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AMENDMENTS TO THE IGF CODE AND DEVELOPMENT OF GUIDELINES FOR LOW-FLASHPOINT FUELS

Report of the correspondence group

Submitted by Sweden

SUMMARY	
Executive summary:	This document contains the report of the Correspondence Group on Amendments to the IGF Code and Development of Guidelines for Low-flashpoint Fuels
Strategic direction:	5.2
High-level action:	5.2.1
Planned output:	5.2.1.2
Action to be taken:	Paragraph 65
Related documents:	MSC 94/21; CCC 1/13, section 4; and SSE 2/20, section 14

BACKGROUND

1 The Sub-Committee on Carriage of Cargoes and Containers (CCC), at its first session, in order to initiate the second phase of development of the IGF Code and progress the work intersessionally, agreed to establish a Correspondence Group on Amendments to the IGF Code and Development of Guidelines for Low-flashpoint Fuels, under the coordination of Sweden. This document reports on the outcome of the work of this group.

2 Representatives from the following Member Governments participated in the group:

AUSTRALIA
CANADA
CHINA
DENMARK
FINLAND
FRANCE
GERMANY
JAPAN
MALAYSIA
MARSHALL ISLANDS
NORWAY
REPUBLIC OF KOREA
SPAIN
SWEDEN
UNITED KINGDOM
UNITED STATES

and an observer from the following intergovernmental organization:

EUROPEAN COMMISSION (EC)

and observers from the following non-governmental organizations:

INTERNATIONAL CHAMBER OF SHIPPING (ICS)
INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)
BIMCO
INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES (IACS)
OIL COMPANIES INTERNATIONAL MARINE FORUM (OCIMF)
COMMUNITY OF EUROPEAN SHIPYARDS' ASSOCIATIONS (CESA)
SOCIETY OF INTERNATIONAL GAS TANKER AND TERMINAL OPERATORS LIMITED (SIGTTO)
INTERNATIONAL ASSOCIATION OF DRY CARGO SHIPOWNERS (INTERCARGO)
EUROPEAN ASSOCIATION OF INTERNAL COMBUSTION ENGINE MANUFACTURERS (EUROMOT)
THE INSTITUTE OF MARINE ENGINEERING, SCIENCE AND TECHNOLOGY (IMarEST)
CLEAN SHIPPING COALITION (CSC)

TERMS OF REFERENCE

3 The group was instructed, based on the work plan for the next phase of development of the IGF Code, to:

.1 use annex 4 to document CCC 1/4 (Norway) as a basis, further develop guidelines for ships using ethyl or methyl alcohol as fuel;

.2 use section 10.6 of annex 2 to document CCC 1/4 as a basis, further develop measures for fuel cells for inclusion in the IGF Code as and when appropriate;

.3 use the annex to document CCC 1/4/12 (CESA) as a basis, further develop measures for ships using low-flashpoint diesel oil for inclusion in the IGF Code as and when appropriate; and

.4 submit a report to CCC 2.

FURTHER DEVELOP GUIDELINES FOR SHIPS USING METHYL/ETHYL ALCOHOL AS FUEL (TOR 1)

4 As instructed by CCC 1, the group embarked on further developing the draft *Interim guidelines for ships using methyl/ethyl alcohol as fuel*, taking into account annex 4 to document CCC 1/4 as a base document, and took action as indicated in paragraphs 5 to 40.

5 In addition to chapters 5 to15, as originally set out in annex 4 to document CCC 1/4, the group decided to consider and further develop chapters 1 to 4 as well, in order to reflect requirements for methyl/ethyl alcohols.

6 Taking into account that the guidelines will be a standalone document (Interim guidelines), the group was of the opinion that in order to get a better overview, the relevant text should be reproduced in full rather than making references to the IGF Code.

Definitions and terminology

7 In considering the definition for "fuel containment system", several group members felt that this definition needs to be revised for methyl/ethyl alcohols. The term is normally used to refer to the carriage of cryogenic products where a primary and secondary barrier may be necessary. With methyl/ethyl alcohol as fuel, the tanks will probably be of the gravity type with a design pressure not greater than 0.7 bar. Methyl/ethyl alcohol is stored at ambient temperatures; therefore, no insulation is required and there is no danger of cryogenic damage to the hull structure in the event of leakage.

8 In this context, it was also pointed out that in the IBC Code there is no requirement for a secondary barrier when transporting these fuels. The only requirement is separation between the fuel tanks and other spaces. Taking the above into account, the group agreed that the definition for "fuel containment system" needs further consideration.

9 The following new definitions were added to chapter 2 in the draft interim guidelines:

.1 gravity tank;

.2 integral tank;

.3 methyl/ethyl alcohol; and

.4 single failure.

10 When referring to "fuel" in the draft interim guidelines, the meaning of "fuel" should be understood as "methyl/ethyl alcohol". It was also pointed out that "Vapour" or "Fuel vapour" for methyl/ethyl alcohol may be the most appropriate terminology instead of the word "gas".

11 In regard to limitation of explosion consequences (section 4.3), the group questioned whether this requirement is applicable to methyl/ethyl alcohol fuels. Hence, the group was of the view that further discussion is needed on this requirement.

12 In regard to defining "accommodation area" and "engine-room area", the group suggested to use the existing definition in SOLAS regulations II-2/3.1 (accommodation space) and II-2/3.30 (machinery spaces and machinery spaces of category A).

Design and arrangement (chapter 5)

13 It was pointed out by several group members that a very likely segment for methanol as fuel is on chemical tankers. The hazards could, for instance, be contamination of fuel system by a non-compatible liquid, spreading of fire from the cargo section to the engine-room. Chemical carriers using methanol as fuel stored in integral cargo/slop tanks should also be considered as a possible case. Based on this, it is proposed to further develop the functional requirements for enabling full segregation between these spaces.

14 Regarding protection of the integral fuel tanks, some members asked for guidance in regard to the possibility to place fuel tanks in the double bottom tanks. In this context, the group noted that according to the IBC Code there is no need for protection of type 3 cargoes, such as methanol. The same principles could be considered for methyl/ethyl alcohol fuel tanks.

15 It was proposed to allow for a distance of 800 mm as a minimum horizontal distance (instead of 760 mm) between the fuel tanks and ship's side. This distance is also consistent with part A-1 in the IGF Code. However, the group was of the view that further discussion is needed, taking into account that the minimum distance may need to be different to that required for LNG fuel tanks.

16 The group agreed that methyl/ethyl alcohol tanks on open decks should be surrounded by a coaming and spills collected in a dedicated holding tank. A coaming height of an "*ample size*" is proposed.

Requirements for location and protection of fuel piping (section 5.7)

17 The group agreed that fuel pipes should not be located less than 800 mm from the ship's side, and it was also pointed out that 800 mm is consistent with part A-1 of the IGF Code for LNG.

18 Regarding fuel pipes that are led through ro-ro spaces, special category spaces and on open decks, it is proposed that other areas, where there is a risk for mechanical damage, should be included as well. In this context, the question was raised if pipes that were led through ro-ro spaces are required to be double walled. However, the group did not embark on any further discussion on this issue.

Material and general pipe design (chapter 7)

19 Considering that methanol can be highly corrosive to certain materials, including steel, the group suggested corrosion resistant materials to be used for, e.g. bunker tanks, pumps, gaskets and pipes (including exhaust pipes).

Piping fabrication and joining details

20 The general understanding within the group was that butt welding reduces the probability of leakages at weak links in the system, e.g. connections. Double mantling reduces the probability of an uncontrolled leakage. A double mantle will also make the piping more resistant against strain, impact and corrosion. Further to this, it is suggested that butt welding and double piping would apply to both high pressure pipes and to low pressure pipes.

21 The group felt that there is a need to further consider the requirements for materials suitable for methyl/ethyl alcohols. The understanding within the group was that only metallic materials should be permitted. However, one member suggested that under specific conditions also non-metallic materials could be suitable.

Redundancy of methyl/ethyl alcohol fuel supply

22 The group was of the view that methyl/ethyl alcohol as the single fuel onboard should be allowed. For single fuel installations, the fuel supply system is required to be arranged with full redundancy and segregation all the way from the fuel tanks to the consumer, so that a leakage in one system does not lead to an unacceptable loss of power.

23 Taking into account that the requirement for two fuel service tanks for each type of fuel onboard is already covered by SOLAS regulation II-1/26.11, there were diverse views on whether to mention this requirement in these interim guidelines or not.

Fire safety (chapter 11)

24 The group identified a number of incorrect references to part A-1 of the IGF Code which are not applicable to methyl/ethyl alcohol fuels. It also identified a number of contradicting requirements in regard to different types of fixed firefighting systems required in this chapter. The group was of the view that fire-extinguishing requirements need to be clarified for the different fuels in mind. Thus, the group was of the view that further discussion is needed on appropriate fire-extinguishing requirements.

25 It was also suggested that the entire chapter 11 on fire safety should be referred to the SSE Sub-Committee for further consideration.

Portable fire extinguishers

26 The issue of appropriate portable fire-extinguishers was mentioned. In this regard the group discussed the most appropriate portable fire extinguisher for methyl/ethyl alcohol fires, and questioned whether a dry powder fire extinguisher was the only type that would work and if there are other equivalent types (e.g. alcohol resistant foam type) that could be suitable for methyl/ethyl alcohol fires.

Fixed fire-extinguishing systems

27 Where fuel tanks are located on the open deck, the current draft text suggests a fixed fire-extinguishing system of alcohol resistant foam type and, in this regard, the group questioned whether a water mist or deluge system could be used as an equivalent system. The group also proposed to require a fixed water spray system for cooling purposes and in order to dilute large spills eventually.

28 Further to this, it was proposed to require a fixed water system in combination with alcohol resistant foam in order to cover the tank top and bilge area under the floor-plates in machinery spaces of category A and pump-rooms containing methyl/ethyl alcohol fuels.

29 It was also noted that fixed water-based fire-extinguishing systems are conventionally approved based on guidelines such as the *Revised Guidelines for the approval of equivalent water-based fire-extinguishing systems for machinery spaces and cargo pump-rooms* (MSC.1/Circ.1165, as amended by MSC.1/Circ.1237, MSC.1/Circ.1269 and MSC.1/Circ.1386), which are designed to extinguish light diesel oil fuel spray fires.

Fire detection

30 With regard to appropriate fire detection systems for methyl/ethyl alcohol, the group suggested that detectors are to be selected based on the fire characteristics of the fuel. It was also suggested that smoke detectors should be used in combination with detectors which can detect methanol or ethanol fires.

31 Detection and localization of fires by fire patrols need to be addressed and further discussed, as methyl/ethyl alcohol fires result in a barely visible flame and generate significantly less smoke than conventional fuels.

Hazardous area zones (chapter 12)

32 With regard to classification of hazardous areas, the group noted that many of the proposed requirements under this section derive from the IEC standard 60092-502 (Electrical installations in Ships-Tankers-Special Features for tankers), and the appropriateness of some of the requirements was questioned, such as the application and use of P/V valves, spaces protected by an airlock and areas within a certain distance from the fuel containment system. Based on the above, the group felt that the text in chapter 12 needs to be further considered with respect to the special properties for methyl/ethyl alcohol fuels.

Ventilation and electrical installation (chapters 13 and 14)

33 The group was of the view that these two chapters had to be reconsidered and redrafted, taking into account the special properties for methyl/ethyl alcohol fuels. One member suggested a new draft text for these chapters, based on the assumption that, in regard to protection of the engine-room, the ESD concept is not permitted for methyl/ethyl alcohol fuels, as was previously agreed by the Sub-Committee (CCC 1/4, paragraph 16 and CCC 1/13,

paragraph 4.5). However, the understanding within the group was that emergency shutdown arrangements could be used in other areas such as bunkering. Due to lack of time, the group did not embark on any further detailed discussion on the content of these two chapters. Therefore, these proposed new chapters need further consideration.

Control, monitoring and safety systems (chapter 15)

Liquid leakage detection (section 15.3)

34 Suitable detection devices were discussed by the group, and it was suggested to require liquid detection devices to be installed in the protective cofferdams surrounding the fuel tanks, in all ducts around fuel pipes, in pump-rooms and in other enclosed spaces containing fuel piping or other fuel equipment.

35 In this context, one member proposed that at least one bilge well should be fitted with a level indicator in each room containing independent storage tank(s) and that alarms should be given at high level in bilge well. However, the group could not reach consensus on this matter.

Level indication for fuel tanks (section 15.4)

36 Different methods of level indication in fuel tanks were discussed and the group noted that for a chemical tanker transporting these fuels based on the requirements in the IBC Code it is required to have a restricted gauging device, meaning that the design must ensure that no dangerous escape of tank content, liquid or spray, can take place in opening the device. The group concluded that this issue should be further discussed, taking into account the properties of methyl/ethyl alcohol fuels and the risks associated with them, including the toxicity which is valid for methanol. However, two members preferred to have the same requirements for level gauges as in the IBC code, meaning that restricted gauging would be required and are to be considered as the only option.

Vapour detection in ducting enclosures and annular spaces (paragraph 15.5.2)

37 Requirements for fuel vapour detection were discussed in the group, and a new draft text on the positioning of detectors, taking into account the special characteristics of methyl/ethyl alcohol fuel vapours as it is heavier than air, was proposed. In this regard, two different concepts were proposed. One of the methods assumes that ventilation is the primary means to detect leakage within double walled piping. However, such an arrangement might not be the most suitable method for liquid fuels. In this context, it was proposed that other methods to detect leakage should be allowed and this requirement should therefore be function based.

Fire detection (section 15.9)

38 The group proposed that after a fire has been detected in a machinery space containing methyl/ethyl alcohol engines or in rooms containing independent tanks for methyl/ethyl alcohol storage, an alarm should be triggered. However, the group agreed that this should be referred to the SSE Sub-Committee as it is within its area of expertise.

Safety functions of fuel supply system (section 15.11)

39 One member proposed a new draft text, specially developed for arrangements where dual fuel engines are considered. The new proposal also included a matrix on required actions to be taken (i.e. alarm, automatic shut-down of tank valve, automatic shut-down of bunkering valve) after a certain parameter is triggered. However, this section was not discussed in detail and, therefore, needs to be further considered.

40 Having considered all the above issues, the group made good progress on the development of the draft interim guidelines, as set out in annex 1, for further consideration by this Sub-Committee. However, it was not able to finalize the draft completely. Some issues were not possible to solve by correspondence and others could not be completed due to lack of time.

FURTHER DEVELOP MEASURES FOR FUEL CELLS FOR INCLUSION IN THE IGF CODE (TOR 2)

41 As instructed by the Sub-Committee, the group embarked on further developing measures for fuel cells for future inclusion in the IGF Code and took action as indicated in paragraphs 42 to 44.

Hydrogen associated with fuel cells

42 The group considered general comments in regard to hydrogen associated with the use of fuel cells in the draft chapter to be introduced into the Code. In this regard, it was pointed out that, although part A-1 of the IGF Code covers natural gas only, the group introduced some provisions mentioning hydrogen. These proposals are, however, intended to address small amounts of hydrogen only associated with some specific fuel cell systems, such as Molten-carbonate fuel cells (MCFC), and not for the use of hydrogen as the primary fuel.

Structuring of the new section for fuel cells

43 Taking into account that a fuel cell is a consumer in the same way as boilers and engines, the group proposed that the regulations for fuel cells are included in chapter 10 of the IGF Code. Furthermore, the group suggested that requirements for fuel containment and fuel supply to the consumer should be covered by other existing parts of the IGF Code. Requirements to materials, ventilation, fire safety, gas detection, protective devices as well as electrical installations and explosion prevention should, in general, be covered by the corresponding existing sections in part A-1 of the IGF Code. It was further pointed out that only special requirements (which are to be developed) for fuel cells and their arrangements should be included in section 10. In regard to development of new definitions, the group agreed that new definitions were needed and, consequently, developed new definitions for fuel cells for future inclusion in section 2.2 in the IGF Code.

44 Having considered the above issues, the group agreed to a draft new text, as set out in annex 2, for further consideration by the Sub-Committee.

FURTHER DEVELOP MEASURES FOR SHIPS USING LOW-FLASHPOINT DIESEL OIL (TOR 3)

Terminology

45 A member of the group made some general comments regarding the term "Diesel Fuel" and suggested changing this term to "Oil Fuels", which is also consistent with the terminology in SOLAS regulation II-2/4.2. It was mentioned that, besides diesel, there are other distillates, intermediate blends and residual oil fuels with a flashpoint below 60°C that may be envisioned for consideration in this provision. Some possible examples that were mentioned were:

.1 distillates such as Marine Gas Oil (MGO) and Marine Diesel Oil (MDO);

.2 intermediates such as Marine Diesel Fuel (MDF) and Intermediate Fuel Oil (IFO); and

.3 residuals such as Marine Fuel Oil (MFO) and Heavy Fuel Oil (HFO).

46 However, the list of different oil fuels is not to be considered exhaustive. In this context, it was also pointed out that the term "diesel" relates to the diesel cycle and would in that case cover all fuels. One other member agreed that the word "diesel" should be avoided. In this context, one member suggested to refer to "distillate marine fuels" and "residual marine fuels", which is also referenced in standards such as ISO 8217.

