAL CONVENTION ON LOAD LINES, 1966

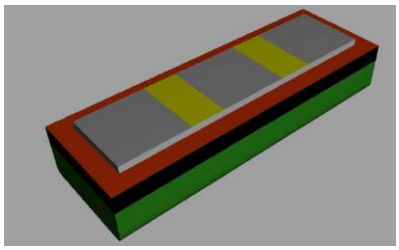
Regulation 36(6) – Continuous hatchways

1 Generally two types of "continuous hatchways" can be distinguished:

.1 In case of a **single** hatchway, the hatchway may be regarded as a "continuous hatchway".

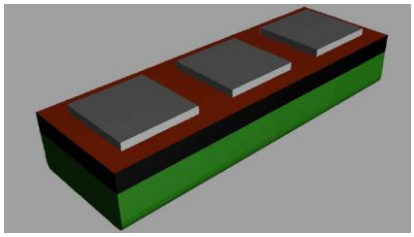
.2 In case **more than one** hatchway is fitted, the following arrangement may be considered as a "continuous hatchway", too:

Detached hatchways linked by weathertight decked steel structures in between. The hatchways are connected by longitudinal coamings connected transversally by decked steel structures. In this case, the equivalent "continuous hatchway" is the entire enclosed volume of the single hatchways and the weathertight spaces between them.

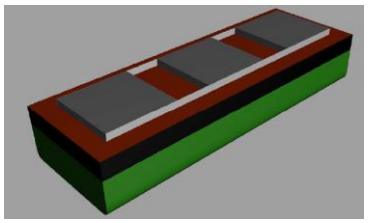


.3 In case more than one hatchway is fitted, the following arrangements shall **not** be regarded as "continuous hatchways":

(1) Detached hatchways: Each hatchway is to be considered as a "separated detached trunk", thus each hatchway may be treated separately as a trunk in the freeboard computation.



(2) Detached hatchways connected by longitudinal coamings: All hatchways may be treated in the same manner as (1).



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ANNEX 15

DRAFT MSC CIRCULAR

UNIFIED INTERPRETATION OF THE CODE ON NOISE LEVELS ON BOARD SHIPS (RESOLUTION MSC.337(91))

1 The Maritime Safety Committee, at its [ninety-fifth session (3 to 12 June 2015)], in order to facilitate its global and consistent implementation of the Code on Noise Levels on Board Ships, as adopted by resolution MSC.337(91), approved a unified interpretation of Code on Noise Levels on board Ships (resolution MSC.337(91)), as prepared by the Sub-Committee on Ship Design and Construction, at its second session (16 to 20 February 2015), as set out in the annex.

2 Member Governments are invited to use the annexed unified interpretation as guidance when applying Code on Noise Levels on board Ships and to bring the unified interpretation to the attention of all parties concerned.

ANNEX

UNIFIED INTERPRETATION OF THE CODE ON NOISE LEVELS ON BOARD SHIPS (RESOLUTION MSC.337(91))

CHAPTER 1

Paragraph 1.3.8

Passenger spaces where they are also occupied by crew such as recreation rooms and open recreation areas should be considered as "other passenger spaces", and therefore are not subject to the Code. However, bulkhead and decks of crew cabins and hospitals adjacent to such rooms/areas should have the weighted sound reduction index (Rw) in compliance with paragraph 6.2 of chapter 6.

Paragraph 1.4.21

Navigating bridge wings include enclosed navigating bridge spaces.

CHAPTER 3

Paragraph 3.3.5

Air conditioning vents should be kept open during the taking of noise measurements on board, unless they are designed to be kept closed in the normal operating condition.

Paragraph 3.3.6

Closing devices of ventilation grilles/louvres of cabin doors should be kept open during the taking of noise measurements on board, unless they are designed to be kept closed in the normal operating condition.

Paragraph 3.3.9

The wording "40% of maximum thruster power" means exactly "40% of maximum" and does not mean "40% of 80% as required by paragraph 3.3.2 of the Code".

Paragraph 3.9

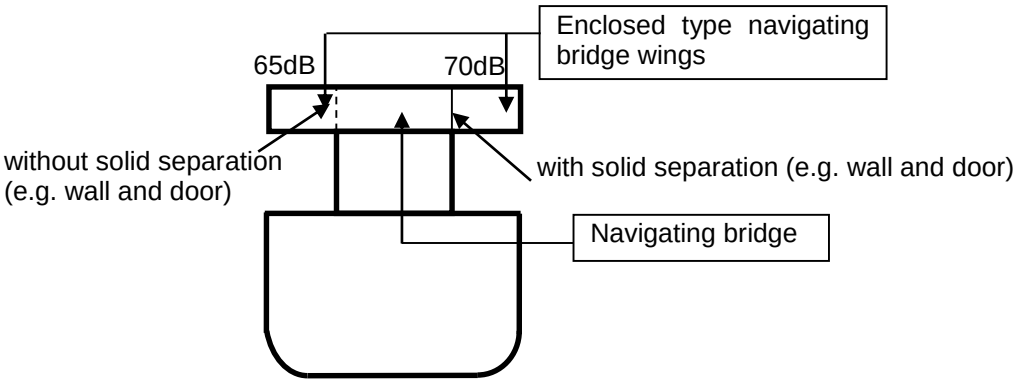
This provision only "acknowledges" the uncertainty; it does not represent any "allowance".

CHAPTER 4

Paragraph 4.2

1 A navigating bridge provided with radio equipment should be regarded as a "navigating bridge" (65dB(A))."Radio rooms" mean separate rooms dedicated for sending/receiving radio messages.

2



3 If a cabin is completely separated by more than one bulkhead from the airborne sound source, those bulkheads are not required to have the airborne sound insulation properties as required in chapter 6. For this purpose, bathroom/toilet/lavatory is not regarded as a cabin but regarded as the origin of airborne sound to another cabin.

4 A room consisting of day-room and bedroom should be regarded as a single "cabin" (60dB(A)/55dB(A)) in cases where the room is for single occupancy. For this purpose, partitions (panel and door) between day-room and bedroom need not have the airborne sound insulation properties as required in chapter 6.

CHAPTER 6

Paragraph 6.2.1

1 The requirements regarding airborne sound insulation properties for bulkheads also apply to components installed in bulkheads (e.g. corridors to cabin doors).

2 In applying this requirement to bulkheads including components as mentioned in the above, the following may apply:

.1 in cases of bulkheads consisting of acoustic insulation panels and doors, this requirement is considered satisfactory where each component forming the surface of bulkheads (acoustic insulation panels and doors, etc.) has at least the required Rw.

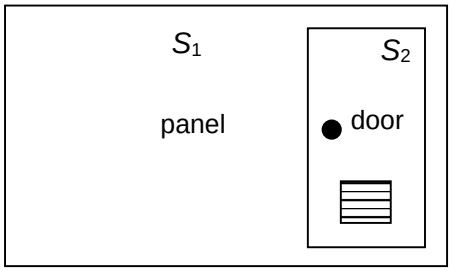
.2 in cases where either acoustic insulation panels or doors forming part of bulkheads have weighted sound reduction index inferior to that required by section 6.2.1 of the Code, this requirement is considered satisfactory provided that the Rw of bulkheads is not inferior to the required value, i.e. the Rw of bulkhead calculated using both the airborne sound insulation properties of the doors and those of the panels is not inferior to the required value. As guidance on evaluation of the Rw of bulkheads, the following formulae can be used:

$$\overline{R} = 10\log_{10}\left[S / \sum_{i=1}^{n}\left(S_i \cdot 10^{-R_i/10}\right)\right]$$

where S: the area of the concerned bulkhead
n: the number of components forming the concerned bulkhead
R_i: the sound reduction index of the component number i
S_i: the area of single component

Note: R_i has frequency elements in frequency range from 100 to 5000 [Hz]

Example: bulkhead consisting of acoustic insulation panels and doors:



$n = 2$
S_1: the area of the panel
S_2: the area of the door
S: the area of concerned bulkhead ($S = S_1 + S_2$)
R_1: the sound reduction index of the panel
R_2: the sound reduction index of the door

3 The requirements regarding airborne sound insulation properties for decks should also apply to decks together with coverings and should, therefore, be tested in laboratory as in the onboard arrangement. However, they need not apply to ceiling panels.

Paragraph 6.2.2

1 Closing devices of ventilation grilles/louvres of cabin doors should be kept open during laboratory tests.

2 Doors should be tested together with the associated door frame. In cases where there is no sill being part of the door frame, the doors should be tested with the gap specified by manufacturers and with sealing materials, if fitted.

***

ANNEX 16

DRAFT MSC CIRCULAR

AMENDMENT TO THE UNIFIED INTERPRETATIONS OF SOLAS CHAPTER II-2, THE FSS CODE, THE FTP CODE AND RELATED FIRE TEST PROCEDURES (MSC/CIRC.1120)

1 The Maritime Safety Committee, at its [ninety-fifth session (3 to 12 June 2015)], with a view to providing more specific guidance on the application of the Unified interpretations of SOLAS chapter II-2, the FSS Code, the FTP Code and related fire test procedures (MSC/Circ.1120), approved an amendment to the appendix to the annex to MSC/Circ.1120, as prepared by the Sub-Committee on Ship Design and Construction, at its second session (16 to 20 February 2015), as set out in the annex.

