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AMENDMENTS TO THE IGF CODE AND DEVELOPMENT OF GUIDELINES FOR ALTERNATIVE FUELS AND RELATED TECHNOLOGIES

Comments on document CCC 11/3 (Norway) – part 2

Submitted by IACS

SUMMARY

Executive summary:	This document provides the second set of comments by IACS on annex 1 to document CCC 11/3 (Norway) as regards the development of the interim guidelines for the safety of ships using hydrogen fuels.
Strategic direction, if applicable:	2
Output:	2.3
Action to be taken:	Paragraph 21
Related document:	CCC 11/3

Introduction

1 This document is submitted in accordance with the provisions of paragraph 6.12.5 of 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.5/Rev.6) and comments on annex 1 to document CCC 11/3 (Norway) which contains the draft interim guidelines for the safety of ships using hydrogen fuels (hereafter referred to as the "draft interim guidelines"). All references in this document are with regard to the draft interim guidelines unless otherwise mentioned.

Discussion and proposals

Comments on section 7

2 With regard to paragraph 7.2.7, it is suggested to make this requirement more clear in respect of constituent gases of air, whose condensation could pose serious hazards. Air consists mainly of nitrogen, oxygen, argon and carbon dioxide. It is noted that condensation of carbon dioxide would be practically minimal, while argon is an inert gas with a boiling point

lower than oxygen. Therefore, limiting the surface temperature of the outer surface of secondary enclosures to -183°C will result in achieving this objective. Consequently, it is suggested to revise paragraph 7.2.7 as follows:[1]

> "7.2.7 The temperature of the outer surface of secondary enclosures should in normal operation not be less than -183°C (oxygen boiling point at atmospheric pressure) ~~cause condensation of air constituent gases~~".

3 As regards paragraph 7.2.9, it is not clear to IACS as to what is "low surface temperature". This term should be clarified or defined. The wording of paragraph 7.4.2.6 can be improved to convey the provision more clearly. It is suggested to revise paragraph 7.4.2.6 as follows:

> "7.4.2.6 Fuel pipes should be seamless ~~steel pipe~~ and fabricated from ~~made of~~ austenitic stainless steel. Materials used for pipes with a design pressure of 20MPa or above are to be, for example, but not limited to 316 L stainless steel."

4 Regarding the material requirements in paragraph 7.4.1.4.3, it is suggested to remove the wording "for the cylinders", as this provision is applicable to all material applications.

Comments on section 8

5 The text in paragraph 8.1.1 (the version without square brackets) is preferred, since it is considered that the other version of paragraph 8.1.1 (within square brackets) mentions "bunkering operations" which should be described in section 18. As regards paragraph 8.3.3, the provision of gastightness for bulkheads of semi-enclosed bunkering stations is superfluous, since for semi-enclosed bunkering stations, hydrogen would not be prevented from spreading to other spaces. Therefore, it is suggested to consider removing the need for the bulkheads of semi-enclosed bunkering stations to be gastight.

6 With regard to paragraph 8.3.9, the wording needs to be modified to convey the recommendatory nature of the interim guidelines by replacing "is to be" by "should be". With regard to paragraph 8.3.10, unacceptable cooling due to the condensation of air should be included. It is suggested to revise that paragraph as follows:

> "8.3.10 Bunkering stations should be arranged to prevent surrounding hull or deck structures from being subjected to unacceptable cooling in the event of a leakage of fuel and/or condensation of air."

7 In respect of paragraph 8.4.4.2, it is suggested to delete "a bolted flange to flange assembly" or to clearly specify that a cryogenic bayonet type connection is to be used to ensure double sealing, as well as vacuum insulation continuity.

Comments on section 9

8 It is suggested to add in section 9.4 the following provision:

> "Sections of liquid hydrogen pipework that can be isolated should be protected by a suitable pressure relief device venting to a safe location, to prevent pressure build-up from trapped liquid."

[1] Here and throughout the document tracked changes are indicated using "grey shading" to highlight new insertions and "strikethrough" to highlight deletion of the text.

9 It is suggested to restore provisions for filters (originally proposed in paragraph 9.5.5), because particulate matter obstructs full closing of valves, which is essential to ensure leak tightness. Also, filters could be safety critical in hydrogen systems, as particulate matter could result in electrostatic discharge ignition hazards, especially in vent lines where H_2/air mixture is available.