Outcome of SSE 2

47 The group also noted the concerns expressed during SSE 2 that should be considered, including:

.1 reference to the 60°C limit made in other IMO instruments;

.2 existing lower flashpoint diesel fuels containing other products (for example mandatory bio content such as Fatty Acid Methyl Esters (FAME) in road diesel) which come with additional safety concerns;

.3 engine manufacturers having identified a need to consider the potential for increased fire risk; and

.4 any potential impact on firefighting systems.

48 With respect to ambient temperatures in engine-rooms, a member of the group provided some background information relating to ambient temperatures in engine-rooms, pointing out that, particularly in engine-rooms, a "rule of thumb" used by major engine manufacturers is that engine-room temperatures are approximately 8 to 13˚C above ambient air temperature.

49 In the event of any leakage of fuel (particularly, for example, in an unmanned engine-room), and where lower flashpoint fuels are being used in the presence of ambient temperatures that are in excess of the flashpoint, consideration needs to be given to any danger of the liquid fuel being present in the vapour phase rather than remaining as a liquid.

50 Further to this, it was emphasized by some group members that further consideration needs to be given to potential sources of ignition such as, for example, non-intrinsically safe electrical equipment.

51 A major part of the discussion in regard to low-flashpoint fuel oils was about the appropriate safety level for these fuels and a possible way forward. However, the opinions were split on how to address all the safety concerns, but they can be summarized as indicated in paragraphs 52 to 54.

52 Fuels with a flashpoint between 43 and 60°C are allowed onboard ships today according to SOLAS regulation II-2/4.2.1, for use in emergency generators and other emergency and auxiliary engines not located in category A machinery spaces subject to specific conditions.

53 It was also pointed out that in section 1.3.1 of the *Guidelines for measures to prevent fires in engine-rooms and cargo pump-rooms* (MSC.1/Circ.1321), the use of fuels with a flashpoint lower than 60˚C is limited to specific cases for ships on restricted service where it could be safely assumed that the ambient temperatures within relevant spaces would not be any higher than 10˚C below the flashpoint of the fuel oil but not less than 43°C; and if such oil fuels were to be heated within 10˚C of the flashpoint, then spaces containing the heated oil would require additional provisions including intrinsically safe electrical equipment and the absence of any other enclosed space over such spaces.

54 In addition, some members questioned the claim that there is no inherent increase in fire risk associated with these fuels.

Possible way ahead

55 As indicated in paragraph 16 of document CCC 1/4/12, the understanding within the group was that it was tasked to further develop measures for ships using low-flashpoint oil fuels for the future inclusion into the IGF Code, which is also according to the correspondence group terms of reference. However, in considering the way forward, the views within the group were divided.

56 One view expressed was that low-flashpoint oil fuels, being more similar to methyl/ethyl alcohols than to natural gas, should be included in the interim guidelines being developed for methyl/ethyl alcohols, rather than in the IGF Code or references within the Code. Thus, the suggestion is to replace the current proposal in the annex to document CCC 1/4/12 on specific requirements for low-flashpoint oil fuels with the wider scope of the interim guidelines being developed for methyl/ethyl alcohols. This approach was supported by two group members.

57 Another view expressed was to proceed along the lines of the original proposal, which is to incorporate the low-flashpoint fuels into the draft IGF Code as an additional part. A large majority of the group supported this approach. However, the group could not reach any consensus on how this should be reflected. In this context, it was pointed out by several group members that SOLAS regulation II-2 already contains significant fire protection measures for oil fuel systems. In addition, detailed guidance on reducing risk in fuel systems is provided in the *Guidelines to minimize leakage from flammable liquid systems* (MSC/Circ.647), the *Guidelines on engine-room oil fuel systems* (MSC/Circ.851) and the *Guidelines for measures to prevent fires in engine-rooms and cargo pump-rooms* (MSC.1/Circ.1321), which are referenced in SOLAS. Based on this, the proposal by some group members is to refer to these circulars and regulations in the draft IGF Code for oil fuels that have a flashpoint between 43 and 60°C, and only specify special requirements for those fuels with a flashpoint lower than 43°C. This approach was supported by a few members.

58 In this context, it was also proposed to add additional requirements on the oil fuels with a flashpoint ranging between 43 and 52°C. Additionally, it was proposed by one member that the additional requirements should be scaled to the relative risk based on the tier being evaluated. The following example was put forward to the group for consideration:

.1 Tier 1 = oil fuels with flashpoint ranging between [52] and 60°C;

.2 Tier 2 = oil fuels with flashpoint ranging between [43] and [52]°C; and

.3 Tier 3 = oil fuels with flashpoint < [43]°C.

59 For oil fuels in tier 1, no additional requirements are proposed.

60 For oil fuels in tier 3, having such an increased fire risk that it would trigger the alternative approach requirements outlined in paragraph 2.3 of the IGF Code.

61 It was, however, noted that this approach may necessitate a restructuring of the IGF Code and the group felt that this would be outside the terms of reference of the correspondence group.

62 The majority of the group supported the "tiered approach", while four members disagreed with this and thought that it was too early to consider this approach and preferred caution on this. It was pointed out that the draft IGF Code is for low-flashpoint fuels and it would not be appropriate to favour diesel with its own flashpoint ranges.

63 Of those members not supporting the "tiered approach", the main concern that was brought up was that this approach will not provide sufficient safety level for fuels in tiers 1 and 2. Another aspect of this was related to the flashpoint itself, and to use the flashpoint as the only parameter when developing safety systems might not be considered to be sufficient, as there may be other parameters that are equally important to address.

64 Taking all of the above into account, the group prepared a draft text, as set out in annex 3, which could be used as a base document for further discussion by the Sub-Committee. The section on the "tiered approach" requires further consideration and has been placed in square brackets, since the proposed "tiered approach" was opposed by four members.

ACTION REQUESTED OF THE SUB-COMMITTEE

65 The Sub-Committee is invited to approve the report in general and in particular, to:

.1 consider the group's opinion that the interim guidelines on methyl/ethyl alcohols is assumed to be a standalone document and decide, as appropriate (paragraph 6);

.2 note the outcome of the discussion on the terminology to be used in the context of the draft interim guidelines on methyl/ethyl alcohols (paragraph 10);

.3 note the progress made on the requirements on methyl/ethyl alcohol fuels (paragraph 40 and annex 1);

.4 note the group's comments regarding hydrogen provisions in the IGF Code associated with fuel cells (paragraph 42);

.5 note the progress made regarding requirements for fuel cells and endorse the draft new text for fuel cells (paragraph 44 and annex 2);

.6 note the views of the group regarding the term "diesel" (paragraph 45);

.7 note the background information on ambient temperatures in engine-rooms (paragraph 48 to 50); and

.8 note the progress made and consider the outcome of the discussions of the group regarding the "tiered approach" for low-flashpoint diesel oils (paragraph 64 and annex 3).

***

ANNEX 1

DRAFT INTERIM GUIDELINES FOR SHIPS USING METHYL/ETHYL ALCOHOL AS FUEL

1 PREAMBLE

The purpose of these interim guidelines is to provide an international standard for ships using methyl/ethyl alcohol as fuel.

The basic philosophy of these interim guidelines is to provide provisions for the arrangement, installation, control and monitoring of machinery, equipment and systems using methyl/ethyl alcohol as fuel to minimize the risk to the ship, its crew and the environment, having regard to the nature of the fuels involved.

Throughout the development of these interim guidelines it was recognized that it must be based upon sound naval architectural and engineering principles and the best understanding available of current operational experience, field data and research and development.

These interim guidelines address all areas that need special consideration for the usage of the methyl/ethyl alcohol as fuel. These interim guidelines consider the goal based approach (MSC.1/Circ.1394). Therefore, goals and functional requirements were specified for each section forming the basis for the design, construction and operation.

The current version of these interim guidelines includes [regulations] to meet the functional requirements for methyl/ethyl alcohol as fuel.

2 GENERAL

2.1 Application

Unless expressly provided otherwise these interim guidelines apply to ships to which part G of SOLAS chapter II-1 applies.

2.2 Definitions

Unless otherwise stated below, definitions are as defined in SOLAS chapter II-2.

2.2.1 *Accident* means an uncontrolled event that may entail the loss of human life, personal injuries, environmental damage or the loss of assets and financial interests.

2.2.2 *Breadth (B)* means the greatest moulded breadth of the ship at or below the deepest draught (summer load line draught). Refer to SOLAS regulation II-1/2.8.

2.2.3 *Bunkering* means the transfer of methyl/ethyl alcohol from land based or floating facilities into a ship's permanent tanks or connection of portable tanks to the fuel supply system.

2.2.4 *Certified safe type* means electrical equipment that is certified safe by the relevant authorities recognized by the Administration for operation in a flammable atmosphere based on a recognized standard. [1]

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

2.2.5 *Control station* means those spaces defined in SOLAS chapter II-2 additionally for these guidelines, the engine control room.

2.2.6 *Double block and bleed valve* means a set of two valves in series in a pipe and a third valve enabling the pressure release from the pipe between those two valves. The arrangement may also consist of a two-way valve and a closing valve instead of three separate valves.

2.2.7 *Dual fuel engines* means engines that employ fuel covered by these interim guidelines (with pilot fuel) and oil fuel. Oil fuels may include distillate and residual fuels.

2.2.8 *Enclosed space* means any space within which, in the absence of artificial ventilation, the ventilation will be limited and any explosive atmosphere will not be dispersed naturally.[2]

2.2.9 *ESD* means emergency shutdown.

2.2.10 *Ethyl alcohol* means C_2H_5OH

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

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

2.2.13 [*Fuel containment system* is the arrangement for the storage of fuel including tank connections. It includes where fitted, a primary and secondary barrier, associated insulation and any intervening spaces, and adjacent structure if necessary for the support of these elements. If the secondary barrier is part of the hull structure, it may be a boundary of the fuel storage hold space.

The spaces around the fuel tank are defined as follows:

.1 *Fuel storage hold space* is the space enclosed by the ship´s structure in which a fuel containment system is situated. If tank connections are located in the fuel storage hold space, it will also be a tank connection space;

.2 *Interbarrier space* is the space between a primary and a secondary barrier, whether or not completely or partially occupied by insulation or other material; and

.3 *Tank connection space* is a space surrounding all tank connections and tank valves that is required for tanks with such connections in enclosed spaces.]

(**Note:** Needs further discussion)

2.2.14 *Fuel preparation room* means any space containing pumps, compressors and/or vaporizers for fuel preparation purposes.
(**Note:** Needs further discussion)

2.2.15 *Gravity tank* means a tank having a design pressure not greater than 0.07 MPa gauge at the top of the tank. A gravity tank may be independent or integral. A gravity tank shall be constructed and tested according to recognized standards, taking into account of the temperature of carriage and relative density of the cargo.

[2] See also definition i IEC 60092-502:1999.

2.2.16 *Hazardous area* means an area in which an explosive gas atmosphere or a flammable gas or vapour is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of electrical apparatus or any other equipment that may provide potential sources of ignition.

[2.2.17 *High pressure* means a maximum working pressure greater than 10 bar.]
(**Note:** Relevance is questioned)

[2.2.18 *Independent tanks* are self-supporting, do not form part of the ship's hull and are not essential to the hull strength.]
(**Note:** Relevance is questioned)

2.2.19 *Integral tank* means a fuel-containment envelope which forms part of the ship's hull and which may be stressed in the same manner and by the same loads which stress the contiguous hull structure and which is normally essential to the structural completeness of the ship's hull.

2.2.20 *LEL* means the lower explosive limit.

2.2.21 *Length (L)* is the length as defined in the International Convention of Load Lines in force.

[2.2.22 *Low-flashpoint fuel* means gaseous of liquid fuel having a flashpoint lower than otherwise permitted under paragraph 2.1.1 of SOLAS regulation II-2/4.]
(**Note:** Further discussion is needed)

2.2.23 *MAWP* means the maximum allowable working pressure of a system component or tank.

2.2.24 *Methyl alcohol* means CH_3OH

2.2.25 *Methyl/ethyl alcohol consumer* means any unit within the vessel using gas as a fuel.

2.2.26 *Multi fuel engines* means engines that can use two or more different fuels that are separate from each other.

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

2.2.28 *Open deck* means a deck having no significant fire risk that at least is open on both ends/sides, or is open on one end and is provided with adequate natural ventilation that is effective over the entire length of the deck through permanent openings distributed in the side plating or deckhead.

2.2.29 *Risk* is an expression for the combination of the likelihood and the severity of the consequences.

2.2.30 *Semi-enclosed space* means s space where the natural conditions of ventilation are notably different from those on open deck due to the presence of structure such as roofs, windbreaks and bulkheads and which are so arranged that dispersion of gas may not occur.[3]

2.2.31 *Single failure* is where loss of intended function occurs through one fault or action.

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

2.2.32 *Source of release* means equipment from which a gas, vapour, mist of liquid may be released into the atmosphere so that an explosive atmosphere may be formed under normal operating conditions, for example valves and flanges in fuel piping systems.

2.2.33 *Unacceptable loss of power* means that it is not possible to sustain or restore normal operation of the propulsion machinery in the event of one of the essential auxiliaries becoming inoperative, in accordance with SOLAS regulation II-1/26.3.

2.2.34 *Vapour pressure* is the equilibrium pressure of the saturated vapour above the liquid, expressed in bar absolute at a specified temperature.

2.3 Alternative design

2.3.1 These interim guidelines contain functional requirements for all appliances and arrangements related to the usage of methyl/ethyl alcohol fuels.

2.3.2 Appliances and arrangements of methyl/ethyl alcohol fuel systems may deviate from those set out in these interim guidelines, provided such appliances and arrangements meet the intent of the goal and functional requirements concerned and provide an equivalent level of safety of the relevant chapters.

2.3.3 The equivalence of the alternative design shall be demonstrated as specified in SOLAS regulation II-1/55 and approved by the Administration. However, the Administration shall not allow operational methods or procedures to be applied as an alternative to a particular fitting, material, appliance, apparatus, item or equipment, or type thereof which is prescribed by these interim guidelines.

3 GOAL AND FUNCTIONAL REQUIREMENTS

3.1 Goal

The goal of these interim guidelines is to provide for safe and environmentally-friendly design, construction and operation of ships and in particular their installations of systems for propulsion machinery, auxiliary power generation machinery and/or other purpose machinery using methyl/ethyl alcohol as fuel.

3.2 Functional requirements

3.2.1 The safety, reliability and dependability of the systems shall be equivalent to that achieved with new and comparable conventional oil-fuelled main and auxiliary machinery.

3.2.2 The probability and consequences of fuel-related hazards shall be limited to a minimum through arrangement and system design, such as ventilation, detection and safety actions. In the event of fuel leakage of failure of the risk reducing measures, necessary safety actions shall be initiated.

3.2.3 The design philosophy shall ensure that risk reducing measures and safety actions for the methyl/ethyl fuel installation do not lead to an unacceptable loss of power.

3.2.4 Hazardous areas shall be restricted, as far as practicable, to minimize the potential risks that might affect the safety of the ship, persons on board and equipment.

3.2.5 Equipment installed in hazardous areas shall be minimized to that required for operational purposes and shall be suitably and appropriately certified.

3.2.6 Unintended accumulation of explosive, flammable or toxic vapour concentrations shall be prevented.

3.2.7 System components shall be protected against external damages.

3.2.8 Sources of ignition in hazardous areas shall be eliminated to reduce the probability of explosions.

3.2.9 It shall be arranged for safe and suitable, fuel supply, storage and bunkering arrangements capable of receiving and containing the fuel in the required state without leakage. Other than when necessary for safety reasons, the system shall be designed to prevent venting under all normal operating conditions including idle periods.

3.2.10 Piping systems, containment and over-pressure relief arrangements that are of suitable design, construction and installation for their intended application shall be provided.

3.2.11 Machinery, systems and components shall be designed, constructed, installed, operated, maintained and protected to ensure safe and reliable operation.

3.2.12 Fuel containment system and machinery spaces containing source that might release liquid or vapour into the space shall be arranged and located such that a fire or explosion in either will not lead to an unacceptable loss of power or render equipment in other compartments inoperable.

3.2.13 Suitable control, alarm, monitoring and shutdown systems shall be provided to ensure safe and reliable operation.

3.2.14 Fixed fuel vapour detection suitable for all spaces and areas concerned shall be arranged.
(**Note:** Proper detection method needs to be further discussed)

3.2.15 Fire detection, protection and extinction measures appropriate to the hazards concerned shall be provided.

3.2.16 Commissioning, trials and maintenance of fuel systems and methyl/ethyl alcohol utilization machinery shall satisfy the goal in terms of safety, availability and reliability.

3.2.17 The technical documentation shall permit an assessment of the compliance of the system and its components with the applicable rules, guidelines, design standards used and the principles related to safety, availability, maintainability and reliability.

3.2.18 A single failure in a technical system of component shall not lead to an unsafe or unreliable situation.

4 GENERAL REQUIREMENTS

4.1 Goal

The goal of this chapter is to ensure that the necessary assessments of the risks involved are carried out in order to eliminate or mitigate any adverse effect to the persons on board, the environment or the ship.

4.2 Risk assessment

4.2.1 A risk assessment shall be conducted to ensure that risks arising from the use of methyl/ethyl alcohol fuels affecting persons on board, the environment, the structural strength or the integrity of the ship are addressed. Consideration shall be given to the hazards associated with physical layout, operation and maintenance, following any reasonably foreseeable failure.