2 Member Governments are invited to apply the amendment to the appendix of the annex to MSC/Circ.1120 and to bring the amendment to the attention of all parties concerned.

ANNEX

AMENDMENT TO THE UNIFIED INTERPRETATIONS OF SOLAS CHAPTER II-2, THE FSS CODE, THE FTP CODE AND RELATED FIRE TEST PROCEDURES (MSC/CIRC.1120)

Appendix, figure 3

Figure 3 in the appendix of the Unified interpretations for typical arrangements for prevention of heat transmission at intersections and terminal points of insulation of decks and/or bulkheads, is amended as follows.

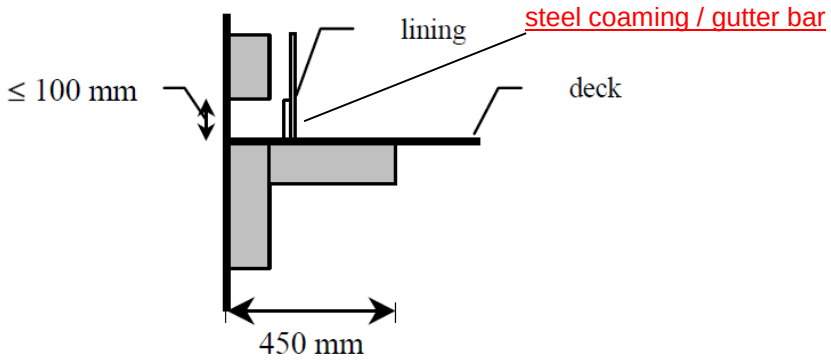


Figure 3

***Note:**
d = Depth of stiffener on girder.

Lining and steel coaming/gutter bar are for accommodation spaces only

***

ANNEX 17

DRAFT MSC CIRCULAR

UNIFIED INTERPRETATION OF SOLAS REGULATIONS II-2/9 AND II-2/13

1 The Maritime Safety Committee, at its [ninety-fifth session (3 to 12 June 2015)], with a view to providing more specific guidance on the application of SOLAS regulations II-2/9 and II-2/13, approved Unified interpretation of SOLAS regulations II-2/9 and II-2/13, as prepared by the Sub-Committee on Ship Design and Construction, at its second session (16 to 20 February 2015), as set out in the annex.

2 Member Governments are invited to apply the Unified interpretation of SOLAS regulations II-2/9 and II-2/13 and to bring them to the attention of all parties concerned.

ANNEX

UNIFIED INTERPRETATION OF SOLAS REGULATIONS II-2/9 AND II-2/13

REGULATION II-2/9

Tables 9.5 and 9.6:

1 Decks and bulkheads

Decks and bulkheads to be insulated to "A-30" fire integrity are those boundaries of single spaces protected by their own fire-extinguishing system.

2 Hatches

Class "A" fire integrity respectively does not apply to hatches fitted on open deck adjacent to ro-ro/vehicle spaces and on decks separating ro-ro/vehicle spaces, provided that such hatches are constructed of steel.

3 Access doors

"A-0" fire integrity does not apply to access doors to ro-ro/vehicle spaces fitted on open decks, provided that such access doors are constructed of steel.

4 Movable ramps

Movable ramps installed on decks referred to in Interpretation1 above which form boundaries of "A-30" fire integrity shall be constructed of steel and shall be insulated to "A-30" fire integrity, except for the "working parts" of such movable ramps (e.g. hydraulic cylinders, associated pipes/accessories) and members supporting such fittings which do not contribute to the structural strength of the boundary. Such movable ramps need not be subject to fire test. This is applicable to doors used for loading/unloading of vehicles.

[5 Ventilation ducts

Where ducts for a ro-ro/vehicle spaces pass through other ro-ro/vehicle spaces, each duct shall be insulated all along itself to "A-30" fire integrity in ways of other ro-ro/vehicle spaces unless the sleeves and fire dampers in compliance with SOLAS regulation II-2/9.7.3.1 in order to prevent spread of fire through the ducts are fitted.]

6 Ventilators

"A-0" fire integrity does not apply to ventilators constructed of steel fitted on open decks adjacent to ro-ro/vehicle spaces.

REGULATION II-2/13

Regulations 13.3.3.2 and 13.3.3.3

The "Lowest open deck" should be a category (10) "Open deck" (as defined in SOLAS chapter II-2, regulations 9.2.3.3.2.2 and 9.2.4.2.2.2) at the lowest height from baseline in way of accommodation spaces.

Regulations 13.4.1.4, 13.4.1.6, 13.4.2.5 and 13.4.2.6

1 Main workshop

A "main workshop" means a compartment enclosed on at least three sides by bulkheads or gratings, usually containing welding equipment, metal working machinery and workbenches.

2 Machinery control rooms

A "machinery control room" means a space which serves for control and/or monitoring of machinery used for ship's main propulsion.

3 Continuous fire shelter

A "continuous fire shelter" means a route from a main workshop, or from a machinery control room, which allows safe escape, without entering the machinery space, to a location outside the machinery space. Such a continuous fire shelter need not be a protected enclosure as envisaged by SOLAS regulation II-2/13.4.1.1 or II-2/13.4.2.1.1. The boundaries of the continuous fire shelter shall be at least "A-0" class divisions and be protected by self-closing "A-0" class doors. The continuous fire shelter shall have minimum internal dimensions of at least 800 mm x 800 mm for vertical trunks and 600 mm in width for horizontal trunks, and shall have emergency lighting provisions. The figures below represent typical arrangements of the continuous fire shelters through trunks or through spaces/rooms to a location outside the machinery space, which should be considered as effective.

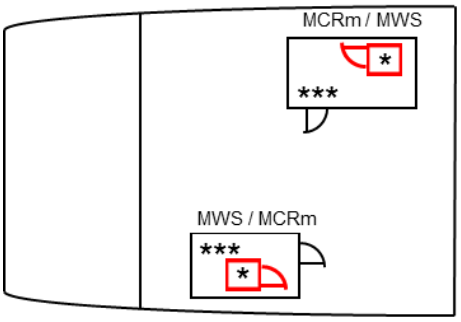


Figure 1 – Single room escape via trunk

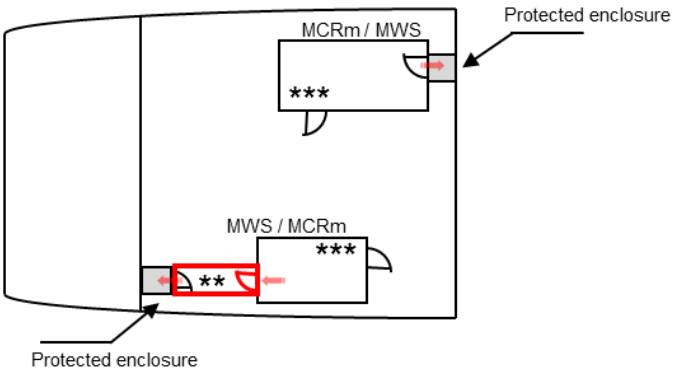


Figure 2 – Single room escape via protected enclosure

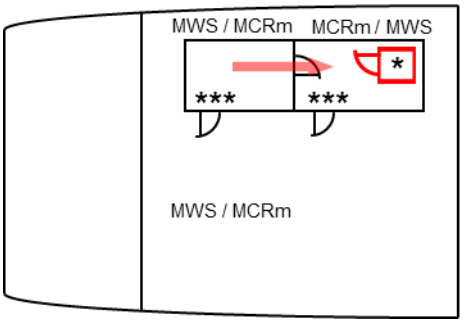


Figure 3 – Room to room escape via trunk

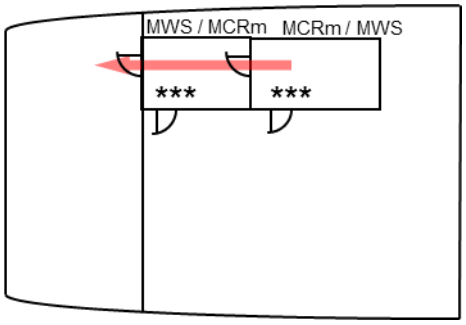


Figure 4 – Room to room direct escape

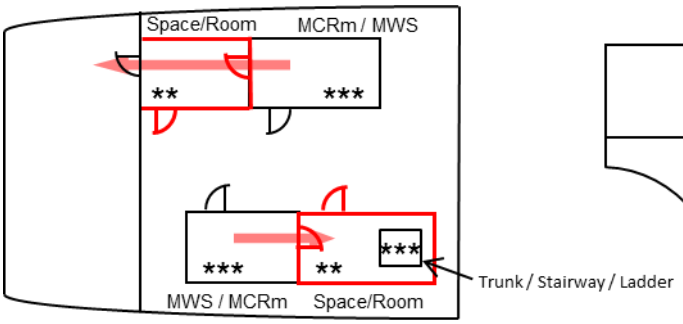


Figure 5 – Room to room escape via other space/room
MCRm: Machinery Control Room
MWS: Main Workshop

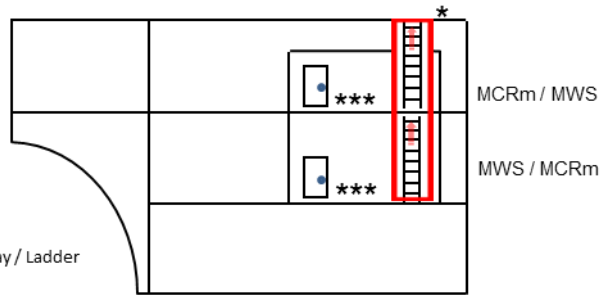


Figure 6 – Room to room escape via trunk (different decks)
* Vertical trunk (minimum dimensions: 800 mm x 800 mm) enclosing ladders or stairways to be at least "A-0" class divisions and to be protected by self-closing "A-0" class doors
** Horizontal trunk (minimum width: 600 mm) to be at least "A-0" class divisions and to be protected by self-closing "A-0" class doors
*** Fire integrity not required

Regulation 13.4.1

1 A "safe position" can be any space, excluding lockers and storerooms irrespective of their area, cargo spaces and spaces where flammable liquids are stowed, but including special category spaces and ro-ro spaces, from which access is provided and maintained clear of obstacles to the embarkation decks (regulations II-2/13.4.1.1.1 and 13.4.1.4).