10 With regard to paragraph 9.6.1, it is suggested that the valves should also be operable when the safety systems as per section 15 are activated. It is proposed to revise paragraph 9.6.1 as follows:

> "9.6.1 Valves in the fuel piping system should be ~~automatic and~~ remotely operated to minimize personnel exposure. This does not apply to normally closed and locked valves not operated during normal service. Valves should be automatically operable when action is required by the safety system as per section 15."

11 Regarding paragraph 9.6.4, it should be acceptable to provide a combined remotely operated and automatic valve for the main fuel line to each consumer. Therefore, it is suggested to revise paragraph 9.6.4 as follows:

> "9.6.4 The main fuel supply line to each gas consumer or set of consumers should be equipped with a remotely operated stop valve and an automatically operated master gas fuel valve coupled in series or a combined remotely and automatically operated valve. The valves should be situated in the part of the piping that is outside the machinery spaces containing gas consumers and placed as near as possible to the consumer. The master gas fuel valve should automatically cut-off the gas supply when activated by the safety system as required in 15.2.2."

12 With reference to paragraph 9.6.7, it is proposed to replace "ventilation" with "bleed", for consistency with paragraphs 9.6.6 and 9.6.8. In respect of paragraph 9.6.10, it is proposed to elaborate the requirements as follows:

> "9.6.10 When a leakage in the fuel system is detected by the safety system followed by automatic shutdown of the master gas fuel valve, the complete fuel system ~~after~~ downstream of the master valve should be automatically de-pressurized and purged with inert gas."

13 With regard to paragraph 9.6.12, it is suggested to clarify that the provision only applies to the case when a master gas fuel valve is provided for each consumer, as follows:

> "9.6.12 For single-engine installations and multi-engine installations, where a separate master valve is provided for each engine, ~~I~~the master gas fuel valve and the double block and bleed valve functions can be combined."

14 It is suggested to add a new paragraph 9.6.14 to ensure that all automatic and remotely operated valves have indications at the locations from where these are operated, as follows:

> "9.6.14 All automatic and remotely operated valves should be provided with indications for open and closed valve positions at the location where the valves are remotely operated."

Comments on section 10

15 It is proposed to add the following functional requirement:

> "It should be possible to purge all gaseous fuel engines and engine exhaust systems."

16 Hazards related to the internal combustion engines using hydrogen as fuel need to be addressed. Performing failure modes, effects and criticality analysis was also recommended within the EMSA's report on the potential of hydrogen as fuel. [2] Therefore, paragraph 10.3.1 is proposed to be revised as follows:

> "10.3.1 Unless expressly provided otherwise, the requirements of section 10.3 of the IGF Code should apply to ships using hydrogen as fuel. A failure modes, effects and criticality analysis (FMECA) should be performed for the internal combustion engines using hydrogen as fuel."

17 It is noted that the provision in paragraph 10.3.4 is already covered in paragraph 10.2.3. Hence, it is suggested to delete paragraph 10.3.4.

Comments on section 11

18 Hydrogen fuel tanks should not be arranged in areas intended for packaged goods. Hence, the application of paragraph 11.3.2 of the IGF Code should be excluded from these interim guidelines.

19 With regard to section 11.6, it may need to be ascertained that the FSS Code has the necessary contents to address hydrogen fire detection. It is also noted that the guidance provided in paragraph 11.5.2 is very general and needs to be supplemented. Therefore, it is proposed to revise paragraph 11.5.2 as follows:

> "11.5.2 Smoke detectors alone should not be considered sufficient for rapid detection of a fire. The type, arrangement and number of hydrogen gas detectors should be decided considering the principles provided in NFPA 2 – Hydrogen Technologies Code, annex M."

20 It is understood that TPRD (thermal pressure relief device) may be provided for compressed hydrogen tanks. The performance of such devices could be affected by the presence of external elements, such as rain or ice (in addition to the water spray systems). It is suggested that this consideration be made during the application of TPRD. A proposal to add a new paragraph 11.6.3 (or maybe adding to paragraph 6.7.13) is as follows:

> "11.6.3 The effect of external elements, such as rain, ice, etc. on the performance of TPRDs (where provided), should be evaluated and suitable or alternative measures be provided."

Action requested of the Sub-Committee

21 The Sub-Committee is invited to consider the proposals in paragraphs 2 to 20 and take action, as appropriate.

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[2] European Maritime Safety Agency (2023), Potential of Hydrogen as Fuel for Shipping, EMSA, Lisbon.