4.2.2 The risks shall be analysed using acceptable and recognized risk analysis techniques, and loss of function, component damage, fire, explosion and electric shock shall as a minimum be considered. The analysis shall ensure that risks are eliminated wherever possible. Risks which cannot be eliminated shall be mitigated as necessary. Details of risks, and the means by which they are mitigated, shall be documented to the satisfaction of the Administration.

[4.3 Limitation of explosion consequences

An explosion in any space containing any potential sources of release[4] and potential ignition sources shall not:

.1 cause damage to or disrupt the proper functioning of equipment/systems located in any space other than that in which the incident occurs;

.2 damage the ship in such a way that flooding of water below the main deck or any progressive flooding occur;

.3 damage work areas or accommodation in such a way that persons who stay in such areas under normal operating conditions are injured;

.4 disrupt the proper functioning of control stations and switchboard rooms necessary for power distribution;

.5 damage life-saving equipment or associated launching arrangements;

.6 disrupt the proper functioning of firefighting equipment located outside the explosion-damaged space;

.7 affect other areas of the vessel in such a way that chain reactions involving, inter alia, cargo, gas and bunker oil may arise; and

.8 prevent persons access to life-saving appliances or impede escape routes.]

(**Note:** Further discussion is needed regarding the need for this requirement)

5 SHIP DESIGN AND ARRANGEMENT

~~This chapter replaces chapter 5 of part A-1.~~

5.1 Goal

5.1.1 The goal of this chapter is to provide for safe location, space arrangements and mechanical protection of power generation equipment, fuel storage system, fuel supply equipment and refuelling systems.

[4] Double wall fuel pipes are not considered as potential sources of release.

5.2 Functional requirements

5.2.1 This chapter is related to functional requirements 3.2.1, 3.2.2, 3.2.3, 3.2.5, 3.2.6, 3.2.~~8~~7, 3.2.12, ~~3.2.13, 3.2.14~~, 3.2.15 and 3.2.17 of ~~this Code~~ these interim guidelines. In particular the following apply:
(**Note:** Any additional functional requirement needs to be further discussed)

.1 ~~The fuel tank shall be sufficiently protected against the effect of external damage caused by collision, grounding, fire or other possible operational damage causes~~. The fuel tank(s) shall be located in such a way that the probability for the tank(s) to be damaged following a collision or grounding is reduced to a minimum taking into account the safe operation of the ship and other hazards that may be relevant to the ship.

.2 ~~[Fuel containment systems], fuel piping and other fuel release sources shall be so located and arranged that released [gas] [fuel] is lead to a safe locations in the open air.~~

Alt 1. Fuel containment systems, fuel piping and other fuel release sources shall be so located and arranged that released fuel, either as vapour or liquid is led to safe locations.

[Alt 2. Arrangements are to be made to contain possible leakages from fuel and vapour piping and lead them to a safe location.]

.3 ~~The access or other openings to spaces containing fuel release sources shall be so arranged that flammable, asphyxiating or toxic [gas] [fuel] cannot escape to spaces that are not designed for the presence of such gases.~~

The access or other openings to spaces containing fuel release sources shall be so arranged that fuel cannot enter spaces that are not designed for the presence of such fuel [vapours].

.4 Fuel piping shall be protected against mechanical damage.

.5 ~~The propulsion and fuel supply system shall be so designed that the remaining power for propulsion and power generation after any [gas] leakage [with following] [requiring] safety actions shall be sufficient for maintaining maneuverability and for providing power for essential services.~~ The propulsion and fuel supply system shall be so designed that safety actions after any fuel leakage, either as liquid or vapour, do not lead to an unacceptable loss of power.

.6 The probability of ~~[a gas]~~ an explosion in a machinery space as a result of a fuel release ~~with [gas or]~~ ~~low-flashpoint fuelled machinery~~ shall be minimized.

5.3 General requirements

5.3.1 ~~Methyl/ethyl alcohol f~~Fuel tanks shall not be located within the accommodation area or engine-room area.

5.3.2 ~~Integral methyl/ethyl alcohol fuel tanks shall be bounded by bottom shell plating, methyl/ethyl alcohol [fuel pump-room(s) or] cofferdams. Minimum horizontal distance between tank and ship side shall not be less than 760 mm.~~
~~(**Note**: More detailed requirements will be required where independent tanks are proposed.)~~
Where integral tanks are not bound by bottom shell plating or fuel pump-room, the fuel tanks to be surrounded by protective cofferdams.

~~[5.3.2.bis The protective cofferdam surrounding the methyl/ethyl alcohol tanks shall be arranged with continuous leakage detection. Arrangements shall be provided to prevent the formation of an explosive atmosphere in the cofferdam in the event of leakage from the tank.]~~
(**Note**: ~~Proposed m~~Moved to 15.8)

5.3.3 ~~Tank spaces forward of the collision bulkhead (forepeak) or/and aft of the aftermost bulkhead (aft peak) shall not be arranged as methyl/ethyl alcohol fuel tanks or as cofferdams.]~~
~~(**Note**: Further discussion needed.)~~
Tank spaces forward of the collision bulkhead (forepeak) or/and of the aftermost bulkhead (aft peak) shall not be arranged as methyl/ethyl alcohol fuel tanks [or their associated cofferdams].

5.3.4 ~~The tank and [surrounding] cofferdam should be provided with fixed sampling points [to facilitate measurement of the gas concentration.]~~
(**Note**: ~~Proposed m~~Moved to 15.8)

5.3.11 ~~Methyl/ethyl alcohol~~ Fuel tanks located on open deck shall be protected against mechanical damage.

5.3.12 ~~Methyl/ethyl alcohol tanks on open deck shall be surrounded by coamings and shall be provided with means for safe disposal overboard of accidental spills.]~~
~~(**Note**: With reference to MARPOL it is questioned if this is allowed. The spills should be collected)~~ Fuel tanks on open deck shall be surrounded by coamings [of ample size] and spills collected in a dedicated holding tank.

5.3.13 ~~One or more holding tanks for collecting drainage and any possible leakage of methyl/ethyl alcohol from fuel pumps, valves or from double walled inner pipes, located in enclosed spaces shall be provided. The bilge system serving the fuel pump-room shall be operable from outside the fuel pump-room.~~
(**Note**: Moved to 5.9 with the addition that "*such holding tank containing methyl/ethyl alcohol leakage shall be arranged in accordance with 5.3.1 and 5.3.2"*)

A shore connection with a standard coupling or other facilities shall be provided for transferring contaminated liquids to onshore reception facilities. The coupling should be drop free.
~~(**Note:** Proposed to move to 5.9)~~
(**Note:** A standard flange needs to be defined in the guidelines)

5.3.14 Two fuel service tanks for each type of fuel used on board necessary for propulsion and vital systems or equivalent arrangements shall be provided. Each tank shall have a capacity sufficient for continuous rating of the propulsion plant and normal operating load at sea of the generator plant for a period of minimum 8 hours. Other arrangements with the same level of redundancy may be accepted by the Administration.
(**Note**: ~~Proposed to move~~ Moved to 9.3 Redundancy of Fuel supply however further discussion is needed)

5.3.15 [The number of sampling points, drain cocks and air vent cocks shall be minimized as applicable as possible and installed in the restricted area in order to prevent non-qualified crews accessing the toxic fuel accidentally or malignantly.]

5.4 Portable tanks

5.4.1 ~~Portable methyl/ethyl alcohol tanks will be specially considered by the Administration. Such portable tanks shall have the same level of safety as permanent tanks.~~
Portable fuel tanks may be accepted on open decks, subject to special consideration by the Administration. Such portable tanks shall have the same level of safety as permanent tanks.

~~5.4.2 The arrangement for portable methyl/ethyl alcohol tanks shall comply with the following requirements including:~~

~~.1 connection to the ship fuel system, including shut down system for tank valves and a fixed safety relief outlet;~~

~~.2 tank monitoring systems interface with the ship system; and~~

~~.3 liquid and vapour detection system.~~

~~5.4.3 Portable methyl/ethyl alcohol tanks shall be located in dedicated areas equipped with:~~

~~.1 spill protection;~~

~~.2 arrangement for supporting/fixing the tanks;~~

~~.3 water spray system for cooling if located on open deck: and~~

~~.4 fire protection with alcohol resistant foam.]~~

~~(**Note**: There is a general support for replacing 5.4.2 and 5.4.3 with the same requirements as for LNG portable tanks)~~

5.4.2 The design of the tank shall be an independent tank. The tank support (container frame or truck chassis) shall be designed for the intended purpose.

5.4.3 Portable fuel tanks shall be located in dedicated areas fitted with:

.1 mechanical protection of the tanks depending on location and cargo operations;

.2 if located on open deck: spill protection and water spray systems for cooling; and

.3 if located in an enclosed space: the space is to be ventilated and equipped with a fixed firefighting system and fire detection system.

5.4.4 Portable fuel tanks shall be secured to the deck while connected to the ship systems. The arrangement for supporting and fixing the tanks shall be designed for the maximum expected static and dynamic inclinations, as well as the maximum expected values of acceleration, taking into account the ship characteristics and the position of the tanks.

5.4.5 Consideration shall be given to the ship's strength and the effect of the portable fuel tanks on the ship's stability.

5.4.6 Connections to the ship's fuel piping systems shall be made by means of approved flexible hoses or other suitable means designed to provide sufficient flexibility.

5.4.7 Arrangements shall be provided to limit the quantity of fuel spilled in case of inadvertent disconnection or rupture of the non-permanent connections.

5.4.8 The pressure relief system of portable tanks shall be connected to a fixed venting system.

5.4.9 Control and monitoring systems for portable fuel tanks shall be integrated in the ship's control and monitoring system. Safety system for portable fuel tanks shall be integrated in the ship's safety system (e.g. shut-down systems for tank valves, leak/vapour detection systems).

5.4.10 Safe access to tank connections for the purpose of inspection and maintenance shall be ensured.

5.4.11 After connection to the ship's fuel piping system,

.1 each portable tank shall be capable of being isolated at any time;

.2 isolation of one tank shall not impair the availability of the remaining portable tanks; and

.3 the tank shall not exceed its filling limits.

5.5 Machinery space concepts

5.5.1 In order to minimize the probability of an explosion in a machinery space with low flashpoint liquid fuelled machinery, the arrangements shall be such that a single failure cannot lead to release of low flashpoint liquid fuel into the machinery space.
(**Note**: This is a revised text as it is agreed that the ESD Concept is not suitable for ethyl/methyl alcohol)

5.6 Requirements for gas safe machinery space

5.6.1 A single failure within the fuel system shall not lead to a release of ethyl or methyl alcohol fuel into the machinery space.

5.6.2 All fuel piping within machinery space boundaries shall be enclosed in [a gas- and water tight enclosure in accordance with 9.6] liquid tight enclosure in accordance with 9.6.

5.7 Requirements for location and protection of fuel piping

5.7.1 Fuel pipes shall not be located less than 760 800 mm from the ship's side.

5.7.2 Fuel piping, whether single or double walled, shall not be led directly through accommodation spaces, service spaces, electrical equipment rooms or control stations unless the piping is double walled and led through a dedicated duct.
The routeing of the piping shall take into account potential hazards due to mechanical damage.
(**Note**: Should be the same as agreed for part A-1)
Fuel piping shall not be led directly through accommodation spaces, service spaces, electrical equipment rooms or control stations as defined in the SOLAS Convention.

5.7.3 Fuel pipes led through ro-ro spaces, special category spaces and on open decks shall be protected against mechanical damage.
(**Note:** Requirement for double walled pipes needs further discussion)

5.7.4 [Fuel piping on open decks outside the cargo area shall comply with followings:

.1 The fuel pipes shall be clearly identified and fitted with a shut-off valve at its connection to the fuel piping system within the cargo area;

.2 The piping is to be full penetration butt welded, and fully radio-graphed. Flange connections in the piping are to only be permitted within the cargo area;

.3 The piping is to be self-draining to the cargo area and preferably into a fuel tank. Alternative arrangements for draining the piping may be accepted by the Administration;

.4 Arrangements are to be made to allow such piping to be purged after use and maintained gas-safe when not in use;

.5 During the use of the fuel piping, all doors, ports and other openings on the corresponding superstructure or deckhouse side are to be capable of being kept closed;

.6 Escape routes are not to terminate within the coamings required by the below (7) or within a distance of 3 m beyond the coamings;

.7 Continuous coamings of suitable height are to be fitted to keep any spills on deck and away from the accommodation and service areas.]

(**Note:** Needs further discussion)

5.7.5 [Fuel piping shall be separated from cargo piping in general. Where fuel transfer piping have a connection with the cargo piping, the connection shall be fitted with a stop valve and it is also to be capable of being separated by means of a removable spool piece and blank flanges when fuel piping is not in use]
(**Note:** Needs further discussion)

5.8 Requirements for ~~machinery space design~~ fuel preparation room design

5.8.1 ~~Fuel preparation rooms or Compressor rooms if arranged, shall be located on an open deck, unless those rooms are arranged and fitted in accordance with the requirements of this Code for tank connection spaces.~~
~~(**Note**: Deletion proposed.)~~
[High pressure pump-rooms and fuel preparation rooms, if such exist, shall have access from open deck and be located outside the engine-room.]
(**Note:** Needs further discussion)

5.9 Requirements for bilge systems

5.9.1 ~~Bilge systems installed in areas where methyl/ethyl alcohol can be present shall be segregated from other bilge systems.~~ Bilge systems installed in areas where fuel [is or can be] within tanks and other equipment shall be segregated from other bilge systems.

[Alt: Bilge systems installed in hazardous areas shall be segregated from other bilge systems.]
(**Note:** Needs further discussion)

~~[~~5.9.2 The bilge system serving the fuel ~~pump-room~~ preparation room shall be operable from outside the fuel ~~pump~~ preparation-room.~~]~~

5.10 Requirements for drip trays

5.10.1 Drip trays shall be fitted where leakage and spill may occur., in particular in way of single wall pipe connections.

5.10.2 Each drip tray shall have sufficient capacity to accommodate the maximum amount spill according to the safety analysis risk assessment.

[5.10.3 Each drip tray shall be fitted with a drain valve to enable drainage to a dedicated bilge holding tank.]
(**Note**: Deletion proposed)

Alt: [Drip trays shall be fitted with drain valves piping to enable drainage to a dedicated bilge holding tank with a means of preventing the backflow from the tank.]
(**Note**: Needs further discussion)

5.11 Requirements for arrangement of entrances and other openings

5.11.1 Direct access shall not be permitted from a non-hazardous space area to a hazardous space area. Where such openings are necessary for operational reasons, an air lock which complies with the requirements of chapter 5.12 shall be provided.

5.11.2 The pump fuel preparation-room shall have an independent access direct from open deck where practicable. Where a separate access from open deck is not practicable, an air-lock complying with 5.12 shall be provided.

5.11.3 Methyl/ethyl alcohol Ffuel tanks and surrounding cofferdams shall have suitable access from open deck for cleaning, maintenance, inspection and gas-freeing, except as given in 5.11.4 and 5.3.9 5.11.5. Procedures for gas-freeing shall be approved by Administration.
(**Note**: moved from 5.3.7)

5.11.4 For methyl/ethyl alcohol fuel tanks without direct access from open deck, the arrangement shall be such that before opening any tank or surrounding cofferdam access located in enclosed spaces, the tanks and cofferdams shall be completely free from flammable/toxic gas vapour or other gases that represent a hazard to the crew.
(**Note**: moved from 5.3.8)

5.11.5 For methyl/ethyl alcohol fuel tanks or surrounding cofferdams without direct access from open deck, the entry space shall comply with the following:

- The entry space shall be [well ventilated];
- The entry space shall have sufficient open area around the methyl/ethyl alcohol fuel tank hatch for efficient evacuation and rescue operation;
- Entry from accommodation spaces, service spaces, control stations and machinery spaces of category A will not be accepted is not permitted; and
- Entry from cargo spaces may be accepted depending upon the type of cargo if the area is cleared of cargo and no cargo operation are undertaken during tank entry.
- [an air lock which complies with the requirements of chapter 5.12 is provided.]

(**Note**: moved from 5.3.9 Well ventilated needs to be defined in "air changes", also need to specify the spaces from which entry is permitted)

5.11.6 The area around ~~methyl/ethyl alcohol~~ [independent] ~~[integral]~~ fuel tanks shall be sufficient to carry out maintenance, inspections, evacuation and rescue operations.
~~(**Note**: moved from 5.3.9)~~

5.11.7 For safe access, horizontal hatches or openings to or within fuel tanks or surrounding cofferdams are to have a minimum clear opening of 600 X 600 mm that also facilitates the hoisting of an injured person from the bottom of the tank/cofferdam. For access through vertical openings providing main passage through the length and breadth within fuel tanks and cofferdams, the minimum clear opening shall not be less than 600 X 800 mm at a height of not more than 600 mm from bottom plating unless gratings or footholds are provided. Smaller openings may be accepted provided evacuation of an injured person from the bottom of the tank/cofferdam can be demonstrated.
~~(**Note**: moved from 5.3.10)~~

Alt: [For access defined in 5.11.3 through horizontal openings, hatches or manholes, the dimensions shall be sufficient to allow a person wearing a self-contained air-breathing apparatus and protective equipment to ascend or descend any ladder without obstruction and also to provide a clear opening to facilitate the hoisting of an injured person from the bottom of the space. The minimum clear opening shall be not less than 600 mm by 600 mm.