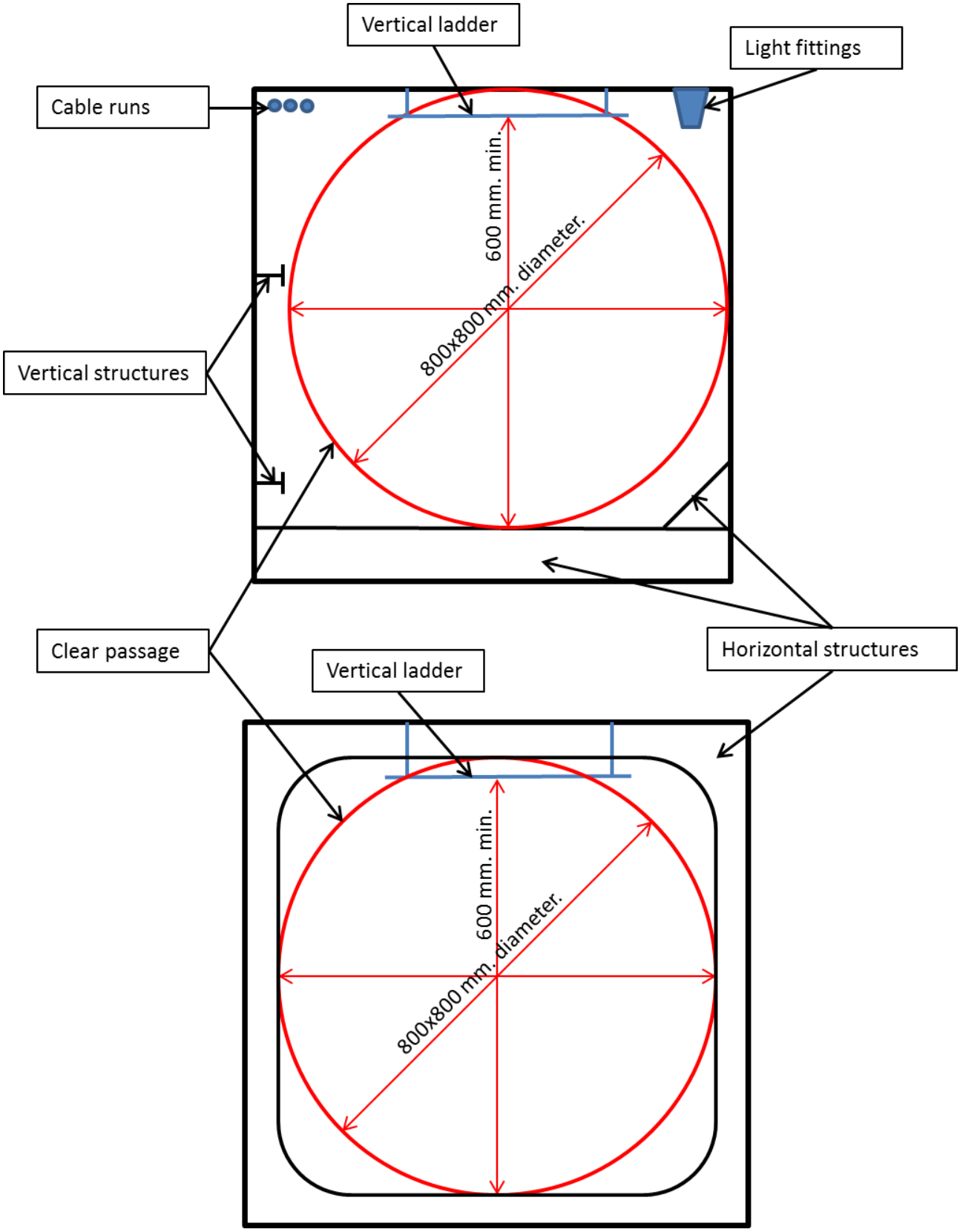
2 Inclined ladders/stairways in machinery spaces being part of, or providing access to, escape routes but not located within a protected enclosure should not have an inclination greater than 60° and should not be less than 600 mm in clear width. Such requirement need not be applied to ladders/stairways not forming part of an escape route, only provided for access to equipment or components, or similar areas, from one of the main platforms or deck levels within such spaces (regulation II-2/13.4.1).

3 Machinery spaces may include working platforms and passageways, or intermediate decks at more than one deck level. In such case, the lower part of the space should be regarded as the lowest deck level, platform or passageway within the space. At deck levels, other than the lowest one, where only one means of escape other than the protected enclosure is provided, self-closing fire doors should be fitted in the protected enclosure at that deck level. Smaller working platforms in-between deck levels, or only for access to equipment or components, need not be provided with two means of escape (regulation II-2/13.4.1.1).

4 A protected enclosure providing escape from machinery spaces to an open deck may be fitted with a hatch as means of egress from the enclosure to the open deck. The hatch should have minimum internal dimensions of 800 mm x 800 mm (regulation II-2/13.4.1.1.1).

5 Internal dimensions should be interpreted as clear width, so that a passage having diameter of 800 mm is available throughout the vertical enclosure, as shown in the figure 7, clear of ship's structure, with insulation and equipment, if any. The ladder within the enclosure can be included in the internal dimensions of the enclosure. When protected enclosures include horizontal portions their clear width should not be less than 600 mm. Figure 7 is given as example of some possible arrangements which may be in line with the above interpretation (regulation II-2/13.4.1.1.1).

Figure 7


Vertical ladder
Light fittings
Cable runs
600 mm. min.
800x800 mm. diameter.
Vertical structures
Clear passage
Horizontal structures
Vertical ladder
600 mm. min.
800x800 mm. diameter.

Regulation 13.4.2

1 A "safe position" can be any space, excluding cargo spaces, lockers and storerooms irrespective of their area, cargo pump rooms and spaces where flammable liquids are stowed, but including vehicle and ro-ro spaces, from which access is provided and maintained clear of obstacles to the open deck (regulation II-2/13.4.2.1.1).

2 Inclined ladders/stairways in machinery spaces being part of, or providing access to, escape routes, but not located within a protected enclosure should not have an inclination greater than 60° and should not be less than 600 mm in clear width. Such requirement need not be applied to ladders/stairways not forming part of an escape route, only provided for access to equipment or components, or similar areas, from one of the main platforms or deck levels within such spaces (regulation II-2/13.4.2.1).

3 Machinery spaces of category A may include working platforms and passageways, or intermediate decks at more than one deck level. In such case, the lower part of the space should be regarded as the lowest deck level, platform or passageway within the space.