5.11.7*bis*1 For access defined in 5.11.3 through vertical openings, or manholes providing passage through the length and breadth of space, the minimum clear opening shall be not less than 600 mm by 800 mm at a height of not more than 600 mm from the bottom shell or deck plating, unless gratings or other footholds are provided.

5.11.7*bis*2 Smaller dimensions may be approved, if at least one main access defined in 5.11.3 has dimensions not less than required in 5.11.7 or 5.11.7*bis*1. The main access should clearly be identified in an access plan.]

5.12 Requirements for air locks

5.12.1 An air lock is a space enclosed by gastight ~~[steel]~~ bulkheads with two ~~substantially~~ gastight doors spaced at least 1.5 m and not more than 2.5 m apart. Unless subject to the requirements of the International Convention on Load Line, the door sill shall not be less than 300 mm in height. The doors shall be self-closing without any holding back arrangements.

5.12.2 Air locks shall be mechanically ventilated at an overpressure relative to the adjacent hazardous area or space.

~~5.12.3 The air lock shall be designed in a way that no gas can be released to safe spaces in case of the most critical event in the gas dangerous space separated by the air lock. The events shall be evaluated in the risk analysis according to 4.2.1.~~

5.12.4 Air locks shall have a simple geometrical form. They shall provide free and easy passage, and shall have a deck area not less than 1.5 m^2. Air locks shall not be used for other purposes, for instance as store rooms.

5.12.5 An audible and visual alarm system to give a warning on both sides of the air lock shall be provided to indicate if more than one door is moved from the closed position.

5.12.6 For non-hazardous spaces with access from hazardous open deck where the access is protected by an airlock, electrical equipment which is not of the certified safe type shall be de-energized upon loss of overpressure in the space.

5.12.7 For non-hazardous spaces with access from hazardous spaces below deck where the access is protected by an airlock, upon loss of under pressure in the hazardous space access to the space is to be restricted until the ventilation has been reinstated. Audible and visual alarms shall be given at a manned location to indicate both loss of pressure and opening of the airlock doors when pressure is lost.
(**Note:** Further consideration required on access to these places at rescue operations)

5.12.8 Essential equipment required for safety shall not be de-energized and shall be of a certified safe type. This may include lighting, fire detection, public address, general alarms systems.

5.12.9 Electrical equipment which is not of the certified safe type for propulsion, power generation, manoeuvring, anchoring and mooring equipment as well as the emergency fire pumps shall not be located in spaces to be protected by air-locks.

6 FUEL CONTAINMENT SYSTEM

6.1 Goal

6.1.1 The goal of this chapter is to provide that fuel storage is adequate so as to minimize the risk to personnel, the ship and the environment to a level that is equivalent to a conventional oil fuelled ship.
(**Note:** applicability needs to be further discussed)

6.2 Functional requirements

~~(**Note**: It is proposed to keep all the FR from part A-1 section 6.2)~~
This chapter refers to functional requirements in 3.2.1, 3.2.2, 3.2.5 and 3.2.8 to 3.2.17.

6.2.1 The methyl/ethyl alcohol fuel tanks shall be so designed that a leakage from the fuel tank or its connections does not endanger the ship, persons on board or the environment. Potential dangers to be avoided include:

- ~~Flammable fuels spreading to ignition sources~~
- ~~Toxicity potential and risk for oxygen deficiency due to fuels and inert gases~~
- ~~[Reduction in] [Restriction of] access to muster stations, escape routes and/or LSA~~
- ~~Reduction in availability of LSA~~

.1 Flammable fuels spreading to locations with ignition sources;

.2 Toxicity potential and risk for oxygen deficiency due to fuels and inert gases;

.3 Restriction of access to muster stations, escape routes and/or LSA;

.4 Reduction in availability of LSA;

.5 The fuel containment arrangement shall be so designed that safety actions after any leakage, irrespective if in liquid of [gas phase], do not lead to an unacceptable loss of power; and

.6 If portable tanks are used for fuel storage, the design of the fuel containment system shall be equivalent to permanent installed tanks as described in this chapter.

6.3 Requirements for fuel tanks venting and gas freeing system

6.3.1 Fuel tank venting system

[6.3.1.1 The methyl/ethyl alcohol fuel storage tanks shall have arrangement for pressure vacuum relief or equivalent during voyage, bunkering and fuel transfer with closed tank hatch covers.]
(**Note:** Moved from 6.3.1.1)

6.3.2 A piping system shall be arranged to enable each fuel storage tank to be safely gas-freed, and to be safely filled with methyl/ethyl alcohol from a gas-free condition. The system shall be arranged to minimize the possibility of pockets of gas or air remaining after changing the atmosphere.
(**Note:** Moved from 6.3.2.1)

6.3.3 The methyl/ethyl alcohol tanks shall be designed and an internal structure such, that the possibilities for gas pockets after ventilation/gas-freeing are minimized. The ventilation pipes shall be positioned accordingly.
(**Note:** Moved from 6.3.5.3.2)

6.3.4 The methyl/ethyl alcohol fuel tank shall have minimum two fixed pipes extended to open air for inert gas purging and gas freeing purposes. The pipes to be self-drained.
(**Note:** Moved from 6.3.2.5. Further discussion is needed on the background of the requirement and other possible solutions)

6.3.1.2 6.3.5 Pressure vacuum relief valves shall be fitted to each fuel tank to limit the pressure or vacuum in the fuel tank. The venting system may consist of individual vents from each fuel tank or the vents from each individual fuel tank may be connected to a common header. High velocity vent valve shall be fitted. The valve shall have an exit velocity of at least 30 m/s.
(**Note:** Moved from 6.3.1.2)

[6.3.1.3 6.3.6 Shut off valves shall not be arranged neither above upstream nor below downstream the pressure/vacuum relieve valves. By-pass valves may be provided.]
(**Note:** Moved from 6.3.1.3)

6.3.1.4 6.3.7 The methyl/ethyl alcohol fuel tank venting system shall be designed with redundancy for the relief of full flow overpressure and/or vacuum. [Pressure sensors fitted in each fuel tank, and connected to an alarm system, may be accepted in lieu of the redundancy requirement for pressure relief.] The opening pressure of the vacuum relief valves shall not to be lower than 0.07 bar below atmospheric pressure.
(**Note:** Moved from 6.3.1.4)

[6.3.1.5 6.3.8 P/V valves shall be located on open deck and shall be of a type which allows the functioning of the valve to be easily checked.] (8.5.16)
(**Note:** Moved from 6.3.1.5)

[6.3.1.6. 6.3.9 Vapour outlets and Iintake openings of vacuum relief valves shall be located at least [1.5 m] [2.0 m] above open tank deck, and shall be protected against the sea.] (8.5.17) Due attention shall be paid to blockage from icing in cold weather operation.
(**Note:** Moved from 6.3.1.6, text in square brackets needs to be further discussed)

6.3.10 The methyl/ethyl alcohol fuel tank vent system shall be sized to permit bunkering at a design rate without over pressuring the fuel tank.
(**Note:** Moved from 6.3.3.7)

6.3.11 The methyl/ethyl alcohol fuel tank vent system shall be connected to the highest point of each tank and vent lines shall be self-drained under all normal operating conditions.
(**Note:** Moved from 6.3.3.8)

6.4 Inerting and atmospheric control within the fuel storage system

Inerting of the vapour space of the fuel tank under normal operation shall be provided.
(**Note:** Moved from 6.3.1.7, further discussion on the requirement is asked for)

6.4.1 Methyl/ethyl fuel tanks and surrounding cofferdams shall be arranged for inert gas purging to ensure a flammable atmosphere is not present.
(**Note:** Moved from 6.3.2.4)

6.4.2 The system shall be designed to eliminate the possibility of a flammable mixture atmosphere existing in the fuel tank during any part of the atmosphere change operation, vapour freeing or inerting by utilizing an inerting medium.
(**Note:** Moved from 6.3.2.2)

6.4.3 Arrangements to prevent back-flow of fuel vapour into the inert gas system shall be provided as specified in 6.4.4 and 6.4.5.
(**Note:** Moved from 6.3.3.1)

6.4.4 To prevent the return of flammable liquid and vapour to any gas safe spaces, the inert gas supply line shall be fitted with two shutoff valves in series with a venting valve in between (double block and bleed valves). In addition a closable non-return valve shall be installed between the double block and bleed arrangement and the fuel system. These valves shall be located outside non-hazardous spaces.
(**Note:** Moved from 6.3.3.2)

6.4.5 Where the connections to the inert gas piping systems are non-permanent, two non-return valves may substitute the valves required in 6.4.4
(**Note:** Moved from 6.3.3.3)

6.4.6 The arrangements shall be such that each space being inerted can be isolated.
(**Note:** Moved from 6.3.3.4)

6.4.7 Methyl/ethyl alcohol fuel tank vent outlets shall be situated normally not less than 3 m above the deck or gangway if located within 4 m from such gangways. The vent outlets are also to be arranged at a distance of at least 10 m from the nearest air intake or opening to accommodation and service spaces and ignition sources. The vapour discharge shall be directed upwards in the form of unimpeded jets.
(**Note:** Moved from 6.3.3.5)

6.4.8 Vapour outlets from methyl/ethyl alcohol tanks shall be provided with devices tested and [**type**] approved to prevent the passage of flame into the tank.[5] Due attention shall be paid in the design and position of the P/V valves with respect to blocking and due to ice during adverse weather conditions. Provision for inspection and cleaning shall be arranged.
(**Note:** Moved from 6.3.3.6)

[5] Ref [IMO MSC/Circ.677 as amended by MSC/Circ.1009] [MSC.1/Circ.1324 which amends MSC/Circ.677 and MSC/Circ.1009]

6.4.9 The arrangements for gas-freeing and ventilation of methyl/ethyl alcohol fuel storage tanks shall be such as to minimize the hazards due to the dispersal of flammable vapours to the atmosphere and to flammable gas mixture in the tanks. The ventilation system for methyl/ethyl alcohol fuel tanks shall be exclusively for ventilating and gas freeing purposes. Connection between fuel tank and pump-room ventilation will not be accepted.
(**Note:** Moved from 6.3.3.9, questioned if the text should be located earlier in this section)

6.4.10 Gas freeing operations shall be carried out such that vapour is initially discharged in one of the following ways:

.1 through outlets at least 2 m above the deck level with a vertical efflux velocity of at least 30 m/s maintained during the gas freeing operation; or

.2 through outlets at lest [2m] [3m] above the deck level with a vertical efflux velocity of at least 20 m/s which are protected by suitable devices to prevent the passage of flame.

When the flammable vapour concentration at the outlets has been reduced to 30% of the lower flammable limit, gas freeing may thereafter be continued at deck level.
(**Note:** Moved from 6.3.3.10, further discussion is needed on bullet point .2)

~~[6.3.1.7 Inerting of the vapour space of the tank under normal operation shall be provided.]~~
(**Note**: Moved to new 6.4 "Inerting and atmospheric control within the fuel storage system")

~~**6.3.2 Atmospheric control within the fuel storage system**~~
~~(**Note**: It is proposed to combine 6.3.2 and 6.3.3 by moving text in 6.3.2 to 6.3.3.)~~

~~6.3.2.1 A piping system shall be arranged to enable each fuel storage tank to be safely gas-freed, and to be safely filled with fuel gas from a gas-free condition. The system shall be arranged to minimize the possibility of pockets of gas or air remaining after changing the atmosphere~~

~~6.3.2. 2 The system shall be designed to eliminate the possibility of a flammable mixture existing in the fuel tank during any part of the atmosphere change operation by utilizing an inerting medium as an intermediate step.~~

~~6.3.2.3 Inert gas utilized for gas freeing of tanks may be provided externally to the ship.~~
~~(**Note**: Proposed to move to 6.3.3.)~~

~~[6.3.2.4 Methyl/ethyl fuel tanks and surrounding cofferdams shall be arranged for inert gas purging well below LEL as well as gas freeing. The tanks shall be kept inert well below LEL at all times.]~~
~~(**Note**: It is commented that the purpose of inerting is not to dilute below the LEL but to remove oxygen and ensure a flammable atmosphere is not present. A suitable value of oxygen percentage to prevent a flammable atmosphere is required. Needs further consideration.)~~

~~6.3.2.5 The methyl/ethyl alcohol fuel tank shall have minimum two fixed pipes extended to open air for gas freeing purposes.~~

~~6.3.5.3.2 The methyl/ethyl alcohol tanks shall be designed with a geometry, internal structure and a position of the ventilation pipes to ensure sufficient gas freeing.~~

6.3.3 Inerting and gas freeing

(**Note**: It is commented that Requirement on atmospheric control of tanks needs to be defined before filling, during fuel consumption and for gas freeing. It can be based on FSS code (non-return device).

6.3.3.1 Arrangements to prevent back-flow of fuel vapour into the inert gas system shall be provided as specified below.

6.3.3.2 To prevent the return of flammable gas to any gas safe spaces, the inert gas supply line shall be fitted with two shutoff valves in series with a venting valve in between (double block and bleed valves). In addition a closable non-return valve shall be installed between the double block and bleed arrangement and the gas fuel system. These valves shall be located outside non-hazardous spaces.

6.3.3.3 Where the connections to the gas piping systems are non-permanent, two non-return valves may substitute the valves required in 6.3.3.2.

6.3.3.4 The arrangements shall be such that each space being inerted can be isolated [and the necessary controls and relief valves, etc., shall be provided for controlling pressure in these spaces].

6.3.3.5 Methyl/ethyl alcohol tank vent outlets shall be situated not less than 3 m above the deck or gangway if located within 4 m from such gangways. The vent outlets are also to be arranged at a distance of at least 10 m from the nearest air intake or opening to accommodation and service spaces and ignition sources. The vapour discharge shall be directed upwards in the form of unimpeded jets.
(**Note**: It is proposed to move 6.3.3.6 to 6.3.3.9 to 6.3.1)

[6.3.3.6 Vapour outlets from methyl/ethyl alcohol tanks shall be provided with devices tested and approved to prevent the passage of flame into the tank[6]. Due attention shall be paid in the design and position of the P/V valves with respect to blocking and due to ice during adverse weather conditions. Provision for inspection and cleaning shall be arranged.]

[6.3.3.7 The methyl/ethyl alcohol tank vent system shall be sized to permit bunkering at a design rate without over pressuring the tank.]

[6.3.3.8 The methyl/ethyl alcohol tank vent system shall be connected to the highest point of each tank and vent lines shall be self-drained under all normal operating conditions.]

6.3.3.9 The arrangement for gas-freeing and ventilation of methyl/ethyl alcohol tanks shall be such as to minimize the hazards due to the dispersal of flammable vapours to the atmosphere and to flammable gas mixture in the tanks. The ventilation system for methyl/ethyl alcohol tanks shall be exclusively for ventilating and gas freeing purposes. Connection between tank and pump-room ventilation will not be accepted.

6.3.3.10 Gas freeing operations shall be carried out such that vapour is initially discharged in one of the following ways:

.1 through outlets at least 2 m above the deck level with a vertical efflux velocity of at least 30 m/s maintained during the gas freeing operation; or

[6] Ref [IMO MSC/Circ.677 as amended by MSC/Circ.1009] [MSC.1/Circ.1324 which amends MSC.1/Circ.677 and MSC.1/Circ.1009].

.2 through outlets at least 2 m above the deck level with a vertical efflux velocity of at least 20 m/s which are protected by suitable devices to prevent the passage of flame.

When the flammable vapour concentration at the outlets has been reduced to 30% of the lower flammable limit, gas freeing may thereafter be continued at deck level.

6.3.4 6.5 Inert gas production on board
(**Note:** Possible reference on inert gas requirements in SOLAS was mentioned)

6.3.4.1 6.5.1 The equipment shall be capable of producing dry inert gas with oxygen content at no time greater than 5% by volume. A continuous-reading oxygen content meter shall be fitted to the inert gas supply from the equipment and shall be fitted with an alarm set at a maximum of 5% oxygen content by volume. The system shall be able to maintain an atmosphere with an oxygen content not exceeding 8% by volume in any part of any fuel tank.

6.3.4.2 6.5.2 An inert gas system shall have pressure controls and monitoring arrangements appropriate to the fuel containment system.

6.3.4.3 6.5.3 Where a nitrogen generator or nitrogen storage facilities are installed in a separate compartment outside of the engine-room, the separate compartment shall be fitted with an independent mechanical extraction ventilation system, providing a minimum of 6 air changes per hour. [If the oxygen content is below 19.5% in the separate compartment an alarm should be given.] A low oxygen alarm shall be fitted.
(**Note**: Consider liquid nitrogen implications)

6.3.4.4 6.5.4 Nitrogen pipes shall only be led through well ventilated spaces. Nitrogen pipes in enclosed spaces shall:

- be fully welded;
- have only a minimum of flange connections as needed for fitting of valves; and
- be as short as possible.

(**Note:** Question raised on the two inconsistent requirements "fully welded" and "have only a minimum of flange connections")

6.3.4.5 6.5.5 Inert gas utilized for gas freeing of tanks may be provided externally to the ship.

7 MATERIAL AND GENERAL PIPE DESIGN

7.1 Goal

7.1.1 The goal of this chapter is to ensure the safe handling of low flashpoint liquid fuel methyl/ethyl alcohol, under all operating conditions, to minimize the risk to the ship, personnel and to the environment, having regard to the nature of the products involved.

7.2 Functional requirements

[7.2.1 This chapter relates to functional requirements 3.2.1, 3.2.5, 3.2.6, 3.2.8, 3.2.9 and 3.2.10, of this Code these interim guidelines. In particular the following apply:

[.1 All materials used shall be suitable for the methyl/ethyl alcohol under the maximum working pressure and temperature.

~~.2~~ ~~Provision shall be made to protect the piping, piping system and components and fuel tanks from excessive stresses due to thermal movement and from movements of the tank and hull structure.]~~

~~(**Note**: It is suggested that 7.2.1.2 apply and there is a new proposal, see .1above)~~

7.3 Requirements for general pipe design

~~(**Note**: There is a general remark that the various parts in this section need to be compared with the requirements already established in the IBC Code and aligned were applicable.)~~

7.3.1 The design pressure shall not be less than 10 Bar, except for open ended pipes where it shall not be less than 5 Bar.

7.3.2 The wall thickness of pipes shall not be less than:

t = (t0 + b + c) / (1 – a/100) mm

t0 = theoretical thickness

t0 = PD / (2Ke + P) mm

P = design pressure as in 7.3.1
D = outside pipe diameter
K = allowable stress N/mm2. See 7.3.3

e = Efficiency factor equal to 1.0 for seamless pipes and for longitudinally or spirally welded pipes, delivered by approved manufacturers of welded pipes, which are considered equivalent to seamless pipes when non-destructive testing on welds is carried out in accordance with recognized standards. In other cases, an efficiency factor less than 1.0, in accordance with recognized standards, may be required depending upon the manufacturing process.

b = allowance for bending (mm). The value for b shall be chosen so that the calculated stress in the bend, due to internal pressure only, does not exceed the allowable stress. Where such justification is not given, b shall not be less than:

b = Dt0 / 2.5r where: r = mean radius of the bend (mm).

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

a = negative manufacturing tolerance for thickness (%).

7.3.3 For pipes the allowable stress K to be considered in the formula for t0 in 7.3.2 is the lower of the following values

Rm / A or Re / B

Where:

Rm = specified minimum tensile strength at ambient temperature (N/mm2).

Re = specified minimum yield stress at ambient temperature (N/mm2). If stress-strain curve does not show a defined yield stress, the 0.2% proof stress applies.

A and B have values of at least A = 2.7 and B = 1.8

7.3.4 Where necessary for mechanical strength to prevent damage, collapse, excessive sag or buckling of pipes due to superimposed loads, the wall thickness shall be increased over that required by 7.3.2 or, if this is impracticable or would cause excessive local stresses, these loads shall be reduced, protected against or eliminated by other design methods. Such superimposed loads may be due to; supports, ship deflections, liquid pressure surge during transfer operations, the weight of suspended valves, reaction to loading arm connections, or otherwise.

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

7.3.6 High pressure fuel piping systems shall have sufficient constructive strength. This shall be confirmed by carrying out stress analysis and taking into account:

.1 stresses due to the weight of the piping system;

.2 acceleration loads when significant; and

.3 internal pressure and loads induced by hog and sag of the ship.

7.3.1 General

7.3.1.1 7.3.7 Fuel pipes and all the other piping needed for a safe and reliable operation and maintenance shall be colour marked in accordance with a standard at least equivalent to those acceptable to the Administration Organization.[7]

7.3.1.2 7.3.8 All fuel piping and [independent fuel] tanks shall be electrically bonded to the ship's hull. Electrical conductivity is to be maintained across all joints and fittings.

7.3.1.3 7.3.9 Piping other than fuel supply piping and cabling may be arranged in the double wall piping or duct provided that they do not create a source of ignition or compromise the integrity of the double pipe or duct. The double wall piping or duct shall only contain piping or cabling necessary for operational purposes.

[7.3.1.4 7.3.10 Bunkering Filling lines to methyl/ethyl alcohol tanks shall be arranged to minimize the possibility for static electricity e. g by reducing the free fall into the fuel tank to a minimum.]
(**Note**: It is commented that this cannot be checked.)

7.3.2 Wall thickness
Ships using methyl/ethyl alcohol as fuel shall meet all the requirements of part A-1, section 7.3.2.

7.3.3 Design condition
[The design pressure P in the formula for t_o in 7.3.2.1 of Part A-1 is the maximum gauge pressure to which the system may be subjected in service, taking into account the highest set pressure on any relief valve on the system.]

7.3.4 Allowable stress
Ships using methyl/ethyl alcohol as fuel shall meet the requirements of part A-1, section 7.3.4 [with the exemption of 7.3.4.5].

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

~~7.3.5~~ 7.3.11 Flexibility of piping

7.3.11.1 The arrangement and installation of ~~gas~~ methyl/ethyl alcohol piping shall provide the necessary flexibility to maintain the integrity of the piping system in the actual service situations, taking potential for fatigue into account. [Especially the high pressure pipes need to be evaluated.] ~~[Due considerations to be taken regarding operational temperature range.]~~
~~(**Note**: Clarification of the last part requested.)~~

~~7.3.6~~ 7.3.12 Piping fabrication and joining details

~~[Ships using methyl/ethyl alcohol as fuel shall meet all the requirements of part A-1, section 7.3.6.]~~

~~**Alternatively:**~~
~~(**Note**: Text of 7.3.6 from section A-1 has been included as amendments are proposed)~~

~~7.3.6.1 Flanges, valves and other fittings shall comply with a standard acceptable to the Administration, taking into account the design pressure defined in 7.3.3.1.~~

7.3.12.1 Piping for methyl/ethyl alcohol shall be joined by welding except

.1 for approved connections to shut off valve and expansion joints, if fitted; and

.2 for other exceptional cases specifically approved by the Administration.

7.3.12.2 The following direct connections of pipe length without flanges may be considered

.1 Butt-welded joints with complete penetrations at the root;

.2 Slip-on welded joints with sleeves and related welding having dimensions in accordance with recognized standards shall only be used in pipes having an external diameter of 50 mm or less. The possibility for corrosion to be considered; and
(**Note:** Further discussion is needed regarding slip-on welded joints, ref. IBC Code 5.2.3.2)

.3 Screwed connections, in accordance with recognized standards, shall only be used for accessory lines and instrumentation lines with an external diameter of 25 mm or less.

7.3.12.3 Welding, post-weld heat treatment and non-destructive testing shall be performed in accordance with recognized standards.

~~7.3.6.2~~ 7.3.12.4 All valves and expansion joints used in high pressure ~~gas~~ methyl/ethyl alcohol systems shall be approved according to a standard acceptable to the Administration.

~~7.3.6.3 The piping system shall be joined by welding with a minimum of flange connections. Gaskets shall be protected against blow-out.~~
~~(Note: Consider relocation)~~

~~7.3.6.4 Piping fabrication and joining details shall comply with the following:~~

~~7.3.6.4.1 Direct connections~~

.1 Butt-welded joints with complete penetration at the root may be used in all applications.

.2 Slip-on welded joints with sleeves and related welding, having dimensions in accordance with recognized standards, shall only be used lines with an external diameter of 50 mm or less.

.3 Screwed couplings complying with recognized standards shall only be used for accessory lines and instrumentation lines with external diameters of 25 mm or less.

7.3.6.4.2 7.3.12.5 Flanged connections

Flanges in flange connections shall be of the welded neck, slip-on or socket welded type. However, socket-welded-type flanges shall not be used in nominal sizes above 50 mm.

7.3.6.4.3 7.3.12.6 Expansion joints

[Where bellows and expansion joints are provided in accordance with 7.3.6.1 the following requirements apply:

.1 If necessary, bellows shall be protected against icing.

.2 Slip joints shall not be used except within the liquefied gas fuel storage tanks.

.3 Bellows shall normally not be arranged in enclosed spaces.]

Alternatively:

[Expansion of piping shall normally be allowed for by the provision of expansion loops or bends in the fuel piping system.

.1 Bellows, in accordance with recognized standards, may be specially considered.

.2 Slip joints shall not be used.]

7.3.6.4.4 7.3.12.7 Other connections

Piping connections shall be joined in accordance with 7.3.6.4.1-7.3.6.4.3 7.3.12.2 but for other exceptional cases the Administration or its recognized organization may consider alternative arrangements.

7.4 Requirements for materials

[7.4.1 Metallic materials

(**Note:** There is a general comments that this needs further consideration and that specific material requirements for methyl/ethyl alcohol fuel needs to be included. Further discussion is needed on material requirements)

[7.4.1.1 Materials for fuel containment and piping systems shall comply with the minimum requirements given in the following tables in part A-1:

~~Table 7.1: Plates, pipes (seamless and welded), sections and forgings for fuel tanks and process pressure vessels for design temperatures not lower than 0°C.~~

~~Table 7.5: Plates and sections for hull structures required by part A-1 paragraph 5.4.13.1.1.2.] (**Note**: Check reference)~~

7.4.1.2 Due consideration shall be taken with respect to the corrosive nature of methyl/ethyl alcohol.~~]~~
(**Note**: Need further information on corrosive nature and perhaps more specific requirements on corrosion resistant materials allowed.)

8 BUNKERING

8.1 Goal

8.1.1 The goal of this chapter is to provide for suitable systems on board the ship to ensure that bunkering can be conducted without causing danger to persons, the environment or the ship.

8.2 Functional requirements

8.2.1 This chapter relates to functional requirements 3.2.1, 3.2.2, 3.2.3, 3.2.4, 3.2.5, 3.2.6, 3.2.7, 3.2.8, 3.2.9, 3.2.10, 3.2.11, 3.2.13, 3.2.14, 3.2.15, 3.2.16 and 3.2.17 of ~~this Code~~ these interim guidelines. In particular the following apply:

8.2.1.1 The piping system for transfer of fuel to the ~~storage~~ fuel tank shall be designed such that any leakage from the piping system cannot cause danger to ~~personnel~~ the persons onboard, the environment or the ship.

8.3 Requirements for bunkering station

8.3.1 General requirements

8.3.1.1 The bunkering station shall be located on open deck so that sufficient natural ventilation is provided. Closed or semi-enclosed bunkering stations shall be subject to special consideration within the ~~safety analysis~~ risk assessment.
~~(**Note**: It is commented that the requirement for bunkering station location is to be compared with IBC Code §3.7.4 and doc FP51/9/7. Additional requirement might be considered for consistency.)~~

[8.3.1.2 Entrances, air inlets and openings to accommodation, service and machinery spaces and control stations shall not face the bunkering connection.]
(**Note:** Needs further discussion, ref. IBC Code 3.7.4)

8.3.1.3 Closed or semi-enclosed bunkering stations shall be subject to special consideration with respect to ventilation. The Administration may require special safety analysis.

8.3.1.4 Closed or semi-enclosed bunkering stations shall be surrounded by gastight bulkheads.

[8.3.1.5 Bunkering lines shall not pass through accommodation, control stations or service spaces. Bunkering lines passing non-hazardous areas shall be double walled or located in gas-tight ventilated ducts.]
(**Note:** Needs further discussion)

8.3.1.6 Fuel piping shall not be led directly through accommodation spaces, service spaces, electrical equipment rooms or control stations as defined in the SOLAS Convention.

8.3.1.57 Arrangements shall be made for safe management of any spilled fuel. Coamings and/or spill trays with possibility to drain eventual fuel spills to a dedicated holding tank shall be arranged. The holding tank shall be equipped with a level indicator and alarm. There shall also be a possibility to drain rain water overboard.

8.3.1.8 The bunkering operation shall be monitored and controlled from a safe location. As a minimum the bunker tank level instrumentation and over fill alarms as well as automatic shutdown shall be readable from this location.

8.3.1.69 Showers and eye wash stations for emergency usage are to be located in close proximity to areas where the possibility for accidental contact with methyl/ethyl alcohol exists. The emergency showers and eye wash to be operable under all ambient conditions. Showers and eye wash stations to be placed in the close vicinity where possibilities for accidental contact with methyl/ethyl alcohol may exist. The showers and eye wash to be operable under all ambient conditions.
(**Note:** This requirement is not only relevant for bunker stations, consider general application)

[8.3.2 Ships' fuel hoses

8.3.2.1 If and when the ships carry their own fuel hoses, these hoses to be suitable for methyl/ethyl alcohol and to be accordingly certified to a minimum bursting pressure of 5 times the normal working pressure.

8.3.2.2 If and when the ships carry their own fuel hoses, arrangements shall be made for safe storage of the hoses and special consideration shall be paid to avoid any leakage from the connection joints. Hoses should be placed on open deck or in a storage room with sufficient ventilation.

8.4 Requirements for manifold

8.4.1 The bunkering manifold shall be designed to withstand the external loads during bunkering. The connections at the bunkering station shall be of dry-disconnect type equipped with additional safety dry break-away coupling/self-sealing quick release. [The couplings shall be of a standard type].
(**Note:** Further discussion regarding the standard is needed)

8.5 Requirements for bunkering system

Ships using methyl/ethyl alcohol as fuel shall meet the requirements of part A-1, section 8.5 with the exception of 8.5.5 which is replaced by the following:

[8.5.5 Means shall be provided for [safely] draining remaining methyl/ethyl alcohol from the bunkering pipes upon completion of operation.]

8.5.1 Bunkering lines shall be self-draining
[Means shall be provided for draining any fuel from the bunkering pipes upon completion of operation.]

8.5.2 Bunker lines shall be possible to gas free and to inert. When not engaged in bunkering, the bunkering pipes shall be free of gas, unless the consequences of not gas freeing is evaluated and approved.

8.5.3 A bunkering Emergency Shut Down (ESD) system shall be arranged. This system shall be operable both from the receiving ship and from the bunker supply facility. An ESD shall not cause any release of fuel neither in gaseous nor liquid form.
(**Note:** Requirement needs to be further discussed)

8.5.4 In the bunkering line, as close to the connection point as possible, there shall be a manually and a remotely operated stop valve arranged in series. Alternatively a combined manually/remotely-operated valve. This valve shall be possible to operate from the bunkering control station.

8.5.5 In case bunkering lines are arranged with a cross-over it shall be ensured by suitable isolation arrangements that no fuel is transferred inadvertently to the ship side not in use for bunkering.

9 FUEL SUPPLY TO CONSUMERS

9.1 Goal

9.1.1 The goal of this chapter is to ensure safe and reliable distribution of fuel to the consumers.

9.2 Functional requirements

9.2.1 This chapter is related to functional requirements 3.2.1, 3.2.2, 3.2.3, 3.2.4, 3.2.5, 3.2.6, 3.2.8, 3.2.9, 3.2.10, 3.2.11, 3.2.13, 3.2.14, 3.2.15, 3.2.16 and 3.2.17 of ~~this Code~~ these interim guidelines. In particular the following apply:

9.3 General requirements to fuel system

9.3.1 The fuel system shall be separate from all other piping system.

9.~~2.1.1~~ 3.2 The methyl/ethyl alcohol fuel supply system shall be so arranged that the consequences of any release of fuel will be minimized, while providing safe access for operation and inspection.

9.~~2.1.2~~ 3.3 The piping system for ~~gas~~ fuel transfer to the consumers shall be designed in a way that a failure of one barrier cannot lead to a leak from the piping system into the surrounding area causing danger to the persons on board, the environment or the ship.

9.~~2.1.3~~ 3.4 Fuel lines inside and outside the machinery spaces shall be installed and protected so as to minimize the risk of injury to ~~personnel~~ persons onboard in case of leakage.
(**Note:** To be moved to 9.5)

9.4 Requirements for fuel distribution

9.4.1 All piping containing methyl/ethyl alcohol fuel passing through enclosed spaces shall be double walled. The outer pipe shall be gas tight and water tight towards the surrounding spaces with the methyl/ethyl alcohol fuel contained in the inner pipe. Such double walled piping is not required in cofferdams surrounding fuel tanks, fuel pump-rooms or other hazardous fuel treatment spaces.

9.4.2 The annular space between inner and outer pipe shall be ventilated to open air. Appropriate means for detecting leakage into the annular space shall be provided.

9.4.3 Inerting of the annular space might be accepted as an alternative to ventilation. The inert gas pressure in the annular space shall be higher than the maximum pressure in the inner pipe. Appropriate means of detecting leakage into the annular space shall be provided as well as alarm for low inert gas pressure.

9.4.4 The outer pipe in the double walled fuel pipes shall be dimensioned for a design pressure not less than the maximum working pressure of the fuel pipes.