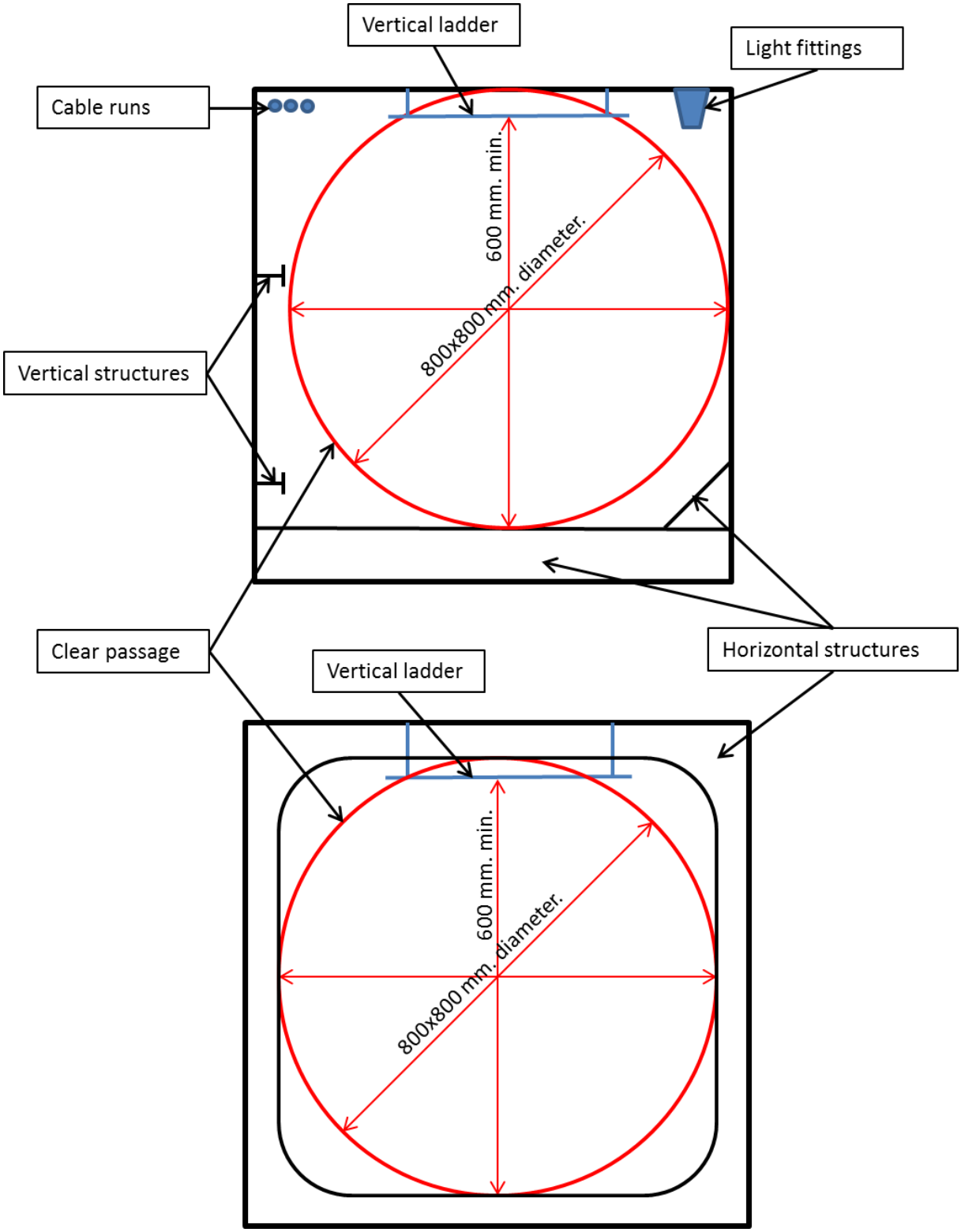
At deck levels, other than the lowest one, where only one means of escape other than the protected enclosure is provided, self-closing fire doors should be fitted in the protected enclosure at that deck level. Smaller working platforms in-between deck levels, or only for access to equipment or components, need not be provided with two means of escape (regulation II-2/13.4.2.1).

4 A protected enclosure providing escape from machinery spaces of category A to an open deck may be fitted with a hatch as means of egress from the enclosure to the open deck. The hatch should have minimum internal dimensions of 800 mm x 800 mm (regulation II-2/13.4.2.1.1).

5 Internal dimensions should be interpreted as clear width, so that a passage having diameter of 800 mm is available throughout the vertical enclosure, as shown in figure 8, clear of ship's structure, with insulation and equipment, if any. The ladder within the enclosure can be included in the internal dimensions of the enclosure. When protected enclosures include horizontal portions their clear width should not be less than 600 mm. Figure 8 is given as example of some possible arrangements which may be in line with the above interpretation (regulation II-2/13.4.2.1.1).

6 In Machinery spaces other than those of category A, which are not entered only occasionally, the travel distance should be measured from any point normally accessible to the crew, taking into account machinery and equipment within the space (regulation II-2/13.4.2.3).

Figure 8


Vertical ladder
Light fittings
Cable runs
600 mm. min.
800x800 mm. diameter.
Vertical structures
Clear passage
Horizontal structures
Vertical ladder
600 mm. min.
800x800 mm. diameter.

***

ANNEX 18

BIENNIAL STATUS REPORT AND OUTPUTS ON THE COMMITTEE'S POST-BIENNIAL AGENDA THAT FALL UNDER THE PURVIEW OF THE SUB-COMMITTEE

SUB-COMMITTEE ON SHIP DESIGN AND CONSTRUCTION (SDC)								
Planned output number	**Description**	**Target completion year**	**Parent organ(s)**	**Coordinating organ(s)**	**Associated organ(s)**	**Status of output for Year 1**	**Status of output for Year 2**	**References**
1.1.2.3	Unified interpretation of provisions of IMO safety, security, and environment related Conventions	Continuous	MSC MEPC		III / PPR / CCC / SDC / SSE / NCSR	Ongoing	Ongoing	MSC 78/26, paragraph 22.12; SDC2/25, section 21
2.0.1.1	Provisions to ensure the integrity and uniform implementation of the 1969 TM Convention	2015	MSC	SDC	HTW	In progress	Completed	MSC 89/25, paragraph 22.34; SDC 2/25, section 11
2.0.1.7	Amendments to the ESP Code	Continuous	MSC	SDC		Ongoing	Ongoing	SDC 2/25, section 20
5.1.1.1	Guidelines on safe return to port for passenger ships	2015	MSC	SDC		In progress	In progress	MSC 81/25, paragraph 23.54; SDC 2/25, section 4
Notes: Target completion year extended to 2016								
5.1.1.3	Amendments to SOLAS and FSS Code to make evacuation analysis mandatory for new passenger ships and review of the Recommendation on evacuation analysis for new and existing passenger ships	2016	MSC	SDC		In progress	In progress	MSC 83/28, paragraph 25.25; MSC 93/22, paragraph 20.11; SDC 2/25, section 14
5.1.1.5	Review of conditions under which passenger ship watertight doors may be opened during navigation and prepare amendments to SOLAS regulation II-1/22 and MSC.1/Circ.1380	2015	MSC	SDC		In progress	Completed	MSC 92/26, paragraph 23.17; SDC 2/25, section 16

SUB-COMMITTEE ON SHIP DESIGN AND CONSTRUCTION (SDC)								
Planned output number	**Description**	**Target completion year**	**Parent organ(s)**	**Coordinating organ(s)**	**Associated organ(s)**	**Status of output for Year 1**	**Status of output for Year 2**	**References**
5.1.1.6	Amendments to SOLAS chapter II-1 and associated guidelines on damage control drills for passenger ships	2016	MSC	SDC	HTW		In progress	MSC 93/22, paragraph 20.22.3 SDC 2/25, section 17
5.2.1.1	Amendments to the criterion for maximum angle of heel in turns in the 2008 IS Code	2015	MSC	SDC	SDC	In progress	Completed	SDC 2/25, section 6
5.2.1.3	Review of general cargo ship safety	2015	MSC		SDC / NCSR / III / HTW	In progress	Completed	MSC 90/28, paragraph 25.10; MSC 93/22, paragraph 15.7
5.2.1.4	Guidelines addressing the carriage of more than 12 industrial personnel on board vessels engaged on international voyages	2015	MSC	SDC		In progress	Completed	MSC 92/26, paragraph 23.19; SDC 2/25, section 8
5.2.1.12	Second generation intact stability criteria	2015	MSC	SDC		In progress	In progress	SDC 2/25, section 5
Notes: Target completion year extended to 2019. See post-biennial agenda.								
5.2.1.13	Amendments to SOLAS chapter II-1 subdivision and damage stability regulations	2015	MSC	SDC		In progress	In progress	MSC 85/26, paragraph 23.35; SDC 2/25, section 3
Notes: Target completion year extended to 2017 and output to be renamed "Amendments to SOLAS regulation II-1/6 and II-1/8-1".								
5.2.1.18	Interpretation of SOLAS regulation II-2/13.6 on means of escape from ro-ro cargo spaces	2015	MSC	SDC		In progress	Completed	MSC 90/28, paragraph 25.13; SDC 2/25, section 15
Notes: Target completion year extended to 2016								

SUB-COMMITTEE ON SHIP DESIGN AND CONSTRUCTION (SDC)								
Planned output number	**Description**	**Target completion year**	**Parent organ(s)**	**Coordinating organ(s)**	**Associated organ(s)**	**Status of output for Year 1**	**Status of output for Year 2**	**References**
5.2.1.19	Classification of offshore industry vessels and a review of the need for a non-mandatory code for offshore construction support vessels	2015	MSC	SDC		In progress	In progress	MSC 85/26, paragraph 23.27; SDC 2/25, section 9
Notes: Target completion date extended to 2016								
5.2.1.21	Guidelines for use of Fibre Reinforced Plastics (FRP) within ship structures.	2015	MSC	SDC		In progress	Completed	MSC 93/22, paragraph 10.10; SDC 2/25, section 12
5.2.1.23	Guidelines for wing-in-ground craft	2015	MSC	SDC	SSE/NCSR/ HTW	In progress	In progress	MSC 88/26, paragraph 23.30; SDC 2/25, section 18
Notes: Target completion date extended to 2016								
5.2.1.24	Amendments to part B of the 2008 IS Code on towing, lifting and anchor handling operations	2015	MSC	SDC		In progress	In progress	MSC 88/26, paragraph 23.36; SDC 2/25, section 7
Notes: Target completion date extended to 2016								
5.2.1.26	Amendments to SOLAS regulation II-1/11 and development of associated Guidelines to ensure the adequacy of testing arrangements for watertight compartments	2015	MSC	SDC		In progress	Completed	MSC 86/26, paragraph 23.36; SDC 2/25, section 10
5.2.1.27	Amendments to SOLAS chapter II-2, the FTP Code and MSC/Circ.1120 to clarify the requirements for plastic pipes on ships	2015	MSC	SDC		In progress	Completed	MSC 88/26, paragraph 23.12; SDC 2/25, section 13