9.~~3~~ 5 Redundancy of methyl/ethyl alcohol fuel supply

~~[~~9.5 ~~3~~.1 ~~For vessels using methyl/ethyl alcohol as their only fuel the fuel system shall be arranged with redundancy and segregation all the way from the fuel tank to the consumer, so that a leakage in the fuel supply system with the following necessary safety actions does not lead to loss of propulsion, power generation or other main functions.]~~
~~(**Note**: Deletion not supported. It is questioned if the use of of methyl/ethyl alcohol as the single fuel should be allowed.)~~
For single methyl/ethyl alcohol fuel installations the fuel supply system shall be arranged with full redundancy and segregation all the way from the fuel tanks to the consumer, so that a leakage in one system does not lead to an unacceptable loss of power.
(**Note:** Single methyl/ethyl alcohol fuel installation needs to be included in definitions)

[9.5.2 Two fuel service tanks for each type of fuel used on board necessary for propulsion and vital systems of equivalent arrangements shall be provided. Each tank shall have a capacity sufficient for continuous rating of the propulsion plant and normal operating load at sea of the generator plant for a period of minimum 8 hours. Other arrangements with the same level of redundancy may be accepted by the Administration.]
(**Note:** Moved from 5.3.14. Requirement also in SOLAS regulation II-1/26.11)

~~9.4~~ 9.6 Safety functions of the methyl/ethyl alcohol supply system

9.6.1 All fuel piping shall be arranged for gas-freeing and inerting.

~~[9.4.1~~ 9.6.2 Methyl/ethyl alcohol fuel tank inlets and outlets valves shall be as close to the tank as possible. Valves required to be operated under normal operation such as when fuel is supplied to consumers or during bunkering shall be remotely operated if not easily accessible.~~]~~

~~9.4.2~~ 9.6.3 The main fuel supply line to each engine-room or set of engines shall be equipped with a manually-operated stop valve and an automatically-operated master fuel valve ~~coupled~~ in series or a combined manually- and automatically-operated valve. The valves shall be situated in the part of the piping that is outside the machinery space containing methyl/ethyl alcohol fuelled engines. The master fuel valve shall automatically shut off the supplies when activated by the safety system required in 15.2.1.2.
(**Note:** Further discussion needed on other alternative arrangements e.g. automatic stopping of pump and closing of inlet valve)

~~9.4.3~~ 9.6.4 The automatic master ~~gas~~ fuel valve shall be operable from safe locations on escape routes inside a machinery space containing a ~~gas-fuelled~~ methyl/ethyl alcohol fuelled engine, the engine control room, if applicable; outside the machinery space, and from the navigation bridge.

~~[9.4.4~~ 9.6.5 The methyl/ethyl alcohol supply line to each consumer shall be provided with a remote shut-off valve. See requirements for low flash point fuel shut down in 15.2.1.2.~~]~~

[9.4.5 9.6.6 There shall be one manually shut down valve in the methyl/ethyl alcohol fuel line to each consumer to assure safe isolation during maintenance.] (9.4.6) [A double block and bleed valve to be fitted on both sides of the shut-down valves.]
(**Note:** The requirement in square brackets needs further consideration)

9.4.6 9.6.7 In the event of a failure, valves shall fail to a safe position. Valves shall fail to a safe position.(9.4.7)

9.4.7 9.6.8 When pipes penetrate the methyl/ethyl alcohol fuel tank below the top of the tank a remotely operated shut-off valve shall be fitted to the fuel tank bulkhead. When the methyl/ethyl alcohol tank is adjacent to a pump-room, the valve may be fitted on the tank bulkhead on the pump-room side.

9.5 7 Requirements for methyl/ethyl alcohol fuel distribution outside of machinery space

9.5.1 9.7.1 [All piping containing methyl/ethyl alcohol fuel that pass through enclosed spaces in the ship shall be enclosed in a duct or pipe that is vapour gas tight and liquid tight [water tight] towards the surrounding spaces with the methyl/ethyl alcohol fuel contained in the inner pipe. Such double walled piping is not required in cofferdams surrounding fuel tanks, fuel pump-rooms or other hazardous fuel treatment spaces as the boundaries for these spaces will serve as a second barrier. Appropriate means for detecting leakage into the annulus shall be provided.] The double wall enclosure is to be connected to a suitable draining tank allowing the collection and the detection of any possible leakage.
(**Note:** Water tight is questioned)

9.6 8 Requirements for methyl/ethyl alcohol fuel supply to consumers in machinery spaces

9.6.1 9.8.1Appropriate means for detecting leakage into the annulus shall be provided. All piping within machinery spaces containing methyl/ethyl alcohol fuel shall be enclosed in a pipe [or duct] that is liquid tight and water tight towards the surrounding spaces with the methyl/ethyl alcohol fuel contained in the inner pipe. Appropriate means for detecting leakage into the annulus shall be provided.
(**Note:** e.g. detection by pressure sensors detecting overpressure or by liquid level sensors in drain tank)

9.8 9 Requirements for the design of ventilated duct, outer pipe against inner pipe gas fuel leakage

[The outer pipe in the double walled fuel pipes shall be dimensioned for a design pressure not less than the maximum working pressure of the fuel pipes. As an alternative the calculated maximum built up pressure in the duct in the case of a pipe rupture when ventilation is not running may be approved used for dimensioning of the duct.]
(**Note:** Dimensioning of the outer pipe needs further consideration and should read as a functional requirement instead of a prescriptive requirement)

9.9*bis* Requirements for pump-rooms and pumps

[9.9.1 Any pump-room shall be located outside the engine-room, be gas tight and water liquid tight to surrounding enclosed spaces and vented to open air.] Pump-room shall be fitted with an arrangement whereby under normal operation the pump-room are ventilated with at least 15 air changes per hour. If methyl/ethyl alcohol vapour is detected, the number of air changes will automatically be increased to 30 air changes per hour.

9.9.2 Hydraulically powered pumps that are submerged in fuel tanks shall be arranged with double barriers preventing the hydraulic system serving the pumps from being directly exposed to methyl/ethyl alcohol. The double barrier shall be arranged for detection and drainage of eventual methyl/ethyl alcohol leakage.

~~[9.9.3 Pumps rooms shall be provided with continuous leakage detection.]~~

10 POWER GENERATION INCLUDING PROPULSION AND OTHER ENERGY CONVERTERS

~~(**Note**: ESD concept not suitable for ethyl/methyl alcohol, hence all ESD related requirements must be deleted. Relevant parts of part A-1 chapter 10 to be included.)~~

10.1 Goal

10.1.1 To provide safe and reliable delivery of mechanical, electrical or thermal energy.

10.2 Functional requirements

10.2.1 This chapter is related to functional requirements as described in 3.2.1, 3.2.11, 3.2.13, 3.2.14, 3.2.16, 3.2.17 and 3.2.18. In particular the following apply:

.1 [The exhaust system shall be designed to prevent any accumulation of unburnt fuel].
(**Note:** This needs to be further discussed)

.2 All consumers of methyl/ethyl alcohol fuel shall have separate exhaust system.

[10.2.2 One single failure in the methyl/ethyl alcohol fuel system shall not lead to loss of propulsion or essential power.]
(**Note:** This text should be aligned with the definition of unacceptable loss of power)

10.3 General

10.3.1 All engine components and engine related systems shall be designed in such a way that explosion risks are minimized.

10.3.2 Fuel injection pumps and injection devices shall be effectively sealed to prevent leakage of methyl/ethyl alcohol into the engine-room.

10.3.3 Fuel injection pumps and injection devices shall be effectively lubricated.

[10.3.4 For trunk and two stroke engines running on methyl/ethyl alcohol, crankcase shall be equipped with gas detection.]
(**Note:** Requirement is questioned)

10.3.5 Engines running on methyl/ethyl alcohol shall be monitored with respect to knocking.

10.3.6 For dual-fuel engines the changing to/from methyl/ethyl alcohol mode and to/from oil fuel-only mode shall be automatic.

10.3.7 In case of a failure in the methyl/ethyl alcohol fuel system, it shall change over automatically from methyl/ethyl alcohol mode to oil fuel mode. There shall also be possibility for manual change over.

10.3.8 In case of an emergency stop or a normal stop the methyl/ethyl alcohol fuel shall be automatically shut off not later than the pilot oil fuel. There shall always be a manual shut off of the methyl/ethyl alcohol fuel system.
(**Note:** This needs to be further discussed)

10.3.9 It shall be possible to change to/from methyl/ethyl alcohol with pilot oil fuel to/from oil fuel at all loads. The change over between fuels shall be with a minimum fluctuation of the engine power.

11 FIRE SAFETY

~~11.1 Ships using methyl/ethyl alcohol as fuel shall meet all the requirements of part A-1, section 11.1-11.6, in addition the following apply~~

~~11.2 Cofferdams with boundaries against machinery spaces or other high fire risk areas shall have class A-60 insulation~~
~~(**Note**: This is not supported. This chapter needs to be reviewed for methyl/ethyl alcohol fuel. Should go the proper sub-committee)~~

11.1 The goal of this chapter is to provide fire protection, detection and fighting for all systems related to storing, handling, transfer and use of methyl or ethyl alcohol as fuel.
(**Note:** Further discussion is needed on appropriate fire-extinguishing requirements)

11.2 Functional requirements

This chapter is related to functional requirements in 3.2.1, 3.2.2, 3.2.4, 3.2.5, 3.2.12, 3.2.14, 3.2.15 and 3.2.17.

11.3 General requirements

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

11.4 Regulation for fire protection

11.4.1 Spaces containing fuel pumps, heat exchangers, pressure vessels etc. shall be regarded as machinery space of category A.

11.4.2 The fire integrity of spaces mentioned in 11.4.1 having boundaries towards accommodation, control station and/or cargo areas shall not be less than A-60.

11.4.3 Any boundary of accommodation up to navigation bridge windows, service spaces, control stations, machinery spaces and escape routes, facing fuel storage tanks on open deck shall have A-60 fire integrity. Navigation bridge windows to have A-0 class.

11.4.4 The fire integrity of fuel tank cofferdam boundaries facing high fire risk spaces such as machinery spaces and similar shall not be less than A-60.

11.4.5 Where bunkering station is not placed on open deck it shall be arranged as a separated bunkering room by permanent steel bulkheads.

11.4.6 Bunkering room as defined in 11.4.5 shall be protected against the sea.

11.4.7 In addition to any other portable fire extinguishers that may be required elsewhere in IMO instruments, one portable dry powder extinguisher of at least 5 kg capacity shall be located near the entrance of the bunkering station.
(**Note:** Consider other equivalent types of portable fire extinguisher)

11.4.8 Where bunkering stations are adjacent to accommodation, control stations, machinery spaces category A or other high fire risk areas the insulation standard shall be at least A-60.

11.5 Regulation for fire main

11.5.1 Where fuel tanks are located on open deck, isolating valves shall be fitted in the fire main, to separate damaged section of the line. Isolation of one section of the fire main shall not deprive the line ahead of the isolated section from water supply.

11.6 Regulation for firefighting

11.6.1 Where fuel tanks are located on open deck, there shall be a fixed firefighting system of alcohol resistant foam type. The system shall be operable from a safe position.
(**Note:** Discuss other appropriate fixed systems (water based))

11.6.2 The foam firefighting shall cover the area below the fuel tank where a large spill of fuel can be expected to spread.

11.6.3 The bunker station shall have a fixed fire extinguishing system of alcohol resistant foam and a portable dry chemical powder extinguisher.

11.6.4 Where fuel tanks are located on open deck, there shall be a fixed water spray system for diluting eventual large spills, cooling and fire prevention. The system shall cover exposed parts of the fuel tank.

11.6.5 Fuel pump-room shall have fixed fire extinguishing systems. Fixed pressure water system in combination with alcohol resistant foam.

11.6.6 A fixed fire detection and fire alarm system complying with Fire Safety System Code shall be provided for all compartments containing the methyl/ethyl alcohol fuel system.

11.6.7 Suitable detectors are to be selected based on the fire characteristics of the fuel. Smoke detectors shall be used in combination with detectors which can detect methanol/ethanol fire.

11.7 Regulation for fire extinguishing of engine-room and pump-room

11.7.1 Main engine-room and pump-room where methyl/ethyl alcohol fuelled engines or fuel pumps are arranged shall be protected by an approved fixed fire extinguishing system for machinery spaces category A as given in SOLAS regulation II-2/10 and the FSS Code.

11.7.2 An approved alcohol resistant foam system covering the tank top and bilge area under the floor plates shall be arranged for machinery space category A and pump-room containing methyl/ethyl alcohol.

~~11.7 Requirements for dry chemical powder fire-extinguishing system~~

~~11.7.1 A permanently installed alcohol resistant foam fire-extinguishing system shall be installed in the bunkering station area to cover all possible fire hazards.~~

~~11.7.2 In addition to any other portable fire extinguishers that may be required elsewhere in IMO instruments, one portable dry powder extinguisher of at least 5 kg capacity shall be located near the bunkering station.~~

~~11.7.3 A permanently installed fire-extinguishing system using alcohol resistant foam shall be installed to cover methyl/ethyl alcohol tanks on open deck.~~

~~11.8 Requirements for fire detection and alarm system~~

~~11.8.1 A fixed fire detection and fire alarm system complying with Fire Safety System Code shall be provided for all compartments containing the methyl/ethyl alcohol fuel system.~~
~~(**Note**: Methyl / ethyl alcohol burns with an invisible flame. Suitable detectors are to be selected based on the fire characteristics on the fuel. Currently not covered by the FSS Code.)~~

~~11.8.2 Smoke detectors alone shall not be considered sufficient for rapid detection of a fire.~~

~~[~~12 EXPLOSION ~~[~~PREVENTION~~]~~ ~~[PROTECTION]~~ AND ~~[~~AREA CLASSIFICATION~~]~~

12.1 Goal

12.1.1 The goal of this chapter is to provide for the prevention of explosions and for the limitation of effects from explosion.

12.2 Functional requirements

12.2.1 This chapter is related to functional requirements 3.2.1, 3.2.2, 3.2.3, 3.2.4, 3.2.5, 3.2.6, 3.2.7, 3.2.8, 3.2.12, 3.2.13, 3.2.14, 3.2.15, and 3.2.17 of ~~this Code~~ these interim guidelines. ~~In particular the following apply:~~

The probability of explosions shall be reduced to a minimum by:

.1 reducing number of sources of ignition; and

.2 reducing the probability of formation of ignitable mixtures.

12.3 General requirements

12.3.1 Hazardous areas on open deck and other spaces not addressed in this chapter shall be analysed and classified ~~decided~~ based on a recognized standard.[8] The electrical equipment fitted within hazardous areas shall be according to the same standard.

12.3.2 Electrical equipment and wiring shall in general not be installed in hazardous areas unless essential for operational purposes and based on a recognized standard.[9]

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

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

12.3.3 All hazardous zones shall be inaccessible for passengers at all times.
(**Note:** Moved from 12.5.4)

12.4 Area classification

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

12.4.2 In order to facilitate the selection of appropriate electrical apparatus and the design of suitable electrical installations, hazardous areas are divided into zones 0, 1 and 2.[10] See also 12.5 below.

12.4.3 Ventilation ducts shall be considered to have the same area classification as the ventilated space.

12.5 Hazardous area zones

12.5.1 Hazardous area zone 0:

12.5.1.1 This zone includes, but is not limited to:

.1 the interiors of methyl/ethyl fuel tanks, any pipework for pressure-relief or other venting systems for ~~gas~~ fuel tanks, pipes and equipment containing methyl/ethyl fuel.

12.5.2 Hazardous area zone 16[11]

12.5.2.1 This zone includes, but is not limited to:

.1 cofferdams and other protective spaces surrounding the methyl/ethyl fuel tanks;

.2 fuel pump-rooms;

.3 areas on open deck, or semi-enclosed spaces on deck, within 3 m of any methyl/ethyl fuel tank outlet, gas or vapour outlet, bunker manifold valve, other methyl/ethyl fuel valve, methyl/ethyl fuel pipe flange, methyl/ethyl fuel pump-room ventilation outlets;

.4 [Area near the fuel tank P/V outlets, within a vertical cylinder of unlimited height and 6 m radius centred upon the centre of the outlet and within a hemisphere of 6 m radius below the outlet]

.5~~4~~ areas on open deck or semi-enclosed spaces on deck, within 1.5 m of methyl/ethyl fuel pump-room entrances, methyl/ethyl fuel pump ventilation inlets and other openings into zone 1 spaces;

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

[11] Instrumentation and electrical apparatus installed within these areas should be of a type suitable for zone 1.

.65 areas on the open deck within spillage coamings surrounding methyl/ethyl fuel bunker manifold valves and 3 m beyond these, up to a height of 2.4 m above the deck;

.76 enclosed or semi-enclosed spaces in which pipes containing methyl/ethyl fuel are located, e.g. ducts around methyl/ethyl fuel pipes, semi-enclosed bunkering stations;

.7 the areas in the vicinity of methyl/ethyl fuel tank P/V vent outlets, within a vertical cylinder of unlimited height and 6 m radius cantered upon the centre of the outlet, and within a hemisphere of 6 m radius below the outlet;

.8 [a space protected by an airlock is considered as non-hazardous area during normal operation,. The equipment required within the air lock shall be certified for hazardous zone 1] but will require equipment required to operate following loss of differential pressure between the protected space and the hazardous area to be certified as suitable for zone 1; and

.9 [an area within 2.4 m of the outer surface of a fuel containment system where such surface is exposed to the weather.]

(**Note:** Sub paragraphs 4, 8 and 9 need further discussion)

12.5.3 Hazardous area zone 2[12]

12.5.3.1 This zone includes, but is not limited to:

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

.2 spaces 4 m beyond the cylinder and 4 m beyond the sphere defined in 12.5.3.1.7; and

.3 air locks.