SUB-COMMITTEE ON SHIP DESIGN AND CONSTRUCTION (SDC)								
Planned output number	**Description**	**Target completion year**	**Parent organ(s)**	**Coordinating organ(s)**	**Associated organ(s)**	**Status of output for Year 1**	**Status of output for Year 2**	**References**
12.1.2.1	Analysis of casualty and PSC data to identify trends and develop knowledge and risk-based recommendations	Annual	MSC MEPC	III	HTW / PPR /CCC/ SDC / SSE / NCSR	Ongoing	Ongoing	MSC 92/26, paragraph 22.29; SDC 1/26, paragraph 24.6

OUTPUTS ON THE COMMITTEE'S POST-BIENNIAL AGENDA THAT FALL UNDER THE PURVIEW OF THE SUB-COMMITTEE

SHIP DESIGN AND CONSTRUCTION (SDC)								
ACCEPTED POST-BIENNIAL OUTPUTS								
Number	**Biennium***	**Reference to High-level Actions**	**Description**	**Parent organ(s)**	**Coordinating organs(s)**	**Associated organ(s)**	**Timescale (sessions)**	**References**
7	2012-2013	2.0.1	Mandatory application of the Performance standard for protective coatings for void spaces on bulk carriers and oil tankers	MSC	SDC		2	MSC 76/23, paragraphs 20.41.2 and 20.48; DE 50/27, section 4
8	2012-2013	2.0.1	Performance standard for protective coatings for void spaces on all types of ships	MSC	SDC		2	MSC 76/23, paragraphs 20.41.2 and 20.48
9	2012-2013	2.0.1	Revision of the provisions for helicopter facilities in SOLAS and the MODU Code	MSC	SDC		2	MSC 86/26, paragraph 23.39
45	2012-2013	5.2.1	Development of a requirement for hoist winches to be tested following any maintenance, repair or modification (MSC.1/Circ.1331)	MSC	SDC		1	MSC 90/28, paragraph 25.31, MSC.1/Circ.1331
58	2012-2013	5.2.1	Finalization of second generation intact stability criteria	MSC	SDC		4	SLF 55/17, paragraph 3.13
73	2014-2015	5.2.1	Revision of section 3 of the Guidelines for damage control plans and information to the master (MSC.1/Circ.1245) for passenger ships	MSC	SDC		3	MSC 93/22, paragraphs 6.28.3 and 6.28.4
76	2014-2015	5.2.1	Application of the Mandatory Code to non-SOLAS ships operating in polar waters	MSC	SDC		3	Formally output 5.2.1.15

SHIP DESIGN AND CONSTRUCTION (SDC)								
ACCEPTED POST-BIENNIAL OUTPUTS								
Number	**Biennium***	**Reference to High-level Actions**	**Description**	**Parent organ(s)**	**Coordinating organs(s)**	**Associated organ(s)**	**Timescale (sessions)**	**References**
98	2014-2015	5.1.1	Computerized stability support for the master in case of flooding for existing passenger ships	MSC	SDC		2	MSC 94/21, paragraphs 6.8 and 18.20

Notes:

* Denotes biennium when the output was placed on the post-biennial agenda

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ANNEX 19

PROPOSED BIENNIAL AGENDA FOR THE 2016-2017 BIENNIUM

SUB-COMMITTEE ON SHIP DESIGN AND CONSTRUCTION (SDC)								
Planned output number	**Description**	**Target completion year**	**Parent organ(s)**	**Coordinating organ(s)**	**Associated organ(s)**	**Status of output for Year 1**	**Status of output for Year 2**	**References**
1.1.2.3	Unified interpretation of provisions of IMO safety, security, and environment related Conventions	Continuous	MSC MEPC		III / PPR / CCC / SDC / SSE / NCSR			MSC 78/26, paragraph 22.12; SDC 2/25, section 21
~~2.0.1.1~~	~~Provisions to ensure the integrity and uniform implementation of the 1969 TM Convention~~	~~2015~~	~~MSC~~	~~SDC~~	~~HTW~~			~~MSC 89/25, paragraph 22.34; SDC 2/25, section 11~~
2.0.1.7	Amendments to the ESP Code	Continuous	MSC	SDC				SDC 2/25, section 20
5.1.1.1	Guidelines on safe return to port for passenger ships	2016	MSC	SDC				MSC 81/25, paragraph 23.54; SDC 2/25, section 4
5.1.1.3	Amendments to SOLAS and FSS Code to make evacuation analysis mandatory for new passenger ships and review of the Recommendation on evacuation analysis for new and existing passenger ships	2016	MSC	SDC				MSC 83/28, paragraph 25.25; MSC 93/22, paragraph 20.11; SDC 2/25, section 14
~~5.1.1.5~~	~~Review of conditions under which passenger ship watertight doors may be opened during navigation and prepare amendments to SOLAS regulation II-1/22 and MSC.1/Circ.1380~~	~~2016~~	~~MSC~~	~~SDC~~				~~MSC 92/26, paragraph 23.17; SDC 2/25, section 16~~

SUB-COMMITTEE ON SHIP DESIGN AND CONSTRUCTION (SDC)								
Planned output number	**Description**	**Target completion year**	**Parent organ(s)**	**Coordinating organ(s)**	**Associated organ(s)**	**Status of output for Year 1**	**Status of output for Year 2**	**References**
5.1.1.6	Amendments to SOLAS chapter II-1 and associated guidelines on damage control drills for passenger ships	2016	MSC	SDC	HTW			MSC 93/22, paragraph 20.22.3 SDC 2/25, section 17
~~5.2.1.1~~	~~Amendments to the criterion for maximum angle of heel in turns of the 2008 IS Code~~	~~2015~~	~~MSC~~	~~SDC~~	~~SDC~~			~~SDC 2/25, section 6~~
~~5.2.1.3~~	~~Review of general cargo ship safety~~	~~2015~~	~~MSC~~		~~SDC / NCSR / III / HTW~~			~~MSC 90/28, paragraph 25.10; MSC 93/22, paragraph 15.7~~
~~5.2.1.4~~	~~Guidelines addressing the carriage of more than 12 industrial personnel on board vessels engaged on international voyages~~	~~2015~~	~~MSC~~	~~SDC~~				~~MSC 92/26, paragraph 23.19; SDC 2/25, section 8~~
5.2.1.12	Finalization of second generation intact stability criteria	2019	MSC	SDC				SDC 2/25, section 5
5.2.1.13	Amendments to SOLAS regulations II-1/6 and II-1/8-1 ~~chapter II-1 subdivision and damage stability regulations~~	2017	MSC	SDC				MSC 85/26, paragraph 23.35; SDC 2/25, section 3
~~5.2.1.18~~	~~Interpretation of SOLAS regulation II-2/13.6 on means of escape from ro-ro cargo spaces~~	~~2015~~	~~MSC~~	~~SDC~~				~~MSC 90/28, paragraph 25.13; SDC 2/25, section 15~~
5.2.1.19	Classification of offshore industry vessels and a review of the need for a non-mandatory code for offshore construction support vessels	~~2015~~ 2016	MSC	SDC				MSC 85/26, paragraph 23.27; SDC 2/25, section 9

SUB-COMMITTEE ON SHIP DESIGN AND CONSTRUCTION (SDC)								
Planned output number	**Description**	**Target completion year**	**Parent organ(s)**	**Coordinating organ(s)**	**Associated organ(s)**	**Status of output for Year 1**	**Status of output for Year 2**	**References**
~~5.2.1.21~~	~~Guidelines for use of Fibre Reinforced Plastics (FRP) within ship structures.~~	~~2015~~	~~MSC~~	~~SDC~~				~~MSC 93/22, paragraph 10.10; SDC 2/25, section 12~~
5.2.1.23	Guidelines for wing-in-ground craft	2016	MSC	SDC	SSE/NCSR/ HTW			MSC 88/26, paragraph 23.30; SDC 2/25, section 18
5.2.1.24	Amendments to part B of the 2008 IS Code on towing, lifting and anchor handling operations	2016	MSC	SDC				MSC 88/26, paragraph 23.36; SDC 2/25, section 7
~~5.2.1.26~~	~~Amendments to SOLAS regulation II-1/11 and development of associated Guidelines to ensure the adequacy of testing arrangements for watertight compartments~~	~~2015~~	~~MSC~~	~~SDC~~				~~MSC 86/26, paragraph 23.36; SDC 2/25, section 10~~
~~5.2.1.27~~	~~Amendments to SOLAS chapter II-2, the FTP Code and MSC/Circ.1120 to clarify the requirements for plastic pipes on ships~~	~~2015~~	~~MSC~~	~~SDC~~				~~MSC 88/26, paragraph 23.12; SDC 2/25, section 13~~
5.2.1…	Revision of section 3 of the Guidelines for damage control plans and information to the master (MSC.1/Circ.1245) for passenger ships	2017	MSC	SDC				MSC 93/22, paragraphs 6.28.3 and 6.28.4
5.2.1…	Computerized stability support for the master in case of flooding for existing passenger ships	2016	MSC	SDC				MSC 94/21, paragraph 18.20

SUB-COMMITTEE ON SHIP DESIGN AND CONSTRUCTION (SDC)								
Planned output number	**Description**	**Target completion year**	**Parent organ(s)**	**Coordinating organ(s)**	**Associated organ(s)**	**Status of output for Year 1**	**Status of output for Year 2**	**References**
12.1.2.1	Analysis of casualty and PSC data to identify trends and develop knowledge and risk-based recommendations	Annual	MSC MEPC	III	HTW / PPR /CCC/ SDC / SSE / NCSR			MSC 92/26, paragraph 22.29; SDC 1/26, paragraph 24.6

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ANNEX 20

PROPOSED PROVISIONAL AGENDA FOR SDC 3

Opening of the session

1 Adoption of the agenda

2 Decisions of other IMO bodies

3 Amendments to SOLAS regulations II-1/6 and II-1/8-1 (5.2.1.13)

4 Computerized stability support for the master in case of flooding for existing passenger ships (5.2.1)*

5 Guidelines on safe return to port for passenger ships (5.1.1.1)

6 Finalization of second generation intact stability criteria (5.2.1.12)

7 Amendments to part B of the 2008 IS Code on towing, lifting and anchor handling operations (5.2.1.24)

8 Amendments to SOLAS and FSS Code to make evacuation analysis mandatory for new passenger ships and review of the Recommendation on evacuation analysis for new and existing passenger ships (5.1.1.3)

9 Clarification of the requirements in SOLAS chapter II-2 for fire integrity of windows on passenger and special purpose ships**

10 Amendments to SOLAS chapter II-1 and associated guidelines on damage control drills for passenger ships (5.1.1.6)

11 Revision of section 3 of the Guidelines for damage control plans and information to the master (MSC.1/Circ.1245) for passenger ships

12 Classification of offshore industry vessels and a review of the need for a non-mandatory code for offshore construction support vessels (5.2.1.19)

13 Guidelines for wing-in-ground craft (5.2.1.23)

14 Amendments to the 2011 ESP Code (2.0.1.7)

15 Unified interpretation to provisions of IMO safety, security, and environment-related Conventions (1.1.2.3)

16 Biennial agenda and provisional agenda for SDC 4

17 Election of Chairman and Vice-Chairman for 2017

18 Any other business

19 Report to the Maritime Safety Committee

***

* Output number to be decided by the Council.

** Subject to approval by MSC 95.

ANNEX 21

JUSTIFICATION FOR A NEW UNPLANNED OUTPUT ON CLARIFICATION OF THE REQUIREMENTS IN SOLAS CHAPTER II-2 FOR FIRE INTEGRITY OF WINDOWS ON PASSENGER SHIPS CARRYING NOT MORE THAN 36 PASSENGERS AND SPECIAL PURPOSE SHIPS WITH MORE THAN 60 (BUT NOT MORE THAN 240) PERSONS ON BOARD

Introduction

1 This paper has been developed in accordance with paragraphs 4.7 of the annex and annex 1 of the *Guidelines on the organization and method of work of the Maritime Safety Committee and the Marine Environment Protection Committee and their subsidiary bodies* (MSC-MEPC.1/Circ.4/Rev.3), taking into account the Organization's objectives (resolutions A.900(21) and A.909(22)) and the High-level Action Plan for the Organization and priorities for the 2014-2015 biennium (resolution A.1061(28)).

Background

2 Based on the consideration of document SDC 2/24/1, it has been identified that the provisions of SOLAS regulation II-2/9.4.1.3.3, as currently drafted, do not facilitate the consistent and global implementation of the intent of this regulation as it might be applied to passenger ships carrying not more than 36 passengers (or special purpose ships carrying more than 60, but not more than 240 persons on board).

IMO's objectives

3 This proposal is considered to be entirely consistent with, and supportive of, the objectives of the Organization, as explained in resolutions A.900(21) and A.909(22), in particular:

> "*DIRECTS the Committees …:*
>
> *…*
>
> *.2 to focus their attention on:*
>
> *…*
>
> - *ensuring the effective uniform implementation of existing IMO standards and regulations relating to maritime safety and environmental protection, placing particular emphasis on the implementation of the revised STCW Convention and the ISM Code …;*
>
> - *addressing safety and environmental protection issues, to the extent feasible, by ship types, with particular emphasis on passenger ships (including high-speed passenger craft) and bulk carriers*
>
> *…*
>
> - *developing a safety culture and environmental conscience in all activities undertaken by the Organization;*
>
> *…*" (resolution A.900(21))

4 The proposal is also aligned with Strategic Directions 2 (SD 2) and 5 (SD 5) of the Strategic Plan for the Organization for the six-year period 2012 to 2017 (resolution A.1037(27)) i.e.:

> "*SD 2 – IMO will foster global compliance with its instruments governing international shipping and will promote their uniform implementation by Member States.*"
>
> "*SD 5 – IMO's highest priority will be the safety of human life at sea. In particular, greater emphasis will be accorded to:*
>
> *.1 ensuring that all systems related to enhancing the safety of human life at sea are adequate, including those concerned with large concentrations of people;*
> *.2 enhancing technical, operational and safety management standards;*
> *…*"

5 Taking into account SD 5 from the 2012-2107 Strategic Plan, it is noted that the twenty-eighth session of the Assembly adopted resolution A.1061(28) in which the following High-level Action and Planned output for the 2014-2015 biennium were agreed:

> "*5.1 Ensuring that all systems related to enhancing the safety of human life at sea are adequate, including those concerned with large concentrations of people*".
>
> "*5.1.1 Review the adequacy of passenger ship safety provisions.*"

Demonstrated need

6 SOLAS regulation II-2/9.4.1.3.3 (resolution MSC.201(81)) applies to all passenger ships (regardless of the number of passengers carried) based on the title of regulation II-2/9.4.1 – "*Openings in bulkheads and decks in passenger ships*". This regulation states:

> "*4.1.3.3 Windows facing life-saving appliances, embarkation and assembly stations, external stairs and open decks used for escape routes, and windows situated below liferaft and escape slide embarkation areas shall have fire integrity as required in table 9.1.*"

However, SOLAS regulation II-2/9.2.2.3.1 states that table 9.1 applies only to passenger ships carrying more than 36 passengers.

7 In addition, for passenger ships carrying not more than 36 passengers, the classification of spaces in table 9.1 is clearly not addressed in SOLAS regulation II-2/9.2.2.4.2. For example, while table 1 contains a fire risk category for "category 4 – Evacuation stations and external escape routes", SOLAS regulation II-2/9.2.2.4.2 does not. A "category 4" space is only defined in SOLAS regulation II-2/9.2.2.3.2, but this is for passenger ships carrying more than 36 passengers.

8 In order to apply the provisions of SOLAS II 2/9.4.1.3.3 to passenger ships carrying not more than 36 passengers by the use of table 9.1, it would appear that the classification of spaces would have to be re-assessed in accordance with SOLAS II-2/9.2.2.3.2 (the classification system intended for ships carrying more than 36 passengers).

9 It is to be noted that by paragraphs 6.1 and 6.2 of the Code of Safety for Special Purpose Ships, 2008 (SPS Code), the application of the provisions of SOLAS chapter II-2 relevant to passenger ships carrying more than 36 passengers (for SPS vessels carrying more than 240 persons on board); and passenger ships carrying not more than 36 passengers (for SPS vessels carrying more than 60 but not more than 240 persons on board) are invoked.

Analysis of the issue

10 It is considered that resolution of the issues discussed above would be practicable (would facilitate the correct and consistent implementation of the intent of what the regulations are intending to achieve), feasible (possible and practical) and proportional. Making the regulatory text clear would also satisfy the test of proportionality in that this action would not exceed that which is necessary to achieve the overall objective of providing clarity to all interested parties as to what is required.

Analysis of implications

11 The Committee is invited to note the information provided in Appendix B that provides the Checklist for Identifying Administrative Requirements and Burdens as referred to in paragraph 4.14.6 and footnote 4 of MSC-MEPC.1/Circ.4/Rev.3.

12 It is recognized that amendments to an IMO convention, in this case SOLAS, will have to be transferred into the national legislation of Member States in order to take legal effect on ships that fly the flag of that State. In this respect the anticipated outcome of this proposal will represent an administrative burden for Governments. However, for those Governments who regulate their ships by a system of primary and secondary legislation, it is hoped that the associated legislative burden will not be excessive.

Benefits

13 As explained above, the clear benefit in resolving this issue is that the amended text will clarify the fire integrity of windows facing life-saving appliances, embarkation and assembly stations, external stairs and open decks used for escape routes, and windows situated below liferaft and escape slide embarkation areas on passenger ships and special purpose ships.