.1 areas 4 m beyond the cylinder and 4 m beyond the sphere defined in 12.5.2.1.7

.2 areas of 1.5 m surrounding other open or semi-enclosed spaces of zone 1 defined in 12.5.2.1; and

.3 air locks.

[12.5.4 All hazardous zones shall be inaccessible for passengers at all times.]]

13 VENTILATION

(**Note**: This chapter needs to be rewritten excluding the ESD-concept and be independently considered for methyl/ethyl alcohol fuels.)

13.1 Goal

The goal of this chapter is to provide for the ventilation required for safe working condition of personnel and safe operation of machinery and equipment where methyl or ethyl alcohol is used as fuel.

12 Instrumentation and electrical apparatus installed within these areas should be of a type suitable for zone 2.

13.2 Functional requirements

This chapter is related to functional requirements in 3.2.1, 3.2.2, 3.2.4, 3.2.5, 3.2.6, 3.2.7, 3.2.8, 3.2.11 to 3.2.14 and 3.2.17.

13.3 Regulations – General

13.3.1 Any ducting used for the ventilation of hazardous spaces shall be separate from that used for the ventilation of non-hazardous spaces. The ventilation shall function at all temperatures and environmental conditions the ship will be operating in.

13.3.2 Electric motors for ventilation fans shall not be located in ventilation ducts for hazardous spaces unless the motor is certified for the same hazard zone as the space served.

13.3.3 Design of ventilation fans serving spaces containing where vapours from fuels may occur shall fulfil the following:

.1 ventilation fans shall not produce a source of vapour ignition in either the ventilated space or the ventilation system associated with the space. Ventilation fans and fan ducts, in way of fans only, shall be of non-sparkling construction defined as;

.2 impellers or housings of non-metallic material, due regard being paid to the elimination of static electricity;

.3 impellers and housings of non-ferrous metals;

.4 impellers and housings of austenitic stainless steel;

.5 impellers of aluminium alloys or magnesium alloys and a ferrous (including austenitic stainless steel) housing on which a ring of suitable thickness of non-ferrous materials is fitted in way of the impeller, due regard being paid to static electricity and corrosion between ring and housing; or

.6 any combination of ferrous (including austenitic stainless steel) impellers and housings with not less than 13 mm tip design clearance.

.7 In no case shall the radial air gap between the impeller and the casing be less than 0.1 of the diameter of the impeller shaft in way of the bearing but not less than 2 mm. The gap need not be more than 13 mm.

.8 Any combination of an aluminium or magnesium alloy fixed or rotating component and a ferrous fixed or rotating component, regardless of tip clearance, is considered a sparking hazard and shall not be used in these places.

13.3.4 Ventilation systems required to avoid any vapour accumulation shall consist of independent fans, each of sufficient capacity, unless otherwise specified in this guideline.

13.3.5 Air inlets for hazardous enclosed spaces shall be taken from areas that, in the absence of the considered inlet, would be non-hazardous. Air inlets for non-hazardous enclosed spaces shall be taken from non-hazardous areas at least 1.5 m away from the boundaries of any hazardous area. Where the inlet duct passes through a more hazardous space, the duct shall be gas-tight and have over-pressure relative to this space.

13.3.6 Air outlets from non-hazardous spaces shall be located outside hazardous areas.

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

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

13.3.9 Non-hazardous spaces with entry openings to a hazardous area shall be arranged with an air-lock and be maintained at overpressure relative to the external hazardous area. The overpressure ventilation shall be arranged according to the following:

.1 During initial start-up or after loss of overpressure ventilation, before energizing any electrical installations not certified safe for the space in the absence of pressurization, it shall be required to:

.2 proceed with purging (at least 5 air changes) or confirm by measurements that the space is non-hazardous; and

.3 pressurize the space.

13.3.10 Operation of the overpressure ventilation shall be monitored and in the event of failure of the overpressure ventilation:

.1 an audible and visual alarm shall be given at a manned location; and

.2 if overpressure cannot be immediately restored, automatic or programmed, disconnection of electrical installations according to a recognized standard[13] shall be required.

13.3.11 Non-hazardous spaces with entry openings to a hazardous enclosed space shall be arranged with an air-lock and the hazardous space shall be maintained at under pressure relative to the non-hazardous space. Operation of the extraction ventilation in the hazardous space shall be monitored and in the event of failure of the extraction ventilation:

.1 an audible and visual alarm shall be given at a manned location; and

.2 if under pressure cannot be immediately restored, automatic or programmed, disconnection of electrical installations according to a recognized standard in the non-hazardous space shall be required.

13.4 Regulations for pump-rooms

13.4.1 Pump-rooms shall be provided with an effective mechanical forced ventilation system of extraction type. During normal operation the ventilation shall be at least 15 air changes per hour. If vapour to a concentration of 30% of LEL is detected the ventilation shall automatically be increased to 30 air changes per hour.

13.4.2 Approved automatic fail-safe fire dampers shall be fitted in the ventilation trunk for pump-room.

[13] IEC 60092-502:1999 Electrical Installations in Ships – Tankers – Special Features, table 5 (ch.8.4.5)

13.5 Regulations for bunkering station

Bunkering stations that are not located on open deck shall be suitably ventilated to ensure that any vapour being released during bunkering operations will be removed outside. If the natural ventilation is not sufficient, a risk assessment to be carried out, and mechanical ventilation shall be provided accordingly.

13.6 Regulations for ducts and double pipes

13.6.1 Ducts and double pipes containing fuel piping shall be fitted with effective mechanical ventilation system of the extraction type, providing a ventilation capacity of at least 30 air changes per hour.

13.6.2 As an alternative to ventilation the annular space of double wall pipes may be monitored by vacuum or overpressure inerted system.

13.6.3 The ventilation system for double wall piping shall be independent of all other ventilation systems.

13.6.4 The ventilation inlet for the double wall piping or duct shall always be located in a non-hazardous area away from ignition sources. The inlet opening shall be fitted with a suitable wire mesh guard and protected from ingress of water.

13.6.5 The capacity of the ventilation for a pipe duct or double wall piping may be below 30 air changes per hour if a flow velocity of minimum 3 m/s is ensured. The flow velocity shall be calculated for the duct with fuel pipes and other components installed.

14 ELECTRICAL INSTALLATIONS

~~14.1 Ships using methyl/ethyl alcohol as fuel shall meet the requirements of part A-1, section 14 except for the requirements in part A-1 section 14.2.1.1.~~

~~14.2 Part A-1, section 14.3.7 shall be met if submerged pumps are used~~

14.1 Goal

The goal of this chapter is to provide for electrical installations that minimizes the risk of ignition in the presence of a flammable atmosphere.

14.2 Functional requirements

This chapter is related to functional requirements in 3.2.1, 3.2.2, 3.2.3, 3.2.4, 3.2.5, 3.2.7, 3.2.8, 3.2.11, 3.2.13, 3.2.17 and 3.2.18.

14.3 Regulations – General

14.3.1 Electrical installations are to comply with a recognized national or international standard which is to be accepted by the Administration.

[14.3.2 Electrical equipment or wiring shall not be installed in hazardous areas unless essential for operational purposes or safety enhancement.]
(**Note:** This requirement is covered by 12.3.2, deletion is suggested)

[14.3.3 Where electrical equipment is installed in hazardous areas as provided in 14.3.2 it shall be selected, installed and maintained in accordance with IEC standards or other standards at least equivalent to those acceptable to the Organization.]
(**Note:** This requirement is covered by 12.3.2, deletion is suggested)

14.3.4 Equipment for hazardous areas shall be evaluated and certified or listed by an accredited testing authority or notified body recognized by the Administration.

14.3.5 The installation on board of the electrical equipment units shall be such as to ensure the safe bonding to the hull of the units themselves.

14.3.6 The bunkering supplier [bunker hose] shall be electrically bonded to the bunkering manifold.

14.3.7 Part A-1, section 14.3.8 shall be met if submerged pumps are used. (**Note:** Needs to reproduce the requirement here)

15 CONTROL, MONITORING AND SAFETY SYSTEMS

~~(**Note**: The whole chapter needs to be rewritten excluding the ESD-concept and be independently considered for methyl/ethyl alcohol fuels.)~~

15.1 Goal

15.1.1 The goal with this chapter is to provide for the arrangement of control, monitoring and safety systems that support an efficient and safe operation of the methyl/ethyl alcohol fuel installations as covered in the other chapters of this guideline. ~~gas-fuelled installation as covered in the other chapters of the code.~~

15.2 Functional requirements

~~The methyl/ethyl alcohol control, monitoring and safety systems shall meet the functional requirements of part A-1, section 15.2.1.~~

~~In addition the following apply:~~

~~Each methyl/ethyl alcohol tank is to be fitted with one high level and one high high level alarm. The high high level alarm shall lead to shut down of bunkering operation.~~

This chapter is related to functional requirements in 3.2.1, 3.2.2, 3.2.3, 3.2.9, 3.2.10, 3.2.11, 3.2.13

.1 The control, monitoring and safety systems of the methyl and/or ethyl alcohol installations shall be so arranged that the remaining power for propulsion and power generation is in accordance with 9.5.1 in the event of single failure.

.2 The safety systems including the field instrumentation shall be arranged to avoid spurious shutdown, e.g. as a result of a faulty vapour detector or a wire break in a sensor loop.

.3 Where two fuel supply systems are required to meet the regulations, each system shall be fitted with its own set of independent fuel control and safety systems.

15.3 General requirements

15.3.1 Suitable instrumentation devices shall be fitted to allow a local and a remote reading of essential parameters to ensure a safe management of the whole methyl/ethyl alcohol fuel equipment including bunkering.

15.3.2 ~~A bilge well with a level indicator shall be provided for each independent storage tank Alarm shall be given at high level in bilge well.~~ Liquid leakage detection shall be installed in the protective cofferdams surrounding the fuel tanks, in all ducts around fuel pipes, in pump-rooms, and in other enclosed spaces containing fuel piping or other fuel equipment.

[At least one bilge well with a level indicator shall be provided for each room, where an independent storage tank(s) is (are) located. Alarm shall be given at high level in bilge will.]

15.3.3 For tanks not permanently installed in the vessel a monitoring system the same ~~has to be provided~~ as for permanent installed tanks is to be provided.

15.4 Requirements for bunkering and fuel tank monitoring

15.4.1 Level indicators for fuel tanks

.1 Each fuel tank shall be fitted with liquid level gauging device(s), arranged to ensure a level reading is always obtainable whenever the fuel tank is operational. ~~The device(s) shall be designed to operate throughout the design pressure range of the fuel tank and at temperatures within the fuel operating temperature range.~~

.2 Where only one liquid level gauge is fitted it shall be arranged so that it can be maintained in an operational condition without the need to empty or gas-free the tank.

~~.3~~ ~~Fuel tank liquid level gauges may be of the following types:~~

~~.1~~ ~~indirect devices, which determine the amount of fuel by means such as weighing or in-line flow metering;~~

~~.2~~ ~~closed devices, which do not penetrate the fuel tank, such as devices using radio-isotopes or ultrasonic devices;~~

(Note: Appropriate type of level indication needs to be discussed, it is however suggested to keep the same requirements for level gauges as in the IBC Code)

15.4.2 Overflow control

.1 Each fuel tank shall be fitted with a high liquid level alarm operating independently of other liquid level indicators and giving an audible and visual warning when activated.

.2 An additional sensor operating independently of the high liquid level alarm shall automatically actuate a shutoff valve ~~in a manner that will both~~ to avoid excessive liquid pressure in the bunkering line and prevent the tank from becoming liquid full. The sensor shall be activated with a high, high level alarm.

~~.3 The position of the sensors in the tank shall be capable of being verified before commissioning. At first loading, testing of high level alarms shall be conducted by raising the cargo liquid level in the fuel tank to the alarm point.~~

~~.4 All elements of the level alarms, including the electrical circuit and the sensor(s), of the high, and overfill alarms, shall be capable of being functionally tested. Systems shall be tested prior to fuel operation in accordance with 18.6.2.~~

~~.5 Where arrangements are provided for overriding the overflow control system, they shall be such that inadvertent operation is prevented. When this override is operated continuous visual indication is to be provided at the navigation bridge, continuously manned central control station or onboard safety centre.~~

15.5 Requirements for bunkering control

15.5.1 ~~Control of the bunkering shall be possible from a safe location remote from the bunkering station. At this location the tank pressure and tank level shall be monitored. Remotely controlled valves required by 9.5.5 and 11.6.6 shall be capable of being operated from this location Overfill alarm and automatic shutdown shall also be indicated at this location.~~ Bunkering control is to be from a safe remote location. At this safe remote location:

- Tank pressure and tank level shall be capable of being monitored.
- The remote control valves shall be capable of being operated from this location.
- Overfill Alarms and Automatic Shutdown shall also be capable of being indicated and activated

15.5.2 ~~If the ventilation in the ducting enclosing the bunkering lines stops, an audible and visual alarm shall be provided at the bunkering control location, see also 15.8.~~ If the ventilation in the ducting enclosure or annular spaces of the double walled bunkering lines stops, an audible and visual alarm shall be activated at the bunkering control location.
(**Note:** This requirement needs further consideration, as it is assuming that ventilation is the primary means to detect leakage from double barrier fuel lines)

15.5.3 ~~If gas is detected in the ducting around the bunkering lines an audible and visual alarm and emergency shut down shall be provided at the bunkering control location.~~ If methyl/ethyl alcohol vapour is detected in ducting enclosure or the annular spaces of the double walled bunkering lines an audible and visual alarm and emergency shutdown shall automatically be activated. An indication of the emergency shutdown should be provided at the bunker control station.

15.6 Requirements for pump monitoring

15.6.1 Fuel p~~P~~umps shall be fitted with audible and visual alarms both on the navigation bridge and in the engine-room. As a minimum the alarms shall include ~~low fuel input pressure~~, low fuel output pressure ~~and high gas output pressure.~~

15.7 Requirements for engine monitoring

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

[.1 operation of the engine in case of ~~low flashpoint~~ methyl/ethyl alcohol fuel only engines; or]

.2 operation and mode of operation of the engine in the case of dual fuel engines.

[15.8 Requirements for ~~gas~~ fuel vapour detection

15.8.1 Permanently installed gas detectors shall be fitted in:

~~.1 the tank connection spaces;~~

~~.2 in all ducts around gas pipes;~~

~~.3 in machinery spaces containing gas piping, gas equipment or gas consumers;~~

~~.4 compressor rooms and fuel preparation rooms;~~

~~.5 other enclosed spaces containing gas piping or other gas equipment without ducting;~~

~~.6 other enclosed or semi-enclosed spaces where fuel vapours may accumulate including interbarrier spaces and hold spaces of independent tanks other than type C;~~

~~.7 air locks;~~

~~.8 gas heating circuit expansion tanks;~~

~~.9 motor rooms associated with the fuel systems; and~~

~~.10 at ventilation inlets to accommodation and machinery spaces if required based on the risk assessment required in 4.2.1.~~

[.1 in all annular spaces of the double walled fuel pipes;

.2 in machinery spaces containing methyl or ethyl alcohol piping, fuel equipment or consumers. The gas detectors shall be placed where vapour may occur;
(**Note:** Methyl/ethyl alcohol vapours are heavier than air)

.3 in pump-rooms;

.4 other enclosed spaces containing fuel piping or other fuel equipment without ducting;

.5 other enclosed or semi-enclosed spaces where fuel vapours may accumulate;

.6 in cofferdams surrounding fuel tanks;

.7 air locks; and

.8 at ventilation inlets to accommodation and machinery spaces if required based on the risk assessment required in 4.2.]

(**Note:** Further discussion needed on spaces where detectors are needed)

~~15.8.2 In each ESD-protected machinery space, a redundant gas detection systems shall be provided.~~

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

15.8.4 The detection equipment shall be located where ~~gas~~ vapour may accumulate and in the ventilation outlets. ~~Gas~~ Vapour dispersal analysis or a physical smoke test shall be used to find the best arrangement.

15.8.5 ~~Gas~~ Fuel vapour detection equipment shall be designed, installed and tested in accordance with a recognized standard.[14]

15.8.6 An audible and visible alarm shall be activated at a ~~gas~~ fuel vapour concentration of 20% of the lower explosion limit (LEL). The safety system shall be activated at 40% of LEL at [two] [one] detectors. ~~(see footnote 1 in table 1).~~
(**Note:** Further discussion is needed on the number of detectors for alarm activation)

15.8.7 For ventilated ducts and annular spaces around ~~gas~~ fuel pipes in the machinery spaces containing ~~gas~~ methyl/ethyl alcohol-fuelled engines, the alarm limit can be set to ~~30~~ 20% LEL. The safety system shall be activated at ~~60~~ 40% of LEL at two detectors. ~~(see footnote 1 in table 1).~~
(**Note:** Question on why these levels differ from those in 15.8.6, further discussion is needed on the percentage level)

15.8.8 Audible and visible alarms from the ~~gas~~ fuel vapour detection equipment shall be located on the navigation bridge or in the continuously manned central control station.