Industry standards

14 There are no industry standards relevant to this issue.

Output

15 It is considered that after a decision of principle has been agreed as to whether, or not, the protection required by SOLAS regulation II-2/9.4.1.3.3 should be afforded to passenger ships carrying not more than 36 passengers; draft amendments to this regulation will be finalized. It is to be noted, that it is consequently not possible, at this time, to provide any base text of the draft amendments to this SOLAS regulation that may be needed. However, the development of this amended text will take full account of MSC.1/Circ.1500. It may be that it is made clear that this regulation only applies to passenger ships carrying more than 36 passengers. Alternatively, supplemental text may be necessary to specify the fire integrity of such windows on passenger ships carrying no more than 36 passengers. Either way, it is intended that the amendments to SOLAS would only apply to "new" ships; and would not apply to "existing" ships.

16 In SMART terms (specific, measureable, achievable, realistic and time-bound), the output from this proposal is considered to be specific and measureable (amendments to address the issue that has been identified will need to be developed) and achievable and realistic (as discussed above). The proposal does not rely on the availability of any new equipment or systems. This is considered relevant in terms of considering the time-bound element of the output i.e. the effective implementation of the proposal will not need to wait for any new technology to come to the market or the development of new working procedures.

Also, in terms of finalising the Organization's consideration of the issue, reference is made to the section below entitled "Priority/urgency".

Human element

17 The completed checklist as per MSC-MEPC.7/Circ.1 is attached at Appendix B.

Priority/urgency

18 It is considered that further consideration of this issue should be addressed as a matter of priority and as soon as practicable within the working arrangements of the Organization. This issue is directly related to the safety of ships, and more importantly the crews and passengers that sail on them.

19 It is proposed that consideration of this proposal could be referred to the session of the SDC Sub-Committee that it is expected will be held in 2016. It is anticipated that once the intent of what needs to be achieved has been agreed, the drafting of the necessary amendments can readily be finalized.

Action requested of the Committee

20 The Committee is invited to add to the work programme of the SDC Sub-Committee a new output on clarification of the requirements in SOLAS chapter II-2 for fire integrity of windows on passenger and special purpose ships.

APPENDIX A

CHECKLIST FOR IDENTIFYING ADMINISTRATIVE REQUIREMENTS AND BURDENS

The Checklist for Identifying Administrative Requirements and Burdens should be used when preparing the analysis of implications required of submissions of proposals for inclusion of unplanned outputs. For the purpose of this analysis, the terms "administrative requirements" and "burdens" are defined as in resolution A.1043(27), i.e. administrative requirements are defined as an obligation arising from future IMO mandatory instruments to provide or retain information or data, and administrative burdens are defined as those administrative requirements that are or have become unnecessary, disproportionate or even obsolete.

Instructions:

(A) If the answer to any of the questions below is **YES**, the Member State proposing an unplanned output should provide supporting details on whether the burdens are likely to involve start-up and/or ongoing cost. The Member State should also make a brief description of the requirement and, if possible, provide recommendations for further work (e.g. would it be possible to combine the activity with an existing requirement?).

(B) If the proposal for the unplanned output does not contain such an activity, answer **NR** (Not required).

1. Notification and reporting? Reporting certain events before or after the event has taken place, e.g. notification of voyage, statistical reporting for IMO Members, etc.	**NR**	Yes □ Start-up □ Ongoing
Description: (if the answer is yes)		
2. Record keeping? Keeping statutory documents up to date, e.g. records of accidents, records of cargo, records of inspections, records of education, etc.	**NR**	Yes □ Start-up □ Ongoing
Description: (if the answer is yes) Records of auditor training are already required to be maintained and kept.		
3. Publication and documentation? Producing documents for third parties, e.g. warning signs, registration displays, publication of results of testing, etc.	**NR**	Yes □ Start-up □ Ongoing
Description: (if the answer is yes)		
4. Permits or applications? Applying for and maintaining permission to operate, e.g. certificates, classification society costs, etc.	**NR**	Yes □ Start-up □ Ongoing
Description: (if the answer is yes)		
5. Other identified burdens?	**NR**	Yes
Description: (if the answer is yes)		

APPENDIX B

CHECKLIST FOR CONSIDERING HUMAN ELEMENT ISSUES BY IMO BODIES

Instructions:
If the answer to any of the questions below is:

(A) **YES,** the preparing body should provide supporting details and/or recommendation for further work.
(B) **NO,** the preparing body should make proper justification as to why human element issues were not considered.
(C) **NA** (Not Applicable) ñ the preparing body should make proper justification as to why human element issues were not considered applicable.

Subject Being Assessed: (e.g. Resolution, Instrument, Circular being considered)

Provisions in SOLAS chapter II-2 relating to windows facing life-saving appliances, embarkation and assembly stations, external stairs and open decks used for escape routes, and windows situated below liferaft and escape slide embarkation areas on passenger ships and special purpose ships.

Responsible Body: (e.g. Committee, Sub-committee, Working Group, Correspondence Group, Member State)

Maritime Safety Committee and SDC Sub-Committee

1. Was the human element considered during development or amendment process related to this subject?	❑Yes ❑No ✓NA
2. Has input from seafarers or their proxies been solicited?	❑Yes ✓No ❑NA
3. Are the solutions proposed for the subject in agreement with existing instruments? (Identify instruments considered in comments section)	✓Yes❑No❑NA
4. Have human element solutions been made as an alternative and/or in conjunction with technical solutions?	❑Yes ✓No ❑NA
5. Has human element guidance on the application and/or implementation of the proposed solution been provided for the following:	
• Administrations?	❑Yes❑ No✓NA
• Ship owners/managers?	❑Yes ❑No✓NA
• Seafarers?	❑Yes❑No✓NA
• Surveyors?	❑Yes❑No✓NA
6. At some point, before final adoption, has the solution been reviewed or considered by a relevant IMO body with relevant human element expertise?	❑Yes ❑No✓NA
7. Does the solution address safeguards to avoid single person errors?	❑Yes ❑No ✓NA
8. Does the solution address safeguards to avoid organizational errors?	❑Yes ❑No✓NA
9. If the proposal is to be directed at seafarers, is the information in a form that can be presented to and is easily understood by the seafarer?	❑Yes❑No✓NA
10. Have human element experts been consulted in development of the solution?	Yes❑ ✓No ❑NA

11. **HUMAN ELEMENT: Has the proposal been assessed against each of the factors below?**	
❑ CREWING. The number of qualified personnel required and available to safely operate, maintain, support, and provide training for system.	❑Yes ❑No✓NA
❑ PERSONNEL. The necessary knowledge, skills, abilities, and experience levels that are needed to properly perform job tasks.	❑Yes ❑No✓NA
❑ TRAINING. The process and tools by which personnel acquire or improve the necessary knowledge, skills, and abilities to achieve desired job/task performance.	❑Yes❑No✓NA
❑ OCCUPATIONAL HEALTH AND SAFETY. The management systems, programmes, procedures, policies, training, documentation, equipment, etc. to properly manage risks.	❑Yes ❑No ✓NA
❑ WORKING ENVIRONMENT. Conditions that are necessary to sustain the safety, health, and comfort of those on working on board, such as noise, vibration, lighting, climate, and other factors that affect crew endurance, fatigue, alertness and morale.	❑Yes❑No✓NA
❑ HUMAN SURVIVABILITY. System features that reduce the risk of illness, injury,or death in a catastrophic event such as fire, explosion, spill, collision, flooding, or intentional attack. The assessment should consider desired human performance in emergency situations for detection, response, evacuation, survival and rescue and the interface with emergency procedures, systems, facilities and equipment.	❑Yes ❑No ✓NA
❑ HUMAN FACTORS ENGINEERING. Human-system interface to be consistent with the physical, cognitive, and sensory abilities of the user population.	❑Yes❑No ✓NA
Comments: (1) Justification if answers are NO or Not Applicable. (2) Recommendations for additional human element assessment needed. (3) Key risk management strategies employed. (4) Other comments. (5) Supporting documentation. Reference Question 3 – SOLAS regulation II-2/9.4.1.3.3	

APPENDIX C

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

Part I – Submitter of the proposal (refer to section 3.2.1.1)*	
1	*SDC 2/WP.5 – Report of the Fire Protection Working Group*
2	*SDC 2*
	19 February 2015
Part II – Details of the proposed amendment(s) or new mandatory instrument (refer to sections 3.2.1.1 and 3.2.1.2)*	
1	*High-level action plan:*
	5.1.2
2	*Planned output:*
	New unplanned output
3	*Recommended type of amendments* (MSC.1/Circ.1481) (delete as appropriate)
	• *Four-year cycle of entry into force*
4	*Intended instrument(s) to be amended (SOLAS, LSA code, etc.)*
	SOLAS chapters II-2
5	*Intended application (scope, size, type, tonnage/length restriction, service (International/non-international), activity, etc.)*
	New passenger ships
6	*Application to new/existing ships (i.e. if intended to be a retro-active application)*
	New passenger ships, or when existing windows are replaced on existing ships
7	*Proposed coordinating sub-committee*
	Sub-Committee on Ship Design and Construction
8	*Anticipated supporting sub-committees*
	None
9	*Time scale for completion*
	Two sessions beginning at SDC 3
10	*Expected date(s) for entry into force and implementation/application*
	1 January 2020
11	*Any relevant decision taken or instruction given by the Committee*

***

ANNEX 22

STATEMENTS BY DELEGATIONS*

OPENING

STATEMENT BY THE DELEGATION OF DENMARK

"In the weekend (14 and 15 February 2015) Denmark was hit by a terrorist attack.