15.8.9 ~~Gas~~ Fuel vapour detection required by this section shall be in operation at all time. ~~continuous without delay.~~]

15.8*bis* Requirements for liquid leakage detection

15.8.1*bis*
Liquid leakage detection shall be installed in cofferdams surrounding fuel tanks, in all ducts and annular spaces around double fuel pipes, in pump-rooms, and in all enclosed spaces containing fuel pipes or other equipment using methyl or ethyl alcohol.

15.9 Requirements for fire detection

[14] IEC 60079-29-1 – Explosive atmospheres – Gas detectors – Performance requirements of detectors for flammable detectors.

~~(**Note**: Needs to be considered specifically for methyl/ethyl alcohol.)~~
Fire detection in machinery space containing methyl or ethyl alcohol engines and rooms containing independent tanks for methyl or ethyl alcohol storage shall give alarms.
(**Note:** Fire detection should be reviewed by the SSE Sub-Committee)

15.10 Requirements for ventilation

15.10.1 Any loss of the required ventilating capacity shall give an audible and visual alarm on the navigation bridge or in a continuously manned central control station or safety centre.

15.11 ~~Safety functions~~ Requirements on safety functions of fuel supply systems

~~(**Note**: Needs further consideration for methyl/ethyl alcohol.)~~

15.11.1 If the fuel supply is shut off due to activation of an automatic valve, the fuel supply shall not be opened until the reason for the disconnection is ascertained and the necessary precautions taken. A readily visible notice giving instruction to this effect shall be placed at the operating station for the shut-off valves in the fuel supply lines.

15.11.2 If a fuel leak leading to a fuel supply shutdown occurs, the fuel supply shall not be operated until the leak has been found and dealt with. Instructions to this effect shall be placed in a prominent position in the machinery space.

Table 1. Monitoring of Methyl/Ethyl alcohol supply system for dual fuel engines

Parameter	**Alarm**	**Aut. Shut down of tank valve**	**Aut. Shutdown of methyl/ethyl alcohol bunkering valve**	**Comments**
High level fuel tank	X			See 15.4.2.1
High, high level fuel tank	X		X	See 15.4.2.2 & 15.5.1
Loss of ventilation in the annular space in the bunkering line	X			See 15.5.2
Gas detection in the annular space in the bunkering line	X			See 15.5.3
Loss of ventilation capacity in ventilated areas	X			See 15.10
Liquid methyl/ethyl alcohol detection in the annular space of the double walled bunkering pipe	X			See 15.5.4
Vapour detection in ducts around fuel pipes	X			See 15.7.1.1

Parameter	**Alarm**	**Aut. Shut down of tank valve**	**Aut. Shutdown of methyl/ethyl alcohol bunkering valve**	**Comments**
Machinery spaces containing methyl/ethyl alcohol fuelled engines	X			See 15.7.1.2
Vapour detection in cofferdams surrounding fuel tanks. One detector giving 20% of LEL	X			See 15.7.5
Vapour detection in crankcase and above stuffing box	X			See 15.7.1.7
Vapour detection in air locks	X			See 15.7.1.6
Vapour detection in cofferdams surrounding fuel tanks. Two detectors giving 40% of LEL	X	X		See 15.7.5
Vapour detection in ducts around double walled pipes, 20% LEL	X			See 15.7.6
Vapour detection in ducts around double walled pipes, 40% of LEL	X	X		See 15.7.6. Two gas detectors to give min 60% LEL before shut down.
Liquid leak detection in annular space of double walled pipes	X	X		See 15.8
Liquid leak detection in engine-room	X	X		See 15.8
Liquid leak detection in pump-room	X	X		See 15.8

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ANNEX 2

DRAFT MEASURES FOR FUEL CELLS FOR INCLUSION IN THE IGF CODE

[10.6 Regulations for Fuel Cells

2.2 Definitions

Fuel cell is a source of electrical power in which the chemical energy of a fuel is converted directly into electrical energy by electrochemical oxidation.

Fuel cell space is a machinery space containing fuel cell installations. The presence of release sources in a fuel cell space will decide if it is regarded as a hazardous or non-hazardous space.

Fuel Cell Power System: Generator system that uses a fuel cell module(s) to generate electrical power and heat. The fuel cell power system includes fuel conditioning, but not fuel storage.

(**Note:** Move to section 2.2 definitions)

10.6.1 Materials

~~The materials shall be suitable for the intended application and shall comply with recognized standards. Their suitability shall be proven. The use of flammable materials is not allowed outside the fuel cells stack. The Class Rules for Materials shall be observed. The use of flammable materials inside the fuel cells stack requires the approval by the Administration or its recognized organization acting on its behalf.~~
The use of flammable materials inside the fuel cell installation space may be accepted based on approval by the Administration if it can be shown that the [risk of fire is minimized] and the consequences of a fire is controlled.
(**Note:** Move to section 7 – Material and General pipe design)

10.6.2 Fuel Cell Specific Ship Arrangement and System Design

10.6.2.1 General

~~The design shall ensure that any single failure in active components of the fuel cell system shall not lead to loss of propulsion or auxiliary power for essential services.~~[15]

~~The arrangement of the fuel cell spaces shall be so that a necessary shut down due to a fuel or oxidant leakage cannot lead to loss of propulsion or auxiliary power for essential services. If the power from the fuel cell is needed for restoration of power in a black out or dead ship situation, the recovery arrangements have to be documented and approved in each case.~~
Loss of a fuel cell installation shall not lead to an unacceptable loss of power

10.6.2.2 Fire-Extinguishing System

In general, the regulations set out in chapter 11 apply. ~~The fire extinguishing system shall be chosen according to the specific fuel cell type and shall not be limited to a water spray system.~~ The fire-extinguishing system is to be suitable for use with the specific fuel cell technology proposed

[15] ~~Active components are components for mechanical transfer of energy, e.g. pumps, fans, electric motors, generators, combustion engines and turbines. Fuel Cells, Heat exchangers, boilers, transformers, switchgear or cables are not considered to be active components.~~

10.6.2.3 ~~Openings~~ Outlets for exhaust air and residual gases

~~Openings for exhaust air and residual gases of the fuel cells systems do not require to be in accordance with chapter 13 if it is ensured that no combustible mixtures are present in the exhaust gas.~~ Exhaust air and residual gases of the fuel cells power systems shall not be combined with ventilation air and shall be let to the open air away from any entrances and other openings. If combustible mixtures are to be expected the requirements of Chapter 12 "Explosion Prevention" shall be fulfilled.

~~**10.6.2.4 Inverter following Fuel Cell**~~

~~If propulsion units or other essential consumers are supplied with electricity from fuel cells power systems, then the inverters shall be so designed that reverse power, such as braking power, cannot pass into the fuel cells. In general, the regulations set out in chapter 14 apply.~~

~~**10.6.2.5 Ventilation System**~~

~~All components for conditioning fuels with a flash point below 60°C – such as preheaters, compressors, filters, reformers etc. – shall be located in a closed space or a suitable enclosure. This space or enclosure shall be ventilated according to chapter 13 and shall be equipped with a gas detection system according to Section 15.8.~~

10.6.2.~~6~~ 4 ~~Fuel Cell Specific Fuel Conditioning~~ System arrangement

~~.1 All components for conditioning the fuel – such as preheaters, compressors, filters, reformers etc. – shall be located in a suitable space or enclosure, which shall be ventilated according to section 13 and shall be equipped with a gas detection system according to section 15.8.~~

~~.2 The installation spaces of the fuel conditioning system shall be separated from the spaces used for storage of the fuel. Doors between the spaces used for fuel storage and those used for fuel conditioning are not permitted.~~

~~.3 Means shall be provided in the fuel cell power system to purge where for safety reasons a passive state is required after shut down or prior to start-up.~~

.~~4~~ 1 Fuel cell power ~~Reformer~~ systems shall be designed for automatic operation and equipped with all the indicating and control facilities required for [safe] assessment and control of the process.

~~.5 If limit values determined for the control process which may lead to hazardous situations are exceeded, the unit shall be switched off and interlocked by an independent protective device.~~

.~~6~~ 2 It shall be possible to switch off the ~~reformer unit~~ fuel cell power system from a permanently accessible [point][location] outside the installation space.

~~.7 If high surface temperatures may occur, the corresponding insulation or contact protection shall be provided.~~

~~.8 If applicable, the firing equipment shall be equipped with a type-tested burner control box and flame monitoring devices. Reliable operation of the flame monitoring devices shall be verified for the corresponding type of fuel and mode of combustion.~~

.~~9~~ 3 Means for purging the combustion chamber and the exhaust gas system shall be provided.

.4 For installations used for means of propulsion, the emergency electric supply or the supply for essential consumers, the gas purity required for the operation of the fuel cell shall be monitored by suitable methods. If the determined limit values are exceeded, an alarm shall be generated or the system shall be switched off.

~~.10 The recirculation of fuel (residual gas) from the fuel cells to the reformer is permissible.~~

.5 Auxiliary systems of the fuel cell power system where gas may leak directly into a system medium (e.g. cooling water) shall be equipped with appropriate gas extraction measures fitted directly after the media outlet from the system in order to prevent gas dispersion. The gas extracted from the auxiliary system media shall be vented to a safe location on the open deck.
(**Note:** Moved from 10.6.2.8)

10.6.2.~~7~~ 5 ~~Fuel Cell Power System~~ Arrangement of fuel cell spaces

~~.1 Fuel cells power systems shall be located in separate spaces. Installation in conventional machinery spaces is not permitted. The regulation for a separate space can also be met by a suitable form of enclosure for the components transferring the fuel. In such case, installation in conventional machinery spaces is admissible.~~

~~.2 The installation spaces of fuel cells stacks and directly associated components shall be arranged outside of accommodation, service and machinery spaces and control rooms, and shall be separated from such spaces. Installation in a conventional machinery space is admissible, on condition that a suitable enclosure is provided.~~

~~.3 Fuel cell power system installation spaces shall have as simple geometrical shape as possible.~~

~~.4 For the fuel cell power system installation space concepts shall comply with chapter 6.3 of this code.~~

.1 Fuel cells shall be located in separate spaces with gas tight steel enclosures.

.2 Fuel cell spaces shall be designed to safely contain fuel leakages and be provided with suitable leakage detection systems.

.3 Fuel cell spaces shall have as simple geometrical shape as possible. Fuel cell spaces where hydrogen may be present shall have no obstructing structures in the upper part and shall be arranged with a smooth ceiling sloping up towards the ventilation outlet.

.4 [The fuel cell space may be categorized as a (6) or (7) space (ref. SOLAS Ch. II-2/ Table 9.5 and 6), depending on the amount of combustible material or fuel present in the space. The categories for the fuel cells spaces have to be decided for each installation.]
(**Note:** This section can be deleted in the final version as it is only for discussion purposes)

.5 In general the temperature of installations in the fuel cell space shall never be above the self-ignition temperature for the fuel used.

.6 For spaces where hydrogen systems are present, the ventilation rate shall be sufficient to avoid gas concentration in the flammable range in all leakage scenarios, including pipe rupture. This is also applicable for spaces containing fully welded hydrogen pipes.

.7 Ventilation ducts from spaces containing hydrogen piping or release sources shall be arranged to prevent entrapped hydrogen pockets forming.

.8 Hydrogen pipes [for auxiliary purposes] are not to be led through enclosed spaces in the ship apart from fuel cell spaces.

.9 The double wall principle is not to be used for [auxiliary] hydrogen pipes. [Auxiliary] hydrogen pipes are in general to be located in well ventilated spaces, and as far as practicable to be fully welded.

10.6.2.~~8~~ 6 Fuel Cell Control Monitoring and Safety System

.1 For gas detection the regulations set out in chapter 15.8 apply.

.2 ~~Auxiliary systems of the fuel cell power system where gas may leak directly into a system medium (e.g. cooling water) shall be equipped with appropriate gas extraction measures fitted directly after the media outlet from the system in order to prevent gas dispersion. The gas extracted from the auxiliary system media shall be vented to a safe location on the open deck.~~
(**Note:** Moved to old 10.6.2.6)

~~.3 For the fuel cells power systems, regulating devices shall be provided to keep the process variables within the specified limits under normal operating conditions. The regulating behaviour shall cover the entire range of operation. Parameter changes which can be anticipated must be considered during the design phase. Faults in a regulating circuit shall not affect the proper functioning of other regulating circuits. The power supply to the regulating circuits shall be monitored and an alarm must be generated on failure of the power supply.~~

.3 If limit values, e.g. temperature, pressure, voltage, determined for the control process which may lead to hazardous situations are exceeded, the unit shall be [automatically] shut down and interlocked by an independent protective device.

~~.4 If a fuel cells power system is used to supply consumers for means of propulsion, the emergency electric supply or the supply for essential consumers, then the electrical power provided by the fuel cells system shall be monitored.~~

.~~5~~ 4 Chemical reactions, such as those taking place during fuel conditioning and within the fuel cell, shall be monitored, e.g. by means of temperature, pressure or voltage monitoring.

~~.6 The safety system of the fuel cell power system shall comply with recognised standards for functional safety (e.g. IEC 61508).~~

~~.7~~ ~~In case of the following events, the affected fuel cells power system must be switched off with due consideration to safety, and then locked out:~~

- ~~emergency shutdown (protective device)~~
- ~~gas detection: when a concentration equal to 40% of the lower explosion limit is reached (Alarm at 20% LFL)~~
- ~~fire detection in hazardous areas affecting the fuel cell~~
- ~~safety switch-off of the system owing to deviations from permissible operating parameters, including chemical reactions~~

~~In addition table 5.1 of MSC.285(86) shall be considered. Fuel Cell Power Systems installation space can be seen equal to machinery spaces. It shall be ensured that the electric power output can be switched off at any load condition.~~

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ANNEX 3

SPECIFIC REQUIREMENTS FOR SHIPS USING LOW FLASH POINT ~~DIESEL~~ OIL FUEL[S] ~~WITH FP < 60°C~~

1 [When using low flash point oil fuels as fuel, the following criteria shall apply for the purposes of this part:

.1 Tier 1 = oil fuels with a flash point ranging between [52] and [60]° C

.2 Tier 2 = oil fuels with a flash point ranging between [43] and [52]° C

.3 Tier 3 = oil fuels with a flash point below [43]° C

2 When used as fuel, tiers 1 and 2 oil fuels must meet the requirements for oil fuel outlined in SOLAS chapter II-2.
(**Note:** This should include besides from SOLAS regulation II-2/4.2.1 also MSC.1/Circ.1321)

3 When using tier 3 oil fuels as fuel, the alternative approach requirements outlined in paragraph 2.3 of this Code shall apply.]

(**Note:** The tiered approach is opposed by four members)

~~1~~ 4 In addition to the requirements for oil fuels in SOLAS chapter II-2 ~~for the fuel system components, installation and energy converters~~, the requirements in part A of this Code ~~the following paragraphs~~ shall apply to vessels using low-flashpoint oil fuels as fuel.

~~2~~ 5 In addition to part A of the Code, the following paragraphs of part A-1 shall apply to ships using ~~diesel~~ tier [2 and 3] oil fuels ~~with FP < 60°C~~ as fuel:

Subject	Paragraphs	Comments
~~Material and general pipe design~~	~~7.1, 7.2~~	~~Requiements for (liquid) gases do not apply~~
~~Power generation~~	~~10.6~~	~~Except gas piping~~
Fuel storage	6.1, 6.2	Except 6.2.1.1 and 6.2.2, 6.2.3 and 6.2.4
Fuel supply to consumers	9.1, [9.2]	
Bunkering	8.1, 8.2, [8.4]	
Ship design and arrangements	5.1, [5.2], 5.9, 5.10	~~See additional requirements par. 3 below~~ Except 5.9.3, 5.10.3 and 5.10.4
Fire safety	11	Except 11.5 [11.3] [11.6]
~~Explosion protection~~	~~12~~	
~~Ventilation~~	~~13.1, 13.2, 13.3~~	

~~3~~ 6 ~~Additional requirements for ships using diesel fuel with FP < 60°C as fuel:~~

~~Requirements for the fuel containment system for low-flashpoint diesel oil~~ The fuel containment system for systems using tier [2 and 3] low flash point oil fuels must meet the following requirements:

.1 Tanks ~~for low-flashpoint diesel oil~~ shall be structural tanks and located such that adjacent spaces have temperatures ~~minimum~~ at least 10 degrees Celsius below the flashpoint.

.2 Piping systems in tanks and their cofferdams shall have no connections with piping systems in the rest of the ship, apart from fuel pipes which shall be arranged as specified in other parts of this Code.

.3 Spaces where [tier 2] low flash point oil fuels are normally present must either:

.1 Using appropriate methods, maintain ambient air temperatures at least 10° C below the lowest flash point of the oil fuel being used; or

.3 .2 Piping in In areas with where temperatures are less than 10 degrees below the flash point of the oil fuel being used, like category A machinery spaces piping must are to be double-walled with ventilation.

.4 Areas containing fuel pipes or adjacent to tanks are to be suitable sufficiently ventilated to prevent aggregation minimize the possibility of accumulation of fuel flammable vapours.

.5 Ventilation pipes for tanks are to be fitted with an approved type of vent head with a pressure-vacuum valve and flame arrester a flame screen. The outlet is to be located in a safe position away from ignition sources. (**Note:** This should not be applicable when the outlet temperature is below the flash point of the fuel)

.6 Drip trays as in section 5.10 are to be drained to a suitable collection tank separated from machinery space drains.

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