Saturday afternoon a peaceful meeting in Copenhagen was attacked by a gunman, and early Sunday morning the Jewish synagogue was similarly attacked. Two persons were killed and five police officers injured.

The police in Denmark acted with determination and resolve and early Sunday morning the situation ended with the death of the presumed perpetrator.

The thoughts of all Danes rest with the families of the deceased and the wounded.

Denmark has received expressions of sympathy and support from leaders around the world. It has warmed the Danish people deeply. We are very grateful for all the support we have received – also here at IMO this morning.

Denmark is an open, free and peaceful democracy and this frightful event will not change this."

STATEMENT BY THE DELEGATION OF ITALY

"At about 13.00 hours on 8 February 2015 IMRCC Rome received a phone call reporting to be on board a boat in an emergency situation.

IMRCC Rome started to take operational coordination on, and required the telecommunication provider from which the phone call came, to locate the satellite phone: it was 58 miles off Tripoli north coast and 112 miles southeast off Lampedusa.

Having informed, according to the SAR Convention, other maritime authorities involved in operations, two merchant vessels, different flag, transiting in the area, were diverted to assist the boat in distress. Italian Coast Guard patrol boats also left Lampedusa harbour for SAR mission. More than 100 people (104) were found on board the boat in distress when Coast Guard units arrived in the area providing transshipment of migrants and going back to Lampedusa.

Meanwhile, few hours later on the same day, Frontex's ICC received a text from Spanish MRCC saying a person reporting to have his brother and other people aboard another vessel in distress.

A confirmation arrived by a further call to Rome's IMRCC from a man, Spanish speaking, referring to the same emergency situation.

* Statements have been included in this annex in the order in which they were given, sorted by agenda items, and in the language of submission (including translation into any other language if such translation was provided). Statements are available in all the official languages on audio file: http://docs.imo.org/Meetings/Media.aspx

Once again with satellite telecommunication provider help, the boat was located in position 25 miles further north-west the previous rescued boat.

MRCC in Rome diverted four merchant ships, as well as a Coast Guard aircraft in the area.

The ITCG aircraft located the dinghy, seeds sunk with two people on board, about 71 Nautical miles north-east from Tripoli and immediately launched an inflatable raft.

The two survivors who referred to be 105 people aboard when had left, were taken on board the merchant vessel at 14.20 hours.

Shortly after, M/V **Bremer Martha** located one more boat in the same area, carrying about 30 people on board, recovered by S/V **Argos Bourboun**. Also in this case 9 survivors claimed to be 106 people at the beginning of the journey.

The SAR operation was completed with arrival in Lampedusa after almost 24 hours from the start.

All operations were conducted in the presence of prohibitive conditions of sea with waves estimated to be 7/8 meters, up to 60 knots wind, low temperatures and hailstorms.

A total of 84 people were rescued alive and 29 died.

More than 209 people are still missing plus 100 people supposed to be aboard the migrants' boats too, as referred by the survivors when disembarked in Lampedusa.

During last weekend, since Friday to Sunday the ITCG rescued around 25 boats and 3,500 people.

During these activities it is to be noted that something new happened: a Coast Guard patrol boat, after having taken on board migrants, was threatened by four armed people asking to get back the migrants' boat with the view, perhaps, to reuse it for future illegal migrants trips."

AGENDA ITEM 8

STATEMENT BY THE DELEGATION OF AUSTRALIA

"First this delegation would like to thank the United Kingdom for kindly coordinating this correspondence group and compliment the group on the work to accommodate a diverse range of views on a complex issue. As the group is aware, Australia has a strong view against having a new category of personnel called "industrial personnel", this delegation would like to put a case forward for the consideration of the distinguished delegates.

Provision 1.2.3 of the 2008 SPS Code says, "The Code is not intended for ships used to transport and accommodate industrial personnel that are not working on board". However, we recall DE 51 and subsequently the MSC 84 regarded "industrial personnel" as "passengers" and not "special personnel" so as to ensure that they do not receive any different treatment than "passengers" because of their employment status. The intent of the use of the term "industrial personnel" in paragraph 1.2.3 of the 2008 SPS Code was not to allow carriage of those personnel on vessels (e.g. crew boat, accommodation barge, etc.) constructed and equipped to lower standards than passenger vessels. But, the Sub-Committee's current considerations seem to be directed towards providing lower crew-like standards for "industrial personnel" than if they had been included in "special personnel". The only basis for considering

"industrial personnel" as being separate from "special personnel" arises through provision 1.2.3 of the 2008 SPS Code. While the 2008 SPS Code does define "passenger" and "special personnel" it does not define "industrial personnel". Time and again during the course of the correspondence group, it was acknowledged by group members that the definition of "industrial personnel" as agreed at SDC 1 (SDC 1/WP.6) should be aligned with the definition of "special personnel" in the 2008 SPS Code. We are of the opinion that the issues raised by provision 1.2.3 of the 2008 SPS Code can be best overcome through the application of a unified interpretation or an amendment to the definition of "special personnel" so that it includes "industrial personnel".

Referring to the report of the correspondence group, established at DE 57, provided in documents SDC 1/18 and SDC 1/INF.11, paragraph 19.3 of the document SDC 1/26 concluded that "although the special personnel definition and training requirements may be considered as a basis for "industrial personnel", the group agreed that the two definitions should remain as two distinct categories". We disagree with this conclusion as this prevents application of the above mentioned interpretation or amendment as an option. We hold the strong view that the categories of "passenger", "special personnel" and "crew" should collectively cover all persons (other than children under one year of age) carried on board all ships and there is no need to separately define "industrial personnel". This principle of no more than three basic personnel categories should be held central to all of IMO's work, since departure from it could result in the creation of any number of special categories of personnel on board and is bound to weaken the implementation and effectiveness of IMO instruments. Rather than creating in SOLAS a new definition of "industrial personnel" and relevant safety requirements that might be developed in relation to them, as has been discussed in the Sub-Committee, our view is that the SPS Code should be given mandatory effect under SOLAS to cover "industrial personnel". The SPS Code has been developed, proven and improved over many years and is therefore an appropriate instrument to mandatorily cover "industrial personnel" rather than develop new requirements for these personnel. It would be counterproductive to give "industrial personnel" separate recognition within the suite of IMO instruments due to the confusion and lack of uniform implementation that is likely to follow.

Further, we would draw the Sub-Committee's attention to the difficulties experienced over many years in making <u>any</u> amendments to SOLAS chapter I due to the provisions of SOLAS article VIII(vi), as suggested in paragraph 5 of the document SDC 2/8/1, submitted by Vanuatu, under this agenda item. Australia concurs with much of this document, although we disagree that the issue of "industrial personnel" can and should be addressed without amending SOLAS.

While the difficulties in amending SOLAS chapter I can be overcome, as was done for high-speed craft through SOLAS chapter X, we believe that any solution should involve mandatory implementation of the SPS Code and the application of that Code to "industrial personnel".

We are aware that our proposal is outside the scope of the task given to the Sub-Committee by the Committee. However, for an appropriate and long-term solution, we urge the Sub-Committee to consider our proposals and take action as appropriate."

AGENDA ITEM 15

STATEMENT BY THE DELEGATION OF THE UNITED KINGDOM

"May we start by thanking the working group and its Chairman for their work on the myriad of issues in their tasking.

On the particular point of means of escape from ro-ro spaces, we acknowledge that the working group had substantial discussion on the issue. The United Kingdom expressed its concerns within the group with its final wording to the proposed circular and we would wish all delegations to be aware of the thrust of those concerns before committing to the circular.

The general requirements for means of escape in SOLAS regulation II-2/1.2.1 is that there be two widely separated, ready means of escape. The further requirement for ro-ro spaces in SOLAS regulation II-2/13 additionally requires that the escape routes shall provide a safe escape to a particular destination. In the opinion of this delegation, the combination of these two regulations means that in either of these two escape routes, the escapee needs to be protected to achieve a safe arrival at the destination. It is our opinion that in order to achieve the SOLAS requirement for a safe means of escape, both routes must in some way be protected.

We do not believe that the wording of the interpretation as it is presented in annex 6 of the working group report (SDC 2/WP.5) is sufficiently robust or clear, even understanding that it is an interpretation, to adequately clarify what is meant by safe escape. We believe that additional wording, such as enclosed trunk and protected stairway is necessary.

Further, SOLAS regulation II-2/13.6 requires that the two safe escapes be at the fore and aft ends of the space. The United Kingdom also acknowledges that the group had substantive debate on this issue as well. However, we have concerns too over the outcome of the group's discussion relating the position of these to the breadth of the space. For example, in a large ro-ro space of substantial length it would be entirely possible for the safe escapes to be located a significant distance from the ends of the space and we would prefer a more specific delineation of the position by measured distance."